B Stability or upheaval? The currency composition of international reserves in the long run[53]

This special feature analyses how the roles of different national currencies as international reserves were affected by the shift from fixed to flexible exchange rates in the wake of the collapse of the Bretton Woods system. It provides evidence on the changes to the currency composition of global foreign exchange reserves since 1947 and examines whether there was a shift in the determinants of the currency composition of international reserves in the early 1970s. The special feature shows that inertia and the effects of policy credibility on international reserve currency choice have become stronger post-Bretton Woods, while network effects appear to have weakened. It also suggests that, historically, policy interventions designed to discourage the international use of a currency have been more effective than interventions to encourage its use. These findings could be relevant for the prospects of international reserve currencies that are already established, such as the US dollar and the euro, as well as for the prospects of other units seeking to acquire international reserve status, such as the renminbi.

1 Introduction

The demand for international reserves and their currency composition have long figured as important elements in the literature on international currency status. Previous studies on this subject have built on a limited evidentiary base, however. Data on the currency composition of international reserves is made available to the public by a small number of central banks. The IMF gathers such data from its members, but publishes only global aggregates and breakdowns between advanced and emerging economies. Earlier studies, such as Chinn and Frankel (2007, 2008), have assembled these aggregated data from the IMF's website and publications starting in the early 1970s. This conveniently coincides with the end of the Bretton Woods system, which is sometimes thought to have occasioned a shift in the demand for international reserves.

These studies have yielded strong conclusions. They find that the demand for a currency as an international reserve is strongly increasing in line with issuing country size, that persistence effects are strong and that to some extent the credibility of policies is also important. But the generality of these findings leaves many questions open. They are derived from analysis of a limited period, i.e. from the breakdown of the Bretton Woods system in the early 1970s to the eve of the introduction of the euro in 1999. Whether patterns in this period carry over to other periods has not been systematically studied. Whether the determinants of the composition of reserves were altered in fundamental ways by the shift from fixed to flexible exchange rates has not been systematically examined either.

But as Frenkel (1978) observed in the wake of the transition to floating, the absence of a legal obligation to peg the exchange rate, together with the absence of the

associated need for international reserves denominated in the US dollar – the anchor currency under the Bretton Woods system – could have fundamentally altered the demand for and composition of reserves. In theory, flexible exchange rates could have enabled countries to economise on reserves, specifically on dollar reserves that were the principal vehicle for foreign exchange market intervention at that point.

So far it has not been possible to test the validity of this "upheaval hypothesis". The data used by previous researchers did not provide information on the currency composition of reserves for the pre-floating exchange rate era (i.e. from the late 1940s to the early 1970s). And the sample of observations available to earlier researchers investigating structural instability in the demand for reserves in the 1970s and 1980s was just too small to draw definitive conclusions.

2   New data on the currency composition of international reserves in the long run

In a recent study, Eichengreen, Chiţu and Mehl (2014) extend the database on the currency composition of global foreign reserves backward and forward in time. They use an array of primary and secondary sources, including a volume published by the IMF (Horsefield, 1969) to gather data for the late 1940s and the 1950s; the Fund's annual reports to gather data from the 1960s to the 1990s; and the COFER database, which provides data for the period 1999-2014.

The new series spans two-thirds of a century from 1947 to 2014. Chart 24 shows the evolution of currency composition of global foreign reserves in this period. A striking feature is the dominance of sterling in the aftermath of the Second World War, when

