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INTERNATIONAL CURRENCY

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Working Paper 13909
<http://www.nber.org/papers/w13909>

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2008

We thank Brad Setser for useful comments regarding the reserves data and Benn Steil for encouraging us to write this paper. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the National Bureau of Economic Research.

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April 2008
JEL No. E42,F0,F02,F31

ABSTRACT

The euro has arisen as a credible eventual competitor to the dollar as leading international currency, much as the dollar rose to challenge the pound 70 years ago. This paper uses econometrically-estimated determinants of the shares of major currencies in the reserve holdings of the world's central banks. Significant factors include: size of the home country, rate of return, and liquidity in the relevant home financial center (as measured by the turnover in its foreign exchange market). There is a tipping phenomenon, but changes are felt only with a long lag (we estimate a weight on the preceding year's currency share around .9). The equation correctly predicts out-of-sample a (small) narrowing in the gap between the dollar and euro over the period 1999-2007. This paper updates calculations regarding possible scenarios for the future. We exclude the scenario where the United Kingdom joins euroland. But we do take into account of the fact that London has nonetheless become the de facto financial center of the euro, more so than Frankfurt. We also assume that the dollar continues in the future to depreciate at the trend rate that it has shown on average over the last 20 years. The conclusion is that the euro may surpass the dollar as leading international reserve currency as early as 2015.

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1. Introduction: When the Dollar Overtook the Pound

In the aftermath of the Second World War, the dollar emerged as the uncontested leader among international currencies, a development of historic significance. In 1899 the share of the pound in known foreign exchange holdings of official institutions had been more than twice the total of the next nearest competitors, the franc and the mark, and much greater than the dollar.¹ Even 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.² The war itself -- including US lending, UK borrowing and other consequences -- had completed the dollar's rise to ascendancy.

The reversal reflected long-run trends in economic fundamentals that had already been underway since the late 19th century. The US economy surpassed the British economy in size in 1872.³ US exports did not pull ahead of UK exports until 1915. The development of the financial system lagged behind; one reflection is that the United States did not establish a central bank until 1913. During the years following 1914, the US passed from net debtor to net creditor while the UK moved in the opposite direction. This had much to do with British borrowing from the United States so as to fight World War I. The dollar was the only currency to remain convertible into gold at a fixed price into the 1920s.⁴ As it emerged as a major international currency, its use in international trade and finance widened increasingly. That the pound retained its dominant position as key currency in the interwar period was primarily due to inertia in such arrangements. But by 1945 the dethroning was complete.

The decline in the pound was clearly part of a larger pattern whereby the United Kingdom lost its economic pre-eminence, colonies, military power, and other trappings of international hegemony. As some wonder whether the United States might now have embarked on a path of "imperial over-reach," following the British Empire down a road of widening 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 US pressure to abandon its remaining

¹ \$105.1 million in pounds, \$27.2m in francs, \$24.2m in marks, and \$9.4 in other currencies. In 1913, the ranking was the same: \$425.4 million in pounds, \$275.1m in francs, \$136.9m in marks, and \$55.3 in other currencies. Lindert (1969, p.16-22).

² Aliber (1966, p.19-20).

³ In real terms --1990 International Geary-Kamis dollars.

⁴ E.g., Nurkse (1944), Bergsten (1975, p.53), and Eichengreen (1992).

imperial designs. But the important role played by a simultaneous run on the pound, and the American decision not to help the beleaguered currency, should also be remembered.⁵

2. Measuring the dollar's international role

In the 1990s, the question arose whether the dollar was in the process of losing its role as unrivaled international currency, as had the pound before it.⁶ The yen and mark had gained steadily during the 1970s and 1980s, as measured by shares in central banks' holdings of foreign exchange reserves, at the dollar's expense. The strong fundamentals of the Japanese and German economies, particularly their current account surpluses and low inflation rates, constituted an obvious explanation.

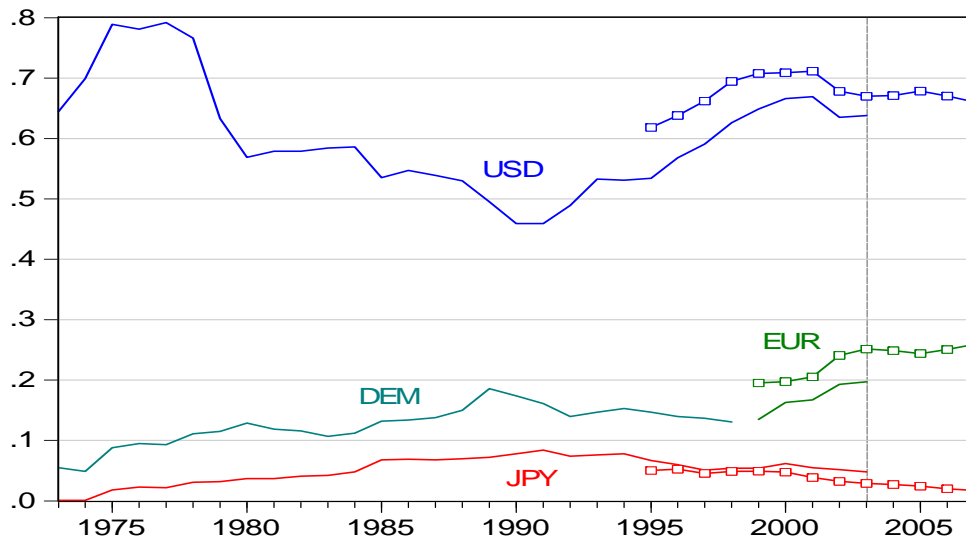
But the facts in the 1990s suggested that the right answer to the question was "no." Observers had confused a fall in the foreign exchange value of the dollar (1985-1995), with a fall in its international role. In reality, the Japanese and German economies and their respective currencies remained far behind the United States and the dollar. Furthermore, the dollar's share in reserves actually *rose* throughout the 1990s, as Figure 1 shows.⁷ The dollar was also in demand in other respects, for example as a transactions currency in Latin America and wherever else in the world people had lost faith in their own currencies.

