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Will the Euro Eventually Surpass the Dollar as Leading International Reserve Currency?

Menzie Chinn and Jeffrey A. Frankel

Might the dollar lose its status as unrivaled international reserve currency? Could it be "going the way of sterling, the guilder, the ducat and the bezant" (Kindleberger 1995, 6)? Some authors argued as much in the early 1990s.[1] The international use of the yen and mark had risen rapidly in the 1970s and 1980s, reducing the share of the dollar (see table 8.1 or figure 8.1).[2] Some suggested that the yen or mark might eventually overtake the dollar as the lead international currency. (See figures 8.2 and 8.3.)

By the turn of the millennium, that idea had come to sound far-fetched. In the meantime, both Japan and Germany had undergone a decade of remarkably low economic growth, the yen had declined, and the mark had

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1. Others who "cried wolf," besides Kindleberger, include Kunz (1995). The February 25, 1995, issue of *The Economist* included an article and leader arguing that "the dollar's dominance is waning" at the expense of the deutsche mark in particular. See also Ramon Moreno, "Will the Yen Replace the Dollar?" *Federal Reserve Bank of San Francisco Economic Letter,* no. 96-30, October 18, 1996.

2. In this study, we rely upon data available to us as of June 2005. Admittedly, there may be some distortions in the way the data have been recorded by the Fund. Ted Truman notes in his discussion that there is a potentially large impact from the establishment of the European Monetary Cooperation Fund. Dollars were swapped for the ECU, which appeared as a lower dollar share, and gold was also swapped for ecu which expanded the base and resulted in a lower dollar share.

Table 8.1 Share of national currencies in total identified official holdings of foreign exchange, end of year (%)

	1965	1973	1977	1982	1987	1992	1997	2003
U.S. dollar	56.1	64.5	79.2	57.9	53.9	48.9	59.1	63.8
Japanese yen	0.0	0.1	2.2	4.1	6.8	7.4	5.1	4.8
Pound sterling	20.0	4.2	1.6	1.8	1.9	2.6	3.3	4.4
Swiss franc	0.0	1.1	1.9	2.3	1.7	0.8	0.5	0.4
Euro	0.0	0.0	0.0					19.7
Deutsche mark	0.1	5.5	9.3	11.6	13.8	14	13.7	
French franc	0.9	0.7	1.1	1	0.9	2.6	1.5	
Netherlands guilder	0.0	0.5	0.7	1	1.2	0.7	0.5	
ECUs	0.0	0.0	0.0	13.8	13.6	9.7	5	
Unspecified currencies	22.9	23.6	4.1	6.5	6.4	13.3	11.3	6.8

Source: IMF data—updated version of statistics contained in the IMF *Annual Report.* 1997 and 2002 figures from 2004 *Annual Report.*

Notes: Shares of total currency holdings by central banks.

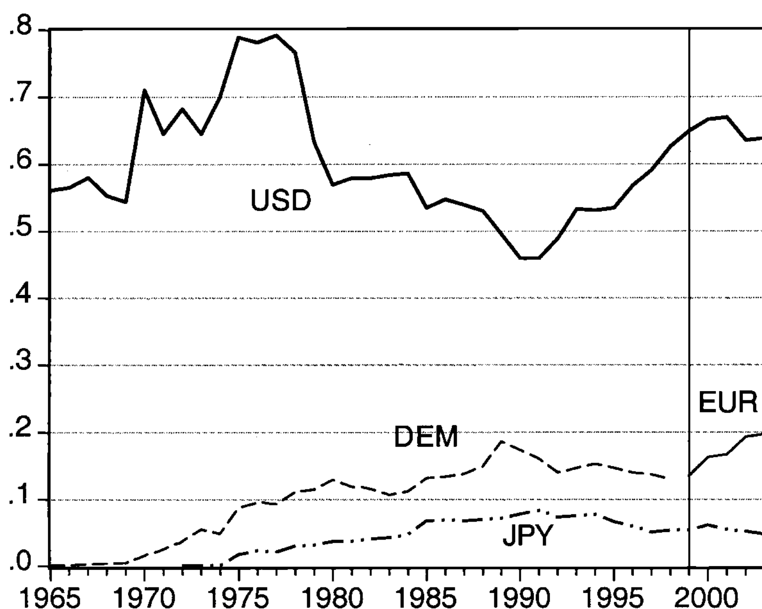

Fig. 8.1 Reserves held by central banks as shares of total—Major currencies

Source: For post-1979 period, revised IMF data from 2004 *Annual Report* spliced into unpublished data.

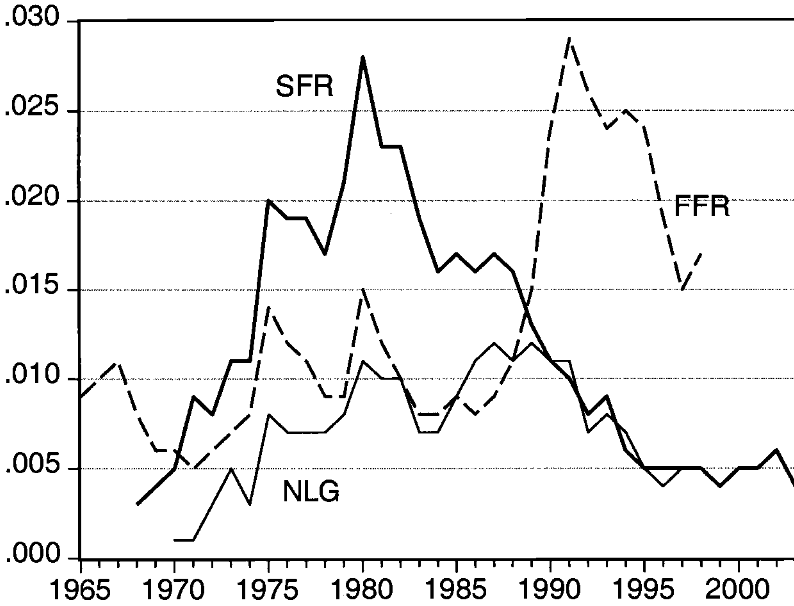

Fig. 8.2 Reserves held by central banks as shares of total—Smaller currencies
Source: For post-1979 period, revised IMF data from 2004 *Annual Report* spliced into unpublished data.

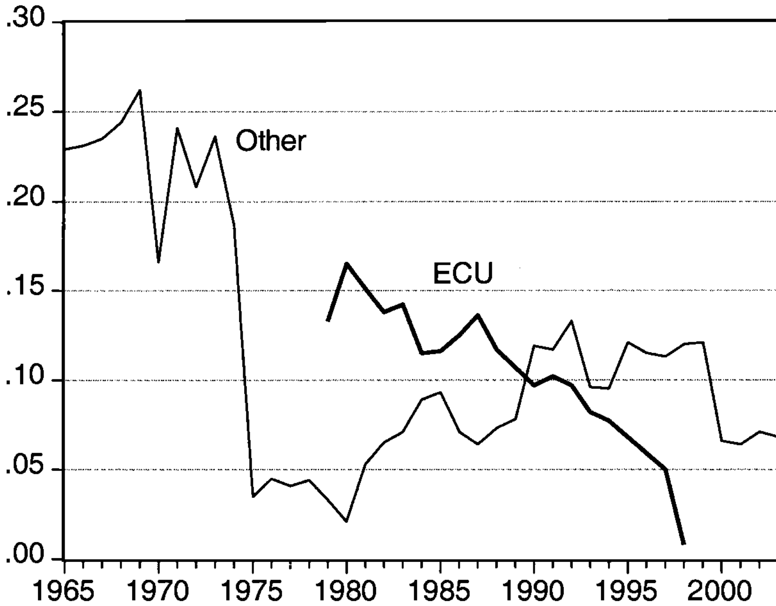

Fig. 8.3 Reserves held by central banks as shares of total—Other currencies
Source: For post-1979 period, revised IMF data from 2004 *Annual Report* spliced into unpublished data.

disappeared altogether. Fears that the international currency status of the dollar was under challenge were premature, as should have been obvious at the time. Indeed, the international role of the dollar, at least as measured by its share of central banks international reserves, had stopped declining in 1990 and had begun to reverse in the early 1990s. (Again, refer to table 8.1 or figure 8.1.) Meanwhile, dollarization was increasing in Latin America and elsewhere.

These developments were overshadowed by exchange rate movements: the continuation of the dollar's post-1985 trend of depreciation, which lasted until 1995. Perhaps people have trouble distinguishing the question of whether a currency like the dollar is declining in international reserve currency status from the question of whether its foreign exchange value is falling. It seems that the question of whether the dollar might lose its privileged status as lead international currency comes up each time the dollar experiences a few years of depreciation (late 1970s, early 1990s).

The dollar underwent a new depreciation in 2002 to 2004. On the basis of this fact alone, one could have predicted that international economists might be once again called upon to try to answer questions regarding the international currency rankings.[3] Indeed, as the rise of the dollar-euro exchange rate reached its third year in late 2004, the financial press began to report that central banks were on the verge of large-scale diversification out of dollars.[4]

This time may be different than the earlier scares in the late 1970s and early 1990s. The difference is that the euro now exists as a plausible rival.[5] Notwithstanding the bumps in the road of European monetary integration and the doubts of many American economists, the European Monetary Union (EMU) became a reality in 1999, and the euro appeared in physical form four years later. The new currency passed the most fundamental tests: the transition was relatively smooth, twelve countries today use the euro (and only the euro), and the new currency has entered into international use as well.

3. "Sometime soon, newspaper stories will begin reporting that central banks in Asia and elsewhere are diversifying out of dollars into euros, and that the dollar is in danger of eventually losing its status as premier international currency" Frankel (2004).

4. For example, *The Economist* (12/04/04, 2/26/05); *Financial Times* (1/24/05, 3/8/05, 3/11/05, 3/19/05, 5/17/05, 5/19/05, 5/21/05); *New York Times* (3/11/05); and many others.

5. One of the present authors in the mid-1990s took a bullish position regarding the prospects for the dollar (e.g., in Frankel 1995): "It is unlikely that some other currency will supplant the dollar as the world's premier currency . . . There is no plausible alternative for the number one position" (Eichengreen and Frankel 1996, 363). But those papers also acknowledged "the possibility of a single currency coming into use throughout Europe, which would indeed pose a challenge to the supremacy of the dollar if it was to happen . . ." (366). "And as the euro becomes more important as a vehicle currency, it is likely to gain use as an intervention currency and to become an increasingly popular form in which other countries hold their reserves. Ultimately, the creation of the euro would mean a new and increasingly powerful rival for the dollar as the international monetary system's leading reserve currency." (372).

Table 8.2 **Roles of an international currency**

Function of money	Governments	Private actors
Store of value	International reserves	Currency substitution (private dollarization)
Medium of exchange	Vehicle currency for foreign exchange intervention	Invoicing trade and financial transactions
Unit of account	Anchor for pegging local currency	Denominating trade and financial transactions

In the first few years of its life, the euro did not receive much respect. This was largely related to its substantial weakness against the dollar. Certainly anyone who had predicted that on January 1, 1999, there would be a worldwide shift out of dollar reserves into the new alternative, and that the increased demand for euros might cause a large appreciation, was initially disappointed.[6] But subsequently this depreciation was fully reversed, and then some, in the strong appreciation of 2002 to 2004.

This paper will seek to ascertain the determinants of international reserve currency status and to make some predictions as to whether the euro might under some conditions eventually overtake the dollar and, if so, when.

8.1 International Currency Rankings

First are some definitions. An international currency is one that is used outside its home country. Reserve currency status is the main subject of this paper, but it is just one of a number of possible measures of international use. The others can be neatly summarized by means of a simple 2×3 table originally suggested by Benjamin Cohen (1971) and refined by Peter Kenen (see table 8.2). The classic three functions of money domestically—store of value, medium of exchange, and unit of account—can be transferred to the level of international money. Under each function, there are important examples of how government authorities and private actors sometimes choose to use a major international currency that is not their own. The subject of this paper appears in the first cell, the decision of central banks to hold their reserves in the form of particular currencies. But other possible

6. "There will probably be a portfolio diversification of $500 billion to $1 trillion into euros. Most of this shift will come out of the dollar. This in turn will have a significant impact on exchange rates during a long transition period. The euro will move higher than will be comfortable for many Europeans . . . The euro will probably be strong from its inception" Bergsten (1997, 84–85). Portes and Rey (1998), also writing at a time of dollar strength, suggested that American policymakers had been overly pessimistic about the euro's prospects. These authors were exceptional in their countercyclical faith in the euro.

criteria of an international currency also appear in the table: currency substitution (e.g., the circulation of dollar currency in Latin America and elsewhere), denominating or invoicing foreign trade, denominating or invoicing international financial flows, pegs for smaller countries' currencies, and foreign exchange trading.

We focus on reserve currency holdings for two reasons. First, annual data for all relevant currencies are available over the last thirty years or more; the other international roles that appear in table 8.2 are nowhere near as comprehensively quantifiable. A second reason for focusing on the reserve currency role is that it is more relevant than the others to the important questions of whether the United States will continue to be able to finance its current account deficit.

8.1.1 Should We Care about International Currency Rankings?

Is this question important? International currency status might seem to have fewer direct implications for the real economy than does the currency's exchange rate. But it is important nevertheless. To begin with, the exchange rate question and the international currency question have always been causally interrelated, notwithstanding some periods such as the early 1990s when they have moved in opposite directions. But the topic has become newly urgent in light of the question whether the U.S. current account deficit is sustainable. How long can it continue? The historical experiences of other countries with current account thresholds and reversals are not particularly relevant in that the argument for sanguinity relies on the special role of the dollar in the world financial system. This paper was written for a conference on the sustainability of the G7 current account imbalances, following two years when the major source of financing of the deficit was purchases of dollar assets by foreign central banks, especially in Asia. The sustainability of the U.S. current account deficit may depend on the continued willingness of foreign central banks to accumulate ever-greater quantities of U.S. assets, unless foreign private investors resume doing so. That, in turn, depends on two factors: (a) the desire of foreign central banks to continue intervening in foreign exchange markets to try to dampen or prevent the appreciation of their currencies against the dollar, and (b) the willingness of central banks to continue to hold the lion's share of their reserves in the form of dollars as opposed to some rival currency, that is, the euro. While the former question received a fair amount of attention in 2003 to 2004,[7] the latter question did not until 2005.[8]

7. For example, Dooley, Folkerts-Landau, and Garber (2003); Goldstein (2004).

8. Perhaps the question whether the currency preferences of central banks will continue to assign a special role to the dollar is not as important as the analogous question for private investors. But this is still a matter of the dollar's place as premier international currency, of which the reserve holdings is the most easily quantified aspect.

