B RESERVE DIVERSIFICATION AND GLOBAL FOREIGN EXCHANGE MARKETS: AN OVERVIEW OF THE LITERATURE[36]

The global financial crisis has reignited discussions as to whether emerging market central banks – such as large reserve holders in emerging Asia or oil-exporting economies – might diversify their foreign exchange reserves away from traditional reserve assets. These discussions have in turn fuelled speculation among market observers as to the extent of the potential impact that reserve diversification – if any – could have on global foreign exchange markets. As a follow-up to last year's report, which examined the emergence of non-traditional reserve currencies and that of the Chinese renminbi as an international currency, this special feature aims to provide an overview of the academic literature on the global financial impact of official reserve diversification. It discusses the multifaceted concept of official reserve diversification, examines the main theoretical channels through which its impact may unfold and reviews the empirical evidence available. The special feature shows in particular that the impact of reserve diversification on global foreign exchange markets is not mechanical, but that it depends on an array of factors, such as the degree of substitutability between reserve assets and related changes in interest rates; the endogenous adjustment of the current account in the medium term; and, importantly, whether private investors – whose portfolio holdings are even larger than those of central banks – regard diversification as a credible signal that prompts them to alter the composition of their own holdings.

I INTRODUCTION

The global financial crisis has reignited discussions as to whether emerging market central banks – such as large reserve holders in emerging Asia or oil-exporting economies – might diversify their foreign exchange reserves away from traditional reserve assets, including US dollar-denominated financial assets. Some observers – such as Frankel (2013) and Prasad (2014) – stress that the crisis has underscored the US dollar's resilience as a reserve currency, insofar as its share in global foreign exchange reserves has remained stable despite the downgrade of US sovereign debt by one rating agency. Others suggest that the crisis might induce reserve-hoarding countries to diversify their holdings into other currencies, such as the euro, owing to renewed confidence in the long-term stability of the euro area, as well as into non-traditional reserve currencies, such as the Australian dollar and Canadian dollar, and the Chinese renminbi, if and when it becomes fully convertible (see ECB, 2013, for additional evidence). These discussions have fuelled speculation among market observers as to the extent of the potential impact that reserve diversification – if any – could have on global foreign exchange markets.[37]

This special feature aims to provide an overview of the academic literature on the global financial impact of reserve diversification. A well-established feature of the composition of foreign exchange reserves is its persistence over time, which arises from the network externalities and lock-in effects that characterise international reserve currency status.[38] Another conventional consideration is that

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37 For instance, Goldman Sachs staff, based on a hypothetical scenario in which emerging market central banks would revert to their pre-crisis allocations in euro, estimate that the latter may lead to a sizeable appreciation of the euro exchange rate, to 1.88 USD/EUR (see Goldman Sachs, "What if reserve managers aimed for pre-crisis EUR allocations?", *Global Markets Daily*, 21 October 2013). Such estimates are overly simplistic, however. They are based on the assumption that changes in reserve allocations materialise solely via valuation effects. They hence assume that there is, for example, no endogenous response in bond yields, no medium-term effect on the current account, and no changes in allocations of private sector portfolios. Taking into account these effects could change the estimates substantially (and potentially even reverse the results).

38 Such inertia can emerge from optimal reserve composition models that incorporate precautionary motives (or other reserve holding motives) as well as specific currency unit characteristics. The currency composition of reserves tends to be driven by determinants which change slowly over time, including trade invoicing practices, the currency composition of external debt, exchange rate anchoring, inflation developments, financial market depth as well as trade and financial openness.

changes to the composition of foreign exchange reserves are likely to be hampered by the fact that large reserve holders are presumed to be reluctant to sell significant amounts of assets denominated in a particular currency, out of concerns about incurring valuation losses on their existing holdings.