Chart 24

Currency composition of globally disclosed foreign exchange reserves

(at market exchange rates and in percentages)
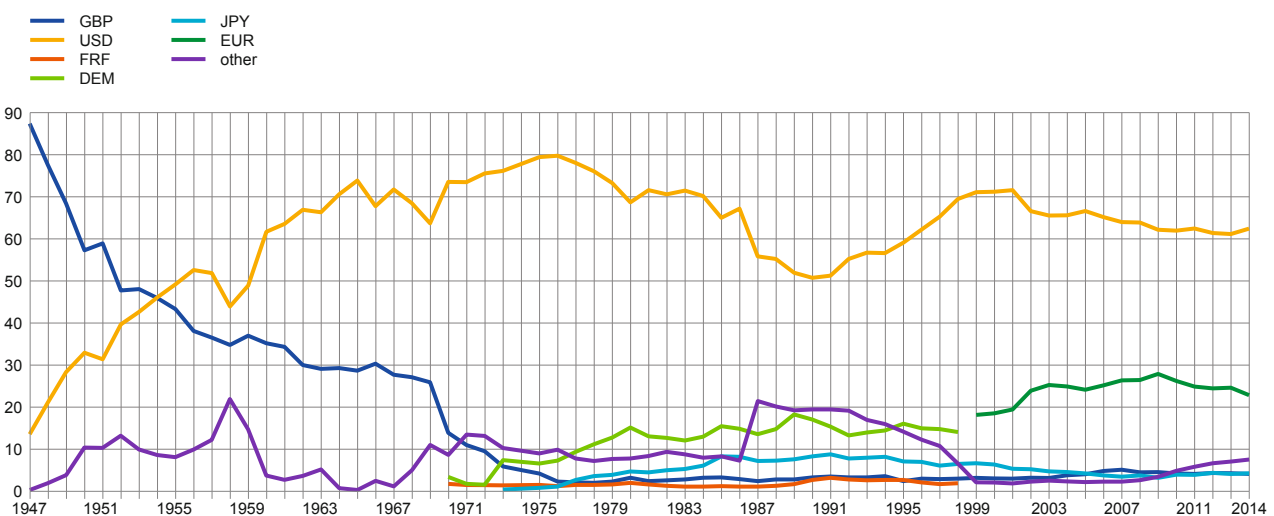
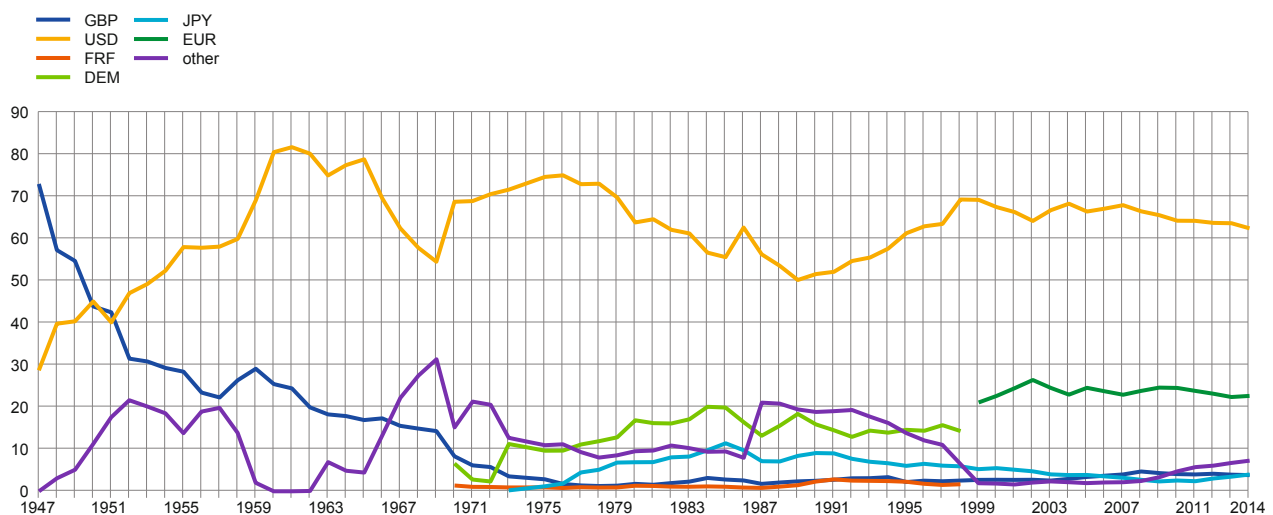Source: Eichengreen, Chiţu and Mehl (2014).
Notes: "Other" units include the ecu, Dutch guilder, Swiss franc, Australian dollar and Canadian dollar, as well as errors and omissions (including unidentified US dollar and sterling reserves prior to 1971).

it accounted for more than 80% of foreign exchange reserves.[54] However, the US dollar quickly overtook sterling in the early 1950s, accounting for more than 50% of global foreign exchange reserves. Its rise continues through the mid-1970s, while sterling's share continues to decline, reaching the low single digits at around the same time. Starting in the 1970s the ascent of the Deutsche Mark and, subsequently, the euro as international reserve units is clearly visible, with the share of the euro increasing until the start of the euro area sovereign debt crisis. The rise and fall of the Japanese yen is visible from Chart 24, too, with its share in global foreign exchange reserves peaking in the early 1990s, i.e. until the point at which Japan's "bubble economy" burst.