Advantages of Having an International Currency

One can think of four advantages to a country of having its currency play a large role in the world.

Convenience for the Country's Residents. It is certainly more convenient for a country's exporters, importers, borrowers, and lenders to be able to deal in its own currency than foreign currencies. The global use of the dollar, as with the global use of the English language, is a natural advantage that American businessmen tend to take for granted.

More Business for the Country's Banks and Other Financial Institutions. There need be no firm connection between the currency in which banking is conducted and the nationality of the banks (nor between the nationalities of the savers and borrowers and the nationality of the intermediating bank). Nevertheless, it stands to reason that U.S. banks have a comparative advantage at dealing in dollars, British banks at dealing in pounds, and so on.

Seignorage. This is perhaps the most important advantage of having other countries hold one's currency. They must give up real goods and services, or ownership of the real capital stock, in order to add to the currency balances that they use. Seignorage is not necessarily large if defined narrowly, as the low-interest loan accruing to the United States when foreign central banks hold their reserves as dollars. But it is much more important if defined broadly as America's "exorbitant privilege" of being able to borrow abroad large amounts in its own currency, especially while simultaneously earning much higher returns on foreign direct investment (FDI) and other investments in other countries. This was the basis of European resentment against the U.S. basic balance deficit in the 1960s and against the dollar standard to the extent that the European need to acquire dollars was the fundamental origin of the deficit. The willingness of Asians and others to continue financing the U.S. current account deficit in the future is certainly related to the dollar's continued role as premier international reserve currency. We are not necessarily talking about seignorage narrowly defined (foreign holdings of U.S. currency, which doesn't pay interest). More important is the U.S. ability to run up huge debts denominated in its own currency at low interest rates. The United States has consistently earned more on its investments overseas than it has had to pay on its debts, a differential of about 1.2 percent per annum (e.g., Cline, 45). Possibly this American role of the world's banker (taking short-term liquid deposits and lending long term in riskier higher-return assets) would survive the loss of the dollar as leading international currency. But it also seems possible that the loss of one would lead to the loss of the other.

Political Power and Prestige. Britain's gradual loss of key currency status was simultaneous with its gradual loss of political and military preeminence. As with most of the other benefits and conditions mentioned in the preceding, causality here flows in both directions. We shall come back to this issue in section 8.3.

Disadvantages of Having an International Currency

One can think of three disadvantages from the viewpoint of a key currency country. They explain why Japan and Germany were in the past reluctant to have their currencies held and used widely and why China worries about the implications of beginning to internationalize its currency.

Larger Fluctuations in Demand for the Currency. It is not automatically clear that having one's currency held by a wide variety of people around the world will result in greater variability of demand. Such instability is probably more likely to follow from an increase in the degree of capital mobility, than from key currency status per se. Nevertheless, the two are related. Central banks are sometimes concerned that internationalization will make it more difficult to control the money stock. This problem need not arise if they do not intervene in the foreign exchange market. But the central bank may view letting fluctuations in demand for the currency be reflected in the exchange rate as being just as undesirable as letting them be reflected in the money supply.

An Increase in the Average Demand for the Currency. This is the other side of seignorage. In the 1960s and 1970s, the Japanese and German governments were particularly worried about the possibility that if assets were made available to foreign residents, an inflow of capital would cause the currency to appreciate and render exporters less competitive on world markets. Again, this is also China's problem today.

Burden of Responsibility. The monetary authorities in the country of the leading international currency may have to take into account the effects of their actions on world markets, rather than being free to devote monetary policy solely to domestic objectives. The Federal Reserve probably cut interest rates more than it otherwise would have in the second half of 1982, and again in late 1998, in response to international debt problems in Latin America and elsewhere. At times Argentina or others have considered officially dollarizing; reluctance to accept any burden of responsibility, even if only implicit, explains the lack of enthusiasm from U.S. authorities.[9]

9. For example, De Long and Eichengreen (2002) or Frankel and Roubini (2003). Thanks to Ted Truman for reminding us of this point.

8.2 The Approach of the Paper

The paper seeks econometrically to ascertain the determinants of international reserve currency shares over the period 1973 to 1998, before the advent of the euro.[10] The exercise is largely parameter estimation and calibration, without a lot of hypothesis testing. We intentionally impose a lot of a priori information because we need to squeeze a lot out of a small sample.

The literature on what determines reserve currency status is fairly well established, if often lacking in quantification. There are three key points:

1. Long-term determinants are important. A list of determining factors appears subsequently, in section 8.5. The most important is the size of the country or region in which the currency is indigenously used, but there are others as well.

2. Network externalities or economies of scale and scope are important. Each country is more likely to use whatever currency is used by others. Thus international currency use is not linear in the determinants. Rather, there may be a *tipping phenomenon:*[11] if one currency were to draw even and surpass another, the derivative of reserve currency use with respect to its determining variables would be higher in that range than in the vicinity of zero or in the range when the leading currency is unchallenged. In that sense, the switch happens rapidly.[12]

3. In the chronological sense, however, the switch happens slowly. Whatever currency has been used in the past will continue to be used in the future. Thus *inertia* is great.

We thus have three tasks: (a) ascertain the most important determinants and their relative weights, (b) confirm that the function is nonlinear and settle on an appropriate functional form, and (c) estimate the extent of inertia, which we will represent by means of a lagged endogenous variable. Our data come from reserve currency holdings of central banks over the period 1973 to 1998. One cannot be confident that any given data set will contain enough information to answer the questions of interest. Unfortunately the available data do not extend anywhere near far back enough in history to observe the fall of the pound from its number one position of a century ago. But the beginning of our data set does capture the mark passing the pound for the number two slot, which may be a useful data point for

10. Among previous attempts to estimate determinants of reserve currency shares are Dooley, Lizondo, and Mathieson (1989) and Eichengreen and Mathieson (2000).

11. Tipping arises in many contexts (Schelling 1978; Gladwell 2000).

12. As Eichengreen (2005) points out, counteracting the arguments about network externalities and tipping, particularly in determining the reserve currency function, is an argument in favor of multiple simultaneous international currencies: competition for the affections of investors.

addressing the tipping phenomenon described in key point 2. We hope that there is enough variation among the other currencies and across the other years to obtain useful estimates of parameters of interest under key points 1 and 3.

The disappearance of the mark, franc, and guilder in 1999 and their replacement by the euro, constitute an irreparable break in the data series. But we hope to turn this obstacle to advantage. We obtain a check on the meaningfulness of the equation that was estimated on pre-1999 data by seeing whether it successfully predicts the direction of movement over the period 1999 to 2003. Then we use the equation to forecast the path of the currency shares of the dollar, euro, and other international currencies into the future, as a function of several different possible scenarios regarding, for example, whether the United Kingdom eventually joins the EMU. While we did not expect to predict that the euro could overtake the dollar anytime soon, we entered this exercise with a completely open mind regarding whether the euro might overtake the dollar in the longer term.

8.3 Brief History

There is of course an important historical precedent.[13] The pound sterling was the premier international currency of the gold standard period. Historians estimate, for example that 60 to 90 percent of the world's trade was invoiced in sterling in the nineteenth century (Broz 1997; Hale 1999). In 1899 the share of pound in known foreign exchange holdings of official institutions was more than twice the total of the next nearest competitors, the franc and the mark, and much greater than the dollar.[14]

8.3.1 When the Dollar Overtook the Pound

The U.S. economy in the late nineteenth century surpassed the British economy in size (1872).[15] United States's exports did not pull ahead of U.K. exports until World War I and did not do so on a permanent and substantial basis until World War II. (See figure 8.4.) The development of the financial system lagged further behind. One reflection is that the United States did not establish a central bank until 1913. During the years following 1914, the United States passed from net debtor to net creditor, while the United Kingdom moved in the opposite direction. This had much to do with British borrowing from the United States so as to fight World War I.

13. Alogoskoufis and Portes (1992) noted early on the precedent for the possible dethroning of the dollar.

14. $105.1 million in pounds, $27.2 million in francs, $24.2 million in marks, and $9.4 million in other currencies. In 1913, the ranking was the same: $425.4 million in pounds, $275.1 million in francs, $136.9 million in marks, and $55.3 million in other currencies (Lindert 1969, 16–22).

15. In 1990 International Gheary-Kamis dollars.

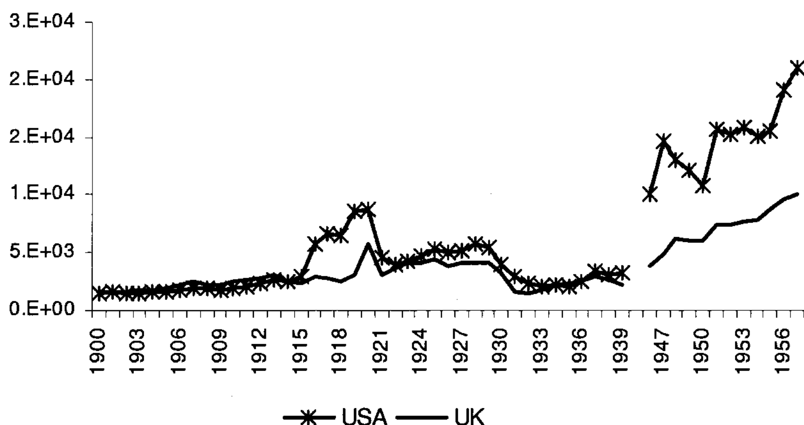

Fig. 8.4 U.S. and U.K. exports, 1900–1957 (in millions of dollars)
Sources: U.K. export data: Department of Trade and Industry, UK; U.K. exchange rate (1946–1970): Global Financial Data; U.S. Export Data: *Historical Statistics of the United States, Colonial Times To 1970,* published by the U.S. Census Bureau.

The dollar was the only currency to remain convertible into gold at a fixed price into the 1920s.[16]

As it emerged as a major international currency, the dollar's use in international trade and finance widened increasingly. The pound retained its dominant position as key currency in the interwar period, in large part due to the inertia in such arrangements that was noted previously. As late as 1940, the level of foreign-owned liquid sterling assets was still double the level of foreign-owned liquid dollar assets. By 1945, however, the position of the dollar and pound, as measured by this statistic, had precisely reversed.[17] World War II—entailing further U.S. lending, U.K. borrowing, and other economic consequences—had completed the dollar's rise to ascendancy.

The decline in the pound was clearly part of a larger pattern, whereby the United Kingdom lost its economic preeminence, colonies, military power, and other trappings of international hegemony. As some of us wonder whether the United States might now have embarked on a path of imperial overreach, following the British Empire down a road of widening federal budget deficits and overly ambitious military adventures in the Muslim world, the fate of the pound is perhaps a useful caution. The Suez crisis of 1956 is frequently recalled as the occasion on which Britain was forced under U.S. pressure to abandon its remaining imperial designs, but the important role played by a simultaneous run on the pound is often forgot-

16. For example, Nurkse (1944), Bergsten (1975, 53), and Eichengreen (1992).
17. See Aliber (1966, 19–20).

ten.[18] Paul Kennedy's (1989) suggestion of the imperial overreach hypothesis and its application to U.S. hegemony may have been essentially correct but ten years premature, much like the forecasts of those in the early 1990s who warned prematurely over the dollar's imminent demise.

8.3.2 The Dollar in the Bretton Woods Era

Though gold was the official international reserve asset of the monetary system that was established in 1944 at Bretton Woods, New Hampshire, the dollar was the true reserve asset of the postwar system. During the initial period of dollar shortage, the European and other currencies were not convertible into gold and so were not prized as the dollar was (Kindleberger 1950). The Europeans and others measured their economic recovery from the wartime destruction by their progressively greater ability to earn dollars through improving trade balances. By 1958 the balance of payments of the major European countries had improved sufficiently that they were able to restore convertibility (McKinnon 1979, 5).

No sooner had the system of fixed-rate convertible currencies come into operation than it was threatened by the onset of gradual rot. In 1958, the United States began to run large balance of payments deficits. Although these deficits were nothing other than the counterpart of the European surpluses, they presaged trouble as Robert Triffin (1960) pointed out. The world's demand for international reserves increases gradually in proportion to international income and trade. As the supply of gold was more or less fixed, the dollar would be increasingly used as a supplementary reserve asset by other countries' central banks under the Bretton Woods regime. But there was only one way that other countries could earn dollars: by running balance of payments surpluses with the United States. This led directly to what came to be known as the *Triffin dilemma.* Either the United States would take measures to limit its balance of payments deficit, or it would allow other countries to continue to accumulate claims against it. In the former case, the world would be deprived of its necessary reserves. In the latter case, the ratio of outstanding dollar liabilities to gold held in Fort Knox would rise without limit, provoking at some point a crisis in which private speculators (and Charles de Gaulle) would lose confidence and present the American authorities with more claims for payment than could be met.[19]

In the 1960s, the U.S. government adopted the stop-gap measure of putting controls on capital outflows. Meanwhile, economists debated three possible general solutions to the dilemma: raising the price of gold so as to increase the effective supply of reserves, creating a sort of paper gold as a

18. For example, Boughton (2001) and "From Suez to Baghdad," Charlemagne, *The Economist*, March 22, 2003 (47).

19. Kenen (1960) argued that central banks would be reluctant to hold reserves in the form of a currency like the dollar that was expected to lose value.

new reserve asset, or moving to floating exchange rates so as to reduce countries' demand for international reserves.[20]

The day of reckoning was in any case accelerated substantially by the expansionary U.S. fiscal and monetary policies of the Vietnam War era and the resulting widening of the balance of payments deficit. In August 1971, the United States unilaterally closed the official gold window, thereby ending the Bretton Woods regime. The attempt to patch up the fixed exchange rate system in the Smithsonian Agreement by devaluing the dollar against gold lasted only a short time. By March 1973, all the major industrialized countries had given up the effort to keep their currencies pegged to the dollar.

8.3.3 The Dollar in the Floating-Rate Era

One might have expected in the post-1973 decades a sharp downward shift in the demand for reserves by those major industrialized countries that moved to floating rates. There is indeed some evidence of a downward shift. But the demand for reserves nonetheless remained surprisingly high.[21] Even though the central banks are willing to tolerate a far higher degree of variability in their exchange rates than before 1973, it takes a much greater amount of intervention to achieve any given effect than in the period when international financial markets were less developed. This may explain the still-high demand to hold reserves.

The fraction of reserves held specifically in the form of dollars began to decline in the late 1970s. While it is important not to confuse a change in the use of a currency with a change in its exchange value against foreign currencies, the downward trend of the dollar was, in fact, partly a reflection of a decline in its value. The depreciation of the dollar was concentrated particularly in three major episodes, one per decade: 1977 to 1979, 1985 to 1988, and 1993 to 1995. In each episode, the dollar exchange rate became an issue of conflict between the United States and its trading partners, Europe in particular. American Treasury secretaries were periodically faulted for a policy of *benign neglect* of the dollar's value.

