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The International Monetary System in Flux: Overview and Prospects

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The International Monetary System in Flux: Overview and Prospects

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Abstract

This paper analyses the architecture of the International Monetary System (IMS) and the role of reserve currencies in it. We begin by describing the evolution of the IMS from the Gold Standard to the Bretton Woods system and the European integration process that led to the creation of the euro. We then discuss the role played by the euro in the IMS as an international reserve currency. Drawing on econometric estimations, we extrapolate the evolution of the shares in international reserves of the euro, the US dollar and the renminbi. In the discussion, we take into account the current sovereign debt crisis and the possibility of a currency war taking place as a result of the reportedly excessive undervaluation of the renminbi and of the expansionist monetary policies undertaken in several advanced economies, namely in the USA. The text ends with a review of proposals for reducing the likelihood of currency wars, which may disrupt the functioning of the current IMS.

Keywords: currency war; euro; financial crisis; International Monetary System; exchange rate misalignments.

JEL Classification: E52; F31; F33; G15.

1. Introduction

The international financial crisis initiated in 2007, followed by the sovereign debt crisis in late 2009, appears to have generated a consensus on the need for reform of the International Monetary System (IMS). At the centre of the debate is the possible emergence of a bipolar system (with the euro and the dollar as the poles) or even of a multipolar system. Over the last decade, the euro has consolidated its position as the second most important international currency. It possesses many of the characteristics that are essential for an international reserve currency, and it is viewed as the most viable alternative to the dollar – see Cooper (2009).

However, the succession of international crises – see, e.g., Alexandre et al., 2009; Bação and Duarte, 2011; Andrade and Duarte, 2011; Bação et al., 2012 – has diminished investors' confidence in financial institutions, namely in the euro zone. This problem has been compounded by the lack of decisive political action to end the euro zone's sovereign debt crisis. Pessimism concerning the future, and desirability, of the euro itself is at record levels. At the same time, the IMS appears to be on the verge of becoming the arena of a currency war (see Cline and Williamson, 2010). Persistently large external imbalances and domestic monetary policy actions designed to prevent or combat recessions are frequently cited as likely causes of a currency war. But some attribute these problems to persistent exchange rate misalignments in emerging economies (see Siregar and Rajan, 2006 and Cline and Williamson, 2011). The authorities in these economies intervene in foreign exchange markets and use capital flow controls to contain the appreciation of their currencies and to be able to accumulate massive amounts of foreign reserves, which may be used as shields during future currency crises.

The aim of this text is thus to analyse the current functioning of the IMS and to discuss its possible evolution in the near future. Special attention will be paid to the international role of the euro and to currency wars. The paper is organized as follows. Section 2 presents a brief historical retrospective of the IMS. Section 3 discusses the threats to the current architecture of the IMS. In section 3 we also report predictions concerning the evolution of the IMS based on an econometric model. Section 4 provides concluding remarks.

2. From the Gold Standard to the Euro

The IMS has been through periods of stability and international cooperation, as well as periods of crisis, exchange rate instability and extreme competitive behaviour by countries trying to conquer new markets for domestic firms (Gilpin, 1987.) In the beginning of the XIX century, most countries had in place a bimetallic monetary system, characterized by the simultaneous circulation of gold and silver coins (see, e.g., Eichengreen, 1996, and Bordo and Schwartz, 1997). Difficulties in the operation of a bimetallic system and the need to develop a monetary system that would facilitate international trade led to the transition from bimetallism to a mono-metallic system based on gold. The Gold Standard thus emerged in the late 1870s.

By then, Great-Britain, which had in fact adopted a gold standard since 1821, displayed worldwide its commercial, industrial and financial power, derived from the industrial revolution. London became the main financial centre and the British pound became the main currency in the IMS, providing a nominal anchor to the system (see Bordo, 1984, and Giovannini, 1986). Countries with strong commercial and financial ties with Great Britain had an incentive to adhere to the Gold Standard, and Portugal was the first European country to join the Gold Standard, in 1854, even before it became dominant (see Reis, 2000 and Duarte and Andrade, 2012).

Under the Gold Standard, the value of currencies was fixed in terms of gold and, at the international level, currencies were freely convertible into gold at that parity (see Bordo and Kydland, 1995, and Bordo and Jonung, 2001). The functioning of this system was thus based on the presumption that countries would sustain the fixed parity, although small fluctuations within narrow bands ("gold points") were allowed. This behaviour gave rise to an automatic adjustment mechanism that ensured balance of payments equilibrium (see Eichengreen 1996 and Duarte, 2006).

Until 1913, this monetary system appeared credible. However, to finance the war effort, many countries resorted to the printing press. The result was an increasing gap between currency in circulation and gold reserves. Inevitably, countries began to suspend the convertibility of their currencies, and the Gold Standard collapsed. A phase of great monetary disorder ensued, characterized by large exchange rate fluctuations (see Gilpin, 1987).