⁵ E.g., Boughton (2001) and "From Suez to Baghdad," Charlemagne, *The Economist*, March 22, 2003, p. 47. The prime minister was told that the US would likely not support British plans to go to the IMF for support of the pound.

⁶ Kindleberger (1995, p.6) and Kunz (1995) are among those who "cried wolf." 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 DM in particular. Others, such as Hale (1995), saw the yen as the challenger.

⁷ The ratios based upon the COFER data assume 70% of the reserves not identified are held in dollars, and 25% in euros. See the discussion at the end of Section 6 for more detail.

Figure 1: Reserves held by central banks as shares of total – 3 major currencies (revised IMF data spliced into old data after 1979, and COFER data starting 1995).



Now the question, “Is the dollar in danger of losing its exclusive role as premier international currency?” comes up yet again. But this time the answer may be “yes.” The primary reason is that the euro now exists as a more serious potential rival than the mark or yen were. A secondary reason is that the US by now has a 25-year history of chronic current account deficits and the dollar has a 35-year history of trend depreciation.

There are various possible criteria of international currency status: use of currencies to invoice trade, to denominate debt and loans, and so forth. We focus on reserve currency holdings for two reasons. First, annual data for all relevant currencies are available over the last three decades or more; the other international roles 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.

That being said, the same factors that determine the holdings of reserve currencies are similar to those that affect other aspect of international currency status, such as the usage of currencies for invoicing of trade in goods and assets. This point is useful to keep in mind as we proceed through our analysis.⁸

⁸ Goldberg and Tille (2006), for example, argue that invoicing in commodities is in dollars because of the lower transactions costs associated with transacting in dollars. But this lower cost is not immutable. The choice of a currency to use in the invoicing of trade and the holding of transactions balances depends upon the macroeconomic volatility associated with various currencies. If the dollar becomes less desirable to hold, the euro could eventually become the currency associated with lower transactions costs.

3. Reserve Currency Determinants

We seek empirically to ascertain the determinants of international reserve currency shares in the past, in order to ascertain the conditions and timing under which the euro might possibly surpass the dollar in the future.⁹ We use as our data base the period 1973-98, before the advent of the euro. The exercise is largely parameter estimation and calibration, without a lot of hypothesis-testing. In other words we need to squeeze a lot out of a small sample and so we intentionally impose some a priori information.

The literature on what determines reserve currency status is fairly well-established, if often lacking in quantification. Three key points.

(1) *Determinants*. There is a list of determining factors, which appears subsequently, in section 5 below. 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*: 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.¹⁰

(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: (1) ascertain the most important determinants and their relative weights, (2) confirm that the function is non-linear and settle on an appropriate functional form, and (3) 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 1973-1998. 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 addressing the tipping phenomenon, item (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 categories (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 turn this obstacle to advantage. We obtain a check on the meaningfulness of the equation that was estimated

⁹ This represents an updating of the estimation in Chinn and Frankel (2007). That paper elaborated on the econometrics.

¹⁰ 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.

on pre-1999 data by seeing whether it successfully predicts the direction of movement over the period 1999-2007. 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, what additional countries eventually join EMU. While we never expected to predict that the euro could overtake the dollar anytime soon, we entered this exercise with an open mind regarding whether the euro might overtake the dollar in the longer term.

4. International Use of the Euro So Far

Of the various 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 tremendous 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 is taking place inside the currency’s home region.¹¹

Outside Europe, the euro has been a success as well. 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. The stock of international debt denominated in euros increased from about 20 percent on the eve of EMU, to 30 percent in 2003 (Rey, 2005, p. 114).

When the euro arrived, although its share approximately equaled the sum of the shares of the mark, French franc and guilder the year before EMU, it was less than what one would get by adding in the share of ECUs (European Currency Units). 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. The euro’s share in central banks’ foreign exchange reserves reached 19.7% in 2003 and has grown steadily thereafter.¹²

¹¹ Gaspar and Hartmann (2005), and Rey (2005).

¹² There have been substantial revisions in the estimated euro shares. For instance, in November 2003 the IMF revised the 2002 estimate from 14.6% to 18.7%. (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.

