



EUROPEAN CENTRAL BANK

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**THE ACCUMULATION OF  
FOREIGN RESERVES**

by an International Relations  
Committee Task Force



EUROPEAN CENTRAL BANK



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# THE ACCUMULATION OF FOREIGN RESERVES

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## PREFACE

In a number of countries, especially emerging market economies, the public sector has in recent years been accumulating sizeable cross-border financial assets, mainly in the form of official foreign exchange reserves. World reserves have risen from USD 1.2 trillion in January 1995 to above USD 4 trillion in September 2005, growing particularly rapidly since 2002. The impressive pace of reserve growth has become an important issue on the international policy agenda and has been considered from various perspectives, including the financing of the growing US current account deficits, the debate on high net savings in the Asian economies and oil-exporting countries, the sustainability of reserve accumulation, and the factors behind exceptionally low yields within and outside the United States.

In January 2005 the International Relations Committee (IRC), a committee established by the European System of Central Banks (ESCB) to deal with international monetary and financial affairs, asked a group of ESCB central bank experts to study the accumulation of foreign reserves in greater detail. The ensuing report by the IRC task force investigated the features, drivers, risks and costs of reserve accumulation, as well as the other uses that certain countries have been making of their accumulated foreign assets. The report also reviewed the main trends in central bank reserve management and provided some evidence for the impact of reserve accumulation on yields and asset prices.

The report – on which this occasional paper is based<sup>1</sup> – was discussed by the IRC in June 2005, and the authors gratefully acknowledge the comments made by the Committee members on that occasion. In addition, in September 2005 the report was sent to the General Council of the European Central Bank (ECB) and, subsequently, to the Economic and Financial Committee, a consultative committee that contributes to the preparation of the work of the ECOFIN Council.

1 Georges Pineau (ECB) chaired the IRC task force and coordinated its work. Ettore Dorrucci (ECB) drafted the paper, and the other task force members carried out the corresponding background studies as acknowledged in the footnotes to each of the seven annexes.

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## SUMMARY

World foreign exchange reserves grew from USD 1.2 trillion in January 1995 to more than USD 4.0 trillion in September 2005<sup>2</sup>. Reserve accumulation in this period exhibited four features that seem largely unprecedented. Three of these features became particularly prominent in 2002-04. First, world reserves grew by around 85% (or 91% if the first eight months of 2005 are included), at a pace three times faster than in 1999-2001. Second, monetary authorities in Asia, including Japan until March 2004, accounted for the bulk of the accumulation, and eight of them are currently among the ten largest reserve holders. Third, fewer official creditors held an increasingly larger share of the total accumulation. The top five reserve accumulating central banks, which accounted for almost 57% of the total reserve accumulation on average in the period 1995-2001, increased their share to more than 68% of the total world accumulation in 2004. The top two, Japan and China, accounted for about half of the total world accumulation in 2002-04, and currently hold around 40% of the total world stock of reserves. A fourth, equally important development has come about more recently: the oil-exporting countries, whose combined current account surplus is estimated to have exceeded that of the Asian economies in 2005, have emerged as a new major group of net capital exporters in the world economy. They, however, have accumulated assets not only in the form of “traditional” reserves, but also by building up foreign assets in so-called oil funds – a phenomenon that is not yet fully captured by the available statistics, including those on the financing of the US external deficit.

Such an unprecedented accumulation of official foreign assets can be seen as the outcome of three main drivers in addition to the more recent oil price hike. First, in the aftermath of the financial crises that occurred in the 1990s and early 2000s, many emerging market economies (EMEs) felt the need to self-insure against future crises. Second, at the beginning of their recoveries and following

strong depreciation of their currencies, the crisis-hit Asian economies pursued export-led growth supported by exchange rate regimes anchoring their currency, de jure or de facto, to the US dollar. Third, certain features of the domestic financial systems of EMEs, especially in Asia, are likely to have played a role. Such characteristics relate mainly to: (i) their underdeveloped local financial systems, entailing difficulties in properly channelling domestic private savings to investment as well as inefficient and/or costly hedging markets; (ii) the resultant tendency towards dollarisation of official and/or private cross-border assets on the part of certain creditor EMEs; and (iii) from a macro viewpoint, an excess of domestic savings over investment driven by either a savings glut (e.g. China) or an investment drought (other Asian emerging market economies). All these features have significant links to reserve accumulation, as explained below.

These recent drivers of reserve accumulation seem to have one aspect in common, namely the role played by the build-up of official foreign assets both as an outcome of and an instrument for integration of the EMEs concerned into the global financial markets. Several emerging countries, especially in Asia, have in fact become major players in international trade but are still underdeveloped from a financial angle. This asymmetry is probably one reason why EMEs now hold around two-thirds of world reserves compared with less than 30% at the end of the Bretton Woods period in the early 1970s, whereas the total reserves of mature economies with complete and deep financial markets, excluding Japan, have remained stable at around USD 500 billion since the early 1990s.

As underlined in the literature, continued reserve accumulation may over time entail some

2 As reported by the IMF in its latest update of the database on Currency Composition of Official Foreign Exchange Reserves. In the remainder of this paper, however, data are updated until the end of August 2005, when world reserves stood at USD 3.9 trillion.



risks and costs, such as inflationary pressure, over-investment, asset bubbles, complications in the management of monetary policy, potentially sizeable capital losses on monetary authorities' balance sheets, sterilisation costs, segmentation of the public debt market and misallocation of domestic banks' lending.