At the same time, countries began to accumulate reserves in currencies that were still convertible in gold. A gold-exchange standard thus emerged. The international scene was, however, different from that in the pre-war. The United States now appeared as the main

creditor of the countries that had participated in the First World War, and as the main economic and financial power in the world. It is unsurprising that the dollar should by then rival the pound as an international reserve currency. Nevertheless, Britain, among other countries, attempted a return to the Gold Standard and to the status quo ante, but the pre-war parities were by now completely misaligned, giving rise to an adjustment problem (see Redmond, 1984 and Bordo and MacDonald, 2003). With the British pound overvalued, Britain recorded persistent external deficits and saw its reserves ebb. On the contrary, those countries that returned to the Gold Standard with undervalued currencies recorded external surpluses and accumulated reserves. This flow could not and did not last for long. The start of the Great Depression further strained the IMS and in 1931 Britain again gave up on the Gold Standard, and so did the other countries that still adhered to it.

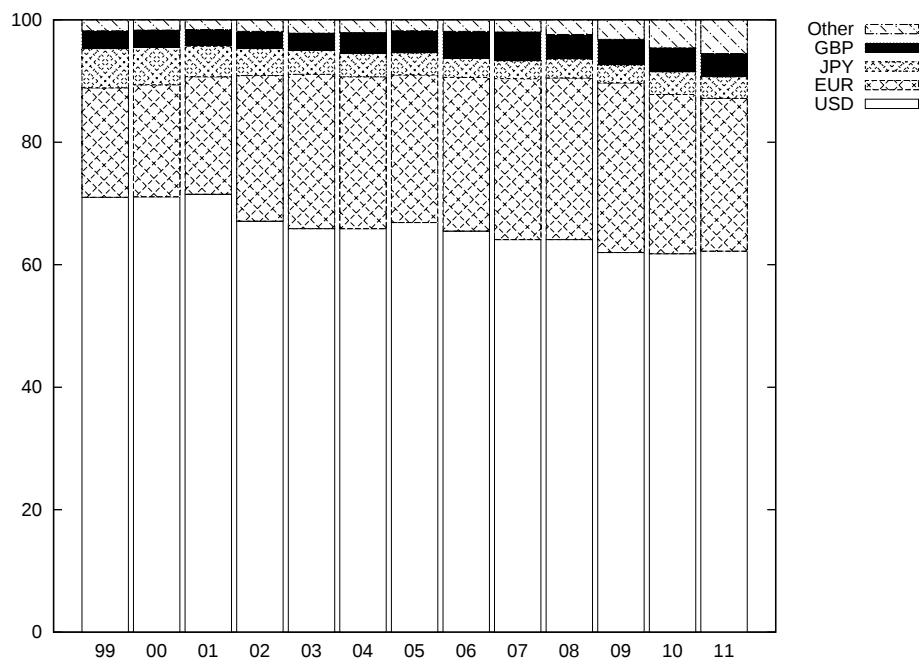
At that time, exchange rates were often steered by government intervention, with frequent competitive devaluations, the adoption of trade restrictions and a bilateral approach to international trade agreements. It was only by the end of World War II that measures to effectively stabilize the IMS were undertaken, already under the aegis of the USA and the dollar. On July 22, 1944, the Bretton Woods agreement was signed. The Bretton Woods monetary system was based on fixed, but adjustable, exchange rates. The exchange rates of other currencies with respect to the dollar would fluctuate within a $\pm 1\%$ band. The dollar itself would be tied to gold, with a fixed parity of 35 dollars per ounce of gold. In the event of a "fundamental disequilibrium", dollar and gold parities could be adjusted (see Williamson, 1985).

The Bretton Woods agreement established that, after a transition period, countries had to allow their currencies to be convertible for current transactions purposes. This rule was a compromise between John Maynard Keynes's view and the American position. According to Keynes, capital controls were essential for countries to retain autonomy of national economic policies. The representatives of the US government were more sympathetic to the liberalization of capital flows. Despite the agreement provisions for an adjustment period, the USA maintained a more liberal framework concerning capital flows than other industrialized countries; these other countries only left the transition period regarding capital flows in 1961. Before that, these countries aimed at maintaining external surpluses, with the aid of import restrictions, with the goal of accumulating dollar (or gold) reserves. An asymmetry thus developed in the working of the system: the country with the anchor currency had persistent external deficits, which supplied the liquidity demanded by the other countries in the system. Eventually, this led to a declining confidence in the value of the dollar and thus in the

sustainability of the Bretton Woods system – a problem known as the "Triffin dilemma" (see Solomon, 1979, and McKinnon, 1993). The 1960s were spent fighting against the difficulties posed by this problem, both to the Bretton Woods system and to the conduct of economic policy in the USA. Notable critics of the situation were the French, whose President, Charles de Gaulle, and Finance Minister, Giscard d'Estaing, bitterly complained about the "exorbitant privilege" that the international role of the dollar granted to the USA (see Eichengreen, 2011).