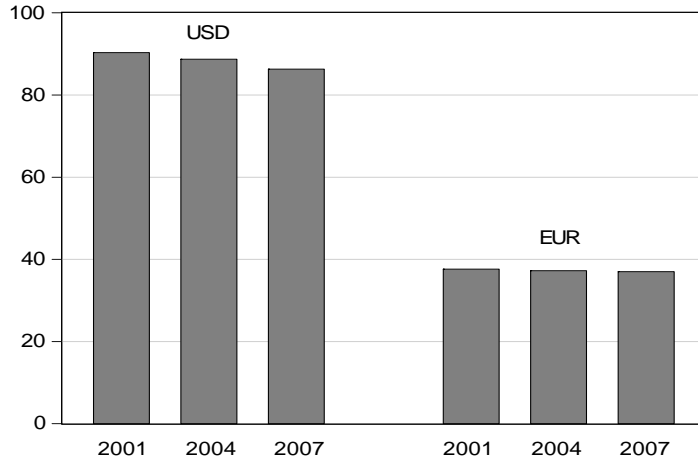
International use of the euro has grown by other criteria as well. About half of euroland trade with non-euro area residents is invoiced in the new currency.¹³ The euro's share in international debt securities rose to above 30% (versus below 20% for the pre-1999 legacy currencies).¹⁴ Anecdotal evidence suggests that euro cash is increasingly accepted in retail transactions around the world, and dollar bills decreasingly so.

The comprehensive triennial survey of foreign exchange trading volume put together by the BIS showed the dollar still easily in first place in 2001, at 85% of all spot trades (out of 200%), followed by the euro at 43% and the yen at 26%.¹⁵ The same ranking holds when one adds in forwards and swaps, and derivatives that are traded over the counter. The next triennial BIS survey, covering April 2004, showed a small gain for the euro. Including also forwards and swaps, the dollar was involved in 89% of all transactions, and the euro in 37% in 2004.¹⁶ The most recent survey, covering April 2007, shows the dollar having declined further, to 86 per cent of all traditional transactions. (Meanwhile, in an unheralded come-back, the pound has been closing in on the yen for the #3 spot.) Over-the-counter FX derivative markets tell a stronger story: the euro has been gaining share since its creation, and the dollar losing share.¹⁷ Figure 2 illustrates the dollar's gradual loss of share in total foreign exchange trading, traditional plus over-the-counter derivatives.

Figure 2: Currency distribution of reported foreign exchange market turnover

Percentage shares of average daily turnover in April of each year (Shares sum to 200%).

Source: BIS (2007) Foreign exchange and derivatives market activity in 2007, page 11.



¹³ Hartmann (1998).

¹⁴ The annual report of the European Central Bank (2003), from which these statistics come, cites data through mid-2003.

¹⁵ To compare foreign exchange trading volume in the euro with volume in its predecessor currencies, one must allow for the disappearance of intra-euro trading, as in the Detken and Hartmann's (2002, p. 558-559) "simple arithmetic of EMU." They find that the observed decline is almost fully accounted for in this way.

¹⁶ Bank for International Settlements (2005).

¹⁷ Bank for International Settlements (2007, p.11).

In short, the euro is the number two international currency, ahead of the yen, and has rapidly gained acceptance, but is still well behind the dollar, which appears to most observers to be comfortably in the number one slot. We now turn to a consideration of the determinants of international currency status.

5. Factors that Suit a Currency for International Currency Status

The literature on international currencies has identified a number of determining variables.¹⁸

(1) 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 should be number 2, ahead of Germany. 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 15 countries.¹⁹ Their combined economic weight is much greater than Germany alone, or Japan. As of 2007, it was not quite as large as the United States, as Table 1 shows. But evaluated at current exchange rates, the value of US GDP apparently fell below that of euroland GDP for the first time in early 2008. Very likely, most of the 12 countries that have acceded to the EU over the last four years will eventually join EMU, which will boost euroland's collective GDP a bit further. If the other three long-time EU members, United Kingdom, Sweden, and Denmark, were to join, euroland would definitively surpass the United States in economic size; but that is much less likely to happen. If any of the larger 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 US and European economies. As an alternative to GDP, we have also looked at countries' trading volume as another indication of their relative weights in the world economy.

Table 1: Economic Size of US vs. Europe

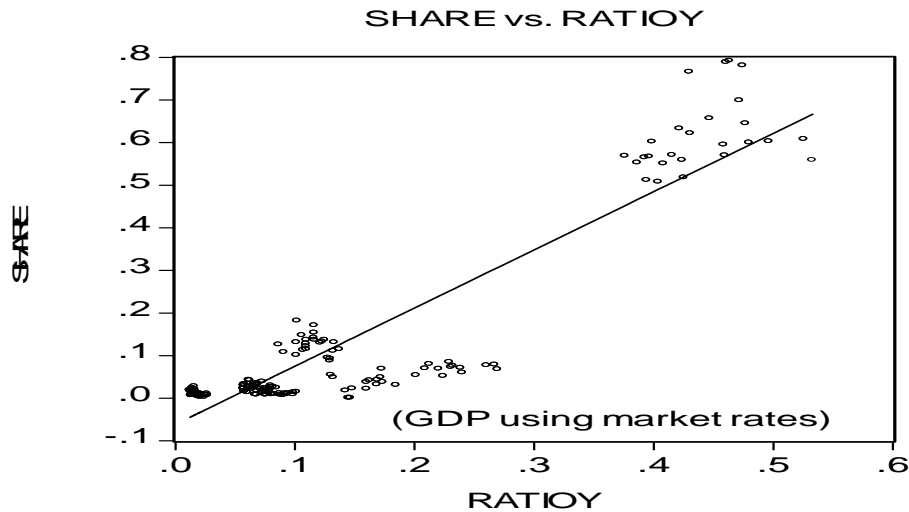
		2004		2007
US		\$ 11.5		\$ 13.8
		trillion		trillion
Euro-zone	Number of members		Number of members	
	12	\$ 9.0 trillion	13 ^{1/}	\$ 11.9 trillion
EU (post-May 2004)		\$12.1		\$ 16.6
	25	trillion	27 ^{2/}	trillion

^{1/} Includes Slovenia, but not Cyprus and Malta, who joined the euro in 2008

¹⁸ Among the relevant references are Aliber (1966), Alogoskoufis and Portes (1992), Bergsten (1975), Black (1989), Dooley et al. (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).