The academic literature suggests that reserve diversification is, in fact, a multifaceted concept. It may take three distinct forms – namely passive, active and stabilising – although their relative importance is difficult to identify empirically. It is especially active diversification – i.e. when central banks buy (or sell) currencies that are appreciating (or depreciating) – which has raised concerns among observers. In theory, its impact on global foreign exchange markets is not mechanical but depends on an array of factors. These include the degree of substitutability between reserve assets and related changes in interest rates, the current account's adjustment over the medium-term, and whether private investors – whose portfolio holdings are even larger than those of central banks – regard diversification as a credible signal that prompts them to alter the composition of their own holdings.

The historical and empirical evidence offers additional insights into the actual impact of reserve diversification on global foreign exchange markets. It suggests that concerns over the destabilising impact of reserve diversification on financial markets are primarily rooted in the experience of the interwar period, when uncooperative policies led to the collapse of the gold standard. Moreover, the demise of the pound as a major reserve currency in the early 1970s shows that a major rebalancing in reserve currency shares does not necessarily occur through the liquidation of existing reserve holdings, but rather through the acquisition of additional (in this case dollar-denominated) assets. The developments in the later part of the 1970s, when concerns surfaced about the dollar's future as a reserve asset, suggest that these concerns did not lead to large sales of dollar assets, but instead to concerted efforts to stabilise the dollar. In line with this, several empirical studies on the more recent period find that reserve diversification has been stabilising, and that central banks tend to lean against the wind in managing their reserve holdings, which also helps to explain the relative stability of currency shares in global reserve holdings.

Finally, the resilience of the share of the US dollar in global foreign exchange reserves since the global financial crisis suggests that if the international monetary system were to evolve in the medium term, this would most likely be towards multi-polarity – with several international currencies playing consequential roles – rather than towards the replacement of the US dollar by another unit as the leading international currency.

Section 2 of this special feature reviews the alternative definitions of reserve diversification. In Section 3, the main theoretical channels of the impact of diversification on global foreign exchange markets are presented. The historical evidence and empirical evidence available are examined in Section 4, while Section 5 provides concluding remarks.

2 RESERVE DIVERSIFICATION AS A MULTIFACETED CONCEPT

In theory, reserve diversification can take three distinct forms (see, for example, Truman and Wong, 2006; and Wong, 2007). Passive diversification refers to changes in the currency composition of reserve holdings that are due not to actual sales or purchases of foreign assets, but to valuation effects on existing holdings. These valuation effects arise from capital gains and losses, interest payments or exchange rate changes. They can be sizeable, notably if reserve holdings are large. Stabilising diversification in turn refers to situations when central banks lean against the wind and

intervene in foreign exchange markets against the market trend (i.e. they purchase a currency when it depreciates, or sell it when it appreciates). This often occurs when central banks seek to stabilise or anchor their exchange rate relative to a specific foreign currency or basket of foreign currencies. Active diversification refers to the opposite strategy: central banks alter the currency composition of their holdings according to the direction of the market trend, hence further adding pressure on foreign exchange markets in this direction. It is especially active diversification away from the US dollar – and its alleged potential impact on global financial markets – which has initiated discussions among observers. As Truman and Wong (2006) explain, one concern is that significant changes in the currency composition of major reserve holders in emerging market economies would trigger marked exchange rate adjustments, which, in turn, would have adverse spillover effects on other financial market segments, along with possible macroeconomic effects.

Empirically identifying the relative importance of passive, stabilising and active diversification is challenging. Available data on the currency composition of foreign exchange reserves are reported on a value basis, which incorporates all three forms of diversification. The data include changes which are due to both movements in major exchange rates and asset prices, as well as to actual official transactions in foreign exchange markets. Reserve changes therefore need to be adjusted for valuation effects to distinguish between developments that are due to prices and those that are due to quantities. This exercise requires an array of assumptions and is thus subject to some degree of uncertainty (see, for example, the discussion in Dominguez, Hashimoto and Ito (2012) for an attempt to estimate valuation effects as determinants of reserve holding developments in emerging economies during the early phase of the global financial crisis).[39] Nevertheless, empirically identifying the effect of active, passive or stabilising diversification remains difficult. Since official transactions in foreign exchange markets do not occur randomly, but are always a reaction to conditions in these markets, the direction of causality between official transactions and exchange rate movements is indeed unclear (Engel, 2013). In other words, do exchange rate movements induce central banks to diversify their reserves? Or does diversification cause movements in exchange rates, in anticipation of the latter? This simultaneity bias is particularly important in the literature on foreign exchange interventions – where central banks are typically presumed to lean against the wind – but no satisfactory solution has emerged so far from this literature (ibid).[40]