Valuation effects arising from exchange rate movements may produce changes in the value of foreign reserves held in different currencies without any sales or purchases by official reserve holders. The early empirical literature on the currency composition of foreign reserves ignored this bias. More recent studies have computed currency shares at constant exchange rates and shown that such valuation effects can be important. In line with this, Chart 25 shows the currency composition of global foreign reserves between 1947 and 2014 at constant exchange rates (using 2014 as the base year). While levels and low frequency movements in currency shares remain broadly unchanged, there are differences in terms of short-run dynamics, for instance at the time of major exchange rate realignments (in 1971, for example) or phases of marked US dollar appreciation (in 1985, for example) or depreciation (in 2002-2007, for example).

Chart 25

Currency composition of globally disclosed foreign exchange reserves

(at constant 2014 exchange rates and in percentages)

Source: Eichengreen, Chiţu and Mehl (2014).
Notes: "Other" units include the ecu, Dutch guilder, Swiss franc, Australian dollar and Canadian dollar, as well as errors and omissions (including unidentified US dollar and sterling reserves prior to 1971).

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[54] For a detailed discussion of the specificities of the aftermath of World War II see Eichengreen, Chiţu and Mehl (2014).

3 Determinants of the currency composition of international reserves in the long run

The new series enables us to examine whether the standard econometric specification fit to data for the fourth quarter of the 20th century also fits this longer time span. It moreover enables us to investigate possible structural breaks in the determinants of the demand for foreign reserves held in different units around the end of the Bretton Woods system.

A basic specification (see, for example, Eichengreen, 1998; Chinn and Frankel, 2007, 2008; and Li and Liu, 2008) relates foreign currency holdings to a lagged dependent variable, issuing country size and exchange rate appreciation. The lagged dependent variable aims to capture persistence or inertia effects of the sort discussed in Triffin (1960), Krugman (1980, 1984), Matsuyama, Kiyotaki and Matsui (1993) and Rey (2001). Relative size aims to capture network effects, which can be motivated by theoretical models of random matching games that see the emergence of international currencies as the solution to a "double coincidence of wants" problem, as discussed in Matsuyama, Kiyotaki and Matsui (1993), for example.[55] The credibility term is motivated by the idea that exchange rate appreciation can make holding a currency attractive and encourage its international use, as in Devereux and Shi (2013); exchange rate depreciation, in contrast, can be expected to have the opposite effect.[56]

To test for shifts around the time of the collapse of the Bretton Woods system, these variables are interacted with a post-1973 dummy. Both changes in the overall relationship and in the sign and size of the individual coefficients can then be investigated with standard Chow tests.

It is worth stressing here that persistence and network effects are different concepts. Persistence is linked in particular to a first-mover advantage. Examples include habit formation or the absence of low-cost alternatives to the dominant unit for providing reserves on the scale demanded. Conversely, network effects may increase the attractiveness of a particular standard (in this case, a reserve currency standard) at a specific point in time without preventing market participants from shifting to another standard at another point in time, to the extent that lock-in effects are weak and agents can coordinate their actions.[57] The success with which open standards for personal electronics have been developed in recent years, weakening lock-in and facilitating shifts between operating systems, illustrates the point.

Table 7 reports the regression results when the share of identified foreign exchange reserves held in a particular currency – purged of exchange rate valuation effects – is used as the dependent variable. Column 1 reports the results obtained with

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[55] In this model, the incentive of an agent to accept a country's currency depends on how often they trade with a citizen of that country. In the estimates, relative size is measured as the share of the GDP of a reserve currency issuing country in global GDP, taking data from Maddison (2010).

[56] We represent credibility effects by using the average rate of currency appreciation vis-à-vis the SDR basket over the preceding five years, in the same way as Chinn and Frankel (2007).