¹⁹ Slovenia joined in January 2007 and Cyprus and Malta in January 2008.

Figure 3: Currency share vs. GDP (at market rates)



(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 have long benefited the dollar and pound relative to the euro and its predecessor the deutschemark, as Frankfurt still lag far behind as a financial center. In our earlier paper, we took it for granted that Frankfurt was the current home of the euro. Under the scenario where the UK decided to join EMU, the euro benefited from the double boost on counting the UK economy into the size of the euroland economy, and bringing the advantages of London's deep financial markets.

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, etc. This measure differs from turnover *of* the currencies (dollar, pound, euro, etc.), a variable that would be much more likely to be determined simultaneously with the international currency status that we are trying to explain. It captures, for example, the pre-eminence 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 but just barely, and with increasing difficulty as one goes back through the 1970s. We also tried an alternative proxy for the size of financial centers -- the size of the countries' stock markets.

(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 inflated away in the future, is critical. 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.²⁰

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. 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 likely source of downward pressure on the dollar. Such fears work to make dollars unattractive.

(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 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. See also Rey (2001).

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,

²⁰ E.g., Tavlas and Ozeki (1991).

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.²¹ And so forth. In this paper we content ourselves with trying to predict reserve currency holdings, with the understanding that international usage of a currency is likely to be influenced by the same factors.

6. Econometric estimation of Demand for Reserve Currencies

We use the IMF annual data on aggregate central bank holdings of the relevant major currencies. The data are not generally available according to holding of individual central banks, because most of them regard this as highly confidential.²²

Functional Form

From inspection of Figure 3, it seems apparent that the relationship between currency shares and GDP shares is nonlinear. Indeed, the functional form cannot literally be linear, because the currency shares are bounded between 0 and 1. A natural way of taking into account such a constraint is to use a logistic transformation of the shares variable.²³ The standard logistic transformation is symmetric, and has a maximal slope at share equal 0.50.

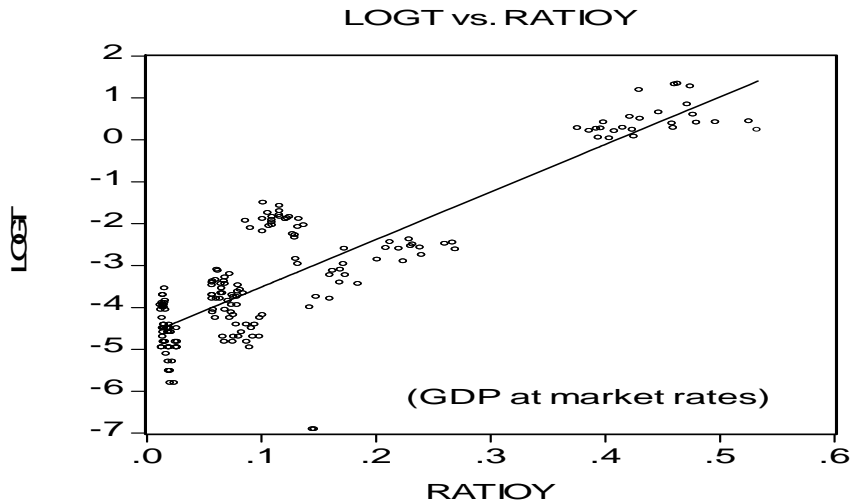
Figure 4 plots the logistic of the currency share against the size variables. The straight line now seems to fit the data much more comfortably, indicating that the logistic may be a good guess.

²¹ In some of our regression tests we tried adding to our list of determinants a measure of the popularity of the major currencies for smaller currencies to peg to (as suggested by Eichengreen and Mathieson, 2000). 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. In what follows we emphasize regressions without the pegging-anchor variable included.

²² The IMF data is broken down into aggregate holdings by industrialized countries and aggregate holdings by developing countries. Some have suggested that the first data set is more interesting because the reliability of the statistics is higher. Others have suggested that the second data set is more interesting because the G10 countries cannot hold their own currencies as reserves.

²³ Logistic = $\log(\text{share}/(1-\text{share}))$.

Figure 4: Logistic share vs. GDP (mkt. rates)



Basic Estimation results, 1973-1998

Table 2 reports results of regressions of currency shares against the variables we have discussed, when estimation is based on the logistic transformation, which reflects the inherent nonlinearity of the problem. Judged by the number of statistically significant coefficients, this functional form is more successful statistically than a linear form. In all instances a lagged endogenous variable is included, to account for partial adjustment, which is an important factor.