Benign neglect was also the policy in the period of dollar appreciation from 1980 to February 1985. A strong dollar has advantages for other countries—improved prospects for their firms that export to the United States or that compete with imports—as well as disadvantages—an adverse shift in their terms of trade, higher prices for imported inputs like oil that (in the short run) have their prices set in dollars, and upward pressure

20. McKinnon (1969) predicted, accurately as it turned out, that a move to floating rates, while it would reduce the *official* demand from central banks for the dollar as a key currency, would not reduce the *private* demand for an international currency. He also predicted that the dollar would remain the currency best suited to such a role.

21. For example, Heller and Khan (1978). From similar evidence, Frenkel (1980, 183) drew the observation that "economic behavior seems to be more stable than legal arrangements."

on wages. A weak dollar has the corresponding disadvantages and advantages. It is evident that the point of view in Europe that disparages both upswings and downswings must have as its objective a stable dollar. Beyond the usual costs that are claimed from a volatile exchange rate, variability in the dollar as the world's key currency was also blamed for a ratcheting up of the level of protectionist barriers (as the United States erects import barriers when the dollar is strong, and trading partners do the same when it is weak), variability in the world price level (as countries intervene to stabilize the exchange rate and suffer consequent movements in their money supplies), and an inflationary bias (the result of the absence of a world nominal anchor to take the place of gold, the pound, or the dollar).

The United States was accused, especially in the 1970s, of having neglected its social responsibility to supply the world with the public good of a stable international money. Such complaints pointed up the conflict inherent in the dual role of the dollar as America's currency and the world's currency. The charge also, in part, provided a rationale for the birth of the European Currency Unit (ECU) in 1979 as a rival currency, which eventually in 1999 became the euro.

8.4 International Use of the Euro So Far

There are a variety of indicators of international currency use. The sort that is available on the timeliest basis is the currency of denomination in cross-border financial transactions. The euro soon after its debut came into wide use to denominate bonds. Within Europe there was a substantial increase in issues of corporate bonds, denominated in euros, together with a rapid integration of money markets, government bond markets, equity markets, and banking. While the frenetic activity seemed to be related to the debut of the euro, it does not meet the definition of *international currency use* because it took place inside the currency's home region (Gaspar and Hartmann 2005; Rey 2005).

Outside Europe, the euro has been a success as well.[22] Detken and Hartmann (2000) studied the data from the euro's first year in operation, doing a careful job of netting out intra-euro-area holdings in order to be able to trace back a measure of euro-precursor currencies for five years before 1999 that is comparable with post-1999 numbers. They found more of an increase in the supply of euro-denominated assets outside of Europe than an increase in demand.[23] The stock of international debt denominated in

22. Even based on just 1999 data, "the euro has become the second most important currency in virtually all segments of international capital markets right from the start of stage 3" (Detkens and Hartmann 2000). Bishop states that "Regular emerging market issuers now seem to regard the euro market as a genuine alternative to dollar markets" (2000).

23. To be sure, unless these excess-supplied euros are piling up as dealer inventories, then arithmetically they must be matched by an increase in demand from European residents. A

euros increased from about 20 percent on the eve of the EMU, to 30 percent in 2003 (Rey 2005, 114).

The last column of table 8.1 reports the euro's share in central banks' foreign exchange reserves—19.7 percent in 2003.[24] Early estimates for 2002 equaled approximately the sum of the shares of the mark, French franc, and guilder just before the EMU, but is less than what one would get by adding in the share of ECUs. This is to be expected: before 1999, the twelve central banks had to hold foreign exchange reserves, including of each others' currencies; these disappeared at the stroke of a pen on January 1, 1999. One cannot simply compare pre- and post-1999 figures to learn if the advent of the euro has hurt the attractiveness of the dollar as international reserve currency.

International use of the euro continued to grow during the first five years of its life.[25] About half of euroland trade with noneuro area residents is invoiced in the new currency.[26] The euro's share in international debt securities has risen to above 30 percent (versus below 20 percent for the pre-1999 legacy currencies). The comprehensive triennial survey of foreign exchange trading volume put together by the Bank for International Settlements (BIS) showed the dollar still easily in first place in 2001, at 85 percent of all spot trades (out of 200 percent), followed by the euro at 43 percent and the yen at 26 percent.[27] The euro's share of foreign exchange transactions in 2003 reached one quarter (out of 100 percent) in Continuous Linked Settlement data. The most recent triennial BIS survey, covering April 2004, showed the dollar still at 85 percent of all spot trades and the euro at 44 percent. Including also forwards and swaps, the dollar was involved in 89 percent of all transactions, and the euro in 37 percent (Bank for International Settlements 2005).

In short, the euro is the number two international currency, ahead of the

depreciation of the euro does not automatically follow. It depends which came first, the increase in supply of euro-denominated assets from nonresidents or the increase in demand from residents. Nevertheless, the finding is suggestive. At a minimum, it illustrates well the point that an increase in international use of a currency need not mean an increase in net demand for that currency or an appreciation.

24. There have been substantial revisions in the estimated euro shares. For instance, in November 2003, the IMF revised the 2002 estimate from 14.6 percent to 18.7 percent. (IMF 2003; ECB 2003); in the 2004 Annual Report, the 2002 share is 19.3. The results reported here use the revised data, spliced together with the old data before 1980 (whereas results reported in the July 2004 preconference and NBER Working Paper no. 11508 used the prerevised data).

25. The most recent annual report from the European Central Bank (2003), from which these statistics come, cites data through mid-2003.

26. Hartmann (1998) predicted that the share of the euro in trade invoicing would gradually increase, though starting out a distant second place to the dollar globally.

27. To compare foreign exchange trading volume in the euro with volume in its predecessor currencies, one must allow for the disappearance of intraeuro-twelve trading, as in Detken and Hartmann's (2002, 558–559) "simple arithmetic of EMU." They find that the observed decline is almost fully accounted for in this way.

Table 8.3 Size of United States vs. Europe (in trillions)

	2003	2004
United States	11.0	11.5
Euro-zone (12 countries)	8.8	9.0
Europe pre-5/1/2004 (15 countries)	11.3	11.5
Europe post-5/1/2004 (25 countries)	11.8	12.1

yen, and has rapidly gained acceptance, but is still far behind the dollar, which appears comfortably in the number one slot. We now turn to a consideration of the determinants of international currency status.

8.5 Factors that Suit a Currency for International Currency Status

The literature on international currencies has identified a number of determining variables.[28]

8.5.1 Patterns of Output and Trade

The currency of a country that has a large share in international output, trade, and finance has a big natural advantage. The U.S. economy is still the world's largest in terms of output and trade. By such measures, Japan is the second largest country. Alarmist fears of the early 1990s, notwithstanding, it was never very likely that Japan, a country with half the population and far less land area or natural resources, would surpass the United States in sheer economic size. But the euro is now the home currency to twelve countries. Their combined economic weight is much greater than Germany alone, or Japan. It is not quite as large as the United States, as table 8.3 shows. But it may be in the future. If the other three long-time EU members, United Kingdom, Sweden, and Denmark, were to join today, euroland would approximately equal the United States in economic size. If the ten countries that acceded to the EU in May 2004 (most of them in Central Europe) were also to join the EMU, the new monetary region would be larger than the U.S. economy. If any of these countries do join, it will be at least some years into the future. Thus, the question of relative size also depends on the growth rates of the U.S. and European economies. As an alternative to GDP, we could also look at countries' trading volume as another indication of their relative weights in the world economy.

28. 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).

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. The fact that much of Japan's imports are oil and other raw materials and that much of its exports go to the Western Hemisphere, for example, helps explain why a disproportionately small share of trade is invoiced in yen as opposed to dollars. Raw materials still tend heavily to be priced in dollars. Whenever the dollar depreciates for more than a few years, the Organization of the Petroleum Exporting Countries (OPEC) starts discussing switching to another currency of denomination. It hasn't happened yet. But it could if the dollar's primacy in other international roles were seriously challenged.

8.5.2 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. The large financial marketplaces of New York and London clearly benefit the dollar and pound relative to the euro and its predecessor the deutschemark, as Frankfurt is still less well developed. Tokyo and Frankfurt financial markets have changed a lot over the last two decades. But they still lag far behind New York and London as financial centers.

It has also been argued that a strong central bank, and a large financial sector to counterbalance the political influence of the trade sector, are important. The point is to get support from Wall Street, to be able to resist political pressure from Main Street in favor of depreciating the currency to help sell goods.[29]

It is surprisingly difficult to come up with a proxy for size, depth, or development that is available for all the financial centers. We have opted to use as our primary measure data on foreign exchange turnover in the respective financial centers: New York, London, Frankfurt, Tokyo, Zurich, and so on. This measure differs from turnover *of* the currencies (dollar, pound, euro, etc.), a variable that would be much more simultaneous with the international currency status that we are trying to explain. It captures, for example, the preeminence of London, which continues despite the small role of the pound. This measure has the virtue of reflecting to some extent all kinds of international financial transactions (both long term and short term, banking and securities, bonds and equities). Moreover, it is possible to patch together a data set covering the desired countries and years—though just barely, and with increasing difficulty as one goes back through the 1970s. We have also tried an alternative proxy for the size of financial centers—the size of the countries' stock markets.

29. For example, Hale (1995) and Frieden (2000).

8.5.3 Confidence in the Value of the Currency

Even if a key currency were used only as a unit of account, a necessary qualification would be that its value not fluctuate erratically. As it is, a key currency is also used as a form in which to hold assets (firms hold working balances of the currencies in which they invoice, investors hold bonds issued internationally, and central banks hold currency reserves). Here confidence that the value of the currency will be stable, and particularly that it will not be monetized or inflated away in the future, is critical.[30] The monetary authorities in Japan, Germany, and Switzerland in the 1970s established a better track record of low inflation than did the United States, which helped their bids for international currency status. As recently as the 1980s, the mean and variance of the inflation rate in the United States were both higher than in those three hard-currency countries, though lower than in the United Kingdom, France, Italy, and many other countries.[31]

Given the good U.S. inflation performance in the 1990s, this is no longer such a concern as it was formerly. A more important negative for the dollar is the fact that the United States is now a large-scale debtor country.[32] Even if the Federal Reserve never succumbs to the temptations or pressures to inflate away the U.S. debt, the continuing U.S. current account deficit is always a possible source of downward pressure on the value of the dollar. Such fears work to make dollars unattractive.

8.5.4 Network Externalities

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 intrinsic 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.

One can make an analogy with language. If one sat down to design an ideal language, it would not be English. (Presumably it would be Esperanto.) Nobody would claim that the English language is particularly well suited to be the world's lingua franca by virtue of its intrinsic beauty, simplicity, or utility. It is neither as elegant and euphonious as French, for example, nor as simple and logical in spelling and grammar as Spanish or Italian. Yet it is certainly the language in which citizens of different countries most often converse and do business, and increasingly so. One

30. For example, Devereux and Shi (2005).

31. For example, Tavlas and Ozeki (1992).

32. The U.S. statistics on both net international investment position and net investment income have shown false alarms in the past. The numbers have repeatedly been revised to postpone the date at which, first the stock position and then the income balance, turn negative. But there is no doubt that the United States has since become the world's largest net debtor.

chooses to use a lingua franca, as one chooses a currency, in the belief that it is the one that others are most likely to use.

Krugman (1984) showed how there can be multiple equilibria in use of an international currency, developing some informal ideas of earlier authors such as Kindleberger (1981), McKinnon (1979), and Swoboda (1969). Matsuyama, Kiyotaki, and Matsui (1993) went to the next level of abstraction analyzing this problem with the theory of random matching games. Rey (2001) also shows the possibility of multiple equilibria in the internationalization of currencies as determined by network externalities and the pattern of international trade.

The implication is that small changes in the determinants will not produce corresponding changes in the reserve currency numbers, at least not in the short run. At a minimum, changes will show up only with a long lag. As noted, the pound remained an important international currency even after the United Kingdom lost its position as an economic superpower early in the century. In the present context, the inertial bias favors the continued central role of the dollar. Also, as already noted, economies of scale suggest that, even in the long run, measures of international currency use may not be linear in the determinants. There may be a tipping phenomenon when one currency passes another.

Another aspect of the network externalities is economies of scope. An individual (exporter, importer, borrower, lender, or currency trader) is more likely to use a given currency in his or her transactions if everyone else is doing so. If a currency is widely used to invoice trade, it is more likely to be used to invoice financial transactions as well. If it is more widely used in financial transactions, it is more likely to be a vehicle currency in foreign exchange trading. If it is used as a vehicle currency, it is more likely to be used as a currency to which smaller countries peg, and so forth. In this paper we content ourselves with trying to predict reserve currency holdings. But this will depend on some of the other measures of international currency use.[33]

8.6 Estimation

We use the International Monetary Fund (IMF) annual data on aggregate central bank holdings of the relevant major currencies. The data are

33. In some of our regression tests, we tried adding to our list of determinants a measure of the popularity of the major currencies as anchors for smaller currencies to peg to (as suggested by Eichengreen and Mathieson). An Asian country that is pegged to the dollar, for example, is likely to hold a larger share of its reserves in the form of the dollar. We recognize that the pegging decision may be endogenous, determined simultaneously with the reserve holding decision and the various other measures of international currency use. We did not find a significant positive effect. Perhaps this is just as well: it saves us the trouble of trying to deal with the endogeneity of the pegging decision. (One possibility would be to use an instrumental variable for pegging choices, such as past colonial status.) In what follows, we emphasize regressions without the pegging-anchor variable included.

not generally available according to holdings of individual central banks because most of them regard this as highly confidential.