Two other noteworthy developments have been recorded in several economies in recent years. First, some progress has been made towards more active management of official reserves, resulting, for instance, in investment in a more diversified range of instruments with longer maturities. Second, a substantial share of official foreign assets has been channelled into vehicles with purposes other than reserve holding. Examples include (i) the creation of oil funds in countries such as Norway, Russia, Venezuela, Kuwait and Oman, which aim to either stabilise their oil revenues (stabilisation funds) or save part of them for future generations (savings funds) or for early reimbursement of foreign debt; (ii) the establishment of "heritage funds" which have more explicit return objectives in economies such as Singapore; (iii) the injection of USD 60 billion from reserve assets into three major state-owned commercial banks in China in order to increase their capital base for their partial privatisation; and (iv) the allocation of USD 15 billion to banks in the Taiwan Province of China (hereinafter called Taiwan) for use in major domestic investment projects. The effects of these innovative ways of using official foreign assets are still to be fully understood, in particular with regard to the link between exchange rate and fiscal policy (e.g. in Russia), between the macroeconomic and the micro-prudential dimension of economic policy (e.g. in China), and between the management of very liquid, low-risk assets at central bank level and the management of longer-term, more return-oriented portfolios by other financial entities (e.g. in Singapore).

Regarding the impact of reserve accumulation on yields, in the existing literature the estimates of the effect of foreign exchange

intervention on US Treasury yields are quite different, and range from negligible to 200 basis points. This paper shows that purchases of US government debt securities by Asian monetary authorities might have affected the level and dynamics of their yields; in particular, there is some evidence that Japanese purchases of US Treasuries might have had an impact of around 65 basis points on three-year US Treasury yields at the time of the most sizeable interventions. Looking forward, the overall market impact of portfolio changes could differ, depending on the preferences of the private sector.

In conclusion, a significant share of the US current account deficits is financed by foreign official institutions pursuing objectives that are, to some extent, insensitive to risk-return considerations. However, EMEs could progressively lessen their need for reserve accumulation by developing policies such as: (i) structural and macroeconomic measures to foster domestic demand; (ii) financial system reforms both at domestic and regional levels, including bond market development; (iii) a well-sequenced shift towards greater exchange rate flexibility, coupled with money market reforms and, possibly, financial account liberalisation; (iv) regional economic surveillance and monetary cooperation which, *ceteris paribus*, would reduce the need for unilateral reserve accumulation.

## I THE PUZZLE OF RESERVE ACCUMULATION SINCE 2002

The accumulation of world foreign exchange reserves (hereinafter called reserves)<sup>3</sup> has exhibited largely unprecedented features since 2002 with respect to: (i) the size and pace of the accumulation, (ii) the degree of concentration of ownership, and (iii) the geographical distribution.

3 For further evidence, see Annex 1. In this paper the expression "reserves" always refers to foreign exchange reserves – i.e. reserves net of gold, special drawing rights (SDR) and reserve positions at the IMF – unless otherwise specified.

**Table 1 Year-on-year changes in foreign exchange reserves and their contribution to global reserve growth**

(January 1995–August 2005)

	2002–2005		1999–2001		1997–1998		1995–1996	
	USD bn	Contribution to world growth (%)	USD bn	Contribution to world growth (%)	USD bn	Contribution to world growth (%)	USD bn	Contribution to world growth (%)
China	536	29.0	67	14.7	36	47.8	50	14.4
Japan	443	24.0	177	39.0	-4	-5.2	91	26.1
Taiwan	130	7.1	30	6.7	2	2.6	-5	-1.5
Russia	114	6.1	26	5.6	-2	-2.8	9	2.6
Korea	102	5.5	49	10.8	21	27.7	8	2.2
India	92	5.0	18	3.9	7	9.4	0	0.0
Malaysia	49	2.7	3	0.7	-1	-1.8	2	0.4
Singapore	41	2.2	1	0.3	-3	-3.4	18	5.2
Algeria	33	1.8	12	2.5	2	2.6	2	0.5
Brazil	19	1.0	2	0.3	-14	-19.0	22	6.2
<b>World</b>	<b>1,849</b>	<b>100</b>	<b>455</b>	<b>100</b>	<b>76</b>	<b>100</b>	<b>349</b>	<b>100</b>

Sources: IMF and ECB Staff calculations.

First, while world reserves more than tripled in the past ten years, they have almost doubled in the last four years alone, with the rate of accumulation increasing dramatically since 2002. World reserves have in fact grown from USD 1.2 trillion in January 1995 to more than USD 4.0 trillion in September 2005 (according to the latest data for 2005 made available by the IMF)<sup>4</sup>, but the pace varied significantly throughout the period. Between 1995 and 2001, the financial crises affecting a number of EMEs in a context of increasingly liberalised capital flows, and the ensuing need to use reserves and then replenish them as self-insurance against future crises, were important factors. However, in 1997-98, in particular, global reserves increased by just USD 76 billion, with crisis-hit countries considerably reducing their foreign assets (see Table 1). Conversely, world reserves grew significantly – by around 30% – in 1995-96 and 1999-2001. In 1995-96 this growth was mainly driven by the interventions of China and Japan, which accounted for 14% and 26% of world reserve growth respectively. In 1999-2001, the desire for self-insurance gained momentum among reserve accumulators; in particular, the reserves lost in 1997-98 were replenished by the ASEAN-5 economies<sup>5</sup> and Russia. Since January 2002,

however, world reserves have risen by 91% (i.e. almost USD 2 trillion), which seems largely unprecedented. In terms of both reserve holdings and contribution to world reserve growth, the top three accumulators have been China, Japan and Taiwan. In the case of a few countries such as Turkey and, since 2003, Argentina and Brazil, such moves can still be interpreted as reserve replenishment, but in most other cases the rate of accumulation appears particularly high not only in comparison with the previous seven years, but also by historical standards.