We can easily summarize the results. Size of the home country (relative income) enters positively, significantly, and robustly. All three rate-of-return variables appear with the hypothesized negative signs: losses in the value of a currency decrease the attractiveness of holding it. They are statistically significant more often than not, though inflation (expressed as the differential vis-à-vis average industrial country inflation) shows up more strongly and consistently than does trend depreciation (estimated as 20-year average rate of change of the value of the currency against the SDR) or exchange rate volatility. Foreign exchange turnover, our measure of the depth of competing financial centers shows up with the hypothesized positive sign, but is only statistically significant in a minority of tests. The coefficient on the lagged endogenous variable suggests a slow adjustment rate. Only about 12% of the adjustment to the long run is estimated to occur in a single year, implying a half-life of about 5-6 years for the adjustment process.

Table 2: Panel Regression for Determination of Currency Shares

Dependent variable: logit of currency shares in reserve holdings Pre-euro sample (1973-98)			
	[1]	[2]	[3]
Constant	-0.65 [0.15]	-0.49 [0.14]	-0.12 [0.06]
GDP ratio (y)	2.77 [0.64]	2.22 [0.62]	1.04 [0.29]
Inflation differential (π)	-2.64 [1.16]		
Depreciation (Δs)		-1.08 [1.29]	-1.10 [0.59]
Exratevar (σ)	-0.98 [0.57]	-0.58 [0.58]	-1.25 [0.34]
FX Turnover ratio (to)	0.45 [0.29]	0.21 [0.30]	0.43 [0.14]
Lag: logit(share _{$t-1$})	0.85 [0.03]	0.88 [0.03]	0.96 [0.01]
N	182	182	156
Sample	1973-98	1973-98	1973-98
Adjusted R2	0.97	0.97	0.99

Notes: Dependent variable is $\text{logit}(\text{share}) \equiv \log(\text{share}/(1-\text{share}))$.

All variables are in decimal form.

GDP at market rates.

Estimated using OLS.

Figures in bold face are significant at the 10% level.

Column [3] omits Japanese yen, and uses cross-section weighted standard errors.

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 [3], in which all variables are statistically significant role.

Having shed some valuable light on the relevant variables and functional form, we estimate and adopt a two-currency version of the determinants of premier reserve currency status. This stripped down equation is more readily used to focus on predictions regarding the dollar-versus-euro choice²⁴

²⁴ The parameters of the two-currency version are estimated in Table 8 of Chinn and Frankel (2007).

Post sample test, 1999-2007

It is useful to assess how our model has done in terms of predicting the trends in reserve holdings since the advent of the euro in 1999.²⁵ This is more difficult to do than one might think. Since the time we conducted our initial analysis, the IMF has ceased reporting reserve holdings in the form it did up to the 2004 annual report. After this point, the IMF has not tried to estimate the composition of reserve holdings of those central banks that do not report details to the IMF. Instead, IMF's COFER database now reports an "unallocated" category. Unfortunately, from our perspective, this category is quite large, accounting for about 26.5% of total reserves. We have to take a stand on the composition of these unallocated reserves. We estimate the dollar share at 70%, and the euro share at 25%.

Both the level and the trend of the actual currency shares during 2005-2007 – up for the euro and down for the dollar – fit very well the simulation where the rate of returns on the currencies were expected to continue their trend of the first four years of the decade, as Figure 5 shows. This gives some grounds for some confidence in what we think we have learned from the historical data regarding the relevant variables, functional form, and coefficients.

7. Extrapolation to the future

The goal 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 years to come. But we want to know if there are plausible scenarios that give a different answer for 20 or 30 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. Secondly, the simulations are of course only as good as the parameters that we estimated from the historical data, most of which are neither precisely estimated nor entirely stable.

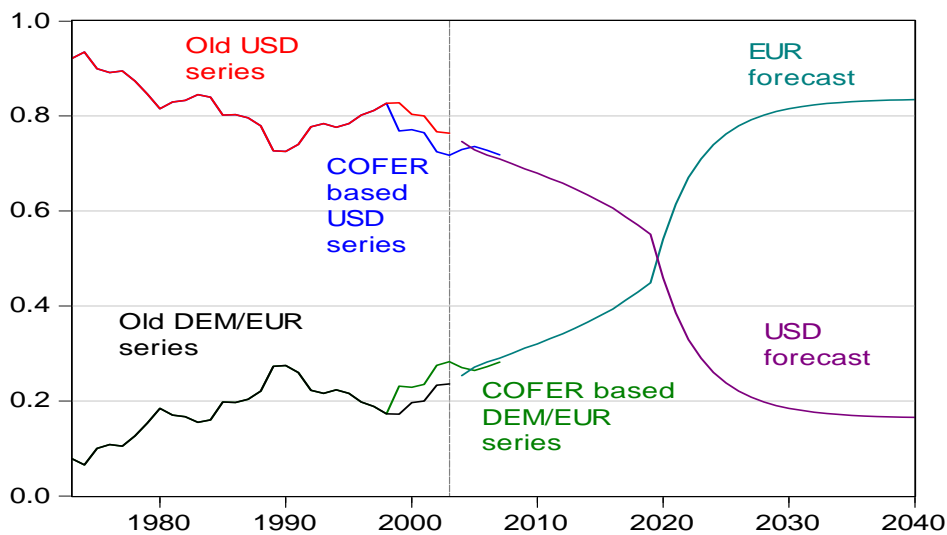
Posited Scenarios

In our earlier work, we experimented with a variety of scenarios. Two of them produced the result that the euro would gradually gain on the dollar, and that sometime early in the 2020s, the system would reach a tipping point, a rapid reversal in which the euro would surpass the dollar, which would then settle in at the number two slot. The