8.6.1 Functional Form

The most important variables are illustrated in scatter plots: the currency shares and the logit transformation of these shares, against GDP at market rates, in figures 8.5 and 8.6, respectively. It appears from figure 8.5

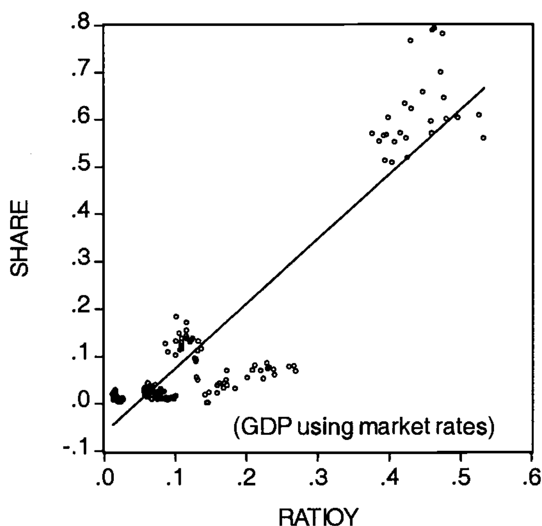

Fig. 8.5 Currency share versus GDP (market rates)

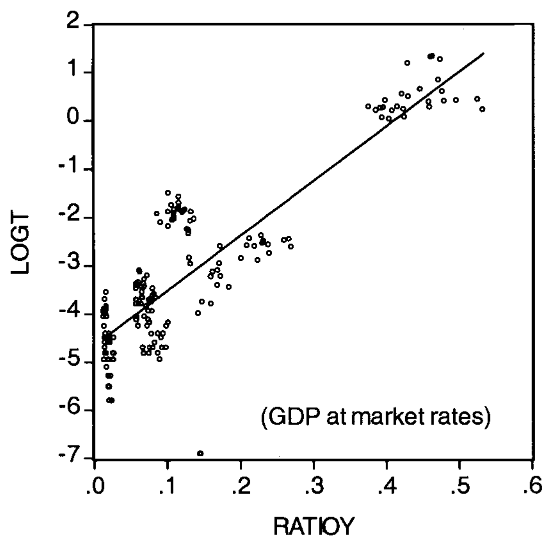

Fig. 8.6 Logistic share versus GDP (market rates)

Table 8.4 **Panel regression on shares (pre-euro)**

	(1)	(2)	(3)	(4)	(5)	(6)
GDPratio (y)	0.098*	0.123*	0.086*	0.115*	0.096*	0.085*
	(0.044)	(0.049)	(0.044)	(0.049)	(0.046)	(0.047)
Inflationdiff (π)	–0.071	–0.107*	–0.097*	–0.143*		
	(0.052)	(0.060)	(0.054)	(0.063)		
Depreciation (Δs)					–0.051	–0.094
					(0.070)	(0.074)
Exratevar (σ)	–0.028	–0.057*	–0.020	–0.055*	–0.033	–0.030
	(0.020)	(0.032)	(0.020)	(0.032)	(0.029)	(0.030)
Fxturnoverratio (to)		0.019		0.023	0.011	0.016
		(0.016)		(0.016)	(0.016)	(0.017)
GDPleader (leader)			0.023*	0.026*		0.023
			(0.013)	(0.014)		(0.014)
lagshare (sh_{t-1})	0.956*	0.944*	0.922*	0.904*	0.956*	0.923*
	(0.017)	(0.020)	(0.026)	(.029)	(.018)	(.027)
N	182	182	182	182	182	182
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.99	0.99	0.99	0.99	0.99	0.99

Notes: Dependent variable is sh (share). Estimated using OLS, no constant. All variables are in decimal form. GDP at market terms.

*Significant at the 10 percent level.

that the relationship between currency shares and GDP shares is nonlinear.[34] The data points representing the nondollar currencies seem to suggest a rather flat dependence on size; but the existence of the data points representing the dollar indicates that the curve must turn sharply upward somewhere in the middle.

Indeed, the functional form cannot literally be linear because the currency shares are bounded between 0 and 1, and not all the right-hand-side variables are similarly constrained. One common way of taking into account such a constraint is to use a logistic transformation of the shares variable.[35] The standard logistic transformation is symmetric and has a maximal slope at share equal 0.50. Figure 8.6 plots the logistic of the currency share against the size variables. The straight line now seems to fit the data much more comfortably, indicating that the logistic may be a good guess.

8.6.2 Basic Estimation Results, 1973–1998

A simple linear relationship is useful as a starting point, even though it cannot literally be correct. Table 8.4 reports results of regressions of cur-

34. It also appears that, for our purposes, it does not matter whether GDP is measured at market rates or in PPP terms.

35. Logistic = log[share/(1 – share)].

rency shares against the variables we have discussed.[36] In all instances a lagged endogenous variable is included to account for partial adjustment, which seems to be an important factor empirically.

Column (1) reports the outcome of a simple regression specification. The results indicate that income share enters positively and significantly, while inflation (expressed as the differential vis-à-vis average industrial country inflation) enters negatively, as does exchange rate volatility. When forex turnover is included, in the specification of column (2), the inflation and volatility effects are significant and in the directions anticipated. Augmenting the specification to include an indicator variable for the leader country (columns [3] and [4]) yields a statistically significant and positive coefficient estimate; but because the United States is the leader during the entire sample period, this variable reduces to a fixed effect for the United States.

Next, the results in columns (5) and (6) report specifications where the inflation variable is replaced by a long depreciation trend, estimated as twenty-year average rate of change of the value of the currency against the special drawing right (SDR). In neither case is this variable statistically significant, and indeed, very few variables appear significant in these cases.

One point of interest is that the coefficients on the lagged endogenous variable suggest a very slow adjustment rate. Only about 4 percent to 10 percent of the adjustment to the long run is estimated to occur in a single year. The half-life is on the order of seventeen years for this slower rate of adjustment.

Now consider the logistic transformation, which reflects the inherent nonlinearity of the problem. Immediately it is clear that, judged by the number of statistically significant coefficients, this is a more successful functional form. Columns (1) to (7) in table 8.5 are analogous to those in table 8.4. Most of the qualitative results are unchanged. The adjustment rate is now somewhat more rapid, about 12 percent per year.

Columns (5) and (6) report the logistic specification substituting a twenty-year depreciation trend for the inflation differential. The estimates are not significant, save for income and the lagged endogenous variable. A little investigation reveals that the results are particularly sensitive to the inclusion of the Japanese yen (which had a strong trend appreciation over the sample period, without ever attaining as big an international role as predicted by many). Excluding data for Japan yields the results in column (7), which indicates a significant role for long depreciation.

36. Seemingly unrelated regression (SUR) panel estimation yields qualitatively similar results. There is an obvious reason to expect a correlation of the error term across currencies: because the shares must sum to one, upward disturbances in one currency should be associated with negative disturbances on average across the others. ("Other currencies" and ecus are not included in the regressions, so the correlation is not perfect.) Because the results do not differ very much, we report the simple panel estimates.

Table 8.5 **Panel Regression on logit transformation of shares (pre-euro)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	–0.506*	–0.648*	–0.497*	–0.674*	–0.488*	–0.487*	–0.117*
	(0.123)	(0.154)	0.124*	(0.154)	(0.138)	(0.138)	(0.061)
GDPratio (y)	2.285*	2.768*	2.735*	3.690*	2.215*	2.775*	1.040*
	(0.564)	(0.643)	(0.781)	(0.923)	(0.616)	(0.854)	(0.288)
Inflationdiff (π)	–1.565*	–2.639*	–1.512*	–2.860*			
	(0.927)	(1.156)	(0.930)	(1.164)			
Depreciation (Δs)					–1.079	–0.920	–1.095*
					(1.294)	(1.306)	(0.594)
Exratevar (σ)	–0.445	–0.981*	–0.594	–1.395*	–0.583	–0.798	–1.251*
	(0.457)	(0.573)	(0.491)	(0.644)	(0.581)	(0.624)	(0.341)
Fxturnoverratio (to)		0.446		0.576*	0.208	0.252	0.427
		(0.289)		(0.303)	(0.302)	(0.305)	(0.145)
GDPleader (leader)			–0.125	–0.217		–0.150	
			(0.150)	(0.156)		0.159	
laglog($sh_{t-1}/1 - sh_{t-1}$)	0.879*	0.851*	0.882*	0.846*	0.881*	0.882*	0.957*
	(0.025)	(0.031)	(0.025)	(.031)	(.029)	(.029)	(.014)
N	182	182	182	182	182	182	156
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.97	0.97	0.97	0.97	0.97	0.97	0.99

Notes: Dependent variable: logit [log(sh/(1 – sh)] estimated using OLS. All variables are in decimal form. GDP at market terms. Column (7) omits Japanese yen, and is estimated using cross-section weighted standard errors.

*Significant at the 10 percent level.

Some readers, correctly noting that our regressions use value shares of reserves, point out two implications. One is that the current exchange rate appears as the valuation term on the left-hand side of the equation and in some cases appears on the right-hand side as well. The second is that changes in our dependent variable do not necessarily represent currency diversification in the sense of central banks physically selling some currencies and buying others. Our reply is that portfolio theory clearly says that shares should be valued at current exchange rates. That the exchange rate sometimes enters calculations of variables on the right-hand side at the same time as the left does not in itself necessarily mean that we have an econometric problem of endogeneity or simultaneity. For one thing, if the specification is correct, having the exchange rate on both sides need not imply simultaneity bias. For another thing, the contemporaneous exchange rate does not always appear directly on our right-hand side. Some equations include the long-run trend depreciation, where the contemporaneous exchange rate does represent the end point, but others do not. Also, while results reported here measure countries' relative GDPs at current exchange rates, we have also tried measuring GDP at purchasing power parity (PPP) rates. It does not seem to make much difference. That said, it might be in-

teresting in future research to try regressions with reserve holdings measured just as quantities (it would probably have to be changes in quantities) to see if central banks are diversifying in this narrow sense of the word.

8.6.3 Postsample Test, 1999–2004

We have chosen one specification to evaluate the reliability of the models out of sample. The postsample period is quite short, comprising only five years worth of data. Hence, we cannot undertake formal out-of-sample tests for parameter stability. Furthermore, given the disappearance of the mark, franc, and other European currencies, we cannot make a prediction as to the levels of the currency shares of the euro and its rivals for the date of its debut. Given these constraints, we adopt a limited test. We conduct an ex post static simulation of the data to see if our parameter estimates can predict correctly the direction of movement of the currency shares looking forward from 1999. We use the coefficient estimates reported in column (2) of table 8.5, which have statistically significant and correctly signed coefficients in all cases save the forex turnover variable.

The results are presented in figures 8.7 and 8.8. They indicate that the models fit quite well. A good deal of work is being done by the lagged endogenous variable. But the important and reassuring point is that our

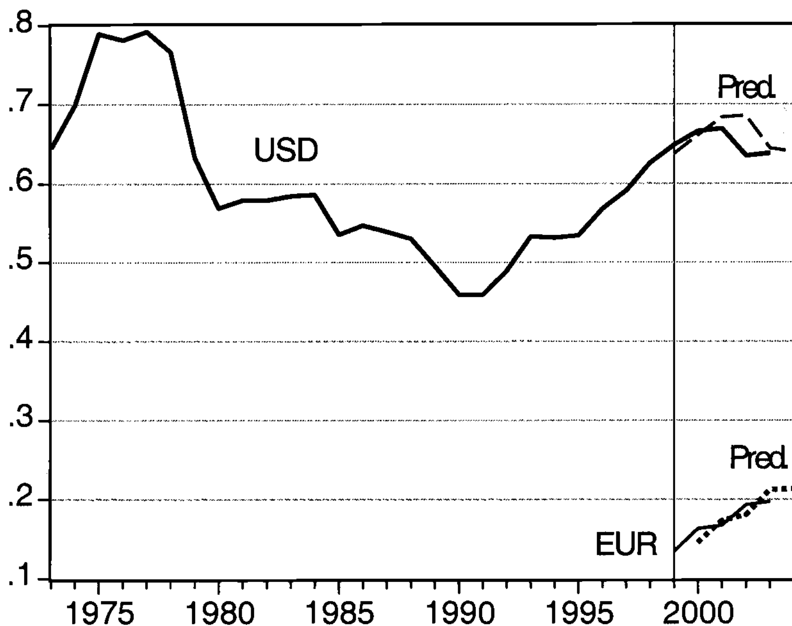

Fig. 8.7 Out-of-sample prediction of USD and EUR using logit without leader variable

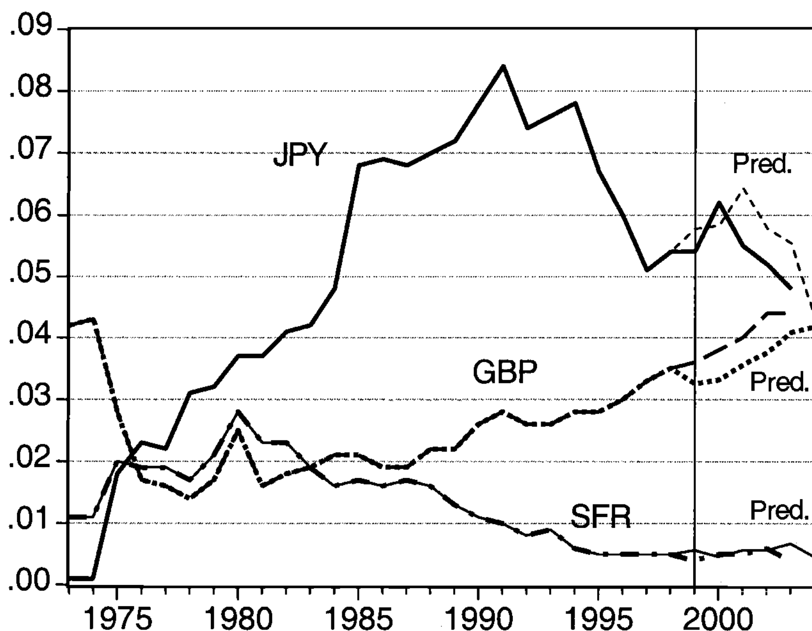

Fig. 8.8 Out-of-sample prediction of GBP, JPY, and SFR using logit without leader variable

equation correctly predicts the direction of movement after 1999 of the currency share: downward for the dollar and yen, and upward for the euro and pound.

We also checked the out-of-sample predictions produced from the specification in column (5), which used long-term trend depreciation rates as the rate-of-return variable in place of inflation rates. The results for the currency shares are similar to those presented in these graphs.

8.6.4 Sensitivity Tests

There is substantial latitude for deciding upon the best variables to include in the empirical specifications. We extended the investigation to include alternative variables. These results are reported in appendix table 1 of the working paper version of this chapter.[37] (We are not calling these robustness checks because we do not have the luxury of sufficient data to expect robust results, or even to dispense with a priori judgments in our basic specification.)

First, we tried a different measure of economic size, trade, in place of GDP. While the coefficient on exports exhibits approximately the same

37. See NBER Working Paper no. 11510.

level of statistical significance, the other variables do not. Gross domestic product is a more standard criterion for size in the literature on international currencies, so we see no reason to prefer the alternative scaling variable.

Another question pertains to network externalities or economies of scope. Does reserve currency use depend upon other instances of international currency status—such as how many currencies are pegged to that key currency? Small countries are more likely to hold their reserves in a given major currency if they are pegged to that currency. We added a variable defined as the share of the world's currencies pegged to a particular base currency as a proportion of all pegged currencies.[38] (At the same time, we omitted our forex turnover variable.) This new variable, capturing the peg anchor role, was not statistically significant. Surprisingly, it actually showed a negative sign, probably because the French franc ranks so high by this criterion and is not yet an important reserve currency.