[57] See the discussions in, for example, David (1986, 1990) and West (2007) for more details.

Table 7

Baseline estimates

	(1) Full sample	(2) Pre-1973	(3) Post-1973	(4) Full sample
Inertia	0.927***	0.758***	0.954***	0.886***
	(0.021)	(0.037)	(0.009)	(0.024)
Network effects	0.216***	0.815***	0.115***	0.426***
	(0.066)	(0.113)	(0.024)	(0.080)
Credibility	0.051**	-0.599***	0.043*	-0.382***
	(0.022)	(0.033)	(0.024)	(0.092)
Post-73 dummy				2.921***
				(0.943)
Inertia × post-73 dummy				0.045**
				(0.023)
Network effects × post-73 dummy				-0.242***
				(0.075)
Credibility × post-73 dummy				0.428***
				(0.116)
Constant	-0.010	-5.725***	0.302	-2.739**
	(0.295)	(0.460)	(0.317)	(1.095)
Currency effects	YES	YES	YES	YES
Time effects	YES	YES	YES	YES
Observations	271	42	229	271
No. of groups	8	4	8	8
R^2 (overall)	0.993	0.988	0.995	0.993

Source: Eichengreen, Chiṭu and Mehl (2014).
Notes: The table reports random effects estimates of a standard reserve demand equation where reserve currency shares purged of exchange rate valuation effects are regressed on their standard determinants over selected sample periods, namely: the full sample period (in column 1); 1947-1972 (in column 2), 1973-2013 (in column 3) and the full sample period allowing for a structural break in the estimated coefficients (in column 4). The standard errors reported in parentheses are robust to heteroskedasticity and clustered heterogeneity; *** p<0.01, ** p<0.05, * p<0.1.

the three explanatory variables over the full sample period. Column 2 reports the results when the sample is restricted to the pre-1973 period. Column 3 reports the results when the sample is restricted to the post-1973 period. Column 4 includes interaction terms with a post-1973 dummy variable as a way of testing for post-1973 structural shifts.

The baseline results are consistent with what previous research has found on data for shorter periods, albeit with some differences. Evidence of persistence is strong; a coefficient of 0.9 on the lagged dependent variable indicates a half-life of roughly seven years (in other words, half of the effect a given shock has on currency shares dissipates after seven years). This suggests that, in order to adequately understand the evolution of currency shares, it is important to consider medium-term evolutions, as we do here. But this point estimate also indicates that the share of a currency in global reserves can be halved in less than a decade, which is what happened to sterling between the mid-1960s and early 1970s. The coefficient on size is important throughout, consistent with the emphasis of previous studies on network effects. The full sample estimates reported in column 1 suggest that the short-run (one-year) effect of an increase in a reserve currency issuing country's share of global output of 10 percentage points corresponds to an increase in the share of its currency in global reserves of roughly two percentage points in the short run and almost 30 percentage points in the long run. The effects of policy credibility as measured by the trend

rate of appreciation of the exchange rate are more mixed, as in previous studies. In Table 7 policy credibility turns positive after 1973, as expected, but not before.[58]

There are significant differences between sub-periods which lend support to the "upheaval hypothesis", namely that the collapse of the Bretton Woods system occasioned a fundamental change in the determinants of the composition of reserves. The coefficient capturing network effects is much smaller in the second period, i.e. after the breakdown of Bretton Woods, than in the first.[59] This evidence suggests a weakening of network effects is consistent with the so-called "new view" of the international monetary system in which, owing to the weakness of network increasing returns, there is more space today for multiple reserve currencies to coexist (see, for example, Eichengreen, 2014). At the same time, there is evidence of an increase in persistence. The coefficient on this variable is larger after 1973 than before, and the difference is statistically significant at the 5% level of confidence.