The insurmountable contradiction between the fixed exchange rate regime and the inflationary economic policy adopted in the USA – especially as a consequence of the Vietnam war and of the expenditures associated with President Johnson's "Great Society" program – threatened to exhaust the USA's gold reserves. These were being used to meet the conversion demands made by those countries that had accumulated dollar reserves, namely France. It should be noted that high US inflation was putting pressure on the price of gold in the open market, driving it away from the official parity (35 USD per ounce). Given this, countries holding dollar reserves had growing concerns about the sustainability of that parity, and thus preferred to convert dollars into gold. Faced with the possibility of exhaustion of gold reserves, President Nixon suspended the convertibility of the dollar in August 1971. In December 1971, an attempt at rebuilding confidence in the dollar gives rise to the Smithsonian agreement. The dollar is devalued against gold and the fluctuation band of other exchange rates is widened to $\pm 2.25\%$. However, in February 1973 the dollar was again devalued and in March 1973 the system collapsed, leading to the widespread fluctuation of exchange rates. Despite this outcome, the search for a framework that could contribute to the stabilization of exchange rates continued. Although other goals were also important – first and foremost the goal of building political union –, Europe took the most decisive steps towards introducing some means of stabilizing the EMS. First, the European Monetary System (EMS) was created in 1979 and with it the European Currency Unit (ECU), against which European exchange rates could fluctuate in a $\pm 2.25\%$ band. The EMS went through several phases, but in 1989 a plan (Delors Report) was presented to create an Economic and Monetary Union in Europe. Eventually, this process was completed in January 2002, with the physical circulation of the euro. The first years of the euro were successful. The share the euro in official reserves (allocated) increased significantly, from 18% to 25%, between 1999 and 2003 – see Figure 1.

Figure 1: Share in Official Reserves (allocated)



Source: COFER, IMF.

The economic and financial crisis that began in 2007 increased the interest alternative reserve currencies, namely the euro, which saw its share increase to almost 28% in 2009. The crisis turned attention to the functioning of the IMS and led to calls for its reform. The dollar was shaken by the turmoil in the US financial sector and by the Great Recession that followed the financial crisis. Therefore, a widely discussed issue has been whether the supremacy of the dollar as an international currency will be challenged by other currencies. Some authors have argued that in the near future it is not likely that the dollar will lose its status as the leading international currency (see Posen, 2008, and Cooper, 2009). Others have argued that the IMS is evolving towards a "multipolar" system (see Ahearne et al., 2007, and Eichengreen, 2010).

The next section discusses this matter and presents predictions based on an econometric model of the share of the main international currencies in official reserves.

3. Reserve Currencies

3.1. Alternatives to the dollar

Can an alternative international currency emerge? The dollar currently enjoys a number of advantages: it is widely accepted; there is a highly liquid market of low-risk assets denominated in dollars (US Treasury Bills); most transactions in forex markets use the dollar – see Cooper (2009). Nevertheless, as Figure 1 shows, its share in official reserves has declined significantly (around 9 percentage points) in the last decade.

The alternatives envisaged in the economic literature focused on the euro, viewed as the most promising candidate (see Detken and Hartmann, 2000, Rey, 2005, Gaspar and Hartmann, 2005, and Chinn and Frankel, 2008). However, the dollar will also have to face the growing competition of the yen and of the BRICs' currencies, especially the renminbi (see Kawai, 2010, Wyplosz, 2010, Huang, 2010, and Lee, 2010). Another possibility is the creation of a global currency based on the IMF's Special Drawing Rights (SDR), which were created with the goal of creating liquidity at the international level (see Williamson, 2009, and Stiglitz, 2010). However, the SDR is still not widely used as a reserve currency. Additionally, it cannot be used by individuals and it is not used in commercial transactions.

The yen's international status is harmed by Japan's high public debt, low interest rates, economic stagnation and the perception that it is a "weak" currency, subject to the intervention of the Japanese central bank in the forex market (see Ahearne et al., 2007, and Cooper, 2009). As for the renminbi, currently it lacks several of the characteristics of an international currency (see, e.g., Kawai, 2010, Wyplosy, 2010, Huang, 2010, Lee, 2010 and Subramanian, 2011). It is still inconvertible in capital accounts and little used in international trade. Chinese financial markets are not well developed and difficult to access by foreign investors, and China imposes strict capital controls.

The emergence of a bipolar or a multipolar system might have a significant impact on the international balance of powers and on the management of international financial stability issues. The consequences of a transition to a bipolar or multipolar system have been discussed in the economic literature, especially in connection with sustainability and stability themes. Some authors (see, e.g., Cohen, 2009, Eichengreen, 2010, and Bénassy-Quéré and Pisani-Ferri, 2011) argue that the transition to a system with several reference currencies may bring improvements in terms of equity and efficiency, relatively to a system in which the issuer of the reserve currency enjoys an "exorbitant privilege" and in which countries hoard

reserves (by accumulating trade surpluses) as an insurance against the volatility of capital flows.

The fact that seigniorage income would be shared by several countries in a bipolar or multipolar system could also facilitate the conduct of economic policy in the issuers of the new reserve currencies. Nevertheless, competition for the status of reserve currency could limit the scope for bolder measures, as countries try to safeguard the conditions required their currency to maintain the reserve currency status.

However, one should bear in mind that a multipolar system would lack a leader, and that this could be viewed as a sign of the inability of a multipolar system to coordinate the actions of countries, when crisis demands it. A bipolar or multipolar system may thus lead to more acute international crises (see Hartmann and Issing, 2002, Bénassy-Quéré and Pisani-Ferry, 2011, and Farhi et al., 2011).