²⁵ In Chinn and Frankel (2007), we assess the out-of-sample forecasting characteristics of the pre-euro equations in Table 2 for all five top international currencies during the first five years of the post-euro period. We now skip directly to the two-currency model, and update the out-of-sample forecast by another three years of data.

first scenario was that EU countries that are not currently in EMU, of which Great Britain is by far the most important for these purposes, would join.²⁶ Even three years ago we did not claim that this scenario was a likely one, and it appears even less likely today, particularly in light of the good performance of the British economy since the start of EMU. The more likely scenario seemed to be the one under which none but small EU members joined the euro – countries that seemed too small to bother taking into account – but under which the dollar continued to lose value in the future at the same rate that it had in the past. This scenario produced a flipping of roles between the dollar and euro taking place around 2022 (Figure 5).

Figure 5: Update of Fig. 12 from Chinn and Frankel (2007), Case 4, Scenario D: Simulation of “UK entry” and continued depreciation of currencies at their 2001-04 rates.



On the one hand, one could argue that this scenario was too pessimistic for the dollar in two respects: first, the 2001-2004 rate of dollar depreciation that we used was more rapid than the longer-term historical average, and, second, the scenario did not allow for likely more rapid economic growth in the US than among European countries. On the other hand, one could argue that the scenario has proven to be too optimistic in three respects: First, the dollar has actually depreciated since 2004 at a more rapid rate, rather than a slower rate. Second, European growth prospects now appear not all that bad after all, in light of a modest recovery of productivity growth in the meantime in Western Europe and in light of the continuing gradual process of accession by countries that, though small in GDP per capita, loom larger in terms of both population and growth prospects.

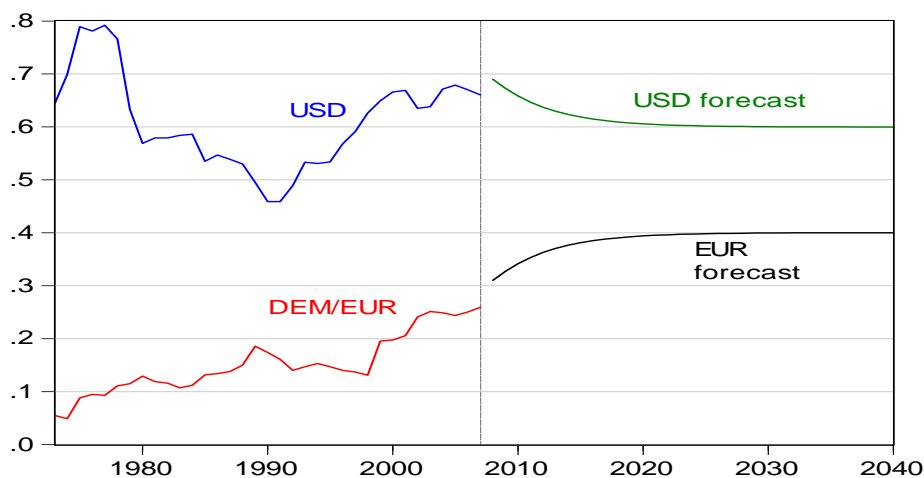
²⁶ The ten accession countries were assumed to join EMU in 2010, Sweden and Denmark in 2015, and the UK in 2020; the US retained its share of world income; and the dollar continued the depreciation experienced over the 2001-04 period

The third point is potentially the most important, by far. The measure of financial development that we have used until now-- forex turnover in Frankfurt versus New York – probably understates the progress of the euro. Galati and Woodridge (2006) “find that the liquidity and breadth of euro financial markets are fast approaching those of dollar markets, and as a result the euro is eroding some of the advantages that historically supported the pre-eminence of the US dollar as a reserve currency.” Three years ago we had taken it for granted that the euro would benefit from the depth and liquidity of London financial markets if and only if the UK were to join euroland, which we have agreed is an unlikely prospect. (In this we shared the assumption by British policymakers, for whom staying out of the euro was presumed to run the danger of substantial negative effects on London as a financial center.) Frankfurt remains far less developed as a financial center than London or New York, which in the earlier scenarios was perhaps the clearest drag on the euro’s progress as an international currency. But as of today, it appears that London has managed in many respects to become the financial center for the euro even while the UK remains outside European Monetary Union.

We now drop from the scenario the idea that the UK, Denmark and Sweden join the euro area anytime soon. We also drop the assumptions that the dollar continues to depreciate indefinitely at the 2001-04 rate (let alone the rate of 2004-07).

Our second scenario is the most conservative case: the dollar in the future depreciates only at the rate experienced on average over the 20 years up to end-2007, and only the new accession countries join the monetary union. Using the actual market GDP levels, exchange rate volatility and trading volumes recorded in 2007, we obtain the predictions for the dollar versus the euro illustrated in Figure 6. In this case, the dollar retains its primacy, even as the euro narrows the gap to a 40-60 difference.