These results are intuitive. That inertia is stronger post-Bretton Woods is reflected by the fact that the post-1973 period has not seen a shift from one currency to another, comparable to the shift from sterling to the US dollar that occurred between 1947 and 1973. Before 1973 serious doubts about the prospects for sterling as a reserve currency caused reserve managers to question their habits and move away from the currency. By contrast, reserve managers seem not to have questioned the status of the US dollar, which has supported inertia in global reserve allocation patterns. The result that network effects are less strong is similarly intuitive. Financial and transactions technologies have continued to advance. Currency swap markets have developed. Hedging instruments have become more widespread. Information on foreign exchange markets has become more freely available. All this has allowed official reserve holders and other market participants to conduct their transactions – and hold reserves against associated contingencies – in currencies other than the dominant one(s) without incurring costs as large as before, thereby weakening network effects.

4   The role of policies

The long time span covered by the new series also enables us to consider the roles not just of market forces but also of policies that governments and central banks have pursued at various times since the Second World War to encourage or discourage the international use of their currencies. As these policies have not been systematically studied previously, Eichengreen, Chiţu and Mehl (2014) also assembled new data on these policies and examined their importance.

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[58] From a statistical perspective, the negative coefficient on the credibility-related exchange rate term for the period before 1973 reflects the fact that sterling depreciated on two occasions in this period when the share of sterling reserves was relatively high, and that the Deutsche Mark appreciated in the early 1970s when the share of Deutsche Mark reserves was low. However, when one fills in values of zero for the missing observations before 1973 (i.e. when the IMF presumably saw no need to report reserves held in currencies other than the US dollar or sterling), the credibility measure for the pre-1973 period turns positive, as is consistent with the theory, though it is insignificantly different from zero. Hence the safest interpretation would appear to be that policy credibility had weaker effects before 1973 than after.

[59] The change in magnitudes is statistically significant at the 1% confidence level according to a Chow test.

They distinguish four categories of measures related to: (a) financial openness, (b) official positions and verbal interventions on internationalisation, (c) reform and regulation of the exchange rate system, and (d) other miscellaneous measures. Financial openness is measured with the two de jure indices developed by Quinn and Toyoda (2008) which capture, on the one hand, how compliant a country is with its IMF obligations relating to current account transactions and, on the other hand, the extent of restrictions to capital outflows and inflows by residents and non-residents.[60] The three remaining categories of measures are coded as dummy variables, with a further distinction being made between measures designed to encourage international currency use and those designed to discourage it. This gives a total of six dummy variables capturing six categories of potential policy effects.[61]

Table 8

Estimates with policy measures

	(1) Full sample	(2) Pre-1973	(3) Post-1973	(4) Full sample	(5) Pre-1973	(6) Post-1973
Inertia	0.917***	0.789***	0.940***	0.916***	0.801***	0.952***
	(0.010)	(0.078)	(0.018)	(0.015)	(0.087)	(0.016)
Network effects	0.260***	0.914***	0.183***	0.276***	0.756***	0.154***
	(0.038)	(0.159)	(0.046)	(0.049)	(0.221)	(0.045)
Credibility	0.006	-0.223	0.014	0.038***	-0.369	0.031*
	(0.018)	(0.525)	(0.014)	(0.013)	(0.371)	(0.017)
IMF art. VIII compliance	0.036***	-0.068	0.030*			
	(0.007)	(0.065)	(0.016)			
Capital flow restrictions				0.023***	-0.012	0.008
				(0.004)	(0.039)	(0.007)
Official position *(supportive)*	-0.368	0.000	-0.592	-0.294	0.000	-0.559
	(1.222)	(0.000)	(1.160)	(1.217)	(0.000)	(1.159)
Official position *(restrictive)*	-3.044***	-3.424	-2.112***	-3.298***	-4.637	-2.164***
	(0.885)	(3.693)	(0.592)	(0.860)	(4.414)	(0.561)
Exchange rate regime *(supportive)*	-0.073	0.000	0.487	-0.060	0.000	0.564
	(0.827)	(0.000)	(0.818)	(0.871)	(0.000)	(0.844)
Exchange rate regime *(restrictive)*	-2.053**	-2.597	-2.588***	-2.058**	-2.194	-2.644***
	(0.936)	(4.922)	(0.536)	(0.924)	(4.795)	(0.510)
Other measures *(supportive)*	-0.098	-1.794**	0.839	-0.180	-1.874*	0.694
	(0.384)	(0.844)	(0.600)	(0.368)	(1.025)	(0.630)
Other measures *(restrictive)*	-5.755***	-10.644**	-3.969***	-5.769***	-10.006**	-3.880***
	(0.824)	(4.337)	(0.425)	(0.847)	(4.121)	(0.422)
Constant	-3.705***	0.000	-2.928*	-2.603***	-2.583	-0.781
	(0.630)	(0.000)	(1.578)	(0.247)	(2.945)	(0.690)
Country effects	YES	YES	YES	YES	YES	YES
Time effects	YES	YES	YES	YES	YES	YES
Observations	271	42	229	271	42	229
No. of groups	8	4	8	8	4	8
R^2 (overall)	0.994	0.991	0.996	0.994	0.991	0.996