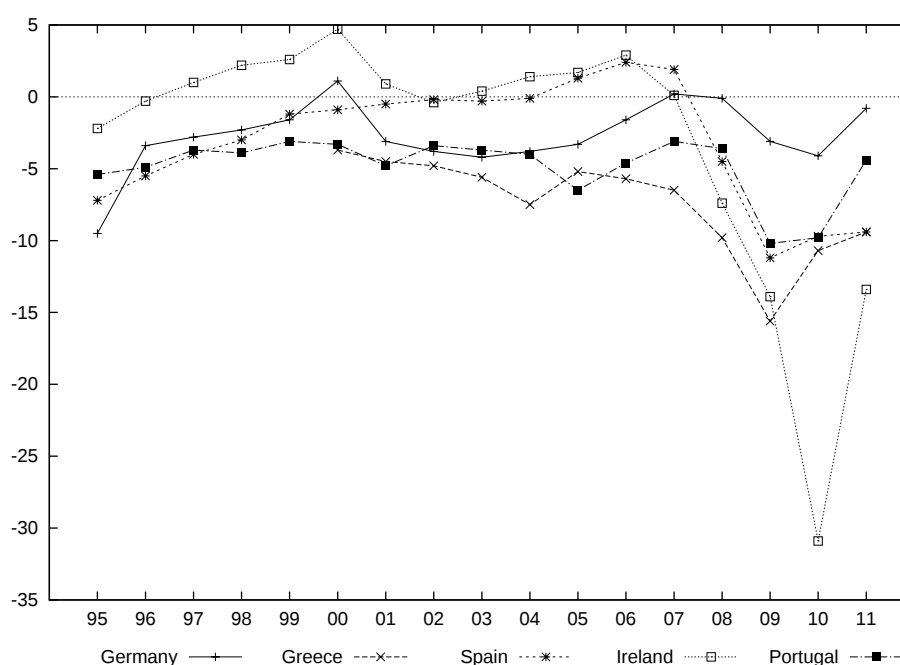
In summary, a bipolar or multipolar IMS can only develop if each pole allows its currency to play an international role. This requires lifting restrictions to international trade and finance, and sophisticated financial markets. Cooperation between reserve currency issuers will be an essential requirement in such a system, especially to allow the management of international liquidity in times of crisis. But, given the evolution from the international financial crisis – that eroded confidence in the dollar – to the euro zone sovereign debt crisis, will the euro provide a reliable pole? And is the talk about "currency wars" a good omen for a multipolar system? We discuss these issues next.

3.2. The Sovereign Debt Crisis

The international financial crisis that began in 2007 arose fears of a repetition of the Great Depression. To prevent this possibility, governments intervened massively with the goal of propping up the economy, and especially to avoid the imminent collapse of the financial system. The intervention in the financial system was explicitly advocated, in October 2008, by the G7 and the Eurogroup. Besides this, the European Commission also called on governments to undertake measures to support the economy.

The impact of the aid given to the financial sector on public deficits was small in the European Union (about 0.5% of GDP – see Banque de France, 2012), although it was very large in certain countries, namely in Ireland (above 20% of GDP in 2010).¹ However, a more powerful impact of the crisis on public finance operated through "automatic stabilizers", i.e., through the decline in tax revenues and the increase in expenditure with social benefits, namely unemployment benefits, that are inevitable during a recession. Additionally, many governments adopted temporary measures to stimulate employment creation, or to provide temporary relief for the unemployed. All in all, the result was a very large increase in public deficits (see Figure 2) and in public debt (see Figure 3).

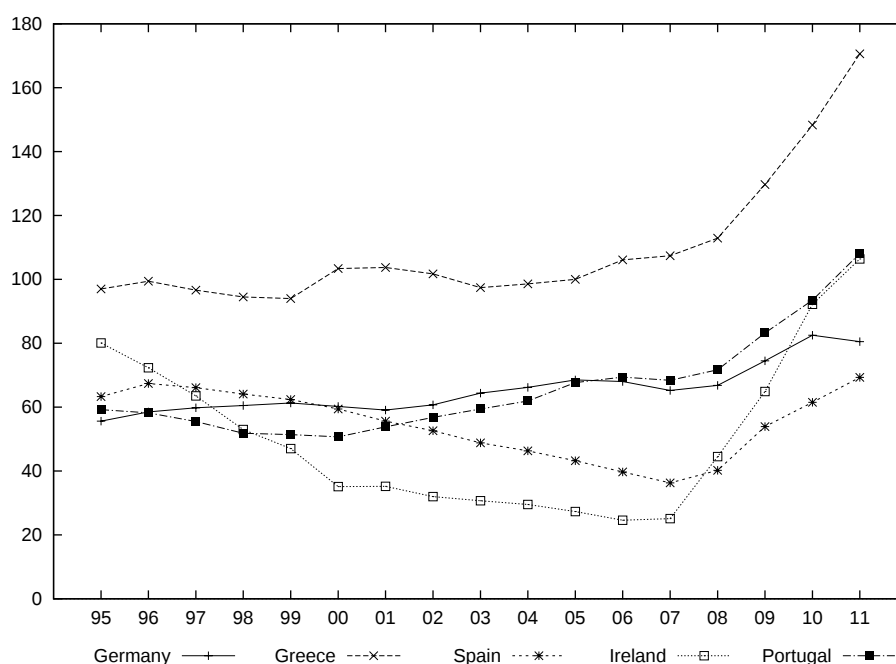
Figure 2: Public Deficits in Selected Euro Zone Countries (%GDP)



Source: Eurostat.

¹ Some governments actually profited from the aid given to the financial sector – see Banque de France (2012, p.19).