Looking back, while world foreign exchange reserves doubled from USD 16 billion to USD 33 billion in the decade from 1959 to 1969, they then tripled in just three years, between 1970 and 1972, reflecting large interventions at a time when the Bretton Woods system was unravelling. Since the early 1970s, i.e. the end of Bretton Woods period, reserve assets have

4 See the IMF Currency Composition of Official Foreign Exchange Reserves (COFER) database. In the remainder of this paper, data are updated until the end of August 2005, when world reserves stood at USD 3.9 trillion.

5 ASEAN stands for Association of East Asian Nations, the members of which are Brunei Darussalam, Cambodia, Laos, Myanmar, Vietnam and the so-called ASEAN-5 countries: Indonesia, Malaysia, Philippines, Singapore and Thailand.

**Chart 1 World foreign exchange reserves: 1945-2005<sup>1)</sup>**



multiplied by a factor of 45<sup>6</sup>, a striking expansion compared with that in the 1950s and 1960s. Yet, despite the very high levels already reached, reserve accumulation has further accelerated in very recent years, as shown in Chart 1.

Post World War II trends contradict the notion that reserve accumulation is mainly driven by the prevalence of *de jure* pegged exchange rate regimes, since such regimes have decreased significantly since the 1970s and even more so since the second half of the 1990s. Over the past decade, in particular, one third of all currencies have been independently floating according to the official IMF classification. This figure, however, is reduced to less than 10% if actual observed exchange rate behaviour is taken as the yardstick. A number of countries are still anchoring their currencies – not necessarily in the form of traditional pegs, but also via heavily managed floating – to either the US dollar or the euro. In particular, the countries pursuing a *de facto* tight peg to the dollar account for around 10% of world GDP at market prices, while a further set of economies with a share of world GDP of about 7% have adopted some form of managed float vis-à-vis the US currency<sup>7</sup>.

Second, the degree of concentration of reserve accumulation has been also increasing over time. This means that, on the official side, the financing of the US current account deficit has become concentrated among increasingly fewer institutions, at least until 2004 (final 2005 data were not available when this paper was prepared for publication). The top five reserve accumulating central banks, which accounted for 56.9% of total reserve accumulation in the period 1995-2001, held a share amounting to 68.4% of world accumulation in 2004. The top two holders, Japan and China, accounted for more than half of the world accumulation between 2002 and the present day; they currently hold around 40% of the total stock of reserves.

Third, as regards the geographical distribution, the Asian economies now account for the bulk of both reserve accumulation and reserve holdings. The share of world foreign reserves held by Asian economies grew from 46% in January 1995 to 64% in August 2005. In particular, the Asian monetary authorities accounted for 77% of the increase in the period 2002-05. As a result, eight Asian monetary authorities are currently among the ten largest reserve holders, with seven of them owning more than USD 100 billion (see Table 2 and Chart 2).

Sizeable foreign asset accumulation has been also taking place in oil-exporting countries such as Russia, Algeria and Norway (see Table 2). While this is generally related to the surge in oil prices, which has been particularly strong since 2004, Russia also benefited from a remarkable increase in the volume of its oil exports. In addition, it should be borne in mind that the IMF reserve statistics do not include “oil funds”, into which several governments channel significant

6 In this period, world reserves *including gold holdings* have multiplied by a factor of “only” 28, if one values gold at the historical price of SDR 35 per ounce.

7 These figures are based on *de facto* exchange rate classifications. Currencies with little or no observed volatility against an anchor currency are considered to be tightly pegged, while those with limited volatility are considered to be managed floaters.

**Table 2 Foreign exchange reserves of countries with the largest holdings: 1995-2005<sup>1)</sup>**

(net of gold, SDR and reserve positions at the IMF; end-of-period holdings; USD billions)