3 THEORETICAL CHANNELS OF THE IMPACT OF RESERVE DIVERSIFICATION ON GLOBAL FOREIGN EXCHANGE MARKETS

In portfolio balance models, the impact of reserve diversification on global foreign exchange markets depends on the degree of substitutability between reserve assets in particular. A key assumption made in these models (see, for example, Branson and Henderson, 1984) is that domestic and foreign bonds are imperfect substitutes. This implies that expected yields on domestic and foreign bonds – adjusted for expected exchange rate movements – are not necessarily equal.[41]

39 A casual inspection of the data on the currency composition of global foreign exchange reserves reported in this report suggests that central banks pursue mixed strategies, since current weights remain broadly – albeit not completely – stable over time.

40 For instance, some studies have used high-frequency data to identify their "true" impact (i.e. with a view to minimising noise arising from other market-moving factors, such as macro data releases) at the cost of being mute on the long-term effect of interventions. Some studies use lagged interventions, but lose sight of their contemporaneous effects (which are presumably important). Finally, it is very difficult to find a valid instrument to deal with the simultaneity bias since almost any variable that is correlated with interventions will also be correlated with economic determinants of the exchange rate.

41 In other words, international investors may regard domestic and foreign bonds as having different characteristics other than their currency of denomination (such as liquidity or usability as an international reserve unit) and may regard one of the bonds as being riskier than the other. They will hence require a premium to hold this bond. By contrast, there is no distinction between domestic and foreign bonds in monetary models of exchange rate determination, and domestic and foreign assets are modelled as perfect substitutes.

In simple portfolio balance models with three regions (the United States, the euro area and emerging markets) and three currencies (two reserve currencies, i.e. the US dollar and the euro, and a third domestic currency), a change in the currency composition of the reserve holdings of emerging markets – initially assumed to be heavily tilted towards the US dollar – can be interpreted as a change from a situation in which the world investor base has an extreme preference for US dollars to one in which there is a stronger preference for the euro (see also Blanchard, Giavazzi and Sa, 2005, for a related discussion). Such changes in preferences lead to a decrease in the demand for US dollars and to an increase in the demand for the euro. As the relative demand for the euro increases, it leads to an appreciation of the latter vis-à-vis the US dollar, everything else being equal. But the magnitude of the euro's appreciation vis-à-vis the US dollar may be less pronounced if investors consider euro and US dollar-denominated bonds as imperfect substitutes and US yields react to changes in reserve holdings. If the risk premium increases significantly together with US yields, the appreciation of the euro may even be reverted.[42] In portfolio balance models with three or more currencies the extent of this effect, and whether bonds denominated in different currencies are substitutes or complements, depends on an array of factors, such as the correlation of their respective returns and relative variance magnitude (Branson and Henderson, 1984, p. 78).