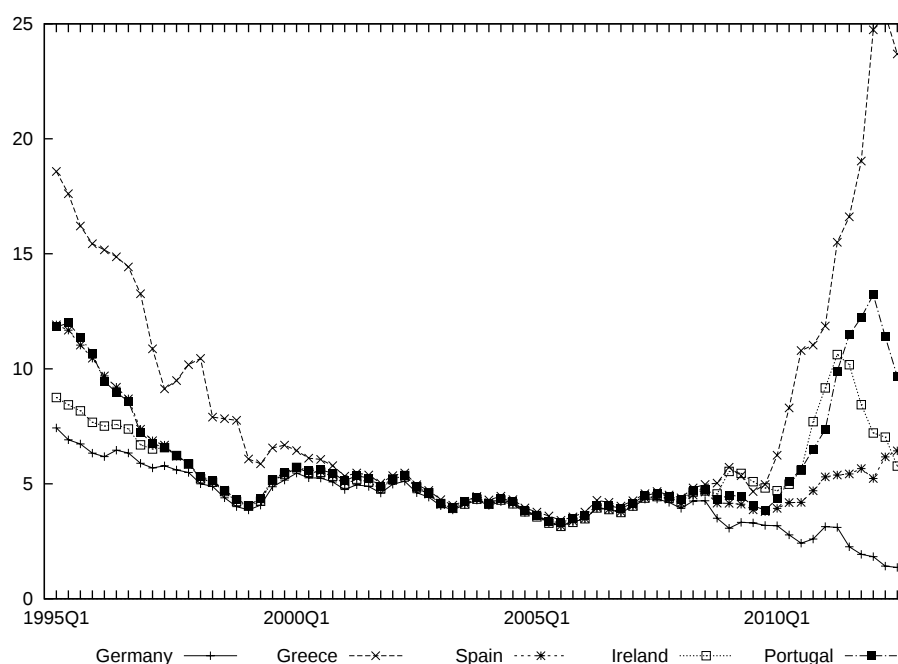
Figure 3: Public Debt in Selected Euro Zone Countries (%GDP)



Source: Eurostat.

The large public deficits and debt levels sent jitters through the financial markets. The disclosure that Greek public finance statistics had been rigged added fuel to the flames and soon after the credit rating of Greek government bonds was downgraded. Interest rates began its ascending movement (see Figure 4), piling pressure on already overstretched public finances. In May 2010, the bailout of the Greek government is announced. Meanwhile, Ireland continued to adopt austerity measures in order to compensate for the mounting costs of the nationalization of several financial institutions. In November 2010, Ireland also receives a rescue package. In April 2011, the Portuguese government finally acknowledges the need for a bailout, which is granted the following month. In October 2011, an agreement for reducing Greece's debt is reached. The following month, both Greece's and Italy's prime ministers resign and are replaced by "technocratic" interim prime ministers. In December 2011, the magnitude of the dangers for the European financial system led the ECB to carry out a long-term refinancing operation amounting to almost 500 billion euros.

Figure 4: Interest Rates in Selected Euro Zone Countries



Source: Eurostat (10-year government bonds).

2012 was marked by a deterioration of economic conditions in Europe, further downgrades of European sovereign ratings, further loans of the ECB to the European financial system, and by the discussion on how to reformulate European economic governance so as to prevent debt crises in the euro zone. The need to balance the risk of moral hazard and the need to convince the financial markets that euro zone countries are now solvent, makes progress difficult. Nevertheless, in March 2012 a new fiscal stability pact was signed, while the establishment of a banking union continues to under analysis. Bailouts continued: in June, Spain was given a "partial bailout", directed at the financial sector, while Cyprus also applied for a bailout.

The uncertainty about the evolution of the euro zone crisis, with speculation about a "Grexit", and even about Germany, rather than the weak countries, leaving the euro, has naturally brought back doubts about the sustainability of the European currency union. Perhaps because of this, the euro has lost some of its importance as a reserve currency: from its peak of 27.7% in 2009 – when the focus was still on the Great Recession in the US – it has declined to 25% in 2011. Thus, until the euro zone sovereign debt crisis is overcome, the prospects that the euro will challenge the dollar as the main international currency appear very slim.

3.3. Currency Wars

Besides the euro crisis, the IMS has also been disturbed by the possibility of a "currency war". The exchange-rate theme has assumed importance in the face of the large and persistent external imbalances that have been recorded in recent years. Persistent exchange-rate misalignments are often cited as a possible cause of the large external imbalances, and as a threat to global stability (see Bhalla, 1998, Posen, 2004, Ahearne et al., 2007, Cline and Williamson, 2008, 2010, Cline, 2010, and Subramanian, 2011). The current architecture of the IMS is seen as incapable of responding to global competitive shifts, or promoting the adjustments necessary to eliminate the imbalances. The large current account deficits of several advanced economies, and the large current account deficits of several emerging economies, are usually put forward as evidence of the deficiencies of the IMS.