Reserve-accumulating countries (with ranking)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005 <sup>1)</sup>	% of GDP	CC <sup>2)</sup>	Regime (de jure) <sup>3)</sup>
1. Japan	172.4	207.3	207.9	203.2	277.7	347.2	387.7	451.4	652.8	824.3	823.1	17.7	N	IF
2. China	73.6	105.0	139.9	145.0	154.7	165.6	212.2	286.4	403.2	609.9	769.0	37.0	Y	MF
3. Taiwan	90.3	88.0	83.5	90.3	106.2	106.7	122.2	161.7	206.6	241.7	253.7	78.2	N	IF
4. Korea	–	29.4	8.9	48.5	74.1	96.2	102.8	121.4	155.3	199.1	205.9	29.1	N	IF
6. Russia	14.4	11.3	12.9	7.8	8.4	24.3	32.5	44.0	73.2	120.6	155.7	20.7	Y	MF
7. India	–	–	23.9	26.8	31.5	36.8	44.9	65.7	95.2	124.7	136.9	18.9	Y	MF
8. Hong Kong	55.4	63.8	92.8	89.6	96.3	107.6	111.2	111.9	118.4	123.6	122.0	75.1	N	CB
9. Singapore	68.8	77.0	71.4	75.0	77.2	80.4	75.8	82.3	96.3	112.8	115.5	104.4	N	MF
10. Malaysia	22.9	25.1	20.0	24.7	29.7	28.6	29.6	33.3	43.5	58.2	75.8	55.5	Y	MF
11. Mexico	15.7	16.7	26.7	29.5	30.7	36.2	40.0	45.8	55.7	61.0	68.6	15.0	N	IF
12. Brazil	51.8	60.1	52.2	44.5	36.3	33.0	35.9	37.8	47.1	54.0	54.8	8.8	N	IF
13. Algeria	2.0	4.2	8.0	6.8	4.4	11.9	18.0	23.1	32.9	39.4	51.7	52.9	Y	MF
14. Thailand	–	–	–	24.7	33.6	32.5	33.2	38.1	42.1	49.1	48.3	29.7	N	MF
15. Norway	21.1	25.2	22.0	17.3	22.5	26.7	22.2	30.7	35.9	42.7	42.7	17.1	N	IF
16. Turkey	–	–	–	–	–	19.6	19.9	26.4	32.3	35.1	41.7	11.8	N	IF
19. Denmark	10.2	13.4	18.2	13.7	21.1	14.5	16.1	25.9	36.0	38.2	34.4	15.8	N	FP
20. Australia	11.3	13.9	16.1	13.4	19.5	16.8	16.4	18.6	29.9	33.9	33.4	6.1	N	IF
<b>Other (non-accumulating) reserve holders (with ranking)</b>														
5. Euro area	277.4	306.8	312.5	284.4	228	218.6	208	215.8	188	179	173.2			
17. US	49.1	38.3	30.9	36.0	32.2	31.2	29.4	33.1	39.2	42.4	38.7			
18. UK	39.2	37.1	28.8	27.3	30.1	39.3	32.0	32.8	35.1	39.5	38.6			

Sources: IMF and CEIC Data Company database.

1) Latest available 2005 data (mostly to August 2005).

2) Capital controls: Y = Yes; N = No.

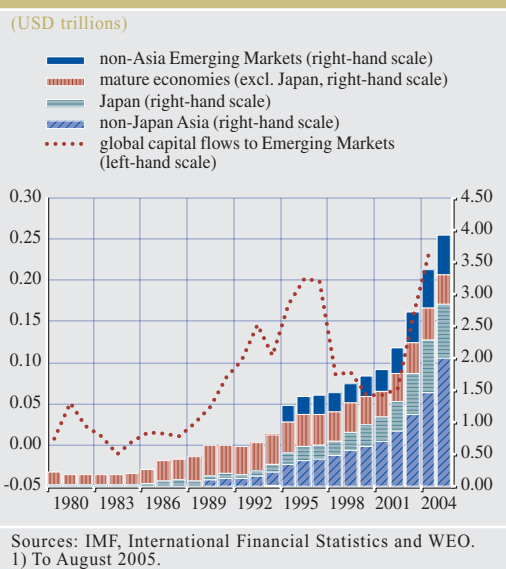
3) IF: Independent floating; MF: managed floating; FP: fixed peg; CB: currency board.

parts of their oil revenues. This is the case for countries such as Venezuela, Kuwait, Oman and, again, Russia and Norway. The amounts involved are often far from negligible. For instance, the market value of the Norwegian government's Petroleum Fund amounted to around 78% of GDP at the beginning of 2005. The latest figures show that the accumulation of both reserves and oil fund assets by this group of countries recorded an even greater rise in 2005, driven by an overall current account surplus estimated to have peaked at more than USD 400 billion (almost 1% of world GDP). Conversely, several non-oil-exporting mature economies have been shedding reserves, although important exceptions are Japan until March 2004 (which carried out large interventions in a deflationary context) and, to a lesser extent, Denmark (which intervened in the framework of the EMS and then ERM II). As Chart 2 shows, the total reserves of mature economies excluding Japan have stabilised at around USD 500 billion since the early 1990s. As a result, the emerging market

and developing economies, which held less than 30% of total world reserves around the time of the collapse of the Bretton Woods system, now hold around two-thirds (see Chart 1)<sup>8</sup>. Between the mid-1980s and 1996 the reserves of this group of economies broadly trended up alongside their net private financial inflows. However, since 1997 the link between these two variables has weakened somewhat, as Chart 2 suggests. The share of reserves held by Latin American countries – albeit on the rise, especially in Mexico and, since 2003, Brazil – amounted to only 5.4% in December 2004. The share of African and Middle East countries remained broadly stable throughout the period considered. At the end of 2004 these economies held 7.1% of global foreign reserve assets.

8 Including gold holdings valued at the historical price of SDR 35 per ounce, the share of EMEs in world reserves increased from less than 20% to over 60% in the same period. With gold valued at market prices, however, the share of reserves held by mature economies would be significantly higher.

