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Stability or Upheaval? The Currency Composition of International Reserves in the Long Run

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The paper analyzes how the role of different national currencies as international reserves was affected by the shift from fixed to flexible exchange rates. It extends data on the currency composition of foreign reserves backward and forward to investigate whether there was a shift in the determinants of the currency composition of international reserves around the breakdown of Bretton Woods. It finds that inertia and policy-credibility effects in international reserve currency choice have become stronger post-Bretton Woods, while network effects appear to have weakened. The paper shows that negative policy interventions designed to discourage international use of a currency have been more effective than positive interventions to encourage its use. These findings speak to the prospects of currencies like the euro and the renminbi seeking to acquire international reserve status and others like the U.S. dollar seeking to preserve it. [JEL F30, N20]
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The currency composition of international reserves has long figured prominently in the literature of international economics. Questions here include what accounts for the continued dominance of the dollar in global foreign exchange reserves: the size of the American economy, the extent of its trade links and the liquidity of its financial markets on the one hand, or inertia and the persistence of past patterns on the other. Subsequently, attention has turned to the scope for the euro to rival the dollar as a reserve currency and at what point the characteristics of the euro area might be such as to encourage central banks to hold euros in amounts comparable or even in excess of their holdings of dollars. And, most recently, investigators have asked when the Chinese renminbi might acquire a significant reserve currency role.[1]

A limitation of previous studies is their very limited evidentiary base. Data on the currency composition of international reserves are made available to the public by only a small number of central banks.[2] The IMF publishes only global aggregates and, recently, breakdowns between advanced economies and emerging and developing countries.[3] Earlier investigators have assembled these aggregated data from the IMF's website and publications starting in the early 1970s, a time that conveniently coincides with the end of the Bretton Woods System, which is sometimes thought to have occasioned a shift in the demand for international reserves.[4]

Investigators using these data have generally found that the demand for a currency as international reserves is strongly increasing in issuing country size, presumably because size is a determinant of the capacity of a country to issue the safe and liquid assets that are attractive as a form of reserves, and also because the availability of reserves in a particular currency plausibly influences how many other countries hold it. Early adoption will then encourage additional countries to hold that same currency in an environment where network effects are important. Such studies also find that persistence is strong, perhaps indicative of habit formation and reluctance on the part of reserve managers to radically alter the composition of their reserve portfolios. Evidence of the importance of policy in the reserve-currency-issuing economies is weaker. For example, inflation as a measure of policy credibility and as a determinant of the rate of return on holding a particular currency shows up as significant in some studies but not in others.

[1]For early discussions of the euro's future and a review of the debate by the time of the advent of the single currency, see for example Bergsten (1997), Feldstein (1997) and Portes and Rey (1998). Recent reviews of the prospects for the Chinese renminbi as an international currency include Chinn (2012), Subramanian and Kessler (2012), Eichengreen (2013), Prasad (2014) and Fratzscher and Mehl (2014).

[2]Truman and Wong (2006) describe the available data.

[3]These IMF data, also known as the Currency Composition of Official Foreign Exchange Reserves (COFER) data base, are confidential; the individual country data have been used only by two internal IMF staff studies (Dooley, Lizondo, and Mathieson, 1989, and Eichengreen and Mathieson, 2001).

[4]See for example Eichengreen (1998), Chinn and Frankel (2007 and 2008) and Li and Liu (2008).

But the generality of these findings is an open question, insofar as they are derived from data for a limited period, typically from the final breakdown of the Bretton Woods System to the eve of the euro in 1998. This is a distinctive economic and monetary period, when the dollar dominated reserve holdings and the issuers of other potential reserve currencies, such as Germany and Japan, actively discouraged international use of their national units. The extent to which patterns in this period generalize has not been systematically studied. Whether relationships identified for this period are stable over longer periods of time has not been investigated.

In particular, whether the demand for reserves denominated in different currencies was altered in fundamental ways by the shift from fixed to flexible exchange rates has not been tested systematically. As Frenkel (1978) observed in the wake of the transition to floating, the absence of legal obligation to peg the exchange rate, together with the absence of the associated need for international reserves denominated in the reference or anchor currency (that is, the U.S. dollar under the Bretton Woods System), could in principle have fundamentally altered the demand and composition of reserves. In theory, flexible exchange rates could have enabled countries to economize on reserves, and specifically on the dollar reserves that were the principal vehicle for foreign exchange market intervention in the earlier period.

But this hypothesis, which we term the "upheaval hypothesis," could not be tested because the data did not provide much information on the currency composition of reserves for the prefloating-exchange-rate era—that is, from the late 1940s to the early 1970s.[5] Relatedly, the sample of observations available to earlier researchers investigating structural instability in the demand for reserves in the 1970s and 1980s was too small for definitive conclusions.[6]

This is our motivation in this paper for extending the data base on the currency composition of international reserves backward and forward in time. Our time series span the two-thirds of a century from 1947 to 2013. We ask whether standard specifications fit to data for the fourth quarter of the twentieth century also fit this longer time-span. We investigate possible structural breaks in the determinants of the currency composition of international reserves around the time of the collapse of the Bretton Woods System.

Like previous studies, we find strong size network and persistence effects, along with policy-credibility effects, as determinant of reserve currency status. In addition, we find evidence of a structural shift in the determinants of reserve currency shares around the time of the breakdown of the Bretton Woods System, with persistence and credibility effects growing stronger and network effects weakening.

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[5]A partial exception is Schenk (2010), who assembles data on the share of the dollar, sterling and a residual "other currencies" category for the period 1950–82.

[6]For instance, Heller and Kahn (1978) examined whether there was a change in the demand for international reserves in 1973 due to the change from fixed to floating exchange rates, using data for the period 1964–76. Their results suggest that there was indeed a shift by industrial countries but not by non-oil developing countries. However, Heller and Kahn also stressed that they had a very short period available for formal statistical testing and that their conclusions should at best be regarded as preliminary (see also Crockett, 1978; Saidi, 1981; and Levy, 1983).

The long time-span covered by our new series also enables us to consider the policies that governments and central banks have pursued to encourage or discourage the international use of their currencies, policies that to our knowledge have not been systematically studied before. We assemble new data on these policies and examine their importance. We find that it has been easier historically to discourage than encourage the use of a currency as international reserves. Intuitively, binding capital controls and related policies suffice to discourage international use of a country's currency. Conversely, while opening the capital account is helpful for enhancing the attractions of a currency as international reserves, doing so is not sufficient, by itself, to result in significant adoption. Fostering international use presupposes, among other things, building deep and liquid financial markets and creating confidence in the future policy, steps that require more than short-run policy interventions. It follows that negative policies designed to discourage international currency use have a stronger short-run impact than positive policies to promote it.

The next section of the paper provides an overview of the data. Section II then describes the econometric methods used to estimate their determinants. Section III reports and interprets basic findings, while Section IV provides some robustness checks. In Section V we discuss further results, notably those for the effects of policy variables, while Section VI concludes.