At the same time, it should be noted that one of the lessons that emerging economies have drawn from past financial crises is that high levels of foreign reserves are an essential tool for dealing with the shocks originated by financial crises. One way of accumulating reserves is to sell more than you buy, for which it may be helpful to keep an undervalued currency, namely through intervention in the forex market; to impose capital controls may also help to achieve the same goal (see Goldstein, 2011). China is deemed to be the quintessential practitioner of this art. This has made other countries reproach China. The USA have been particularly sensitive about this matter, and have threatened with trade restrictions. China is one of the countries with the largest current account surplus, and have been accumulating large amounts of foreign reserves, whereas the USA have been reporting large external deficits, and have been increasing their foreign debt (see Ahearne et al., 2007). Since the renminbi's exchange rate does not float enough to correct the imbalance, voices in the USA claim that China is manipulating the exchange rate. It was in this context that the term "currency war" appeared. It was popularized by the Brazilian finance minister, Guido Mantega, who complained about the over-valuation of the Brazilian currency, but other currencies would also get embroiled in a currency war, namely in East Asia.

According to Cline and Williamson (2010), issuers of overvalued currencies and posting large external deficits, could be justified in their intervention in forex markets to prevent further appreciation of their currencies. However, exchange-rate manipulation by countries bent on maintaining current-account surpluses can only worsen global imbalances. Cline and Williamson (2011) estimated the fundamental equilibrium exchange rate for a group of currencies. By comparing those estimates with the actual exchange rates in October

2011, Cline and Williamson also estimated the misalignment implicit in actual exchange rates, and thus were able to conclude on which currencies were overvalued, undervalued or at the equilibrium level. Some of the results are reproduced in Table 1. The group of countries with undervalued currencies includes China, Singapore, Malaysia and Hong Kong. On the other side are countries such as Japan, Brazil, USA, Australia and the euro area.

Table 1: Exchange-Rate Misalignments

Country	FEER (2007 REER=100)	REER (2007=100)	Overvaluation (%)	Undervaluation (%)
Euro area	96.1	97.6	1.6	
Australia	99.8	118.1	15.5	
Brazil	117.1	123.6	5.2	
China	131.0	118.4		10.6
USA	81.3	89.6	9.3	
Hong Kong	101.7	88.2		15.4
Japan	116.0	127.5	9.0	
Malaysia	114.7	100.0		14.7
New Zealand	79.6	100.8	21.0	
Singapore	141.2	116.2		21.5
Thailand	101.1	100.5		0.6

Source: Adapted from Cline and Williamson (2011).

Notes: FEER: fundamental equilibrium exchange rate.

REER: real effective exchange rate (end of October 2011).

Prevention (or resolution) of a currency war requires that governments be willing to let the exchange rates converge to their equilibrium values, and thus to lose this instrument of economic policy. However, the conflict over exchange rates has been stoked up by economic policy measures adopted by advanced economies with a view to fighting the Great Recession. The US Federal Reserve, the central bank of Japan and the Bank of England, have introduced massive liquidity provision measures, usually known as "Quantitative Easing" (QE). The ECB has created a 3-year lending facility, charging an interest rate of 1% (LTRO- Long Term Refinancing Operations). Emerging economies have reacted to these measures with annoyance; they view these measures as devaluations in disguise (see Darvas et al., 2011).

Unsurprisingly, the G20 has shown a growing concern about these issues. However, an agreement on how to rebalance global demand is yet to be reached. The IMF also appears to be taking a passive stand on the matter. There is, therefore, a lack of the necessary leadership to build a consensus and stabilize the system. How will all this play out? The next section gives some hints.

3.4. Empirical Analysis

In this section we estimate, using panel data, a model for the share of a currency in official reserves. The group of countries is composed of the US dollar, the UK pound, the Japanese yen, the Swiss franc and the euro, since these are the main international currencies (over the sample, these currencies accounted for over 90% of allocated official reserves). The estimated model is similar to that estimated in Chinn and Frankel (2008). Chinn and Frankel estimated their model on a pre-euro sample. Their goal was to evaluate the likelihood that the euro would overtake the dollar as the main reserve currency. Here we estimate the model on a sample that begins after the introduction of the euro (1999) and ends in 2011, and our goal is comment on the likely evolution of the international role of the euro and of the dollar, and what space there will be for other variables in official reserves.

The dependent variable in the model is the share of each currency in allocated official foreign exchange holdings, according to the COFER (Currency Composition of Official Foreign Exchange Reserves) database provided by the IMF. The variables commonly used to explain the behaviour of this share (see Chinn and Frankel, 2008) include the share of the currency issuer's country in world GDP (*gdp*), the evolution of inflation in the currency issuer's country (*infl*), the turnover of the currency in foreign exchange markets (*fe_turn*), the volatility of the currency's exchange rate against the SDR (*er_vol*) and its appreciation (*er_diff*). The share in world GDP (which should not be too different from the share in world trade) is an indicator of the country's importance in the world economy. Naturally, the currency issued by more important countries should be in more demand. The turnover in foreign exchange markets may be viewed as another measure of the importance of the currency. However, trust in the value of a currency should also matter for the decision to hold it. Confidence in a currency may be eroded by high inflation in the currency issuer's country. Additionally, confidence in a currency may be associated to an appreciation of that currency, or to low volatility in its exchange rate. Further details on the data employed are given in Table 2.