**Chart 2 World foreign exchange reserves and total net private financial inflows of EMEs: 1980-2005<sup>1)</sup>**



## 2 POSSIBLE DRIVERS OF THE RECENT RESERVE ACCUMULATION

Traditional criteria, such as the adoption of foreign exchange controls or de jure exchange rate regimes and the adequacy of foreign reserves, may not provide a full understanding of the phenomenon of reserve accumulation (see also Annex 2 for greater detail and a review of the literature).

First, the presence or absence of controls on capital movement is not a factor that distinguishes reserve-accumulating economies from other economies, as Table 2 confirms. Second, sustained intervention has been taking place even in economies with de jure independent floating currency regimes, thus confirming the de facto managed nature of such regimes. This may have been partly because expectations of further appreciation of the exchange rate produced short-term capital inflows, adding to exchange rate pressure in the economy and thus inducing the local authorities to intervene in order to prevent excessive exchange rate appreciation and/or to smooth out volatility. Third, the notion used in the literature of “adequacy” or “excess” of

foreign reserves does not capture the key features of the process of accumulation, at least since 2002. Indeed, the main reserve-accumulating economies have ratios of reserve assets to imports that are well above the three to four months’ coverage, which is the rule of thumb. Taiwan, for instance, would be able to finance its imports with its reserves for around two years. Similarly, the ratios of reserves to total external debt maturing within one year have risen far above the level of 1 recommended by the Greenspan-Guidotti rule, reaching a value of around 10 in China for example. Turning to the ratio of reserves to broad money, which indicates the potential for a capital flight from the domestic currency by residents, this indicator has also increased significantly above the threshold values, reaching levels of around 90% in India and Singapore. Finally, an alternative indicator that can be used is the ratio between a country’s reserve assets and its IMF quota. If this ratio is greater than unity, then the country concerned has foreign assets exceeding the maximum IMF resources it could borrow based on its IMF quota. Again, for most reserve accumulators this ratio far exceeds 100%.

All in all, these considerations support the view that reserve accumulation in most countries has gone beyond the levels warranted by conventional indicators, suggesting that the build-up is largely influenced by other factors. Three of the fundamental drivers of reserve accumulation, all of which are in some way related to financial globalisation, stand out in addition to the more recent oil price hike:

- (i) A desire to self-insure against financial crises (virtually all EMEs share this motivation, although it is expected to lose weight as accumulation progresses, and is already less important than a few years ago);
- (ii) The pursuit, at least during certain periods (e.g. following a financial crisis), of export-led growth by a number of Asian economies, supported by exchange rates

anchored de jure or de facto to the US dollar;

- (iii) The combined effect of a number of features related to the financial structure of several EMEs, including underdeveloped domestic financial systems and dollarisation of foreign assets in certain net creditor Asian economies.

First, reserves may have been accumulated in order to weather potential turbulence in currency markets and/or shocks to the balance of payments. The literature shows that this may have been particularly the case for EMEs characterised by a high degree of capital mobility coupled with underdeveloped domestic financial systems. This sensitisation to financial risk is, in fact, mainly related to developments such as the impressive expansion in holdings of cross-border assets and liabilities<sup>9</sup> and the increased vulnerability to sudden stops in capital flows in a context of financial account liberalisation. While reserve accumulation may no longer be proportional to the actual risks faced by certain countries, this does not seem to be the case as yet for most Latin American emerging market debtor economies. At least until recently, these economies have long been unable to borrow abroad in their domestic currencies – though in countries like Mexico and Brazil there were signs in 2005 that this situation was significantly easing – and, therefore, have had a particular incentive to accumulate reserves to self-insure against a possible loss of access to international capital markets. Even today in Asia external risk mitigation considerations still continue to be one of the reasons for reserve accumulation. Unilateral reserve build-up may also have been one way to pursue greater independence from potential recourse to IMF financing, to the extent that countries do not regard conditional borrowing rights with the IMF and their own assets as perfect substitutes.<sup>10</sup>

Before focusing on the two other drivers of reserve accumulation listed above, it should be

observed that, with a few temporary exceptions (e.g. Brazil until 2002 and India until 2000 and then again since 2004), the main emerging market reserve accumulators have not behaved as standard economic theory would predict, i.e. maintained current accounts in deficit or close to balance coupled with net foreign direct investment (FDI) inflows and other financial inflows from mature economies. EMEs have been providing the rest of the world, and especially the United States, with net resources in the form of current account surpluses. This implies that a significant excess of domestic savings over investment has, as a rule, been a characteristic shared by all major reserve accumulators (including Japan), although this has been the outcome of different trends in savings and investment in the economies concerned. Certain economies, moreover, have not only recorded current account surpluses but have also been confronted with increasing exchange rate pressure arising from net financial inflows. Accordingly, four different groups of reserve accumulators can be distinguished on the basis of the trends in their balance of payments and savings-investment balance. These groups are shown in Chart 3, which focuses on the top nine emerging market reserve accumulators and confirms that, though as a result of different developments, all these economies have on average recorded excess domestic savings over investment, i.e. current account surpluses. This, however, does not imply reserve accumulation *per se*. The phenomenon can therefore only be understood in conjunction with other features typifying the countries under examination.