I. Overview of the Data

Our data on the currency composition of foreign exchange reserves are drawn from a volume published by the International Monetary Fund to take stock of its first 20 years of existence (Horsefield, 1969), which we used to gather data for the late 1940s and the 1950s; from the Fund's annual reports, which we used to gather data for the 1960s, 1970s, 1980s and 1990s; and from the COFER data base, which provided data for the period 1999–2013. (See the online appendix for details on how the data were assembled.[7])

These sources report reserves held in U.S. dollars (including Eurodollars) and British pounds from 1947, in French francs and German deutschemarks from 1970, and in Dutch gilders, Swiss francs and Japanese yen from 1973. Reserves held in ECU were reported starting in 1987. The franc, deutschemark, gilder, and ECU were then succeeded by the euro starting in 1999. Australian dollar and Canadian dollar reserves are reported starting in 2012.[8] In all, 11 currencies were at one point or another reported as reserve currency units by the IMF.

[7]Throughout, these are "allocated" foreign exchange reserves; there is also a residual unallocated component, attributable to central banks that decline to report the currency composition of their reserves (including certain major official reserve holders in Asia, which we do not analyze—more on this below).

[8]For part of the period there is in addition a small residual category of "claims in other currencies." Before 2005 the IMF did not distinguish between reserves in "other currencies" (reserves whose currency of denomination was reported but which was other than one of the currencies distinguished in its reports) and reserves whose currency of denomination was not reported to the IMF. In 2005 the IMF revised its data back to 1994, distinguishing the two types of "others." However, since we do not have information on the distinction prior to 1994, we do not analyze the "other currencies" category prior or subsequent to this.

An important issue is whether to adjust the data for valuation effects due to exchange rate changes. These can produce changes in the value of foreign reserves held in different currencies without any action by central banks holding reserves. Although the early empirical literature on the currency composition of foreign reserves ignored this complication, recent studies have computed currency shares at constant exchange rates and shown that such valuation effects can be important.[9] We report results both with and without valuation adjustments.

Note that reserves held in different currencies are available at the aggregate level only, not for individual countries.[10] Inability to use panel-data methods is not of concern for our purpose, however. We are mainly interested in testing the "upheaval hypothesis" and understanding the role of common forces affecting all reserve holders over the long run. What matters most for this is the time dimension, which is emphasized in our new data set.

The currency composition of disclosed reserves may not match that of nondisclosed reserves. But the importance of nondisclosed reserves is a relatively recent phenomenon; it largely reflects the increase in China's reserve holdings in the 2000s. Nondisclosed reserves accounted for about 47 percent of total foreign exchange reserves in 2014 against 20 percent only in the late 1990s. In robustness checks we show that our main results remain intact when we focus on a subset of advanced economies for which country-level data are available (see below).

Figure 1 shows the currency composition of foreign reserves since 1947. A striking feature of the figure is the dominance of the British pound in the aftermath of World War II, when it accounted for more than 80 percent of foreign exchange reserves. This is then followed by a sharp reversal, with the dollar quickly overtaking sterling and accounting for more than 50 percent of identified foreign exchange reserves by the early 1950s. The dollar's rise then continues through the mid-1970s.[11] Sterling's share similarly continues to decline, reaching the low single digits at around the same time.

Some fluctuations around these trends plausibly reflect exchange rate changes. For example, the dollar's declining share of global reserves after 1976 in part reflects the dollar's depreciation in the course of the subsequent decade, interrupted by its recovery in the first half of the 1980s (Frankel, 2007). Sterling's accelerating fall in the late 1960s and early 1970s similarly reflects the impact of the devaluation of the pound around the time of the collapse of the Bretton Woods System, just as its further drop in 1976 reflects in part the balance-of-payments and currency crisis that year.[12] This is an indication that it will be important, especially when

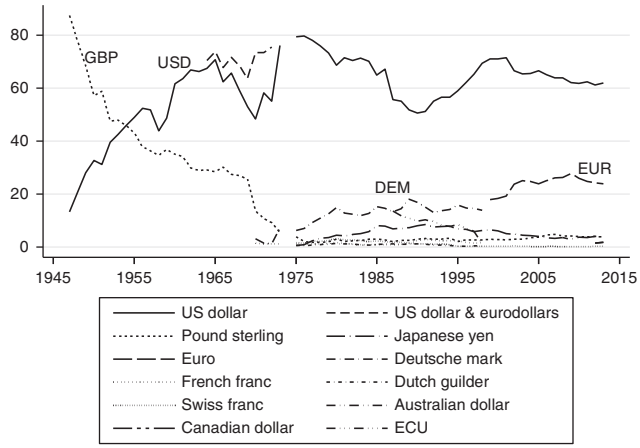
[9]See Truman and Wong (2006) and Ouyang and Li (2013), for example. See also Dominguez, Hashimoto, and Ito (2012) for an attempt to estimate valuation effects as determinants of changes in reserve composition in emerging markets in early stages of the global financial crisis.

[10]Countries typically do not publish the composition of their reserve holdings. Short time series have been published by some countries, however (see ECB, 2013).

[11]This is the case of Eurodollar assets, which are included along with U.S.-issued reserve assets denominated in dollars.

[12]See Cairncross and Eichengreen (1981) and Burk and Cairncross (1992).

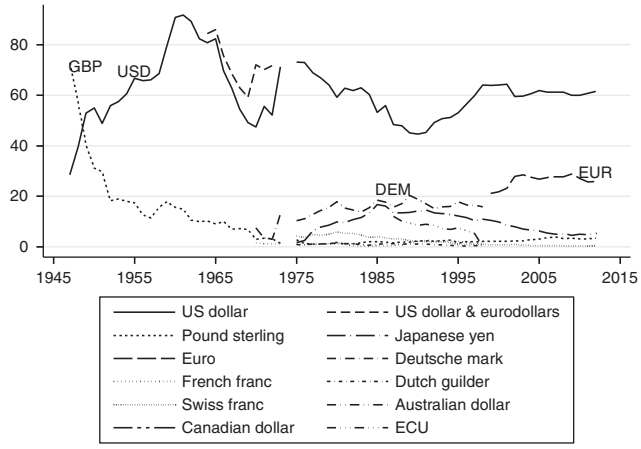
Figure 1. Currency Composition of Globally Disclosed Foreign Exchange Reserves (1947–2013, percent)



Source: Authors' calculations based on IMF data and sources (see the online appendix).

Note: The currency shares are derived from U.S. dollar-denominated amounts for the period 1947–69 and 1999–2013 as well as from SDR-denominated amounts for the period 1970–72. The currency shares for the period 1973–99 are directly provided by the IMF in its annual reports (based on SDR valuation). Starting in 1979 the Fund added the SDR value of ECUs issued against the U.S. dollar to the SDR value of U.S. dollar reserves; after 1987 the ECU was treated as a separate unit. The currency shares reported here exclude unallocated foreign exchange reserves post-1994 (that is, about 40 percent of total foreign exchange reserves at the end of the sample).

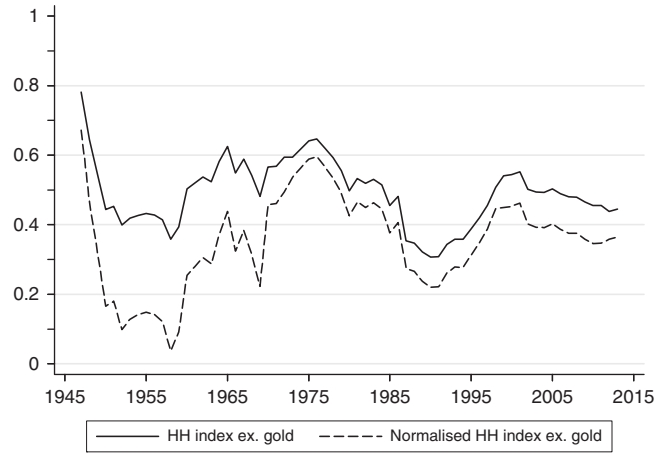
Figure 2. Currency Composition of Globally Disclosed Foreign Exchange Reserves at *Constant* Exchange Rates (1947–2012, percent)



Source: Authors' calculations based on IMF data and sources (see the online appendix).