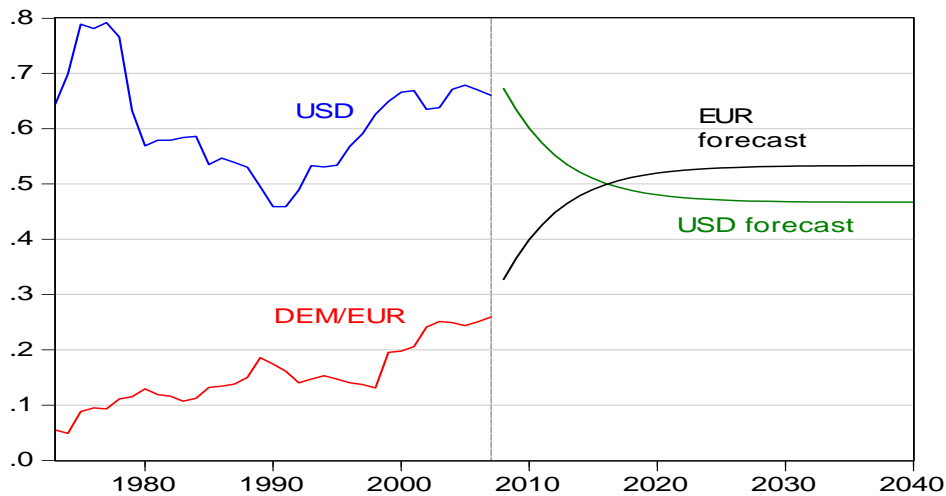
Figure 6: Only accession countries join EMU in 2010 (UK stays out), and currencies depreciate at the 20-year rate experienced up to 2007.



As noted above, the issue of financial depth is important. Our third scenario implements the idea that London, not Frankfurt, is in some sense the true financial center of the euro. It seems implausible, however, to assert that London is entirely devoted to providing the liquidity for the euro area. We chose to allocate 20% of London forex trading to the euro area.²⁷ Applying this measure of financial depth, we obtain the forecast shown in Figure 7. In this case, the euro overtakes the dollar sometime around 2015.

These simulations illustrate what sort of combinations of assumptions can drive the tipping points in our model.²⁸

Figure 7: Only accession countries join EMU in 2010 (UK stays out), but 20% of London turnover counts toward Euro area financial depth, and currencies depreciate at the 20-year rates experienced up to 2007.



8. Conclusion

Although our econometric analysis pertains only to the reserve currency role, we believe that similar considerations apply to other criteria of international currency status. This includes the use of the dollar versus euro as currencies in which to invoice trade, denominate debt, hold cash, and conduct foreign exchange transactions. Consequently,

²⁷ This figure is selected on the basis of the fact that 42% of the total 200% of forex trading in London involves the euro on one side of the transaction or the other. Divided by two equals 21%. BIS (2007).

²⁸ For instance, this forecast presumes, as in Figure 6, dollar volatility remains much higher than euro volatility. Assuming that this gap shrinks to that prevailing at end-2003 (as in our previous study) would overturn this role reversal.

*

if the dollar were to overtake the euro as a reserve currency, it is natural to conjecture that the international usage of the dollar would also be eclipsed by the euro along these other dimensions as well.

Possible Implications if the Dollar is Dethroned

In recent years, foreign central banks have financed by accumulation of dollar reserves a higher fraction of the US current account deficit, as compared to earlier in the decade, when the capital inflows came more from the private sector. But the US cannot necessarily rely on the support of foreign central banks indefinitely. One reason for this, which holds even if China and some oil-exporters continue to keep their currencies undervalued, is that they can diversify their currency holdings out of dollars, without necessarily allowing appreciation on a trade-weighted basis. The important point is that there now exists a credible rival for lead international reserve currency, the euro, which has many of the desirable characteristics of an international currency. This was not true in the late 1970s and early 1990s when the press feverishly speculated that the dollar might be overtaken by the yen or mark.

It is true that each Asian central bank stands to lose considerably, in the value of its current holdings, if dollar sales precipitate a dollar crash. But I agree with Barry Eichengreen (2005) that each individual participant will realize that it stands to lose more if it holds pat than if it joins the run, when it comes to that. Thus if we are relying on the economic interests of other countries, we cannot count on being bailed out indefinitely.

If individual economic self-interest will not keep foreigners buying dollars indefinitely, might major foreign governments feel an obligation to do so on geopolitical grounds? They did so in the 1960s, in part because the Soviet threat drew the Western allies together, which produced a degree of solidarity and cooperation (notwithstanding troublemaking by Charles DeGaulle) that is not in evidence today. Even then, the Bretton Woods system broke down. To recap the history, the day of reckoning implied by the Triffin Dilemma was in any case accelerated substantially by the expansionary U.S. fiscal and monetary policies of the Viet Nam War era, and the resulting widening of the balance of payments deficit. International investors sold dollars. In August 1971 the United States responded by unilaterally closing the official gold window and devaluing the dollar, thereby ending the Bretton Woods regime. By March 1973, all the major industrialized countries had given up the effort to keep their currencies pegged to the dollar. Central bank holdings of the yen and the mark rose rapidly in the remainder of the 1970s and 1980s (though the level still remained well behind the dollar for easily understood reasons).