9 According to the IMF, worldwide gross external assets have increased from USD 2.4 trillion in 1980 to around USD 40 trillion today.

10 Reserve accumulation is also likely to have indirectly smoothed the progress of regional monetary and financial cooperation in East Asia. The total size of bilateral swap arrangements available in East Asia under the Chiang Mai Initiative, amounting to around USD 39.5 billion in March 2005, could soon rise by up to 100% following a decision taken by ASEAN+3 Finance Ministers at their meeting in Istanbul on 4 May 2005. On this occasion it was also announced that the financing threshold above which IMF conditionality would not apply will be increased from 10% to 20%.



One of these features may, in a number of countries and for limited periods, have been the pursuit of some form of export-led growth, which is the second possible driver of reserve accumulation identified in this paper. In particular, in Asian countries other than China and India, the investment/GDP ratio has dropped significantly since the mid-1990s, as a result of: (i) the 1997-98 financial crises

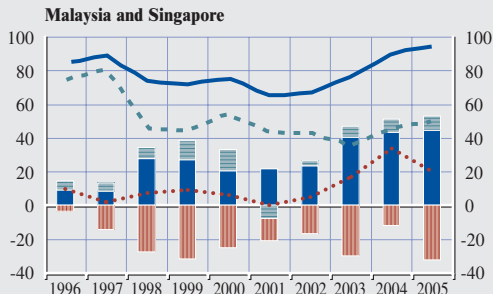
(see Charts 3a and 3c) and (ii) the bubble years in Japan. Most notably, in the ASEAN-5 countries and Korea the average investment/GDP ratio, which was 34.7% in 1996, was still 24.1% in 2004. With the savings ratio remaining broadly unchanged, this seems to have induced several of these countries to use the US dollar as a monetary anchor to underpin export-led growth after 1997. It should be

**Chart 3 Reserve accumulation, balance of payments composition and savings-investment balance in the nine main emerging market reserve accumulators**

(USD billions; data aggregated for country clusters as described in the text)

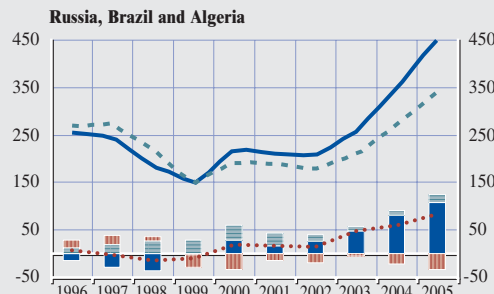
**a. Current account-driven, in conjunction with a drop in domestic investment after the 1997-98 Asian crises**

- current account
- other capital inflows (+) or outflows (-)
- net FDI inflows (+) or outflows (-)
- gross national savings
- change in total reserves
- investment



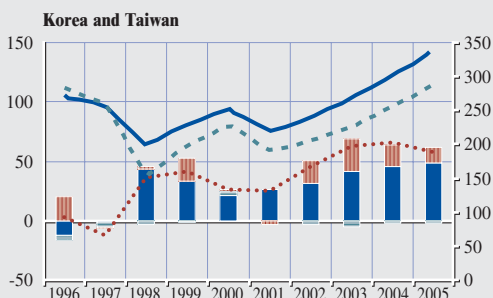
**b. Current account-driven, in conjunction with domestic savings growing more than investment**

- current account
- other capital inflows (+) or outflows (-)
- net FDI inflows (+) or outflows (-)
- gross national savings
- change in total reserves
- investment



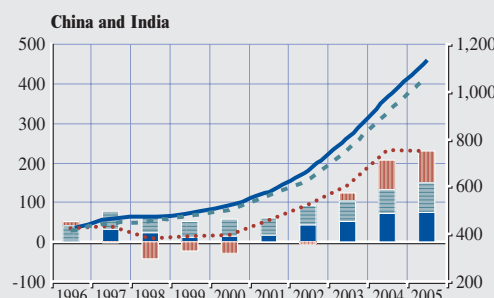
**c. Driven both by the current account and the financial account, in conjunction with a drop in domestic investment after the 1997-98 Asian crises**

- current account
- other capital inflows (+) or outflows (-)
- net FDI inflows (+) or outflows (-)
- gross national savings (right-hand scale)
- change in total reserves
- investment (right-hand scale)



**d. Driven both by the current account and the financial account, in conjunction with domestic savings growing more than investment**

- current account
- other capital inflows (+) or outflows (-)
- net FDI inflows (+) or outflows (-)
- gross national savings (right-hand scale)
- change in total reserves
- investment (right-hand scale)



Sources: IMF and ECB staff calculations.

Notes: Reserve accumulation does not fully equal the algebraic sum of the other balance of payments items shown in the charts. The remainder is given by the sum of errors and omissions and the "capital account" as defined in official statistics. 2005 data are IMF annual estimates.

observed, however, that in more recent years the contribution of net exports to real GDP growth has been declining in most Asian economies, with the notable exceptions of Singapore, Hong Kong S.A.R. and, since 2003, Korea. Moreover, the recent experience of Korea – which saw its currency appreciate by around 24% against the US dollar between the initial months of 2002 and the final months of 2005<sup>11</sup> while reserves doubled in the same period to USD 206 billion – suggests that other factors have been at play.