Source: Eichengreen, Chiţu and Mehl (2014).
Notes: The table reports random effects estimates of a standard reserve demand equation where reserve currency shares purged of exchange rate valuation effects are regressed on their standard determinants over selected sample periods, namely: the full sample period (in column 1); 1947-1972 (in column 2), 1973-2013 (in column 3) controlling for financial openness and policy measures that aim to support or restrict international currency use. Estimates in columns (1) to (3) use Quinn and Toyoda (2008)'s de jure index of compliance with IMF obligations relating to current account transactions as a metric of capital openness while those in columns (4) to (6) use their index of restrictions to capital flows. The standard errors reported in parentheses are robust to heteroskedasticity and clustered heterogeneity; *** p<0.01, ** p<0.05, * p<0.1.

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[60] The indices run from 0 (financial autarky) to 100 (complete financial openness).

[61] Other measures include currency swap agreements, other multilateral financing arrangements (such as the Gold Pool) and other measures pertaining the global financial architecture (such as the introduction of the SDR or plans for a substitution account).

The results, reported in Table 8, confirm that policies matter, but not all policies and not all in the same way. In particular, it would appear that it is easier to discourage than to promote reserve currency use. Policies that aim to support currency use are often unsuccessful, with a few notable exceptions. There is some evidence that financial openness helped to strengthen the importance of a particular unit as a reserve currency. For instance, the estimates of column 4 suggest that a one-standard-deviation increase in a country's financial openness (i.e. about 21 index points) is associated with an increase in the share of its currency in global reserves of roughly half a percentage point in the short run and almost 6 percentage points in the long run. But other supportive policies were less obviously important. Their effect is typically found to be insignificant.

In contrast, policies that aim to discourage currency use have often had significant effects. This is the case of unsupportive official positions, of unsupportive exchange rate regime measures (i.e. devaluing/debasing one's currency, for instance the repeated devaluations of sterling between 1947 and 1976 or those of the US dollar in the early 1970s), and of other unsupportive measures that may have dented confidence in a unit as a store of value (for instance the collapse of the Gold Pool or discussions about an IMF substitution account in the case of the US dollar). The estimates in column 4 suggest that devaluations are typically associated with a decline in the share of a country's currency in global reserves of roughly two percentage points in the short run and almost 24 percentage points in the long run.[62]

The earlier findings on structural changes in the coefficients of network effects are not altered by adding the policy variables. Hence this is further evidence in favour of the "upheaval" hypothesis, which suggests that the determinants of the demand for and composition of international reserves changed significantly around the time of the collapse of the Bretton Woods system.

5   Concluding remarks

This special feature has shown evidence suggestive of a shift in the determinants of currency shares of global foreign reserves around the time of the breakdown of the Bretton Woods system. It has shown that the effects of inertia and the credibility of policies on reserve currency choice have become stronger post-Bretton Woods, while those associated with network effects have become weaker.

From a policy perspective, the stronger effects of inertia may be seen as acting in favour of the leading reserve currency, namely the US dollar, a fact further underscored by the resilience of its share in global reserves since the global financial crisis. In contrast, the fact that network effects have become weaker may be seen as suggesting that the leading currency's first-mover advantage, and continued dominance, should not be taken for granted, other things being equal.

Moreover, the special feature has presented evidence suggesting that, historically, it has been easier to discourage than to encourage the use of a currency as an

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[62]   As previously mentioned, these estimates are obtained with currency shares already purged of exchange rate valuation effects.

international reserve unit.[63] These results suggest that the policy toolkit to encourage reserve currency status and overcome inertia effects has been dominated in the past by two instruments: macroeconomic stability and financial openness. The policy toolkit available for discouraging international currency use has additional instruments, including official statements and exchange rate regime-related measures, which appear to have had larger and more powerful effects.