Note: see Figure 1. Currency shares at constant exchange rates calculated using the BIS methodology (and 2012 as base year), as described in Wong (2007). The currency shares reported here exclude unallocated foreign exchange reserves post-1994 (that is, about 40 percent of total foreign exchange reserves at the end of the sample), as in Figure 1.

Figure 3. Currency Concentration of Globally Disclosed Foreign Exchange Reserves (1947–2013)



Source: Authors' calculations based on IMF data and sources (see the online appendix).

Note: the chart shows the basic and standardized Hirschman-Herfindhal (HH) indices calculated for the currency breakdown of global foreign exchange reserves since 1947, that is, the sum of squared reserve currency shares (also scaled by a function of the number of currency units in each year, in the case of the standardized index). An index value of 1 indicates a monopolistic market; an index value of 0 indicates a perfectly competitive market.

considering relatively short-term fluctuations, to analyze currency holdings at constant as well as current exchange rates (contrast Figures 1 and 2).

Starting in the 1970s we then observe the rise of the deutschemark and the euro as international reserves. The lines representing these currencies trend upward until the outbreak of the euro area sovereign debt crisis in 2010.[13] We also see the rise and fall of the Japanese yen, whose share in global reserves peaks in the late 1980s and early 1990s, coincident with the end of the "bubble economy" and the onset of the Japanese economic and financial crisis, along with the rise of various subsidiary reserve currencies.

Figure 3 shows these developments from another perspective. It plots the Hirschman-Herfindhal (HH) index for the concentration of foreign exchange reserves from 1947 through 2012, where a value of unity indicates total concentration of reserves in one currency. Two versions of the index are displayed: the simple HH index, and the index adjusted for the number of currencies in the global reserve portfolio.[14] The indices confirm the high concentration of reserves in one currency (sterling) immediately after World War II, the subsequent rapid fall in concentration as sterling is liquidated and the dollars are earned, then the growing concentration of reserves in dollars in the 1960s and

[13]The impact of the crisis on the euro's international role is analyzed by ECB (2013).

[14]A number that rose with time, most notably in the 1970s, when the two lines in the figure converge.

1970s, and finally very gradual movement in the direction of less dollar-concentrated reserve portfolios.

Still, it is the reversal of fortunes at the beginning of the period that is the figure's most striking feature. Understanding how this came about requires first understanding why sterling appeared so dominant after World War II. Sterling and the dollar each accounted for roughly 40 percent of global foreign exchange reserves in the 1920s and early 1930s (Eichengreen and Flandreau, 2009). Britain and America's departures from the gold standard in 1931 and 1933 then led foreign central banks to liquidate their sterling and dollar holdings. France and other members of the gold bloc continued to hold limited amounts of dollars, as did a number of Latin American countries. The Central European countries that relied on exchange control to manage their balances of payments in the 1930s partially rebuilt their sterling reserves after 1933, as did the Scandinavian countries, which were de facto or de jure members of the sterling bloc. Nonetheless, reserves held in sterling and the dollar were small in the late 1930s by the standards of both the 1920s and the period after World War II.

The overwhelming dominance of sterling in 1947 thus reflected the willingness of the United Kingdom's wartime allies to accept sterling-denominated claims on the British government in payment for materiel provided to the British economy and its armies overseas. Many of the sterling balances held in 1947 were accumulated in these special wartime circumstances. It followed that many of sterling's holders wished to transform it into other reserve assets as soon as permitted, where the dollar was the obvious alternative, or to use it to purchase merchandise (that is, to liquidate it entirely), which they did over time. Hence the reversal of fortune evident in Figure 1.

The constraints on these operations were several. First, there were regulatory restrictions. Britain imposed regulations limiting the conversion of sterling balances held in London by overseas official and private holders, and it negotiated similar regulatory arrangements with other countries. Some of these "blocked" sterling balances could be used for purchases of merchandise and/or other assets within the sterling area (the group of countries that held most or all of their reserves in sterling in London, pegged their exchange rates to sterling, and maintained a common system of exchange controls vis-à-vis the rest of the world) but not elsewhere, and specifically not for purchases of dollars or payments to the so-called dollar area. In addition to members of the sterling area, sterling reserves were also held by members of the so-called transferable account area. Its members, mainly European countries, were permitted to use their sterling reserves for payments between transferable accounts and sterling area accounts but not for payments with members of the dollar area (so-called American account countries).[15]

The effect was to limit the scope for converting sterling into dollars or using it to purchase merchandise, in the dollar area in particular. Sterling could be redistributed among sterling area countries, but their governments and residents could liquidate their sterling reserves only by using them in settlements with the

[15]Details on these arrangements may be found in Schenk (1994 and 2010).

United Kingdom itself, which maintained a variety of trade and capital controls to limit the practice.

To be sure, controls could be evaded, and some sterling balances, such as the sterling earnings of American account countries, were freely convertible into dollars. But such conversions were limited by a second factor, namely the danger of capital losses on residual sterling balances if the resulting loss of reserves by the U.K. forced it to devalue the currency, as in 1949.[16] Avoiding self-defeating action was not easy, however, since it required collective action, and since the incentive remained for individual parties to surreptitiously diversify if they could get away with it. The relatively elaborate sterling, transferrable and American account arrangements of the late 1940s can be thought of as monitoring and enforcement technologies designed to support such collective action and prevent the disorderly liquidation of sterling reserves.

Finally, there were political constraints. Many of the postwar holders of sterling were Britain's wartime allies. Many shared a common colonial heritage and were members of the British Commonwealth. This caused governments to hesitate in taking steps to maximize the value of the national reserve portfolio at the expense of the United Kingdom and the rest of the sterling area.

II. Specification

Our basic specification relates foreign currency holdings to a lagged dependent variable, issuing-country size, and exchange rate appreciation. The lagged dependent variable aims to capture persistence or inertia effects of the sort discussed in Triffin (1960).[17] Relative size can be motivated by theoretical models of random matching games that see the emergence of international currencies as the solution to a "double coincidence of wants" problem where the incentive of an agent to accept a nation's currency depends on how often he/she trades with a national from that country, as discussed in, for example, Matsuyama, Kiyotaki, and Matsui (1993). We measure relative size as the share of a reserve currency issuing country in global GDP, taking data from Maddison (2010).

This is a good place to highlight the distinction between network effects and persistence and to emphasize that one does not imply the other. Persistence can have other sources besides network effects giving rise to first-mover advantage. Examples include habit formation or the absence of low-cost alternatives to the dominant unit for providing reserves on the scale demanded. Conversely, network effects may increase the attractions of a particular standard (in this case, a currency standard) at a specific point in time without preventing market participants from shifting to another standard at the next point in time, assuming that mechanisms making for lock-in are weak and agents can coordinate their actions (as argued by

[16]The dilemma was analogous to that facing twenty-first century emerging markets holding mainly dollars as reserves in periods when questions are raised about the prospective stability of the dollar. Diversifying out of dollars may precipitate the dollar depreciation that portfolio managers fear if it goes too far, too quickly.