We also wished to investigate the thesis that the use of a reserve currency could be negatively affected by a country's net debtor position. We did not have good data for these countries' net foreign asset position that was available for the entire sample. We used the cumulative current account balances reported by Lane and Milesi-Ferretti (2001). These results indicate a statistically insignificant relationship between net foreign assets and reserve currency use. Again, the coefficient is of a surprisingly negative sign, probably because the dollar's share continued strong in the 1990s even as the United States underwent its big swing from creditor to debtor.

As mentioned, one of the key determinants is the liquidity of a candidate's financial center, which we measured by turnover in the foreign exchange market. We investigated using alternative measures of financial market liquidity and depth. We considered three stock market measures: capitalization and total value traded, both of them defined as a share of GDP, and also stock market turnover. In no case did these variables enter with statistical significance. In two cases, value traded and turnover, they entered with the unexpected sign.

We also considered a measure of the depth of countries' bond markets but found no support for its role as a determinant of a reserve currency's use; data availability limited us to the 1990 to 1998 period, an admittedly short sample.

8.6.5 Results Using New Data Series

In September of 2005, the IMF released thoroughly revised data extending back to 1995. Unfortunately, these data are noncomparable to previously reported data. Of the three series the IMF reports—industrial country central bank holdings, developing country central bank holdings,

38. Eichengreen and Mathieson tried this peg-anchor variable.

Table 8.6 Panel regression on industrial country reserve shares (pre-euro)

	(1)	(2)	(3)	(4)	(5)	(6)
GDPratio (y)	0.156*	0.180*	0.126*	0.150*	0.156*	0.124*
	(0.057)	(0.061)	(0.059)	(0.064)	(0.058)	(0.062)
Inflationdiff (π)	–0.086	–0.127*	–0.112*	–0.153*		
	(0.072)	(0.082)	(0.073)	(0.083)		
Depreciation (Δs)					–0.081	–0.128
					(0.095)	(0.099)
Exratevar (σ)	–0.045*	–0.079*	–0.034	–0.067	–0.056	–0.046
	(0.027)	(0.042)	(0.028)	(0.043)	(0.039)	(0.040)
Fxturnoverratio (to)		0.022		0.022	0.016	0.019
		(0.021)		(0.021)	(0.022)	(0.022)
GDPleader (leader)			0.026	0.026		0.026
			(0.016)	(0.016)		(0.017)
lagshare (sh_{t-1})	0.930*	0.919*	0.902*	0.891*	0.930*	0.901*
	(0.020)	(0.023)	(0.027)	(0.029)	(0.022)	(0.028)
N	182	182	182	182	182	182
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.99	0.99	0.99	0.99	0.99	0.99

Note: See table 8.4 notes.
*Significant at the 10 percent level.

and aggregate central bank holdings—it turns out that only the industrial country central bank holdings is close to being consistent across the old and new series. This result is probably due to the fact that the less-developed country holdings have, in the past, incorporated much more estimation of the reserve composition.[39]

In order to see how much the newer data might alter the results, we re-estimated the specifications comparable to those in tables 8.4 and 8.5.[40] The results are reported in tables 8.6 and 8.7.

Briefly put, the shares regressions yield results largely unchanged from those using the aggregate, older data, although fewer statistically significant coefficients are in evidence. Logit regressions show larger impacts for GDP and the inflation differential than in the previous regressions. However, in contrast, the logit regressions involving twenty-year depreciation are not successful in general; perhaps this reflects the greater importance associated with inflation for industrial country central bank holdings.

39. "This year's data were compiled under a new rule that the estimation of the currency composition of reserves be limited to data gaps of less than four quarters. As a result, the aggregate currency composition is now calculated almost exclusively on the basis of reserves data reported by the authorities to COFER. Reserves held by nonreporting developing countries, for which the currency composition was previously estimated, have been moved to the new category 'Unallocated reserves'" (IMF 2005, 109).

40. As mentioned earlier, the industrial country central bank holdings underwent a much more minor revision. Hence, we spliced these series to the previously reported IMF series.

Table 8.7 Panel regression on logit transformation of industrial country shares (pre-euro)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	–0.367*	–0.480*	–0.378*	–0.550*	–0.238	–0.258	–0.297
	(0.139)	(0.160)	0.148*	(0.165)	(0.163)	(0.164)	(0.186)
GDPratio (y)	1.432*	1.807*	2.202*	3.326*	0.904	1.738	1.368
	(0.705)	(0.752)	(1.048)	(1.193)	(0.806)	(1.173)	(0.952)
Inflationdiff (π)	–3.082*	–4.254*	–3.030*	–4.694*			
	(1.132)	(1.401)	(1.133)	(1.420)			
Depreciation (Δs)					–0.358	–0.226	–1.432
					(1.775)	(1.780)	(2.200)
Exratevar (σ)	–0.116	–0.685	–0.370	–1.388*	0.224	–0.112	–0.379
	(0.573)	(0.699)	(0.628)	(0.818)	(0.754)	(0.829)	(1.227)
Fxturnoverratio (to)		0.472		0.685*	–0.075	–0.003	0.167
		(0.334)		(0.357)	(0.383)	(0.390)	(0.519)
GDPleader (leader)			–0.180	–0.315		–0.192	
			(0.181)	(0.193)		0.196	
laglog($sh_{t-1}/1 - sh_{t-1}$)	0.935*	0.915*	0.933*	0.903*	0.956*	0.952*	0.941*
	(0.027)	(0.030)	(0.027)	(.031)	(0.032)	(0.032)	(.036)
N	182	182	182	182	182	182	148
Sample	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.98	0.97	0.97	0.98	0.97	0.97	0.97

Notes: Dependent variable: logit[log(sh/(1 – sh)] estimated using OLS. All variables are in decimal form. GDP at market terms.

*Significant at the 10 percent level.

8.7 Extrapolation to the Future

The goal of the project is to use the estimated parameters to forecast the shares of the dollar, euro, and other currencies in the coming decades. Under any plausible scenario, the dollar will remain far ahead of the euro and other potential challengers for many years. But we want to know if there are plausible scenarios that provide a different answer for twenty or thirty years into the future and, if so, what are the variables that are most important to this outcome. First, two caveats—these are simulations incorporating fairly mechanical variations. There are no interactions between, say, exchange rate depreciation and exchange rate volatility. We do not even attempt to predict the future course of these variables. Second, the simulations are, of course, only as good as the parameters that we estimated from the historical data, which are neither precise nor entirely stable.

8.7.1 Posited Scenarios

If none of the explanatory variables were to change in the future from its current values, then the long-run shares of the currencies could be esti-

mated with no further inputs.[41] This will almost certainly show the dollar retaining the lead even in the long run. We regard this scenario as quite possible, but not the only one.

A high-euro scenario would have many European countries joining the EMU by the end of this decade. Most eager to join are the ten countries that joined the EU in May 2004 (eight of which are in Central Europe). It is also possible that the three remaining long-standing EU members, Denmark, Sweden, and the United Kingdom, might join at some point. All these countries together would make it likely that euroland exceeds the United States in income and trade. In that case, it becomes a real possibility that the euro would gradually gain on the dollar and eventually challenge it for the number one position. The key question is whether the United Kingdom joins, not just because it is the largest of them, but also because it would bring with it the London financial markets. By 2005, it did not look likely that Britain would join in the coming ten years. We are certainly not predicting that it will.

We could also experiment with different assumptions regarding the other explanatory variables. Real growth has been slower in Europe than in the United States for some years, largely due to lower population growth. If this trend in growth were to continue, it would retard the trend in currency use. United States's monetary policy in the first part of the current decade was looser than European Central Bank (ECB) monetary policy. Is it possible that the Fed will eventually come under pressure to monetize the growing U.S. national debt? Or that the exchange rate will become more volatile, in response to current account deficits or troubles in the Mideast? It may be worth exploring a few different scenarios.

8.7.2 Results of the Simulations

In order to focus on the dynamics between the two key reserve currencies, at this point we pare down the analysis to the dollar and the euro. We use a two-currency specification informed by what we have learned from our seven-currency regressions. In particular, we continue to transform the shares variable using the logistic function. Focusing on a two currency specification is helpful as (a) it is difficult to model the other reserve currencies with shares less than 10 percent, and (b) it allows us easily to impose the adding-up constraint.

The results are reported in table 8.8, for specifications involving inflation differentials and depreciation. Columns (1) and (3) report stripped down specifications involving only income and the inflation and depreciation variables. Columns (2) and (4) report the more comprehensive specifica-

41. As the reciprocal of one minus the speed of adjustment, times the value fitted from the rest of the variables and parameter estimates.

Table 8.8 Two-currency system (pre-euro)

	(1)	(2)	(3)	(4)[a]
Constant	–0.392*	–0.465*	–0.470*	–0.532*
	(0.132)	(0.167)	(0.159)	(0.165)
GDPratio (y)	0.762*	1.015	0.904*	0.974†
	(0.247)	(0.773)	(0.294)	(0.688)
Inflationdiff (π)	–0.554	–0.844		
	(1.247)	(1.259)		
Depreciation (Δs)			–3.497	–4.524†
			(3.642)	(3.337)
Exratevar (σ)		–2.375*		–2.381*
		(1.213)		(1.121)
Fxturnoverratio (to)		0.489		0.652†
		(0.487)		(0.454)
laglog($sh_{t-1}/1 - sh_{t-1}$)	0.829*	0.775*	0.830*	0.795*
	(0.043)	(0.085)	(0.043)	(.076)
N	26	26	26	52
Sample	1973–1998	1973–1998	1973–1998	1973–1998
Adj. R^2	0.86, 086	0.85, 0.87	0.86, 0.87	0.86, 0.87

Notes: See table 8.7 notes.
[a]Weighted least squares.
*Significant at the 10 percent level.
†Significant at 20 percent marginal significance level.

tions, including exchange rate variability and turnover. In these pared-down specifications, income and exchange rate variability are the most significant variables, although income is not always statistically significant even when the coefficient estimate is fairly large. The rise in standard errors in the two-currency estimation suggests that variation across currencies contributed substantial power to the seven-currency results reported earlier. In these specifications, depreciation shows up as borderline (20 percent) significant in column (4). We use this specification in the simulations that follow.

We consider four scenarios, defined by alternative assumptions regarding the relative size of the euro area and the United States. In case 1, the ten countries that joined the EU in 2004 join the EMU in 2010, and the United States grows slightly relative to world income, increasing its share by 2 percentage points over thirty years. In case 2, the United States only holds steady its proportion of world income, while the euro area grows by the ten accession countries.[42] In case 3, the accession countries join in 2010, and

42. We are being conservative as regards the new EU ten. Current plans are for the euro area to be expanded to fifteen members in 2006 and eighteen in 2007.

Sweden and Denmark in 2015. Finally, case 4 incorporates U.K. entry in 2020.[43]

For each of these cases, we consider four possibilities for exchange rate depreciation: scenario A involves the currencies depreciating (against the SDR) at the same trend rate that they did over the 1990 to 2004 period; this turns out to be virtually zero depreciation. Scenario B assumes the exchange rates stay at the end-2004 levels. Scenario C considers the possibility of the currencies continuing to depreciate at the twenty-year trend rates realized at the end of 2004. Finally, scenario D contemplates the persistence of the trends observed over the 2001 to 2004 period, when the dollar depreciated at a 3.6 percent rate per annum, and the euro appreciated at a 4.6 percent rate.

Table 8.9 summarizes the outcome of the simulations. Some scenarios lead to erosion of the dollar's position as the world's premier international reserve currency. Briefly put, if the United Kingdom joins the EMU (case 4), the euro becomes the dominant currency. The only U.K.-in scenario in which it does not is when twenty-year trend depreciation is assumed to drop to zero, which begins with an immediate jump in the dollar's value in 2005. If currency trends of the recent past persist (scenario D), the euro not only gains dominance, but does so rapidly—by 2019.

In the other combinations, the dollar retains the lead, although the degree of dominance depends upon the assumptions underlying the scenario and rate of currency depreciation. When the U.S. dollar retains its lead, it typically does so by about 30 to 35 percentage points. When the euro gains the lead, the lead can range from 10 percentage points (the scenario with no entry of the United Kingdom, Sweden, or Denmark; strong U.S. growth; and rapid dollar depreciation combined with euro appreciation) to 65 percentage points (U.K. entry and rapid dollar depreciation and euro appreciation).

Figures 8.9 to 8.12 display the simulated dynamics of the U.S. dollar (USD) and euro (EUR) holdings (here expressed as shares of the sum of USD and EUR reserve holdings). Figure 8.11 illustrates that when the euro area is composed of the current Euro-twelve and the accession countries (as of 2010), and the exchange rates remain at their end-2004 levels, the dollar retains its dominance. Figure 8.12 represents the scenario where Sweden and Denmark join the euro area in 2015 as well, and the currencies continue to depreciate or appreciate at the 20 year trends that held at the

43. As Ted Truman has noted, there will be some distortion of the ratios if and when the United Kingdom joins the euro area as its reserves of euro are extinguished as foreign currency reserves. Thus, the dollar amount of reserves will be unchanged (the numerator) but the dollar + euro amount (the denominator) will be reduced, so the dollar's share rises. This is also the reason why the dollar's share jumped in 1999 after the creation of the euro; the deutsche mark reserves held by euro area countries were extinguished.

Table 8.9 Summary of simulation results

	Rate of long depreciation equals 1990–2004 rate (0%) (Scenario A)	Level of exchange rate stays at end-2004 levels (Scenario B)	Rate of long depreciation remains at 2004 rates (Scenario C)	Rate of depreciation over 2001–2004 period continues (Scenario D)
United Kingdom, Sweden, and Denmark stay out, United States grows relative to Euro area (Case 1)	USD retains dominance	USD retains dominance	USD retains dominance	Euro exceeds USD in 2024
United Kingdom, Sweden, and Denmark stay out of EMU (Case 2)	USD retains dominance	USD retains dominance	USD retains dominance	Euro exceeds USD in 2023
United Kingdom stays out of EMU (Case 3)	USD retains dominance	USD retains dominance	USD retains dominance	Euro exceeds USD in 2022
United Kingdom joins EMU in 2020 (Case 4)	USD retains dominance	Euro exceeds USD in 2022	Euro exceeds USD in 2022	Euro exceeds USD in 2020

Notes: Summary of outcomes for combination of Cases and Scenarios. USD = U.S. dollar. EMU = European Monetary Union. Case 1: Accession countries join EMU in 2010; U.S. share of world income rises by 2 percentage points over thirty years. Case 2: Accession countries join EMU in 2010; United States retains share of world income. Case 3: Accession countries join EMU in 2010; Sweden and Denmark join in 2015; United States retains share of world income. Case 4: Accession countries join EMU in 2010; Sweden and Denmark join in 2015; United Kingdom joins in 2020; United States retains share of world income. Scenario A: Twenty-year rate of depreciation stays at past rate (0 percent), requiring an appreciation after 2004. Scenario B: Exchange rates remain at end-2004 levels. Scenario C: Twenty-year rate of depreciation at end-2004 persists. Scenario D: Rate of depreciation/appreciation experienced over 2001–2004 continues after 2004.