Table 2: Data Definitions and Sources

Variable	Description	Source of raw data
<i>reserves</i>	share of each currency in allocated official foreign exchange holdings	COFER (Currency Composition of Official Foreign Exchange Reserves), IMF
<i>gdp</i>	share of the currency issuer's country in world GDP	World Economic Outlook Database, IMF
<i>infl</i>	deviation from average consumer price inflation in the G7 in each year	World Economic Outlook Database, IMF
<i>fe_turn</i>	turnover of the currency in foreign exchange markets as a fraction of total turnover	Triennial Central Bank Survey, Foreign exchange and derivatives market activity in 2010, BIS
<i>er_vol</i>	average standard deviation of the exchange rate vis-à-vis the special drawing rights unit of account, in deviation from the average value across the five currencies used in our study	Exchange rate archive, IMF
<i>er_diff</i>	annual end-of-period change in the logarithm of the exchange rate against the SDR (SDRs per currency unit)	Exchange rate archive, IMF

Since the variable to be explained (share in foreign exchange reserves) is bounded between 0 and 1, it is customary (see again Chinn and Frankel, 2008) to apply to it the logit transformation:

$$y = \ln\left(\frac{x}{1-x}\right) \quad (1)$$

where x is the share in foreign exchange reserves and $\ln()$ is the natural logarithm. By applying this transformation, we obtain a new variable which can take any real value. This variable may then be regressed on a linear function of explanatory variables, without concern for the possibility that the result of the estimation might yield shares outside the $[0,1]$ interval, as would be the case if the dependent variable went untransformed.

However, one may ask whether this particular transformation should be used rather than some alternative transformation. We thus decided to embed the logit transformation in a more general framework, appearing as a particular case of the Box-Cox transformation applied to the ratio:

$$w = \frac{x}{1-x} \quad (2)$$

We thus analyse the performance of the following transformation:

$$z = \frac{w^\lambda - 1}{\lambda} \quad (3)$$

and choose λ so as to minimise the sum of squares of the implied residuals. Notice that as λ approaches zero, z approaches the logarithm of w , i.e., the logit transformation of x .

Our procedure² thus consists of the following steps:

- i) transform x into z using the current value of λ
- ii) estimate the model:

$$z = b_1 + b_2 gdp + b_3 infl + b_4 fturn + b_5 ervol + b_6 erdiff + b_7 z_{-1} + s \quad (4)$$

- iii) save the estimated z 's ($\hat{z}$)
- iv) compute the implied residuals:

$$s = x - \frac{(\hat{z}\lambda + 1)^{\frac{1}{\lambda}}}{1 + (\hat{z}\lambda + 1)^{\frac{1}{\lambda}}} \quad (5)$$

- v) save the sum of squares of e
- vi) repeat the preceding steps for different values of λ and choose the λ that minimises the sum of squared implied residuals. The values of λ go from 0 to 1, with a step length equal to 0.01.

Note that in step 3 a difficulty may arise, which is that $\hat{z}\lambda + 1$ may be negative and thus the exponentiation may not be feasible when λ is fractional. This happened in very few cases, located on the fringe of the area where the minimum value of the sum of squares was found. Nevertheless, we opted to consider the implied residual equal to x in those cases, since the value of $\hat{z}\lambda + 1$ was between -1 and 0. This also provided a smooth evolution of the sum of squares along the grid for λ .

² All computations were performed with Gretl 1.9.11.

What was the result of this procedure? The optimal value of λ was found to be 0.2. Although this means that the logit transformation is not strictly optimal, one should bear in mind that the sum of squares was actually very flat in this region. This result suggests that the logit transformation may be a reasonable approximation to the optimum in this class of transformations. To elucidate this issue, we will estimate both the logit model and the optimised model (with $\lambda=0.2$), and compare the results. Note that we are interested in the effect of the explanatory variables on the share of each currency in official reserves (x), but this is a nonlinear function (via w and z) of the explanatory variables. To compare the results obtained for different nonlinear functions of these explanatory variables, we need to move from the estimated coefficients to the marginal effects of each explanatory variable on x , i.e., we need to compute for each explanatory variable v :

$$\frac{\partial x}{\partial v} = \frac{\partial x}{\partial w} \frac{\partial w}{\partial z} \frac{\partial z}{\partial v} \quad (6)$$

Given the nonlinearity of w and z , the marginal effect of variable v will depend on the value of v . In the context of this study, we decided to compute the marginal effect for each variable-country pair at the value taken by that variable in that country in the year 2011 (the last year in our sample). The results are reported in Table 3 for the case of the logit transformation, and in Table 4 for the case of the optimised model.

Table 3: Estimated Coefficients and Marginal Effects (logit transformation)

	Coeff	s_d	euro	USD	GBP	JPY	CHF
gdp	1.5158***	0.39051	0.277	0.360	0.057	0.051	0.002
infl	-3.3795*	1.8042	-0.617	-0.802	-0.127	-0.115	-0.004
fe_turn	0.78785***	0.16983	0.144	0.187	0.030	0.027	0.001
er_vol	-2.1357	4.1929	-0.390	-0.507	-0.081	-0.072	-0.003
er_diff	0.93717***	0.10714	0.171	0.222	0.035	0.032	0.001
z_1	0.95802***	0.0094886	0.175	0.227	0.036	0.033	0.001

Joint significance of differing group means:

$F(4, 49) = 1.29643$ with p-value 0.284437

Breusch-Pagan test statistic:

$LM = 1.3263$ with p-value = $\text{prob}(\text{chi-square}(1) > 1.3263) = 0.249465$

The dependent variable is $z = \ln(x/(1-x))$, where x is the share of each currency in allocated official reserves.