[17]See also Krugman (1980 and 1984), Matsuyama, Kiyotaki, and Matsui (1993) and Rey (2001).

David, 1986, 1990). The success with which open standards for personal electronics have been developed in recent years, weakening lock-in and facilitating shifts between operating systems, illustrates the point (see West, 2007).

The credibility term is motivated by the idea that exchange rate depreciation can make holding a currency unattractive and discourage its international use (and conversely appreciation), as in Devereux and Shi (2013). Currency fluctuations are important for credibility because reserve holders prefer reliable stores of value and may be reluctant to hold reserves denominated in units that tend to depreciate too much for too long, as evidenced in discussions in early 2015 about the decline in the euro's share of global foreign exchange reserves. We proxy credibility effects with the average rate of currency appreciation vis-à-vis the SDR basket over the preceding five years, in the spirit of Chinn and Frankel (2007).[18]

In focusing on the lagged dependent variable, country size, and exchange rate trend appreciation in our baseline specification, we follow the existing empirical literature (see for example Chinn and Frankel, 2007, 2008; and Li and Liu, 2008). Similarly, in interpreting these variables in terms of persistence, network, and policy-credibility effects, we build on analytical models emphasizing these factors. The idea that network effects are an important determinant of international currency choice was analyzed by Krugman (1980 and 1984), who focused on the increasing returns and multiple equilibria that result from economies of scale in a partial equilibrium model of currency exchange. In his model, a collective choice to engage in trade using a particular unit reduces transactions costs, in turn further encouraging the practice. Strategic externalities and economies of scale also feature in the random matching game of Matsuyama, Kiyotaki, and Matsui (1993). Rey (2001) stresses the self-reinforcing effects on transaction costs of using a particular unit in foreign exchange markets arising from the pattern of real bilateral trade (what she calls "thick market externalities"). Devereux and Shi (2013) take the argument to a dynamic general equilibrium model in which vehicle currencies enable agents to economize on the number of currency trading posts.[19]

Whether country size is an ideal, or for that matter adequate, measure of these network effects can be disputed. In what follows we consider also alternative proxies, such as the volume of the issuing country's foreign exports and market liquidity, which is often thought to be important to the choice of a particular unit as a reserve currency (as in for example Portes and Rey, 1998 and Papaioannou and Portes, 2008). It could also be argued that economic size may, in fact, strengthen credibility—for example, because larger countries have greater fiscal capacity. As we show below, however, our results remain unchanged if we control for the public-debt-to-GDP ratio and the fiscal balance-to-GDP ratios.

Similarly, persistence effects reflecting habit formation have been considered in the earlier analytical literature (see for example de Vries, 1988). Again, however,

[18]We calculate trend appreciation using data from the IMF's *International Financial Statistics*.

[19]A different approach is that of Lyons and Moore (2009) who develop a model in which the pattern of currency trade is driven not by merchandise trade but by asset trade and the information it conveys. In their model, if the information available to market participants is insufficiently symmetric, currency pairs never trade directly and an international (vehicle) currency is used instead.

whether our proxy, the lagged dependent variable, is in fact capturing habit formation as opposed to serially correlated omitted variables can be questioned. Long ago, in early econometric work on partial adjustment models, Griliches (1961) suggested instrumenting the lagged dependent variable as a means of addressing this problem. We implement a version of his approach in Section IV.

Analogously, it can be questioned whether contemporaneous exchange rate changes are the best measure of policy credibility. To address concerns about the adequacy of the proxy, in further robustness checks we consider also annual CPI inflation rates, exchange rate volatility, the level of public debt, bond yields, and the current account balance as additional measures of policy credibility (again in Section IV).[20]

Finally, we take advantage of the long span of our sample period to assemble information on policy measures taken by the major reserve currency issuers (the United States, the United Kingdom, Germany, Japan) to encourage or discourage use of their currency as international reserves. These include whether the capital account was open or closed, whether the stated position of the authorities in the issuing country was supportive or opposed, and whether exchange rate arrangements and agreements were supportive in the sense we define below. In constructing these measures we draw on a large range of sources, including Fukao (1990), Henning (1994), Schenk (2010), Tavlas (1991), Takagi (2011) and Takeda and Turner (1992).[21]

We include time effects throughout. Doing so is important given that our data span a long period by the standards of the previous literature. The time effects capture changes in the structure of the international monetary and financial system as well as other global changes in the world economy for which we do not otherwise control.[22] In addition, we estimate the resulting equations with random country effects to account for unobserved country-specific variation.[23]

This is an unbalanced sample by currency and year, raising the question of how to treat the missing observations. One option is to proceed with the

[20]We take data for these variables from the IMF's *International Financial Statistics, Global Financial Data* and Fratzscher, Mehl, and Vansteenkiste (2011).

[21]An overview of the resulting data is in the online appendix.

[22]Including an entire vector of year effects would absorb all time series variation common to all currency units and introduce a large number of additional coefficients to be estimated. We therefore included instead a vector of nonoverlapping five-year effects.

[23]Earlier studies for shorter periods have similarly used random country effects (for example, Ouyang and Li, 2013). Estimates obtained with fixed effects yield economically implausible coefficients for the size variable, and are probably distorted by the time fixed effects (insofar as the estimates become close to those obtained with random effects, once we do not include time effects). The Hausman test rejects random effects relative to fixed effects at the 10 percent level of confidence only. We also correct for heteroskedasticity and clustering when computing panel-consistent standard errors. One might also wish to correct for left-censoring of the estimates that include values of zero with Tobit estimates (which also means dropping the correction for heteroskedasticity and clustered heterogeneity, implying inefficient standard errors). We report Tobit estimates in robustness checks, together with system GMM estimates to account for possible endogeneity arising, for example, from the dynamic specification of our model (see Section IV below).

unbalanced panel, because these are the data that official sources provide. Another is to fill in values of zero for the missing observations, since the IMF presumably saw no need to report reserves held in French francs and deutschemarks before 1970, or gilder, Swiss francs and yen before 1973 or Australian dollars before 2012 because such holdings were very small (effectively zero by the standards of reserves held in the form of U.S. dollars).[24] We report results using both procedures in what follows.

To test for shifts around the time of the collapse of Bretton Woods, we interact these variables with a post-1973 dummy variable. We test for changes in the overall relationship and in the sign and size of the individual coefficients. In robustness checks we also run rolling Chow tests to investigate whether years other than 1973 qualify as breaks.

III. Results

Table 1 shows regression results when the share of identified foreign exchange reserves held in a particular currency purged of valuation effects is used as the dependent variable. Columns 1–2 report results with the three basic explanatory variables. Columns 3–4 is then for the pre-1973 period and columns 5–6 for 1973 on. Column 7 includes interaction terms with a post-1973 dummy variable as a way of testing for post-1973 structural shifts. In other estimates, we substitute zeroes for missing observations of the dependent variable in Table 1.[25]

These estimates are consistent with what previous investigators found for the recent period, albeit with some differences. Consider Table 1. Evidence of persistence is strong; a coefficient of 0.9 on the lagged dependent variable indicates a half-life of roughly seven years. This suggests that, in order to adequately understand the evolution of currency shares, it is important to consider medium-term evolutions, as we do here. But this point estimate also indicates that the share of a currency in global reserves can be halved in less than a decade, which is what happened to sterling between the mid-1960s and early 1970s. The coefficient on size is important throughout, consistent with the emphasis of previous authors on network effects. The effects of economic size and credibility are much larger in the long run than in the short run. The full sample estimates reported in column 2 of Table 1 suggest that a one-standard deviation increase in size corresponds to an increase in the share of an economy's currency in global foreign exchange reserves of about 1.5 percentage points in the short run (within the year), against 21 percentage points in the long run. A one-standard deviation appreciation (above trend) in a currency's exchange rate corresponds to an increase in its share of global

[24]Just as reserves held in other currencies were even smaller throughout the period and are therefore not reported.