More sophisticated models suggest that distinguishing between short-term and long-term effects, as well as portfolio and current account effects, is also important. An important study in this respect is by Blanchard, Giavazzi and Sa (2005), who use a portfolio balance framework to model the joint dynamics of the current account and the exchange rate, while allowing for imperfect asset substitutability and valuation effects. They show that a three-country version (the United States, the euro area and China) of their model sheds light on the impact of a revaluation of the Chinese renminbi on the euro's exchange rate. In this model, if the renminbi appreciates against the US dollar, the euro also strengthens against the US dollar, due to portfolio and trade effects. As to the portfolio effect, the revaluation of the renminbi shifts Chinese demand away from US dollar-denominated assets towards euro-denominated assets, which puts upward pressure on the euro's exchange rate. In terms of the trade effect, the revaluation induces US demand to shift away from Chinese goods (which have become more expensive) towards euro area goods, which also contributes to a strengthening of the euro.[43] In a similar vein, the model helps to shed light on marked differences between the short-term and long-term impact of a change in the composition of China's reserves away from the US dollar. In line with a portfolio effect, a decline in the share of the US dollar in China's reserves leads to an initial depreciation of the US dollar and to an appreciation of the euro. In the longer run, however, the US current account balance improves, together with the US net external debt position. This enables the US dollar to gradually strengthen and eventually leads to a smaller depreciation.[44] Simulations based on a calibrated version of the model (in which parameter values are taken as of 2005) suggest that changes in the composition of China's reserves – if they are significant – can have a large impact on the US dollar exchange rate. Assuming a decline in the share of the US dollar in total foreign (private and central bank) portfolios from 30% to 28% (which corresponds to halving the share of the US dollar in the reserves of both the People's Bank of China and the Bank of Japan, according to Blanchard, Giavazzi and Sa), the

42 By contrast, a sterilised foreign exchange intervention has no effect on exchange rates or interest rates in monetary models of exchange rate determination. In these models, such interventions indeed result in an exchange of perfectly substitutable domestic assets for foreign assets on the central bank's balance sheet, while money supply remains unchanged.

43 Bernanke (2005) observes that this effect depends in turn on patterns of substitution and complementarity among goods and currencies. For instance, if Chinese goods and euro area goods are viewed as complements by potential buyers in other countries, a renminbi revaluation may reduce global demand for euro area exports to such an extent that it could lead to a weakening of the euro.

44 Bernanke further observes that the speed of adjustment of the exchange rate and the current account in this model crucially depends on the elasticities of foreign and domestic asset demands with respect to expected return differentials. As he puts it, dynamics may be even more complex if the degree of asset substitutability is not constant but varies over time or across (private vs public) investors (see Bernanke, 2005, p. 51).

dollar would depreciate by up to 9% in real effective terms (see Blanchard, Giavazzi and Sa, 2005, p. 31). Recent extensions of the model have also helped to shed light on the impact of the growing role of the Chinese renminbi on other major currencies.[45]

The impact of reserve diversification also largely depends on whether private investors regard it as a credible signal which prompts them to alter the composition of their own holdings. It has been argued that the impact of official reserve management on exchange rates has weakened with the rapid expansion of private sector transactions in foreign exchange markets. As the argument goes, the magnitude of official transactions is now simply too small relative to the depth and liquidity of global foreign exchange markets to have any discernible effect, which would be a major difference relative to patterns of the more distant past.[46] However, the impact of official diversification may be amplified by a signalling or coordination channel, following the model of Sarno and Taylor (2001). Statements (or even rumours) by emerging market authorities about a possible diversification of their reserve holdings in the future may indeed be interpreted by private investors as a signal that relative demand for global currencies could fundamentally change. Concerns about frontloading may prompt these investors to alter the composition of their own holdings, before any official transaction has taken place. In turn, this may create bandwagon effects which magnify the potential effect of actual official reserve diversification.

4 EMPIRICAL EVIDENCE ON THE IMPACT OF RESERVE DIVERSIFICATION ON GLOBAL FOREIGN EXCHANGE MARKETS

Concerns about the destabilising impact of reserve diversification on foreign exchange markets originate primarily from the experience of the interwar period, when uncooperative policies led to the collapse of the gold standard. In this period, France's concerns were similar to those of China now (Accominotti, 2009). The Banque de France held more than half of the world's foreign reserves, which were allocated into gold, pounds sterling and US dollars. Concerns that the pound might be taken off the gold standard after 1929 provided an incentive for the Banque de France to liquidate its holdings denominated in the British currency. But the large size of its holdings made it difficult to do so without precipitating the pound's collapse and severe valuation losses. The Banque de France decided therefore not to liquidate its sterling reserves, but rather to intervene in foreign exchange markets in support of the pound sterling. However, its eventual exit from the gold standard in 1931 resulted in such heavy losses for the Banque de France, that it had to be put in technical bankruptcy and bailed out by the French government under strict conditionality. As concerns mounted that the US dollar would also leave the gold standard, the French authorities' decision to resolutely stick to gold caused the Banque de France to convert all of its US dollar assets into gold, through fear of incurring additional losses. This helped precipitate the devaluation of the US dollar in 1933 and to the global transmission of a severe monetary contraction in subsequent years.[47]