Another factor that may have produced resistance to exchange rate appreciation and, hence, supported reserve accumulation in these countries, is their high degree of trade openness (90% on average in Asia). This implies a higher pass-through of exchange rate changes into domestic prices, and hence a stronger deflationary bias in the event of currency appreciation.

Unlike other Asian EMEs, China saw its investment/GDP ratio rise between 1996 and 2004<sup>12</sup>, which has not prevented the country from recording current account surpluses in the presence of a saving rate increasing even more (see Chart 3d). In this context, the Chinese authorities have maintained an exchange rate policy that has resulted in currency depreciation in real effective terms since 2002. Between that year and the exchange rate reform of 21 July 2005, the real effective exchange rate (REER) of the renminbi fell by around 15%, though still remaining above the 1995 level. This trend – which the recent exchange rate reform has only partly reversed – has supported, together with very low labour costs, the price competitiveness of Chinese exports, thus helping to fuel growth in a dual economy characterised by a rural population of underemployed workers accounting for two-thirds of the population but less than 30% of GDP.

Besides the developments described above, net excess savings have to be also examined in connection with certain features of EMEs'

financial structures, which leads to the discussion of the third driver of reserve accumulation. Given the inability of their financial markets to channel private savings to investment, either domestically or abroad, in certain countries the public sector may have endeavoured to direct residual savings abroad, thus leading to reserve accumulation. This seems to apply to China, given its outward foreign exchange controls and the role of the public sector in the economy. Indirect confirmation of this interpretation may possibly be provided by the case of Japan, where the suspension of intervention operations since mid-March 2004 seems to have been associated with – and made possible by – a considerable increase in the share of foreign assets held by the private sector.

A related aspect is that several reserve-accumulating countries are becoming international net creditors. In some of these countries, however, external assets remain largely or fully denominated in foreign currency, either because they lend only limited amounts in domestic currency (e.g. Japan) or because lending in their domestic currencies is precluded by asymmetric foreign exchange controls (e.g. China). This leads to fundamental mismatches in their national balance sheets, consisting of sizeable holdings of liquid assets mainly denominated in US dollars that are not balanced on the liability side. Especially in Asia, asset dollarisation has led to attempts to “socialise” the exchange rate risk, i.e. to use reserve assets as a vehicle to transfer this risk from the private to the official sector, though not reducing it for the economy

11 In nominal effective terms, after remaining relatively stable in 2002-03, the Korean won appreciated by more than 20% between May 2004 and end-2005.

12 The trend in investment recorded in China, which runs counter to those of most other countries in the region, may be partly due to China's growing role as a hub in the Asian production and export chain. Given this role, it is difficult for China's regional partners to let the exchange rate significantly appreciate in the absence of measures to revalue or introduce greater flexibility in China's exchange rates. The immediate reaction of Malaysia to the 2% revaluation of the renminbi in July 2005 clearly confirms this point.

as a whole<sup>13</sup>. In certain countries this may have been partly justified by the fact that private hedging is more difficult and costly, particularly in periods characterised by one-way bets on the exchange rate, which constrains private capital outflows even in the absence of restrictions on them.

On the whole, these recent drivers of reserve accumulation seem to have one aspect in common, namely the role played by the build-up of official foreign assets both as an outcome of and an instrument for integration of the EMEs concerned into the global financial markets. Several emerging countries, especially in Asia, have in fact become major players in international trade but are still underdeveloped from a financial angle.

### 3 DOMESTIC RISKS AND COSTS OF RESERVE ACCUMULATION

While past experience indicates that central banks were usually able to sterilise the

expansionary impact of foreign exchange purchases on base money, interventions have been larger and more prolonged in recent years. When specific features of today's reserve-accumulating EMEs, such as their underdeveloped financial systems, are taken into account, some risks and costs may materialise as a result of the process of accumulation. The most significant ones are summarised in Table 3 and include inflationary pressure, overinvestment, asset bubbles, complications in the management of monetary policy, segmentation of the public debt market, potentially sizeable capital losses on monetary

<sup>13</sup> Unlike in Asia, there has been little socialisation of the exchange rate risk in Latin America. One exception was Brazil in 1997-99, when the currency mismatches of the corporate and banking sector were transferred to the public sector through a number of measures, including the issuance to residents of Treasury securities linked to the US dollar. As a result, the overall exposure of the economy to exchange rate fluctuations did not change significantly. There is, however, strong evidence that since 1999 the Brazilian private sector has been hedging against exchange rate risk on its own, thus no longer relying on the official sector's safety net.

**Table 3 Potential risks and costs of reserve accumulation <sup>1)</sup>**

	Potential risk or cost	Underlying factors
<b>Risks</b>	(1) Conflict between exchange rate stability and inappropriate easing of monetary conditions, eventually resulting in inflation and/or overinvestment and/or bubbles	Unsuccessful sterilisation due to e.g. (i) underdeveloped financial markets and shortage of sterilisation instruments; (ii) snowball effects (i.e. higher interest rates produced by sterilisation coupled with expectations of exchange rate appreciation produce massive capital inflows, thus forcing the central bank to intervene/sterilise even more)
	(2) Difficulties for central banks in managing the money market and, more generally, in implementing monetary policy	Excessive central bank dependence on liquidity-absorbing transactions, whereas the money market is more easily managed via liquidity-providing operations
	(3) Segmentation of the public debt market, thus impairing its liquidity	Excessive sterilisation through issuance of central bank liabilities instead of government paper
	(4) Market (i.e., currency and interest rate) risk, resulting in potentially sizeable capital losses on the balance sheet of the monetary authority	Accumulation over time of a potential for currency revaluation/appreciation, which materialises when intervention ceases or is no longer effective; interest rate risk
<b>Costs</b>	(1) Sterilisation costs	The yields paid on domestic sterilisation instruments exceed those on foreign assets
	(2) Concerns about bank profitability	Particularly because of controls on lending, the banking sector might have hardly any alternatives to buying low-yield sterilisation instruments

Source: Eurosystem.