[25]This will be evident from the increase in the number of observations; see Table B1 in the online appendix.

Table 1. Basic Estimates

	(1) Full Sample	(2) Full Sample	(3) Pre-1973	(4) Pre-1973	(5) Post-1973	(6) Post-1973	(7) Full Sample
Inertia	0.992***	0.927***	0.997***	0.758***	0.989***	0.954***	0.886***
	(0.002)	(0.021)	(0.003)	(0.037)	(0.004)	(0.009)	(0.024)
Network effects		1.538***		5.808***		0.819***	3.036***
		(0.471)		(0.807)		(0.173)	(0.570)
Credibility		0.172**		−2.007***		0.145*	−1.279***
		(0.072)		(0.109)		(0.079)	(0.307)
Post-73 dummy							2.921***
							(0.943)
Inertia × post-73 dummy							0.045**
							(0.023)
Network effects × post-73 dummy							−1.722***
							(0.534)
Credibility × post-73 dummy							1.436***
							(0.388)
Currency effects	YES	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES	YES
Observations	288	271	54	42	234	229	271
No. of groups	8	8	4	4	8	8	8
R^2 (overall)	0.987	0.993	0.964	0.988	0.995	0.995	0.993
R^2 (within)	0.899	0.881	0.900	0.767	0.831	0.836	0.887
R^2 (between)	1	1	0.998	1	1	1	1

Note: The table reports random effects estimates of our baseline equation where reserve currency shares purged of valuation effects are regressed on their standard determinants over selected sample periods, namely: the full sample (in columns 1 and 2); 1947–72 (in columns 3 and 4), 1973–2013 (in columns 5 and 6) and the full sample allowing for a structural break in the estimated coefficients (in column 7). Standard errors reported in parentheses are robust to heteroskedasticity and clustered heterogeneity; ***p<0.01, **p<0.05, *p<0.1.

foreign exchange reserves of about 0.2 percentage points in the short run, against 2 percentage points in the long run.

The effects of policy credibility as measured by the trend rate of appreciation of the exchange rate are more complex. Previous studies reported mixed results for this variable; our results are mixed as well. In Table 1 policy credibility shows up as positive after 1973, as expected, but significantly negative, somewhat counterintuitively, before. When we add the zero observations, however, the policy credibility measures for the pre-1973 period turns positive, though it is insignificantly different from zero.[26] The safest interpretation would appear to be that policy credibility had weaker effects before 1973 than after. Tables B2 and B3

[26]Arithmetically, the negative coefficient on the credibility-related exchange rate term for the period before 1973 reflects the fact that sterling depreciated on two occasions in this period, when the share of sterling reserves was relatively high, and that the deutschmark appreciated in the early 1970s, when the share of deutschmark reserves was low.

in the online appendix show that most of these results carry over when we instead compute currency shares without adjustment for valuation effects, as in earlier studies.[27]

Comparing our results for the full sample period with the benchmark linear estimates of Chinn and Frankel (2007, Table 8.4, p. 303), our estimates of the size effect (designed to capture network effects) are about twice as large (but they are exactly the same when we restrict the estimation period to post-1973, as they do). Those of the lagged dependent variable (designed to capture persistence effects) are the same. And the estimate for the exchange rate trend (designed to capture credibility effects) is essentially identical to theirs, except that in our sample it is statistically significant.[28]

However, there are significant differences between subperiods. The coefficient capturing network effects in Table 1 is much smaller in the second period than in the first. The change in magnitudes is statistically significant at the 1 percent confidence level.[29] This evidence suggestive of a weakening of network effects is consistent with the so-called new view of the international monetary system (see for example Eichengreen, Chiţu, and Mehl, forthcoming) in which, due to the weakness of network increasing returns, there is more space today for multiple reserve currencies to coexist. At the same time, there is evidence of an increase in persistence. The coefficient on this variable is larger after 1973 than before, and the difference is statistically significant at the 5 percent level of confidence.[30]

These results are intuitive. That inertia is stronger post-Bretton Woods reflects the fact that the post-1973 period has not seen a rapid shift from one currency to another comparable to the shift from sterling to the dollar that occurred between 1947 and 1973. Before 1973, serious doubts about the prospects for sterling as a reserve currency caused reserve managers to question their habits and move away from the currency; that the United States has, for the most part, avoided creating equally serious doubts about the dollar has allowed persistence effect to, well, persist.

That network effects are less strong is similarly intuitive. This reflects progress with interoperability between currency units and declining switching costs, and

[27]Table B2 reports results with missing observations and Table B3 without. The main difference is that the interaction term for policy credibility and the post-1973 period dummy in column 4 is now insignificantly different from zero. That this result changes is not surprising, since allowing for exchange rate effects in the dependent variable creates the potential for spurious correlation with the exchange rate when the latter is included as an independent variable. We are therefore more inclined to trust the estimates of credibility effects in Table 1.

[28]Note that one needs to use unstandardized explanatory variables to compare the magnitude of our estimates with theirs. We also compute the exchange rate as SDRs per national currency unit, whereas Chinn and Frankel compute it as national currency units per SDR, which explains the difference in the reported sign of the effect.

[29]According to a Chow test.

[30]Our most extensive discussion of the "old" and "new" views is in Chiţu, Eichengreen, and Mehl (2014). In practice, the large coefficient on the lagged dependent variable (evidence of significant—but not insurmountable—persistence effects) may reflect the obstacles to the quick liquidation of sterling reserves discussed in Section II.

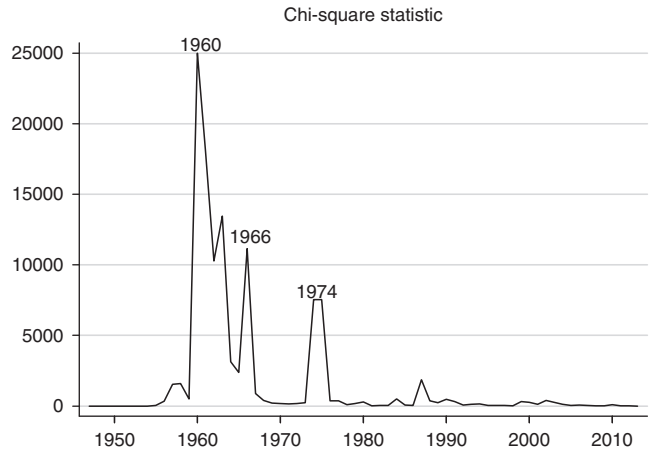
argues for replacing the traditional (or "old") view of international currencies—according to which sufficiently strong network increasing returns lead to a natural monopoly in international currency status—with a "new" view with very different theoretical foundations and empirical implications. The new view builds on the literature on standards that emphasizes open systems, for instance in information technology or systems engineering. It builds on work in which switching costs can be overcome by effective coordination mechanisms and/or large shocks (see for example David and Bunn, 1988; Clark, 2003; Farrell and Klemperer, 2007).[31] Examples of forces that contributed to reduce switching costs in this context include advances in financial and transactions technologies, development in currency swap markets, proliferation of hedging instruments, progress with availability of information on foreign exchange markets. All this has allowed central banks and others engaged in international transactions to conduct their transactions—and hold reserves against associated contingencies—in currencies other than the dominant one(s) without incurring costs as large as before, thereby weakening network effects.