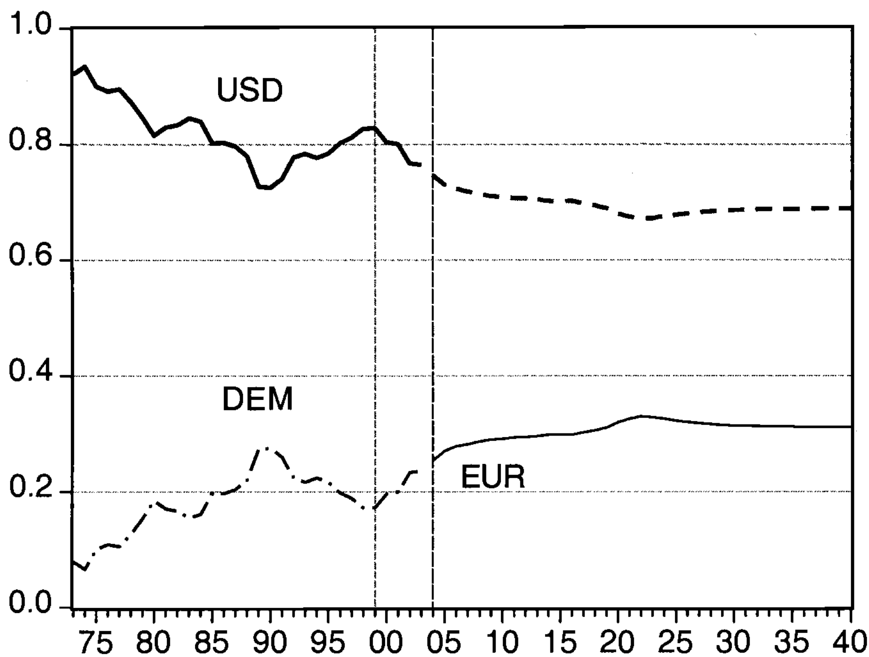

Fig. 8.9 Case 2, scenario B: Simulation of "No United Kingdom, Sweden, Denmark" and no further depreciation of the level of the exchange rate after 2004

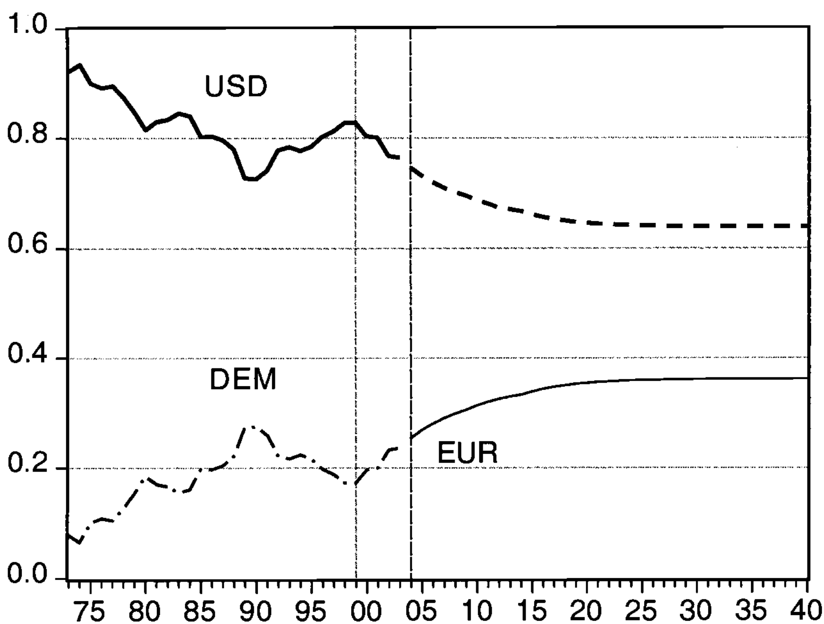

Fig. 8.10 Case 3, scenario C: Simulation of "No United Kingdom" and depreciation at 2004 twenty-year trend rate

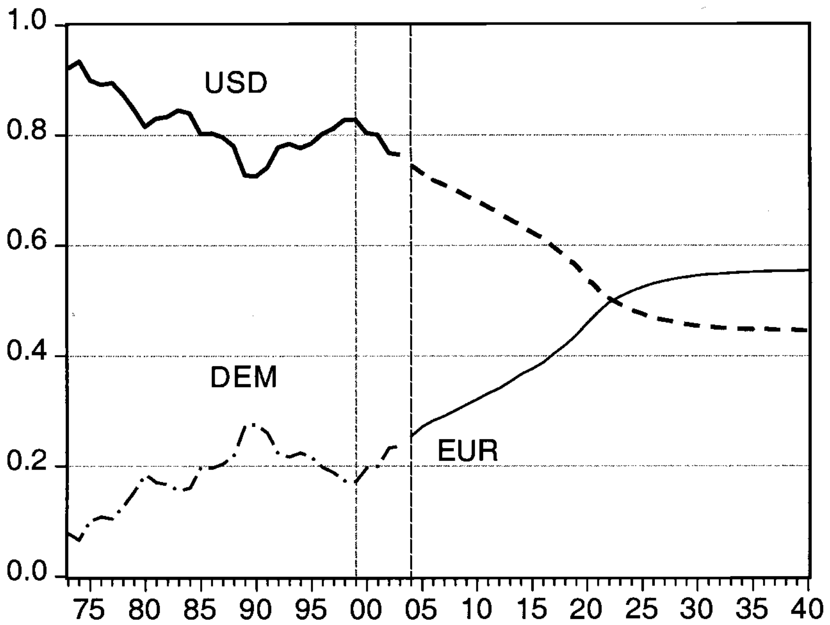

Fig. 8.11 Case 2, scenario D: Simulation of "No United Kingdom, Sweden, Denmark" and continued depreciation of the exchange rate at the 2001 to 2004 rate

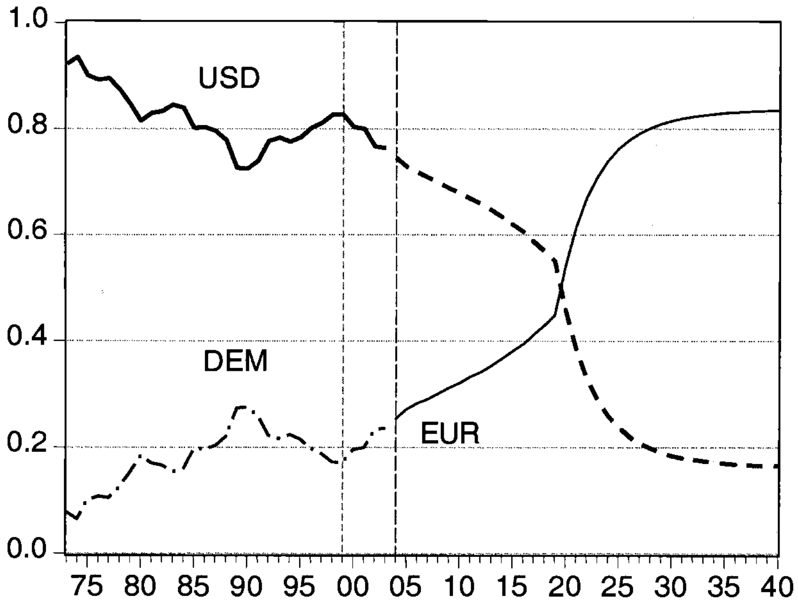

Fig. 8.12 Case 4, scenario D: Simulation of "U.K. entry" and continued depreciation of the exchange rate at the 2001 to 2004 rate

end of 2004. The dollar also retains its dominance here, but by a very slightly smaller amount. Euro dominance occurs (by 2023) if the currencies continue the trends experienced over the 2001 to 2004 period (3.6 percent depreciation for the dollar, 4.6 percent appreciation for the euro, both on an annualized basis).

The euro gains overwhelming dominance in the instance where the United Kingdom joins the euro area *and* rapid depreciation persists indefinitely. In this combination, the switchover occurs in 2020 and eventually the euro accounts for more than 80 percent of combined USD and EUR holdings.

8.8 Summary Conclusions

The major payoff of the paper is predictions about scenarios under which the euro might in the future rival or surpass the dollar as the world's leading international reserve currency. That question appears to depend most importantly on two things: (a) whether enough other EU members join euroland so that it becomes larger than the U.S. economy and, in particular, whether the United Kingdom comes in, with its large financial markets; and (b) whether U.S. macroeconomic policies eventually undermine confidence in the value of the dollar through inflation and depreciation. Whatever value this exercise has probably consists of estimating, contingent on those two things happening, how quickly the euro might rise to challenge the dollar. We find that if all thirteen EU members who are not currently in the EMU join it by 2020, including the United Kingdom, then the euro overtakes the dollar a few years later. We also find that even if some of these countries do not join, a continuation of the recent trend depreciation of the dollar, were it to occur for whatever reason, could bring about the tipping point even sooner.

Euro enthusiasts suffered some serious setbacks in 2005.[44] But most assessments of the sustainability and adjustment of the U.S. current account see a role for substantial depreciation of the dollar in the future, whether operating via expenditure switching or a valuation effect. Our results suggest that such dollar depreciation would be no free lunch: it could have consequences for the functioning of the international monetary system as profound as the loss of the dollar's preeminent international currency position, and along with it the exorbitant privilege of easily financing U.S. deficits.

44. This is due to a slowdown of some major European economies, gross violation of the Stability and Growth Pact, rejection of a new EU constitution in French and Dutch referenda, dispute over the EU budget, and a renewed depreciation of the euro.

Appendix

Data Description and Sources

Share is the proportion of currency holdings. *GDPratio* is the share of world GDP (evaluated at market exchange rates); *Inflationdiff* is the difference between a 5 year moving average of Consumer Price Index (CPI) inflation and industrialized country inflation; *Exratevar* is the trade weighted exchange rate volatility (monthly), measured as a five-year moving average; *Fxturnoverratio* is turnover is daily turnover divided by total five center turnover; *peg-anchor variable* is the proportion of pegged exchange rates linked to a particular currency.

Reserve Currency Holdings

These are official reserve holdings of member central banks, at end of year. The data used are a spliced version of updated 2003 data obtained July 1, 2004 (for 1980 onward) to unpublished data for 1965 to 2001. Not available (NA) observations set to 0 except for the euro legacy currencies. In logistic transformations, 0 entries set to 0.000001 (0.0001 percent). The source is the IMF *Annual Reports,* table I.2, and IMF unpublished data.

Ratio of GDP to Total World GDP

This is the ratio of GDP in USD (converted at official exchange rates) to GDP of world aggregate. Sources are the IMF *International Financial Statistics.* Euro-area, world GDP data are from IMF *World Economic Outlook.*

Inflation

This is calculated as log difference of monthly CPI, averaged. The five-year moving average is centered. Sources are the IMF *International Financial Statistics;* euro-area inflation for 1980 to 1998 is ECB data from Alquist and Chinn (2002).

Exchange Rate Volatility

This is calculated as the standard deviation of the log first difference of the SDR exchange rate. The source is IMF *International Financial Statistics.*

Forex Turnover

1989, 1992, 1995, 1998, and 2001 are from Bank for International Settlements (BIS) *Triannual Surveys.* Billions of dollars of daily turnover, in April. Data from 1977 to 1988 are from G30, New York Fed surveys, and central bank surveys. Observations in between survey years are log-

linearly interpolated. For 1973 to 1979, interpolation is using 1977 to 1979 relationship.

Net International Investment Position Is Cumulated Current Account

These net investment positions are normalized by world GDP (converted at official exchange rates). The source is Lane and Milesi-Ferretti (2001).

Linked Currency Counts

For 1973 to 2000, tabulation is based on data from Shambaugh (2004). The source is personal communication from Jay Shambaugh. The variable used in the regression is the proportion of currencies linked to a particular base currency (USD, DEM, etc.) as a proportion of all pegged rates tabulated.

Financial Depth Variables

These are stock market capitalization to GDP ratio, stock market total value traded to GDP ratio, stock market turnover ratio, private bond market capitalization to GDP ratio, public bond market capitalization to GDP ratio. The source is Beck, Demirgüc-Kunt, and Levine (2000).

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Comment Edwin M. Truman

Introduction

Chinn and Frankel provide a clear, insightful, and provocative paper. They set themselves the daunting task of determining whether and, if so, when the euro will surpass the dollar as an international reserve currency. Along the way, they offer a number of insightful comments, including on the demise of sterling as an international and reserve currency as well as on the vicissitudes of the dollar over the past several decades.

Using aggregate data on the currency of denomination of IMF member countries' foreign exchange reserves from 1973 to 1998, covering about 85 percent of total foreign exchange reserves as of the end of 2003, Chinn and Frankel use a panel regression to estimate a nonlinear relationship to explain currency shares in those reserves.[1] They find that size (GDP), inflation, exchange rate depreciation or appreciation, exchange rate variability, and foreign exchange market turnover appear in various forms of the rela-

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1. The 85 percent figure comes from the companion IMF (2004, 104) table I.3 to table I.2 and similar tables in earlier *Annual Reports,* which is the source of the Chinn and Frankel data. Revised data, which Chinn and Frankel were unable to use in their paper because the series are incomplete, were published by the IMF in 2005. The new IMF (2005, 109) data cover only 70 percent of total foreign exchange reserves at the end of 2003.

tionship with various degrees of significance. Based on the coefficient on the lagged dependent variable, they also find considerable inertia in the currency composition of reserves—around 90 percent.

Finally, Chinn and Frankel estimate a two-currency model of foreign exchange holdings in U.S. dollars and deutsche marks from 1973 to 1998 using their favored explanatory variables. They employ those estimates to extrapolate the dollar-euro share of foreign exchange reserve holdings under different scenarios with respect to the size of the euro area and the behavior of the dollar. They conclude that if not only the ten newest members of the European Union but also Denmark, Sweden, and, in particular, the United Kingdom join the euro area at various points between now and 2020, the U.S. dollar will lose its dominance in international foreign exchange reserves. The only exception is the extreme case where the average rate of depreciation of the dollar is zero from 2004 onward.