Table 4: Estimated Coefficients and Marginal Effects (Box-Cox transformation)

	coeff	s_d	euro	USD	GBP	JPY	CHF
gdp	1.2719***	0.078652	0.297	0.277	0.093	0.084	0.006
infl	-0.61909	0.48854	-0.145	-0.135	-0.045	-0.041	-0.003
fe_turn	0.34298***	0.032968	0.080	0.075	0.025	0.023	0.001
er_vol	-6.6043**	2.6872	-1.542	-1.440	-0.484	-0.435	-0.029
er_diff	0.53583***	0.079264	0.125	0.117	0.039	0.035	0.002
z_1	0.92694***	0.0044233	0.216	0.202	0.068	0.061	0.004

Joint significance of differing group means:

$F(4, 49) = 1.40078$ with p-value 0.247621

Breusch-Pagan test statistic:

$LM = 2.57567$ with p-value = $\text{prob}(\text{chi-square}(1) > 2.57567) = 0.108518$

The dependent variable is $z = (w^{0.2} - 1)/0.2$, where $w = \ln(x/(1-x))$ and x is the share of each currency in official reserves.

Since the data we are using is panel data, the question of whether to use a pooled, fixed or random effects model naturally arises. The results of the specification tests reported (the individual effects test and the Breusch-Pagan test) indicate that the pooled model is indeed adequate.

In both the logit and the Box-Cox models, the signs of the estimated coefficients are the same and are what one would expect: an increase in GDP share, in foreign exchange turnover and in the exchange rate contribute to augmenting the weight of the currency in official reserves; an increase in inflation and in the volatility of the exchange rate lead to a decline in the weight of the currency in official reserves. It is also important to note that there appears to be a lot of persistence: the coefficient on the lagged weight is between 0.92 and 0.96. Nevertheless, there is a difference in the results concerning the significance of inflation and of the exchange rate volatility. In the logit model, exchange rate volatility is not significant at the 10% level, whereas in the Box-Cox model inflation is not significant at the 10% level. It is unsurprising then that these are also the variables where the estimated marginal effects differ more between the two models. However, inflation and exchange rate volatility are the least significant variables in both models - all other variables are significant at the 1% level.

What do our results imply for the near future of the international monetary system? To answer this question we calculated the shares that our model predicts each of the currencies will have in official reserves between 2012 and 2017. Naturally, this requires the specification of values for the explanatory variables in those years. In the cases of the share in world GDP and inflation, we used the forecasts reported by the IMF in the World Economic Outlook. In the cases of the turnover in foreign exchange markets and exchange rate volatility, we assumed the variables will remain at their 2011 levels. Finally, in the case of exchange rate appreciation, we assumed the change in the value of the exchange rate would converge to zero by 2017. This scenario leads to the evolution report in Table 5. Over the next five years, both models predict a very significant decline of the importance of the five currencies in our sample, from 94.6% to 82.2% (Box-Cox model) or 80% (logit model). The only share predicted to increase is that of the UK pound. The logit model predicts a large fall of the euro's share (minus 9.6 percentage points), whereas the Box-Cox model predicts that the biggest loser will be the dollar (minus 6.1 percentage points). These results are in stark contrast with some of the scenarios reported in Chinn and Frankel (2008), according to whom the dollar will continue its decline and be replaced by the euro.

Table 5: Predicted Evolution of Official Reserves' Composition

	2011	2017 (Box-Cox)	2017 (logit)
EUR	25.0%	19.3%	15.4%
USD	62.1%	56.0%	58.3%
GBP	3.8%	4.5%	4.1%
JPY	3.5%	2.3%	2.1%
CHF	0.1%	0.1%	0.1%
Total	94.6%	82.2%	80.0%

Instead, our results suggest that over the next five years there will be a fast increase in the importance of other currencies in the international monetary system. The obvious candidate appears to be China's renminbi. Nevertheless, other emerging countries' currencies may well move forward to fill the gap left by the euro and the dollar. Such development is likely to require emerging countries not only to continue to grow at a fast pace, but also to take steps towards full integration of their currencies in the international monetary system.

4. Conclusion

The international importance of the dollar has been declining and our econometric model suggests that this will continue to happen in the near future. Therefore, there will be space for other currencies to occupy in official reserves. Nevertheless, the emergence of a multipolar IMS does not appear likely in the short run, given the problems that the euro zone and the Japanese economy face, and the restrictions that affect the international use of the Chinese currency. Most likely, the IMS will continue in a state of flux for some years, until one, or several, of the alternative reserve currencies is able to rise above the rest and challenge the dollar's dominance.

Whether this process of sorting out reserve currencies will be accompanied by an explicit currency war is unclear. In fact, participation in a currency - with the goal of achieving a depreciation of one's currency - is *prima facie* incompatible with issuing an international reserve currency, demanded for its worth and usefulness in international transactions, as our econometric model corroborates. However, in the short run governments appear to be worrying about stabilization of the domestic economy rather than about the international standing of the currency. Mediation by international forums such as the G20 may thus be important in shaping a smooth path in the years to come for the International Monetary System.

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