The alternative to using historical information and priors as a basis for hypotheses about structural shifts in the relationship between reserves and their determinants is to let the data speak. When we run rolling Chow tests for the coefficients on persistence, issuing-country size as a proxy for network effects, and policy credibility, the test statistic is largest in 1960 (see Figure 4). This was the year when U.S. official foreign monetary liabilities first exceeded U.S. gold reserves and when Triffin (1960) warned that a run by official foreign creditors that would exhaust U.S. gold reserves was now possible. There is evidence of another structural break in 1966. This was the year preceding the second post-World War II devaluation of sterling, which was already then of great concern to investors, and was followed by another discrete decline in sterling reserves. It was the year immediately before France's withdrawal from the Gold Pool, which collapsed shortly afterwards, under which the United States and European countries holding dollar reserves agreed to reimburse the United States for a portion of the gold it lost when other countries converted their dollars into gold.[32] It was also a year of heightened concern over the future of the Bretton Woods System and hence of the dollar peg.[33] The only other Chi-square-statistics that

[31]Open standards, such as Linux, Apache or TeX, to take a few examples, are interoperable by design, with no specific cost or benefit for any user (aka foreign reserve holder) for selecting one product (aka unit) over another on the basis of standardized features. The vendors' (aka reserve currency issuers) products (aka units) compete on an array of factors, such as performance, price, user-friendliness, and so on (aka reliability as a store of value, liquidity, and so on) while maintaining users' data intact and transferable (aka foreign reserve holdings in a particular unit) even if the latter decide to switch to a competing product (aka to an another unit). Where the old view emphasized network effects, the new view emphasizes open systems, as just noted. Where the old view placed great weight on network effects, first-mover advantage and lock-in, the new view posits that interchangeability costs are not that high and first-mover advantage can be overcome relatively quickly.

[32]The Gold Pool is the subject of Eichengreen (2007, Chapter 3).

Figure 4. Time-Varying Structural Break Test Results



Note: The figure shows the time-varying Chow test statistic (that is, of the restriction test that the three coefficients on persistence, size and credibility interacted with a step dummy are insignificant) obtained when the step dummy is allowed to vary across all years of our sample. The critical value of a χ^2 (3) distribution at the 1 percent level of confidence is 11.34.

come close to rivaling the 1960 and 1966 values are in the first years of the floating exchange rate era, in line with the "upheaval hypothesis."

Dividing the sample in 1966 as opposed to the early 1970s has minimal impact on point estimates and confidence intervals.[34] Nonetheless, the fact that the sharpest shift in the relationship between the currency denomination of foreign reserves, on the one hand, and persistence, issuing-country size, and policy credibility, on the other, occurs in the 1960s rather than in 1971–74 highlights how contemporaries may have overestimated the extent to which the actual collapse of Bretton Woods would tarnish the attractions of the dollar. It highlights how they may have overestimated the extent to which the demand for and composition of reserves would be altered in fundamental ways by the *actual* shift from fixed to flexible exchange rates, as opposed to *anticipations* thereof.[35]

But regardless of whether one places the shift in 1960, 1966 or the early 1970s, our results are consistent with the fact that the determinants of the demand for and

[33]One indication is that there is a sharp local peak in the number of books citing Bretton Woods, according to Google's Ngram Viewer around 1966–68. The year 1968 was in turn a key year in negotiations to create Special Drawing Rights as a possible alternative to dollar reserves; an amendment to this effect to the IMF's Articles of Agreement was drafted and ratified by a growing number of countries in the course of the year, although the amendment only came into effect in 1969 and actual SDRs were only issued (in small amounts) starting in 1970.

[34]Note also that dividing the sample in 1960 leaves too few observations for meaningful estimates for the preceding period.

[35]As aforementioned, see for example Frenkel (1978) and Heller and Kahn (1978).

composition of international reserves fundamentally changed by the time of the breakdown of Bretton Woods.

IV. Robustness

We subjected these results to an extensive series of robustness tests: allowing for the impact of financial market development and liquidity, controlling for additional potential determinants of reserve currency choice, replacing exchange rate variability with alternative inflation-based measures of credibility, allowing for time-varying covariances (or "beta") that may affect the demand for a currency as a safe asset, using Tobit and GMM estimators to control for zero values and simultaneity, estimating error-correction models as an alternative treatment of persistence, allowing for nonlinear effects by specifying the dependent variable as a logistic function of currency shares, allowing for region fixed effects, and estimating the same aggregate relationships on a panel of country-level data for the Group of Ten advanced economies.[36] The results are strikingly consistent with those reported above.

- We examined the impact of financial market development and liquidity, emphasized previously by inter alia Portes and Rey (1998) and Papaioannou and Portes (2008). Following Chinn and Frankel (2007 and 2008) we added (the logarithm of) foreign exchange market turnover (in billions of U.S. dollars) as a measure of liquidity. This required us to limit the sample to the period since 1973 due to the unavailability of earlier data on turnover.[37] The new variable entered with a positive coefficient indistinguishable from zero, although it is difficult to say whether this reflects the absence of an effect or the more limited sample size.
- An alternative is to use stock market capitalization relative to GDP as a measure of financial market liquidity and development, in the manner of Rajan and Zingales (2003).[38] We constructed estimates of stock market capitalization using data from Rajan and Zingales (2003) and Beck, Demirgüç-Kunt, and Levine (2009).[39] The estimates again showed market development and liquidity as entering with an insignificant coefficient and adding little to the variation explained by the equations in Section III.[40]

[36]See Tables B4–B10 in the online appendix.

[37]Foreign exchange turnover was taken from the BIS Triennial Surveys of global foreign exchange market activity back to 1986 as well as from G30 and national central bank reports for the period 1973-86, as in Chinn and Frankel (2007 and 2008). Following the practice of these other authors they were linearly interpolated to annual data.

[38]Chen, Peng, and Shu (2009) and Huang, Daili, and Gang (2014) use stock market capitalization as a measure of liquidity and financial development and find that it is economically important and statistically significant in the recent period. A further alternative would be to use bond market capitalization as a metric, but data then would have an insufficiently long time span: BIS data usually go back to the mid-1990s and those from Beck, Demirgüç-Kunt, and Levine (2009) to the late 1980s.

[39]We used the Rajan and Zingales (2003) data for the period 1950–99 (linearly interpolated to annual data) and the data in Beck, Demirgüç-Kunt, and Levine (2009) for the period 1999–2013. The data on nominal GDP were taken from the IMF's *International Financial Statistics*.