45 For instance, in a three-currency model (dollar, euro, renminbi) the growing role of the renminbi as an investment currency (modelled as higher renminbi-denominated holdings in both US and euro area portfolios) can be shown to be either neutral or stabilising for the euro-dollar exchange rate, be it under a renminbi peg with respect to the dollar or a free float (see Bénassy-Quéré and Forouheshfar, 2013).

46 For instance, Truman and Wong (2006) report that the average absolute change in the US dollar's share of global reserves between 1970 and 2005 stands at 2.2% (net of valuation effects). They calculate that, in terms of foreign exchange reserve holdings of US dollars as of the end of 2005, this corresponds to USD 92 billion for a full year, or less than USD 400 million per trading day, compared with about USD 2 trillion a day in turnover in global foreign exchange markets at that time.

47 See Eichengreen (1992) for an in-depth discussion of the role of the gold standard in the international transmission of the Great Depression.

The demise of the pound sterling as a major reserve currency in the early 1970s shows that a major rebalancing in reserve currency shares does not necessarily occur through the liquidation of existing reserve holdings, but rather through the acquisition of additional (in this case US dollar-denominated) assets. Between 1969 and 1975 the share of the pound sterling in global reserves declined markedly from about 25% to less than 4%. This decline did not mainly occur as a result of the liquidation of sterling assets (also known as "sterling balances").[48] It stemmed from the accumulation of significant US dollar-denominated assets, notably by industrialised and oil-exporting economies, due to foreign exchange market interventions in the wake of the collapse of the Bretton Woods system and to inflows of petrodollars after the first oil price shock. The outstanding amount of US dollar-denominated reserves more than sextupled between 1969 and 1975, from about USD 20 billion to over USD 120 billion. Sterling-denominated reserves, in turn, remained broadly unchanged, from USD 8 billion in 1969 to USD 6 billion in 1975.[49] These developments therefore explain, to a large extent, the marked decrease in the relative share of the pound sterling in world reserves and the concomitant increase in the share of the US dollar (from about 63% to almost 80%). In future, if the experience of the early 1970s is any guide, large reserve holders could similarly diversify their holdings by purchasing large amounts of assets denominated in currencies other than the US dollar. Hence they would not necessarily need to liquidate their dollar-denominated assets to that end.

The later part of the 1970s, when concerns surfaced about the US dollar's future as a reserve asset, suggests that these concerns did not materialise into the liquidation of US-dollar assets, but instead into concerted efforts to stabilise the US dollar. After the collapse of the Bretton Woods system, the continued depreciation of the US dollar in the 1970s – together with stagflation and US current account deficits of an unprecedented size – raised discussions about the future of the US dollar as a reserve currency.[50] The creation of a "substitution account" to address an alleged "dollar overhang" in the portfolios of foreign central banks and to avoid putting additional downward pressure on the US dollar was openly discussed. This notwithstanding, central banks continued to accumulate US dollar-denominated reserves throughout the 1970s to stabilise the value of their existing dollar-denominated assets, including through concerted interventions in support of the US dollar that involved the Federal Reserve System, the Deutsche Bundesbank and the Bank of Japan. Consistently with this, Horii (1986) finds no evidence of large-scale diversification of reserves away from the US dollar in this decade, after controlling for valuation effects.[51] In future, if this historical experience is also any guide, a loss of confidence in the US dollar's ability to serve as an official store of value would not necessarily be associated with massive US dollar sales in the short term, since large reserve holders might have an interest in intervening in markets to stabilise the value of their existing US dollar holdings.