At the other extreme, if the dollar continues to depreciate against the SDR over the next two decades at the same rate as it has over the past four years (3.6 percent a year) and the euro continues to appreciate at the same rate (4.6 percent a year), then the euro will replace the dollar with the largest share in international reserves by 2020 or a few years later depending on the size of the euro area. This calculation implies dollar depreciation against the SDR of 25 percent by 2020, which is not implausible, but is an extreme scenario as the dollar would have to depreciate by about 40 percent, on average, against the euro, yen, and pound sterling, given that the dollar currently has about a 39 percent effective weight in the SDR basket that Chinn and Frankel use for their calculations.[2] Similarly, a continued euro appreciation of 4.6 per year against the SDR implies an appreciation of 43 percent against the SDR and about 60 percent, on average, against the dollar, yen, and sterling, which is much less plausible.

Comments

My comments focus on (a) the estimates and the extrapolations, (b) whether Chinn and Frankel have asked and answered the most interesting question, and (c) the relevant model of foreign exchange reserve diversification by national monetary authorities.

Are the Estimates Credible?

Chinn and Frankel employ a carefully laid out analytical and empirical framework and produce bold quantitative extrapolations yielding clear answers to the questions they pose: the euro most likely will overtake the dollar as the leading reserve currency within two decades. The results are offered with two caveats: the extrapolations are purely mechanical, and

2. See Truman (2005b) on more plausible scenarios for prospective dollar depreciation.

they are based on historical estimated parameters that are neither precise nor entirely stable.

Those caveats point to a problem in interpreting the results of the paper. The point estimates are not credible except in the broadest terms: (a) the attractiveness of the euro for reserve holdings would rise if the United Kingdom joined the euro area and (b) sustained significant weakness of the dollar would reduce the attractiveness of the dollar for official foreign exchange reserve holdings. However, putting point estimates on the size of these effects is problematic.

First, the core conclusions about the importance of U.K. membership in the euro area and the role of continued dollar depreciation and euro appreciation are based on coefficients that are significant only at the 20 percent level. This is true for the size variable (GDP) and the foreign exchange turnover variable (calculated by market, not by currency).[3] These two variables drive the positive effect on the euro's share of international reserves associated with U.K. membership in the euro area.[4] The exchange rate depreciation variable also is only significant at the 20 percent level. Thus, notwithstanding the authors' transparent caveats, you have to have a lot of faith in these very weakly significant coefficients to buy the Chinn and Frankel results.

Second, in the case of the exchange rate variable, the coefficient is potentially biased in size and significance. The dependent variable is the dollar's value share in international reserves composed of dollars and deutsche marks.[5] But the dollar's depreciation against the SDR, though expressed as long-term average, is an explanatory variable. Thus, one should not be surprised that a depreciation of the dollar, expressed as the rise in the dollar price of the SDR, is loosely associated with a lower share of dollars in foreign exchange reserves. Figure 8C.1 shows the dollar's value share of foreign exchange reserves from 1973 to 2003.[6] It also shows an alternative quantity series.[7] Finally, it shows the dollar price of the SDR over

3. I am also skeptical whether the GDP variable is correctly specified in the multicurrency regressions. The scatter plots look more like two different populations.

4. As Chinn and Frankel acknowledge, they have not adjusted downward the euro's share of international reserves upon British entry into the euro area in 2020. As of the end of 2004, 55 percent of U.K. foreign exchange reserves were in euro-denominated assets, and these would be extinguished upon entry into the euro area, temporarily boosting the dollar's share; see table 8C.1.

5. We do not know for sure, but there is a strong presumption that most countries mark their foreign exchange reserves to market values when they report the currency composition of their foreign exchange reserves to the IMF.

6. The data on the dollar's share of foreign exchange reserves in figure 8C.1 are comparable to the data in the Chinn and Frankel figure 8.1, but they may not be identical because Chinn and Frankel had access to unpublished data.

7. These data are from the series reported in table I.3 and similar tables in IMF annual reports rather than table I.2 and similar tables, which are the source of the Chinn and Frankel data.

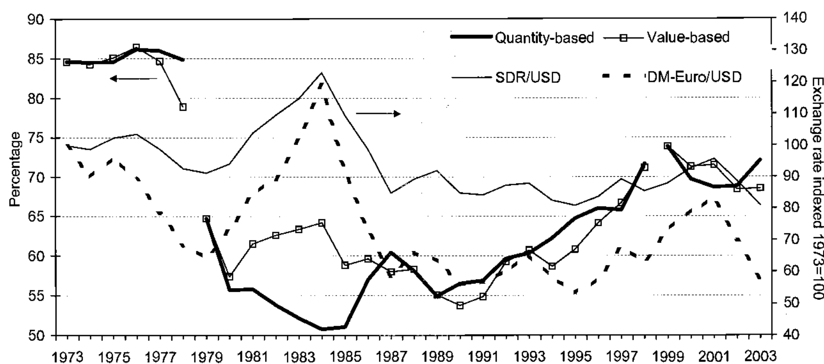

Fig. 8C.1 U.S. dollar's share of foreign exchange reserves (1973–2003)

Sources: IMF *Annual Report* (2004), table I.3 and similar tables in earlier *Annual Reports.*

Notes: The precipitous drop in both quantity- and value-based shares in 1979 reflects mainly deposits of U.S. dollars by members of the European Monetary System (EMS) in the European Monetary Cooperation Fund.

European Currency Units (ECU) were introduced in 1979 with the creation of the European Monetary Cooperation Fund. The IMF evaluated total quantity changes in ECUs issued against dollars by applying the SDR price of the U.S. dollar on the swap date to the estimated change in dollar holdings. Similarly, quantity changes in ECUs issued against gold were determined by applying the SDR price of the ECU on the swap data to the ECU price of gold used by the EMS and multiplying by the change in the number of ounces. However, the introduction of the ECU as treated by the IMF data distorted the IMF's data on the dollar's share of foreign exchange reserves because (a) the amount of dollar reserves declines and (b) the total amount of foreign exchange reserves increases. A rough estimate is that the combined influence of these two factors causes a drop of about 15 percentage points in the dollar's share shown in the figure, 5 percentage points from effect a and 10 percentage points from effect b. The basic data used by Chinn and Frankel are influenced only by the first effect, and it is unclear whether the revised data series they received from the IMF were adjusted to eliminate it.

The introduction of euro in 1999 led to a break in the quantity- and value-based series, with the new series based at 1999 year-end value.

this period and the dollar price of the deutsche mark. The latter, of course, moves much more than the former.

Figure 8C.1 illustrates that quantity shares do behave differently from value shares. Chinn and Frankel argue that it is value shares that are relevant in a portfolio-balance model. True, but is that the right model to use to answer these questions? It will reveal a tendency toward *passive* diversification out of a currency as it depreciates, but that is quite different from *active* diversification of current holdings—quantity shifts—that is the focus of most market observers of this phenomenon. I return to this issue below.

In addition, the use of the dollar price of the SDR as the exchange rate variable, rather than a broader exchange rate index, may adversely affect the results. In particular, this choice may affect the finding that exchange

rate volatility measured in terms of the SDR is statistically significant. I would have preferred that Chinn and Frankel had used a broader index. They frequently speak about whether a currency is a "stable international money," but they do not say what they mean by the term. They do try inflation as an explanatory variable, but in the end they discard it. It is also curious that Chinn and Frankel do not employ any rate of return variables in their regressions other than changes in capital values associated with exchange rate movements.

Finally, it is well known that the IMF's data on the currency composition of international reserves are only as good as the information the Fund receives from members. It is also well known that the data for developing countries are particularly shaky. It is unfortunate that readers have to wait for the next Chinn and Frankel paper to learn whether regressions on the two separate components of the aggregate data set, once the IMF has produced consistent series, confirm the stability of the relationships for industrial and developing countries.

Is This the Most Interesting Question?

The most interesting question to ask in this area concerns the U.S. dollar's and the euro's future roles as international currencies, not about their respective shares in countries' foreign exchange reserves. Although Chinn and Frankel are careful to state that they are only investigating one of the six potential roles of an international currency (see their table 8.2, taken from Kenen [1983]), their discussion often conflates a currency's reserve role with its broader international role. Chinn and Frankel argue that the dollar's reserve role is central to the issue of the continued smooth financing of the U.S. current account deficits, the topic of the NBER conference, by official inflows. However, the importance of that channel is frequently exaggerated. It is true that the increase in foreign official assets in the United States financed 59 percent of the U.S. 2004 current account deficit, but it is equally true that the increase in foreign private assets in United States financed 152 percent of the deficit.

A currency's broader international role is much more interesting and economically significant. A relevant question is whether the two phenomena are related, but Chinn and Frankel do not explicitly consider this question. Moreover, in considering a currency's international role one should try to distinguish between a currency's use by agents of a country or area issuing the currency in dealing with other countries and that currency's use by agents of another country where no aspect of the transaction is connected to the country or area whose currency is involved. See Truman (1999, 2005a). Only the U.S. dollar is an international currency in this sense. A significant amount of trade that does not involve the United States is denominated in U.S. dollars. In addition, governments and private

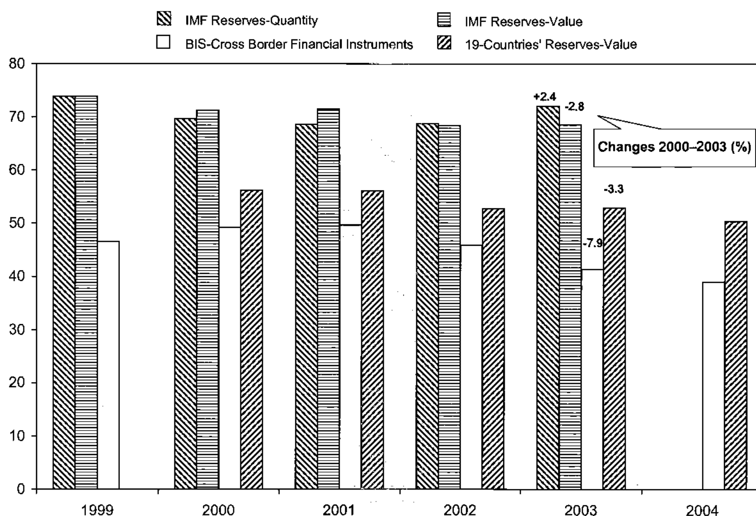

Fig. 8C.2 U.S. dollar's share

Sources: IMF *Annual Report* (2004), table I.3 and similar tables in earlier *Annual Reports* (IMF Reserves-Quantity and Value); BIS *Quarterly Review* (appendix tables 5 and 13); various central banks (nineteen countries' reserves).

agents in markets outside the United States issue a significant amount of dollar-denominated debt.[8]

We do not have a good data set to illustrate this point. Indeed, the BIS data depicted in figure 8C.2 exaggerate the role of the euro because, for example, they include as international debt instruments issued by euro-area countries within the euro area or in London.[9] Nevertheless, the data in figure 8C.2 are interesting because they show the contrast between the IMF data for the dollar's share in foreign exchange reserves (value and quantity shares) from 1999 to 2004, the BIS data on the currency composition of cross-border financial instruments, and data we have collected on currency composition of nineteen individual countries' foreign exchange reserves from 2000 to 2004.[10] From 2000 to 2003, the dollar's value share in the BIS data on financial market instruments declines by almost three times as much as in the IMF data on the dollar's value share of international re-

8. There is some issuance in euro as well, but most of that is issued in euro area or at least in EU financial markets, that is, London.

9. The BIS data combine information on the currency breakdown of (a) BIS reporting banks' liabilities to nonbanks, (b) international money market instruments (such as commercial paper), and (c) international bonds and notes.

10. Anna Wong painstakingly assembled these data. The list of countries is larger than reported in Truman (2005b).

serves. However, the dollar's quantity share of reserves actually increases in the IMF data by 2.4 percent. The change in the dollar's value share in the foreign exchange reserves of nineteen countries that publish these data is comparable to the change in IMF data on its value share. The change in the dollar's quantity share for the sample of nineteen countries is again an increase (2.7 percent), almost identical with the IMF series.

Chinn and Frankel might have tried to answer a more interesting question: whether the euro is likely to replace the dollar as an *international currency* and, if so, why and when? Short of that, they might have used one of the series on international currency shares, for example, the currency denomination of trade, to explain international reserves shares. Their implicit story is that a currency's broader international role depends on its reserve role.

For example, in their discussion of the advantages and disadvantages of having an international currency—the broader role—Chinn and Frankel speak of convenience for the country's residents, more business for the issuing country's banks and financial institutions, seignorage, and political power and prestige. It is not clear how or why any of those functions are related to the reserve role of the dollar. The partial exception is that seignorage derived from issuing low-risk debt that is attractive to foreign monetary authorities, which has nothing to do with the much larger amount of seignorage from the use of the U.S. currency in private international transactions.[11]

When they come to disadvantages, Chinn and Frankel again conflate the dollar's various roles. Fluctuations in the demand for the U.S. dollar, by which they mean dollar-denominated assets, do not affect the U.S. money stock except trivially in the case of currency, which is elastically supplied by the Federal Reserve in any case. An increase in foreign demand for assets denominated in a country's currency will tend to appreciate its exchange rate, but that demand can come from private as well as official sources. Chinn and Frankel do note a disadvantage associated with the dollar's international role: the Federal Reserve has to take account of feedback effects from its policy actions onto the attractiveness of dollar-denominated assets and the broader global financial market implications of its actions, for example, as was the case in the wake of the Russian default in 1998.[12]

11. Foreign official holdings of U.S. Treasury bills, bonds, and notes were $1.2 trillion as of March 2005. A generous estimate would be that the saving to the U.S. Treasury from foreign official demand for such low risk debt is 50 basis points, yielding $6 billion in seignorage. Estimates of seignorage from foreign private use of U.S. currency are about twice as large. The U.S. currency outstanding is about $700 billion. A conservative estimate in the data on the U.S. international investment position is that $33 billion in U.S. currency circulated abroad at the end of 2004. At an interest rate of 3 percent, another conservative number, the United States receives $10 billion in seignorage from the private international use of U.S. currency.

12. When the Bank of England raised rates in the fall of 1998, I asked a senior official of the Bank of England if the monetary policy committee had taken account of the international financial implications of their action. I was told that there were none. I was also told that the Bank of England hoped that the Federal Reserve, on the other hand, would take account of the international financial implications of its actions!

What Is the Right Model?