- We controlled for a number of additional potential determinants of reserve currency choice, such as the public debt-to-GDP ratio, fiscal balance-to-GDP ratio, current account balance-to-GDP ratio, volume of exports in goods, long-term bond yields, exchange rate volatility (as estimated from GARCH(1, 1) models (which may be thought of as alternative measures of policy credibility), as well as reserve-currency-country exports of goods (which might be thought of as an alternative measure of network effects). The main results were again robust to these changes. In particular, the coefficients on persistence, network effects, and credibility were little different from those obtained with our basic model in Table 1. There was similarly little change in the estimated structural shifts pre- and post-1973. Of the additional control variables, only public debt and the fiscal balance enter significantly. This is consistent with Frankel's (2013) observation that the two periods when the downward trend in the dollar's share starting in the mid-1970s paused—namely the 1990s and the most recent few years—are also the two periods when the U.S. budget balance improved.
- Insofar as finance theory suggests that it is covariances that matter, not the first or second moments, it could also be argued that if a currency has a " negative beta" (that is, it appreciates in times of crisis), it will be regarded as attractive to hold as reserves. We hence estimated time-varying currency betas which we included as an additional control variable.[41] Our standard results remained robust.
- In addition, we estimated the same equation excluding the euro and replacing the exchange rate trend with CPI inflation as still another measure of policy credibility (results are not reported for sake of brevity). The main findings were robust to these changes as well.[42]
- We obtained panel Tobit estimates to control for the boundedness of reserve currency shares, which may lead to censoring insofar as several units have values close to near zero and only a few are closer to the distribution's center.[43] The results were again unchanged from those for our basic model in Table 1. The

[40]Another alternative still is to substitute the log level of market capitalization for country size. In this case, stock market capitalization enters positively (but insignificantly) before 1973, while the interaction term for the post-1973 is negative (but also insignificant). This echoes the pattern found in the baseline model for economic size. Hence it is hard to know whether results obtained using this specification are in fact capturing the effects of market development and liquidity, or those of country size, with which market capitalization is correlated. This causes us to prefer the results shown in Table 1 and discussed in the text.

[41]The time-varying betas were estimated as five-year rolling beta estimates where the dependant variable are log currency *i* returns and the independent variable is the weighted average of the log returns in all other currencies of our sample (a proxy for world currency returns minus currency *i* itself to avoid spurious correlations), and where the weights are time-varying country shares in world exports in year *t*.

[42]One exception was that the effect for the credibility of policies measured by inflation rates was found to have weakened post-1973 (not increased). This is likely to reflect the correlation between relatively high British inflation and the falling share of sterling in international reserves over the earlier period. U.S. inflation in the later period, evidently, had a smaller and less significant effect, on the other hand.

[43]As noted before, one then has to forego robust standard errors adjusted for clustering.

estimates where we allowed for the possibility of a structural break in 1973 were, in fact, virtually identical to those in Table 1.[44]

- We adjusted for possible endogeneity using GMM. The estimation results were obtained with a collapsed set of instruments, as suggested in Roodman (2009), in order to minimize instrument proliferation bias.[45] The resulting estimates were again very close to those obtained with our baseline specification.
- Since reserve currency shares are persistent, we estimated error-correction models. The resulting long-run estimates suggest that the elasticity of currency shares with respect to a one-standard deviation increase in economic size is about 21, against one in the case of a one-standard deviation exchange rate appreciation. These elasticities are in the same ballpark as in the baseline model. The single-equation error-correction model estimates further suggest that the speed of adjustment was on the order of 6 percent per year. In other words, half of the deviation from equilibrium is eliminated after seven years, again consistent with the baseline estimates.
- We controlled for unobserved continent effects. We grouped currency units by continent: North America (Canadian dollar, U.S. dollar), Asia-Pacific (yen, Australian dollar) and Europe (all other units). The full model estimates are again similar to those of the baseline model in terms of sign, statistical significance, and economic magnitude. They again suggest that network effects became weaker and credibility effects stronger after the breakdown of Bretton Woods. They also suggest that inertia effects tended to become stronger.[46]
- We considered a logistic transformation of the dependent variable in the spirit of Chinn and Frankel (2007 and 2008).[47] We again find evidence of significantly stronger credibility effects following the breakdown of Bretton Woods, as in the baseline specification. There is also evidence that inertia effects became stronger and network effects weaker after the breakdown of Bretton Woods, but in this case the change is not statistically significant. [48]
- Finally we estimated the same relationships on country-level data for a subset of advanced economies (the former G10; see CGFS, 2010 and Kubelec and Sá,

[44]The reason is that we have no right/left-censored variables, in fact, so that Tobit estimation is actually not needed. When we obtain estimates without missing observations, the standard errors become quite large, however, which might be due to the fact that they are not robust to heteroskedasticity.

[45]In constructing the instrument matrix, we treated persistence, size, and credibility as endogenous and the year dummies as exogenous. The very high *p*-value of the Hansen statistic (which overwhelmingly suggests that the instruments are orthogonal) likely indicates that the number of instruments remains still very large relative to the number of currency units despite the Roodman (2009) correction. Moreover, there is evidence of significant dynamic effects at only the 25 percent level of confidence, as measured in the first-order serial correlation of the first-differenced disturbances of the estimated models (and evidence of second-order serial correlation in two specifications).

[46]Although the change was not statistically significant.

[47]Where the logistic transformation is defined as log[share/(1-share)].

2012). These provide annual foreign exchange reserve holdings divided into U.S. dollar and nondollar holdings. We used the share of the U.S. dollar in total foreign exchange reserves as the dependant variable and estimated the basic specification using panel-data methods. The results were again broadly similar as those described above. Again there was evidence of significantly stronger inertia effects and weaker network effects after the collapse of Bretton Woods. There was also evidence of stronger credibility effects, although this change was not statistically significant.[49]

V. Policy Variables

The long span of our new series allows us to consider whether, not only factors like persistence, network effects, and credibility, but also policies to encourage or discourage the international use of particular national units had a bearing on international reserve currency status.

One potential explanation for the continued dominance of the U.S. dollar is the reluctance of other countries to permit international use of their currencies. Germany in the 1960s and 1970s used capital controls and other measures to limit the accessibility and liquidity of the deutschemark as a way of discouraging central banks from holding deutschemark reserves, on the grounds that their doing so might undermine the Bundesbank's efforts at inflation control. Japan between the 1950s and the early 1980s similarly maintained a panoply of controls and regulatory restrictions designed to limit official foreign holdings of the yen, on the grounds that such holdings would complicate its pursuit of industrial policies.

We consider measures adopted to support and discourage use of their national currencies as foreign reserves by these two countries and, in addition, by the United States and the United Kingdom.[50] The United Kingdom, as noted, took a variety of steps in the 1940s and 1950s to limit the liquidation of sterling reserves; subsequent policy initiatives, such as the City of London's financial "big bang" liberalization in 1986, can be seen as supporting sterling's international role. The United States for its part adopted a number of policies to support the dollar's international role, such as the Interest Equalization Tax in 1963 and the Voluntary Credit Restraint Program in 1965, designed to limit capital outflows, stem gold losses, and foster confidence in official convertibility of the dollar.

We distinguish four categories of measures related to: (a) financial openness, (b) official positions and verbal interventions on internationalization, (c) reform

[48]It could be argued that a logistic transformation of the dependent variable is not practical here because such a nonlinear transformation may lead to inconsistent estimates (especially when reserve currency shares are close or equal to zero). See Santos Silva and Tenreyro (2006) for further details.

[49]This may reflect the fact that we could not adjust the dependent variable for exchange rate valuation effects in the absence of information on the currency composition of non-U.S.-dollar reserve holdings. These results are available from the authors on request.

[50]We are not aware of similar measures adopted by other countries in our data set.

and regulation of the exchange rate system-cum-regime, and (d) other miscellaneous measures. Financial openness is measured with the two de jure indices of Quinn and Toyoda (2008) which capture, on the one hand, how compliant a country is with its obligations under the IMF's Article VIII to free from government restrictions the proceeds from international trade of goods and services and, on the other hand, the extent of restrictions to capital outflows and inflows by residents and nonresidents.[51] Under each category we further distinguish measures designed to encourage international use of the currency from measures to discourage it. This gives us a total of six dummy variables capturing six categories of potential policy effects.