References

Chinn, Menzie and Frankel, Jeffrey (2007), "Will the Euro Eventually Surpass the Dollar as Leading International Currency?", in Clarida, Richard (ed.), *G7 Current Account Imbalances and Adjustment*, University of Chicago Press, Chicago, pp. 283-338.

Chinn, Menzie and Frankel, Jeffrey (2008), "Why the Euro Will Rival the Dollar", *International Finance*, 11, pp. 49-73.

David, Paul (1986), "Narrow Windows, Blind Giants and Angry Orphans: The Dynamics of Systems Rivalries and Dilemmas of Technology Policy", *Technology Innovation Project Working Paper*, No 10, Center for Economic Policy Research, Stanford University, March.

David, Paul (1990), "The Economics of Compatibility Standards: An Introduction to Recent Research", *Economics of Innovation and New Technology*, 1, pp. 3-41.

Devereux, Michael and Shi, Shouyong (2013), "Vehicle Currency", *International Economic Review*, 54, pp. 97-133.

Frankel, Jeffrey (2007), "Exchange Rate Policy", in Feldstein, Martin (ed.), *American Economic Policy in the 1980s*, University of Chicago Press, Chicago, pp. 293-341.

Frenkel, Jacob (1978), "International Reserves: Pegged Exchange Rates and Managed Float", in Brunner, Karl and Meltzer, Allan (eds.), *Public Policies in Open Economies*, Carnegie-Rochester Conference Series on Public Policy 9, pp. 111-140.

Eichengreen, Barry (1998), "The Euro as a Reserve Currency", *Journal of the Japanese and International Economies*, 12, pp. 483-506.

Eichengreen, B. (2014) "International Currencies Past, Present and Future: Two Views from Economic History", *Bank of Korea Working Paper*, No 2014-31, October.

Eichengreen, B., Chiţu, L. and Mehl, A. (2014), "Stability or Upheaval? The Currency Composition of International Reserves in the Long Run", *Globalization and Monetary Policy Institute Working Paper*, No 201, Federal Reserve Bank of Dallas.

Horsefield, Keith (1969), *The International Monetary Fund 1945-1965: Twenty Years of International Monetary Cooperation: Chronicle*, IMF, Washington, D.C.

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[63] The historical analysis presented here is backward looking and may not capture the evolving nature, and therefore the potential impact, of such policy interventions designed to encourage the international use of a currency.

Krugman, Paul (1980), "Vehicle Currencies and the Structure of International Exchange", *Journal of Money, Credit and Banking*, 12, pp. 513-526.

Krugman, Paul (1984), "The International Role of the Dollar: Theory and Prospect", in Bilson, John and Marston, Richard (eds.), *Exchange Rate Theory and Practice*, University of Chicago Press, Chicago, pp. 261-278.

Li, David and Liu, Linlin (2008), "RMB Internationalization: An Empirical Analysis", *Journal of Financial Research*, 11, pp. 1-16.

Maddison, Angus (2010), *Statistics on World Population, GDP and Per Capita GDP, 1-2008 AD*, unpublished manuscript, University of Groningen.

Matsuyama, Kiminori, Nobuhiro Kiyotaki and Akihiko Matsui (1993), "Toward a Theory of International Currency", *Review of Economic Studies*, 60, pp. 283-307.

Rey, Hélène (2001), "International Trade and Currency Exchange", *Review of Economic Studies*, 68, pp. 443-464.

Quinn, D. and Toyoda, A.M. (2008), "Does Capital Account Liberalization Lead to Growth?", *Review of Financial Studies*, 21, pp. 1403-1449.

Triffin, Robert (1960), *Gold and the Dollar Crisis: The Future of Convertibility,* Yale University Press, New Haven.

West, Joel (2007), "The Economic Realities of Open Standards: Black, White and Many Shades of Gray", in Greenstein, Shane and Stango, Victor (eds.), *Standards and Public Policy*, Cambridge University Press, Cambridge, pp. 87-122.