Over the last four decades, our allies have been willing to pay a financial price to support American leadership of the international economy, because they correctly saw it to be in their interests. In the 1960s, Germany was willing to offset the expenses of stationing U.S. troops on bases there so as to save the United States from a balance of payments deficit. The U.S. military has long been charged less to station troops in high-rent Japan than if they had been based at home. In 1991, Saudi Arabia, Kuwait, and a number of other countries were willing to pay for the financial cost of the war against

Iraq, thus temporarily wiping out the U.S. current account deficit for the only time in a twenty-year period. Repeatedly the Bank of Japan, among other central banks, has been willing to buy dollars to prevent the U.S. currency from depreciating (late 1960s, early 1970s, late 1980s).

During the same period that the United States has lost its budget surplus and the twin deficits have re-emerged, i.e., since 2001, we have also lost popular sympathy and political support in much of the rest of the world.²⁹ In the past, deficits from imperial overstretch have been manageable because others have paid the bills for our troops overseas: Germany and Japan during the Cold War, Kuwait and Saudi Arabia in 1991. Now the hegemon has lost its claim to legitimacy in the eyes of many. Next time the US asks other central banks to bail out the dollar, will they be as willing to do so as Europe was in the 1960s, or as Japan was in the late 1980s after the Louvre Agreement? We fear not.

Our scenarios of dollar-euro rivalry are not meant to express an optimistic forecast regarding European economics or governance. Europeans have made many mistakes, the leaders and public alike. But so have Americans.

Summary of conclusions

Predictions about scenarios under which the euro might in the future rival or surpass the dollar as the world's leading international reserve currency are the major payoff of this paper. Several years ago, we thought the conditions that would produce a reversal of roles within the subsequent two decades were along the lines of either a scenario under which the United Kingdom joined EMU, which seems unlikely, or one in which the dollar continues to depreciate at the same rate as it had over 2001-04 (4 per cent per year, trade-weighted), presumably because US macroeconomic policies eventually undermine confidence in the value of the dollar. Now, even with the UK out of EMU, if a fraction of London's financial markets is counted as the home for euro transactions then, we find that the euro could overtake the dollar as early as 2015.

If the dollar does indeed lose its role as leading international currency, the cost to the US would probably extend beyond the simple loss of seignorage narrowly defined. We would lose the exorbitant privilege of playing banker to the world, accepting short-term deposits at low interest rates in return for long-term investments at high average rates of return. When combined with other political developments, it might even spell the end of economic and political hegemony. These are century-long advantages that are not to be cast away lightly.

Most recent assessments of the sustainability and adjustment of the US current account feature substantial depreciation of the dollar in the future, whether adjustment then operates via expenditure-switching or a valuation effect. Our results suggest that such dollar depreciation would be no free lunch, and could have profound consequences

²⁹ In sharp contrast to international attitudes at the dawn of the century, the U.S. is now viewed unfavorably in most countries surveyed by the Pew Global Attitudes Project. Other surveys give similar results.

for the international monetary system. These consequences include the loss of the exorbitant privilege of easy financing of large US deficits, both government and national. The political influence that American policymakers have internationally, including in international institutions, could also be diminished.

If the euro were to overtake the dollar in a few decades, it would be a once-in-a-century event. But it happened to the pound in the last century, so who is to say it could not happen to the dollar in this?

Acknowledgments

We thank Brad Setser for useful comments regarding the reserves data and Benn Steil for encouraging us to write this paper.

Data Appendix

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 CPI inflation and industrialized country inflation; Exratevar is the trade weighted exchange rate volatility (monthly), measured as a 5 year moving average; Fxturnovertatio is turnover is daily turnover divided by total 5 center turnover.

Reserve currency holdings. Official reserve holdings of member central banks, at end of year. The data used is spliced version of Updated 2003 data obtained July 1, 2004 (for 1980 onward) to an unpublished data for 1965-2001. NA observations set to 0 except for the euro legacy currencies. Then, US dollar series is based on COFER data beginning at end-2004, while Euro series is based on COFER data beginning at end 1999. 70% of unallocated reserves are categorized as dollar reserves, while 25% are categorized as euro reserves. Note the 2007 entry is for 2007Q3. In logistic transformations, 0 entries set to 0.000001 (0.0001%). Sources: IMF Annual Reports, Table I.2, IMF unpublished data, and Currency Composition of Official Foreign Exchange Reserves (COFER) data, December 28, 2007 version.
<http://www.imf.org/external/np/sta/cofer/eng/index.htm> .

Ratio of GDP to total World GDP. Ratio of GDP in USD (converted at official exchange rates) to GDP of world aggregate. Sources: IMF, *International Financial Statistics* and IMF, *World Economic Outlook*.

Inflation. Calculated as log difference of monthly CPI, averaged. Five year moving average is centered. Source: IMF, *International Financial Statistics*; Euro area inflation for 1980-1998 is ECB data from Alquist and Chinn (2002). Industrial country inflation from *International Financial Statistics*.

Exchange rate volatility. Calculated as the standard deviation of the log first difference of the SDR exchange rate. Source: IMF, *International Financial Statistics*.

Forex Turnover. 1989, 1992, 1995, 1998, 2001, 2004, and 2007 from BIS *Triennial Surveys*. Billions of dollars of daily turnover, in April. Data from 1977-88 from G-30, NY Fed surveys, central bank surveys. Observations in-between survey years log-linearly interpolated. For 1973-1979, interpolation using 1977-79 relationship.

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