Figures A1–A5 in the online appendix provide an overview of the measures. The measures other than the two financial openness indices are coded as standard 0/1 dummies in the empirical estimations, in the same manner as policy measures that aim to explicitly encourage international currency use.

Insofar as these policy measures were not adopted randomly, the effects we measure may not be causal. Still, the results, in Table 2, are suggestive. They confirm that policies matter, but not all policies and not all in the same way. They suggest that it is easier to discourage than to promote reserve currency use. Policies that aim to support currency use are often unsuccessful, with a few notable exceptions. There is some evidence that financial openness helped to strengthen the importance of a particular unit as a reserve currency. For instance, the estimates of column 4 suggest that a one-standard-deviation increase in a country's financial openness (that is, about 21 index points) is associated with an increase in the share of its currency in global reserves of roughly half a percentage point in the short run and 6 percentage points in the long run. But other supportive policies were less obviously important. Their effect is typically insignificant.

In contrast, policies that aim to *discourage* currency use have often had significant effects. This is the case of unsupportive official positions, unsupportive exchange rate regime measures (that is, devaluing/debasing one's currency like the repeated devaluations of sterling between 1947 and 1976 or those of the U.S. dollar in the early 1970s), and other unsupportive measures that may have dented confidence in a unit as a store of value (for example, like the collapse of the Gold Pool or discussions about an IMF substitution account in the case of the dollar).[52] For instance, the estimates of column 4 suggest that devaluations are typically associated with a decline in the share of a country's currency in global reserves of roughly 2 percentage points in the short run and 24 percentage points in the long run.[53]

Note that none of our findings concerning structural changes in impact of network effects is altered by adding the policy variables. This is further evidence in

[51]The indices run from 0 (financial autarky) to 100 (complete financial openness) and are available for all the currencies in our sample.

[52]In general, the effect of unsupportive official positions and unsupportive exchange rate regime-related initiatives is economically smaller than that of other unsupportive measures.

[53]As aforementioned these estimates are obtained with currency shares already purged of exchange rate valuation effects.

Table 2. Estimates with Policy Measures

	(1) Full Sample	(2) Pre-1973	(3) Post-1973	(4) Full Sample	(5) Pre-1973	(6) Post-1973
Inertia	0.917***	0.789***	0.940***	0.916***	0.801***	0.952***
	(0.010)	(0.078)	(0.018)	(0.015)	(0.087)	(0.016)
Network effects	1.855***	6.513***	1.305***	1.969***	5.392***	1.097***
	(0.273)	(1.130)	(0.331)	(0.347)	(1.572)	(0.323)
Credibility	0.021	–0.746	0.046	0.127***	–1.238	0.104*
	(0.059)	(1.760)	(0.045)	(0.043)	(1.244)	(0.056)
IMF art. VIII compliance	0.036***	–0.068	0.030*			
	(0.007)	(0.065)	(0.016)			
Capital flow restrictions				0.023***	–0.012	0.008
				(0.004)	(0.039)	(0.007)
Official position (supportive)	–0.368	0.000	–0.592	–0.294	0.000	–0.559
	(1.222)	(0.000)	(1.160)	(1.217)	(0.000)	(1.159)
Official position (restrictive)	–3.044***	–3.424	–2.112***	–3.298***	–4.637	–2.164***
	(0.885)	(3.693)	(0.592)	(0.860)	(4.414)	(0.561)
Exchange rate regime	–0.073	0.000	0.487	–0.060	0.000	0.564
(supportive)	(0.827)	(0.000)	(0.818)	(0.871)	(0.000)	(0.844)
Exchange rate regime	–2.053**	–2.597	–2.588***	–2.058**	–2.194	–2.644***
(restrictive)	(0.936)	(4.922)	(0.536)	(0.924)	(4.795)	(0.510)
Other measures (supportive)	–0.098	–1.794**	0.839+	–0.180	–1.874*	0.694
	(0.384)	(0.844)	(0.600)	(0.368)	(1.025)	(0.630)
Other measures (restrictive)	–5.755***	–10.644**	–3.969***	–5.769***	–10.006**	–3.880***
	(0.824)	(4.337)	(0.425)	(0.847)	(4.121)	(0.422)
Country effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Observations	271	42	229	271	42	229
No. of groups	8	4	8	8	4	8
R^2 (overall)	0.994	0.991	0.996	0.994	0.991	0.996
R^2 (within)	0.904	0.828	0.864	0.902	0.828	0.863
R^2 (between)	1	1	1	1	0.999	1

Note: The table reports random effects estimates of our baseline equation where reserve currency shares purged of valuation effects are regressed on their standard determinants over selected sample periods, namely: the full sample (in columns 1 and 4); 1947–72 (in columns 2 and 5), 1973–2013 (in columns 3 and 6) controlling for policy measures that aim to support or restrict international currency use of the U.S. dollar, Pound sterling, Deutsche Mark and Japanese yen and for financial openness for all currency units. Standard errors reported in parentheses are robust to heteroskedasticity and clustered heterogeneity; ***p<0.01, **p<0.05, *p<0.1, ^{+}p <0.16.

favor of the "upheaval" hypothesis that the determinants of the demand for and composition of international reserves changed significantly with the collapse of Bretton Woods.

VI. Conclusions and Implications

We have analyzed whether the demand for and composition of international reserves was fundamentally altered by the shift from fixed to flexible exchange rates around the time of the collapse of the Bretton Woods System. In doing so we have utilized newly assembled data on the currency composition of reserves,

its determinants, and policy measures designed to encourage or discourage the internationalization of national currencies since World War II.

We find strong evidence of shifts in the determinants of currency shares around the time of the breakdown of Bretton Woods: the effects of inertia and the credibility of policies on reserve currency choice became stronger post-Bretton Woods, while those associated with network effects weakened.

That the effects of inertia have become stronger may be seen as acting in favor of the leading currency, namely the dollar, a fact underscored by the resilience of its share in global reserves since the financial crisis (a period encompassed by our data). In contrast, that network effects have weakened works against the dollar's first-mover advantage. To be sure, persistence can have other sources besides network effects giving rise to first-mover advantage, such as habit formation or the absence of viable alternatives for providing reserves on the scale demanded. At the same time, the observation that persistence is not guaranteed by network effects suggests that its existence, and the dollar's continued dominance, should not be taken for granted.

In addition, our results suggest that the policy toolkit to encourage reserve currency status and overcome inertia effects has been dominated by two instruments: macroeconomic stability and capital account openness. In contrast, the policy toolkit available to discourage international currency use has additional instruments, including official announcements and, exchange-rate-regime-related measures.

These last findings have obvious implications for China's earlier policies of discouraging international use of the renminbi and now for its efforts to promote it. They are consistent with the effectiveness of China's capital controls in limiting international use of the currency and with the evidence of Huang, Daili, and Gang (2014) that the renminbi still punches below its weight as an international reserve unit. There is ample earlier precedent for the effectiveness of such restrictive policies. At the same time, our findings suggest that, while capital account liberalization may be necessary for renminbi internationalization, it will not suffice, and that the success of the other policy initiatives needed to achieve this goal cannot be taken for granted.

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