In line with this, several empirical studies that have focused on the more recent period find that reserve diversification was stabilising, and that central banks tend to lean against the wind in managing their reserve holdings. In particular, Lim (2007) uses the IMF's aggregated COFER data for the period 1999-2005 and finds evidence that changes in the share of the US dollar (adjusted for valuation effects) are negatively correlated with the US dollar's exchange rate. He interprets these findings as evidence that reserve diversification in response to exchange rate changes has tended to be stabilising for exchange markets, which also helps explain the relative stability of currency shares in global reserve holdings. Wong (2007) finds similar evidence over the same sample period,

48 See Schenk (2010) for more details.
49 Moreover, part of the decline may have been due to valuation effects. For an analysis of these developments, see also McKinnon (2013).
50 See Henning (1994) on these discussions.
51 By contrast, he finds some evidence for stabilising reserve diversification in the early part of the 1980s, when the dollar was appreciating.

with the share of the dollar in global reserves being negatively correlated with the US dollar's exchange rate. Moreover, she finds that Japan was the main source of stabilising diversification among the advanced economies. Ouyang and Li (2013) reach similar conclusions for emerging economies over the period 1999-2012. As they explain, emerging economies tend to buy (or sell) assets denominated in depreciating (or appreciating) currencies, after controlling again for valuation effects, but also for a host of other determinants of reserve currency choice.

Finally, recent studies provide evidence in support of the existence of a signalling channel of reserve diversification. In particular, Fratzscher and Mehl (forthcoming) find that statements by Chinese authorities pointing to the possible diversification of China's reserves led to a disproportionately large appreciation of the euro against the US dollar, and of the currencies anchored to the euro. This confirms earlier results in Fratzscher and Mehl (2009), according to which statements on exchange rates and reserves by emerging market policy-makers exert a statistically and economically significant impact on the exchange rate of the euro and the yen vis-à-vis the US dollar on the day they occur, with the euro being affected the strongest. On average, a statement pointing to the possibility of loosening the US dollar peg or diversifying reserves away from the US dollar leads to an appreciation of 0.25% of the euro and of 0.15% of the yen against the US dollar.

5 CONCLUDING REMARKS

While the aforementioned considerations were of particular relevance for the short to medium term, from a longer-term perspective, one open issue that might remain is whether a more diversified international monetary system – i.e. one with multiple international currencies, where the US dollar, the euro and possibly the renminbi and other currency units would all play consequential roles – would in turn be a source of stability or instability in global foreign exchange and financial markets.

Some observers have argued that the emergence of a multipolar monetary system would help solve Triffin's dilemma and address potential shortages of global safe assets (see Fahri, Gourinchas and Rey, 2011). Since the supply of reserve assets would indeed become more elastic, a multipolar system could respond more flexibly to the growth in international real and financial transactions and grow with the global economy's needs. Moreover, since investors would increasingly consider reserve assets denominated in different currencies as substitutes, a multipolar system might also exert disciplinary effects on the policies of reserve currency issuers. They would need to more swiftly address a worsening in their fundamentals to avoid potentially large and disruptive capital outflows. The ability of reserve currency issuers to run large current account deficits and use foreign capital to indulge in financial excesses would hence be markedly limited, which would make the global economy financially safer (Eichengreen, 2010).

However, other observers have expressed concerns that increasing substitutability between reserve currencies would foster instability in global foreign exchange and financial markets. As they argue, a multipolar currency system could increase the likelihood of self-fulfilling runs on reserve currencies, among both private and official investors, each of whose interests consist of anticipating crises ahead of others and in converting their holdings first. At the same time, official reserve managers have less incentive to "herd" – i.e. to buy or sell a currency because others do it – than other investors (ibid.). They often take a longer-term perspective, because, unlike private fund managers, they are not accountable to short-term-oriented investors. In addition, official reserve managers often pursue objectives which are not strictly related to the maximisation of risk-adjusted

returns, but to precautionary motives or global financial stability. In other words, official reserve managers are more likely to act as stabilising investors which, as a result, should contribute to stabilising global exchange rate configurations.

In any case, it remains essential that any transition towards a multipolar international monetary system occurs in an orderly manner so that disruptions and excessive volatility can be avoided.

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