I am skeptical whether active reserve diversification, driven by the profit motive, is the right rubric to use in considering these issues. Moreover, recall that Chinn and Frankel test for only passive reserve diversification. The Chinn and Frankel results confirm the well-known observation that there is substantial inertia in international reserve holdings. The issue is what explains this inertia.

A number of explanations are possible, but I think the most plausible is the fact that as a first approximation most countries accumulate foreign exchange *reserves* as a by-product of another policy—pursuit of an exchange rate objective. Normally, a country does not have a quantity objective for its foreign exchange reserves. The country has a price objective for its foreign exchange *rate,* which means the monetary authority cannot simultaneously have a quantity objective, and, as well, it probably does not think primarily in portfolio-balance terms about the country's reserve holdings.[13] They want to peg their currency to another currency (for example, China and Hong Kong pegging their currencies to the U.S. dollar) or they want to resist the appreciation of their currency (for example, Japan, Korea, India, and even the United States when it built up its meager foreign exchange holdings in the late 1980s and early 1990s).

Occasionally, a country has a war-chest or quantity motive, as was the case for the United States in 1980 and early 1981, when the U.S. Treasury and Federal Reserve went on accumulating foreign exchange after having covered the repayment of the Carter bonds. A war-chest motive was involved for many East Asian economies in the immediate wake of the Asian financial crisis, but it is difficult to separate that motive from the motive to prevent currency appreciation that would weaken export-led growth. Moreover, the war-chest argument for reserve accumulation in East Asia had lost its potency after about 2001. Nevertheless, the major economies of non-Japan Asia increased their foreign reserves by more than 100 percent on average over the following three years. Japan also increased its foreign exchange reserves by more than 100 percent over the three-year period.

In this context, it is not surprising that the currency composition of a country's foreign exchange reserves is a secondary question, except in the case of a country that may be in the process of joining a monetary area, as is the case for a number of the countries listed in table 8C.1. As long as a country's foreign reserves are small, the authorities keep them in the most liquid assets; dollar assets are the most liquid. Moreover, the currency com-

13. At a later date, the authorities may begin to think in these terms. For example, the central banks of Australia, Iceland, and Israel state that they use a benchmark approach to the currency composition of their foreign exchange reserves.

Table 8C.1 Diversification of foreign exchange reserves 2000–2004 (%)

	U.S. dollar		Euro		Yen		Other currencies	
	Share 2004	Change 2000–2004	Share 2004	Change 2000–2004	Share 2004	Change 2000–2004	Share 2004	Change 2000–2004
Lithuania[a]	4	–78	96	80	0	–1	0	–1
Romania	36	–37	59	35	0	0	5	2
Canada[b]	48	–27	49	27	4	0	0	0
Latvia	38	–16	59	26	3	–2	0	–9
Croatia	16	–10	84	14	0	0	0	–4
The Philippines	83	–9	10	8	4	–1	4	2
Slovenia	12	–9	83	11	0	0	4	–2
Switzerland	34	–7	48	3	0	–3	19	7
United Kingdom	30	–6	55	17	15	–12	0	0
Bulgaria	6	–4	91	3	0	0	3	2
Germany	98	–1	0	0	2	1	0	0
Finland	30	0	0	0	5	–10	65	10
Slovak Republic	22	0	78	3	0	–3	0	0
United States	0	0	57	10	43	–10	0	0
New Zealand	57	4	43	26	0	–31	1	1
Colombia	85	5	12	–3	3	–1	0	0
Australia	45	5	45	15	10	–20	0	0
Hong Kong[c]	79	11	11	–1	2	–2	9	–8
Norway	35	14	43	–3	6	–6	16	–4
Subtotal	50	–6	36	12	7	–5	7	–1
Uruguay[d]	82	n.a.	11	n.a.	4	n.a.	3	n.a.
Iceland[e]	40	n.a.	40	n.a.	5	n.a.	15	n.a.
Sweden[e]	37	n.a.	37	n.a.	8	n.a.	18	n.a.
Grand total	50	n.a.	36	n.a.	7	n.a.	8	n.a.
Memo: Peru[f]	90	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Sources: Central bank annual report (Bulgaria, Colombia, Finland, Germany, Hong Kong, Iceland, Lithuania, New Zealand, Norway, Peru, The Philippines, Romania); ministry of finance annual report (Canada); central bank web site (Sweden); IMF SDDS reserve template web pages (Latvia, Croatia, Uruguay); monthly statistical bulletin on central bank or ministry of finance web site (United States, United Kingdom, Switzerland, Australia, Slovak Republic, Peru).

[a]Assumes 2004 share is the same as in 2003.

[b]Canada holds only three currencies as foreign exchange reserves: U.S. dollar, yen, and euro. Prior to 2003, data published by Canada's ministry of finance only differentiate between U.S. dollar and non-U.S. dollar foreign exchange reserves. Hence, to derive the yen and euro shares for 2000–2002, we assume that the yen share during the period was the same as it was in 2003, and the rising euro share was derived as a residual.

[c]Since 2003, the Hong Kong Monetary Authority has grouped yen, euro, and other European currencies together into one category as "Non-U.S. dollar bloc." The 2003–2004 yen and euro shares in this table are derived by assuming that they remain the same as in 2002 in the "Non-U.S. dollar bloc," which has decreased as a share of the total since that time.

[d]Earliest data available are for August 2003.

[e]Data are available for only 2004.

[f]Earliest data available are for July 2002, but only differentiate between the U.S. dollar and other currencies (yen, euro, pound, and Canadian dollar).

position of the reserves of small holders is of little interest to or importance for the functioning of the international financial system.

The issue of reserve diversification focuses on a much smaller group of countries. As of the end of 2004, only eighteen countries held more than SDR 25 billion ($39 billion) in foreign currency reserves. Of course, those eighteen countries face another problem if their authorities begin to view their reserves not as the by-product of an exchange rate objective but as a portfolio of assets to manage, paying due attention to risk and return. Their portfolio decisions may interfere with their exchange rate objectives. If China were to begin to sell dollar investments on a large scale and replace them with euro or yen investments, the People's Bank of China might find itself in effect buying back some of those dollars. The portfolio-balance type of explanation is that some of the dollar assets China would have sold to invest in euro or yen would be unwanted at the current dollar exchange rate with the Chinese yuan and would be recycled by the financial markets back to China. Of course, the Japanese ministry of finance and euro-area finance ministers would also not be too happy about the resulting upward pressure on their currencies.

It is for this reason that I have proposed (Truman 2005b) an international initiative with respect to reserve diversification. It includes five elements.

First, as a supplement to the "Data Template on International Reserves and Financial Liabilities" (reserve template) of the IMF's Special Dissemination Standard (SDDS), the major industrial countries should commit to providing regular, for example, at least quarterly with a one-month lag, information on the currency composition of their individual holdings of foreign exchange reserves (off-balance sheet as well as on-balance sheet). At least twenty-three of the forty-eight countries that subscribe to the reserve template of the SDDS and that have committed to supplying historical data on their reserves also now voluntarily provide periodically (at least annually) specific information on the currency composition of their foreign exchange reserves.[14] Those countries that voluntarily disclose some information on the currency composition of their foreign exchange reserves include eleven industrial countries (Australia, Canada, Finland, Germany, Iceland, New Zealand, Norway, Sweden, Switzerland, the United Kingdom, and the United States) and twelve emerging market

14. Full compliance with the reserve template requires the periodic disclosure of international reserves broken down by currencies in the SDR basket as a group (the euro, Japanese yen, U.K. pound, and U.S. dollar) and those not in the SDR basket. Additional disclosure of the currency composition of foreign exchange reserves is optional. The forty-eight countries comply by providing historical data their reserves including information on the type of investments held, for example, securities, bank deposits (in domestic or foreign banks, onshore and offshore), equities, as well as on-balance-sheet and off-balance-sheet assets and liabilities. An additional thirteen countries subscribe to the SDDS and must comply with the reserve template going forward, but do not supply historical data.

economies (Bulgaria, Croatia, Colombia, Hong Kong, Latvia, Lithuania, Peru, the Philippines, Romania, Slovenia, the Slovak Republic, and Uruguay). See table 8C.1.[15] Together, their foreign exchange reserves were $532 billion as of July 2005, or 15 percent of the global total of $3.5 trillion.[16]

This is an excellent start on transparency in this area. Increased transparency would reduce financial market uncertainty regardless of whether the other elements of my proposal were adopted. What is important to recall is that the development of the original reserve template that was incorporated into the SDDS was a project of the G10 central banks meeting under BIS auspices. Expanding that template to *mandate* the disclosure of the currency composition of foreign exchange reserves should similarly be an exercise in central bank cooperation under the aegis of the BIS logically involving the G20 countries, which hold two-thirds of global foreign exchange reserves.

As a second step, a standard for reserve diversification should be established. One starting point might be one-third U.S. dollar, one-third euro, and one-third yen for countries other than the United States, Japan, and those in the euro area. The standard for the euro area, Japan and the United States, might be fifty-fifty. In both cases, countries could be permitted discretion of up to, say, plus or minus 10 percentage points. Alternatively, each country could declare a different benchmark as long as it disclosed its benchmark and its compliance going forward and as long as the country committed in advance to a smooth adjustment to any new benchmark.

Third, Japan and the euro area should agree to an off market transaction to swap dollars for euro and yen assets, respectively, to achieve the fifty-fifty standard. The United States is close to fifty-fifty; see table 8C.1.

Fourth, Japan and the euro area should agree to feed the swapped dollars into the market on daily basis over a period of at least five years. Assuming that each holds only dollars today, which is an extreme estimate, the total dollar holdings to be disposed of would be $500 billion, or $100 billion a year, or about $400 million a day. The resulting effects on foreign exchange rates of the regular daily sales of $400 million are likely to be triv-

15. The countries listed in table 8C.1 include a few, as noted in the table, that disclose only the break between their U.S. dollar and non-U.S. dollar reserves.

16. The twenty-three countries include seven of the twenty-one with significant holdings of foreign exchange reserves (more than SDR 25 billion at the end of July 2005): Australia, Germany, Hong Kong, Norway, Switzerland, the United Kingdom, and the United States. The eleven industrial countries hold 24 percent of the total foreign exchange reserves of industrial countries, with Japan with 63 percent of industrial countries' foreign exchange reserves the only major holdout. Six G10 countries are on the list, accounting for 18 percent of G10 countries' foreign exchange reserves. Five G20 countries are on the list, accounting for 7 percent of their combined foreign exchange reserves.

ial in a market for which daily turnover was $1.9 trillion per data in April 2004.[17]

Fifth, other countries should be encouraged immediately to diversify their current marginal purchases of dollars according to the standard or their benchmark. They also should be encouraged to adjust their existing portfolios smoothly over a five-year period following the suggested examples of Japan and the euro area. If the Japanese and euro-area authorities wanted to facilitate this process by other countries or to stretch it out for more than five years, they could engage in swaps of their currencies for the dollars held by other countries and, thus, remain in control. They might be motivated to do so out of concern over their respective dollar exchange rates.

The full establishment and implementation of this standard not only would increase transparency but also would remove considerable uncertainty overhanging international financial markets without causing large effects on exchange rates.

Table 8C.1 provides some context on the diversification of foreign exchange reserves over the past four years. At the end of 2004, the U.S. dollar's value share in the reserves of the twenty-three countries was 50 percent. This is substantially less than the share estimated by the IMF for 2003 (IMF 2005, 109), which was 65.9 percent. The difference reflects the underrepresentation Asian and Latin American countries in the data in table 8C.1.

Over the past four years, the euro's share in the foreign exchange reserves of the nineteen countries for which we have reasonable time series data has risen by 12 percentage points. However, the decline in the U.S. dollar's share accounts for only half of the increase. The yen and other currencies contribute 5 and 1 percentage points, respectively.

Five countries have increased the dollar's share in their foreign exchange reserves: New Zealand, Colombia, Australia, Hong Kong, and Norway. Meanwhile, Lithuania, Romania, Canada, Latvia, and Croatia have substantially reduced the dollar's share in their reserves—by more than 10 percentage points. The declines for the other countries principally reflect valu-

17. Hildebrand (2005) describes a similar transparent program of gold sales by the Swiss National Bank, which appears to have had essentially no market impact. On the other hand, Blanchard, Giavazzi, and Sa (2005) estimate that if China and Japan were unexpectedly to shift half of their foreign exchange reserves, which they also assume are now all in U.S. dollars, into other currencies, the dollar's share in global portfolios would decline from 30 to 28 percent, which is a substantial shift within their framework, leading to a decline in the dollar possibly as large as 8.7 percent if the full adjustment was anticipated to occur over a period of one year. Their model is built on the assumption of imperfect asset substitution; the closer the parameterization is to perfect substitutability, the smaller the initial exchange rate adjustment and the more prolonged the adjustment process. In the limit, the model degenerates, and the speed of adjustment goes to zero.

ation effects. These data are value shares, and the presumption is that most countries mark the value of their foreign exchange holdings to market.

Seven countries have had large increases (15 percentage points or more) in the euro's share: Australia, Canada, New Zealand, the United Kingdom, Latvia, Lithuania, and Romania. The adjustments by the last three countries no doubt are responses to those countries' increasingly close ties to the European Union.

Three countries have reduced the yen's share substantially (by more than 10 percentage points): Australia, New Zealand, and the United Kingdom. Presumably these adjustments were responding, in part, to the low yield on yen-denominated assets. However, they also reflect relative value effects.

In the case of the United States, the euro's share rose by 10 percentage points between 2000 and 2004, and the yen's share declined by the same amount. Over the period, the United States made no purchases of euro or yen, earned a higher yield on euro-denominated assets than on yen-denominated assets, and the euro appreciated more against the dollar than the yen; this explains the decline in the yen's share in U.S. foreign exchange reserves.

Conclusion

Chinn and Frankel have written a provocative and interesting paper. Their central result is that the dollar will be replaced by the euro as the leading international reserve currency within two decades, especially if the United Kingdom joins the euro area and the U.S. dollar continues to depreciate at its recent pace against the SDR. The forces behind a decline in the dollar's share are plausible, but the dating of the takeover by the euro is empirically unconvincing. A better bet is not in this century.

Chinn and Frankel might have addressed a more interesting question. The more economically relevant question is the dollar and the euro's broader roles as international currencies, rather than their narrow roles as reserve currencies. Furthermore, the authors in their discussion often conflate the two roles rather than exploring their interaction.

Finally, the implicit framework—active reserve diversification—that Chinn and Frankel employ is probably flawed even if they had applied it appropriately by looking at quantity shares of international reserves, which they did not. The accumulation of foreign exchange reserves is driven primarily by price (exchange rate) considerations linked to other economic policy objectives, not by considerations associated with profit maximization using a portfolio-balance framework.

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