<sup>1)</sup> In Annex 3 some background information is provided on how these risks and costs might have become relevant, to varying degrees, in the recent past across a sample of large reserve holders.

authorities' balance sheets, sterilisation costs, and misallocation of domestic banks' lending (see Annex 3 for greater detail). At the same time, the risks and costs may vary significantly from country to country and, over time, within each country. Hence, the balance of incentives and disincentives to accumulate reserves may also change. Looking forward, if net disincentives were to materialise in a number of countries, accumulation would probably decrease overall but it might also become further concentrated in a smaller group of economies.

In China, the intervention-related rise in reserve money was almost entirely sterilised in 2002, but the sterilisation rate proved to be much more limited in 2003-04, partly because of implementation difficulties. Partly as a result, the annual consumer price index (CPI) rate increased from -0.8% in 2002 to 3.9% in 2004, alongside signs of overinvestment and local property price bubbles. Yet inflation remains subdued in China if one considers its impressive growth rate, and even trended down significantly after October 2004. Financial "repression" in the form of both administrative measures to limit credit expansion and asymmetric controls on capital flows played an important role in achieving this. Even though such measures entail a cost in terms of misallocation of resources and have not prevented the country from recording massive "speculative" inflows and some interest rate tightening, they nevertheless allow China to benefit from exchange rate stability and some degree of monetary policy autonomy at the same time. Moreover, sterilisation costs have been kept under control, even when US interest rates reached their low point, and have become easier to manage since the current US tightening cycle started in mid-2004.

In Korea, where the intervention-related growth in reserve money was largely sterilised in 2003-04, the main problem faced by the central bank is in its own view, the over-reliance of its monetary policy on liquidity-absorbing transactions. Moreover, in 2004

the interest payments on the Monetary Stabilisation Bonds issued by the Bank of Korea to control the money supply were significantly higher than prevailing US interest rates. This negative differential contributed to the loss of KRW 150 billion (about USD 130 million) posted in the Bank of Korea's 2004 balance sheet. The sizeable intervention, which in just a few years has made this country the fourth largest reserve holder in the world (starting from a level of USD 9 billion as recently as end-1997), has not prevented the won from appreciating strongly against the US dollar since 2002. Such an appreciation might occasionally have led to some tension between the objective of maintaining a fairly stable effective exchange rate in a regional context and the strategy of inflation targeting pursued by the central bank since 1998.

In India, the large capital inflows recorded in recent years have presented a challenge for the conduct of monetary policy and triggered a debate on the need for exchange rate adjustment. At the beginning of 2004, the Ministry of Finance agreed with the Reserve Bank of India to issue government securities and bills exclusively for sterilisation purposes. In comparison with issuance of the central bank's own liabilities, this measure proved successful in permitting sterilisation operations that do not contribute to segmenting the sovereign bond market. However, India has experienced a very unfavourable differential between foreign and domestic interest rates, entailing sterilisation costs.

In Russia, central bank interventions have been accompanied by strong liquidity growth and increased inflationary pressure. While tight fiscal policy and the setting-up of the oil stabilisation fund in 2004 (which has proved to be a substitute for sterilisation) have greatly helped the Bank of Russia to keep monetary conditions reasonably balanced, the current monetary and fiscal policy frameworks and instruments may need to be further adjusted if progress is to be achieved in keeping inflation under control in the period ahead. Thus, the

debate on moving to inflation targeting and a more flexible exchange rate policy<sup>14</sup> is likely to continue in Russia.

Besides these general risks and costs, reserve accumulation has also had some implications for the balance sheets of certain central banks. These implications are described in Annex 4 with regard to seven Asian central banks. In particular, it should be noted that the foreign assets of most of these institutions are currently much greater than their capital base.

#### 4 MAIN TRENDS IN CENTRAL BANK RESERVE MANAGEMENT

Not only have world reserves increased dramatically in recent years, but the way they are managed has also evolved over time. The frameworks for foreign reserve management, however, vary significantly across countries, with China and Japan – the two largest reserve holders – being examples of management styles that differ from trends prevailing elsewhere. While recent trends in reserve management are analysed more thoroughly in Annex 5, their main features are summarised below.

Reserve management in Japan is still strictly considered from a policy viewpoint, and in fact it is conducted along “passive” guidelines by the Ministry of Finance, i.e. with limited sensitivity to the risk/return trade-off. Little information is available on reserve management in China. Regarding the other Asian economies, the most important development in reserve management has been the use of a broader range of instruments. In addition, so-called heritage funds and investment corporations have been set up, for example by Singapore and Korea respectively, with more explicit longer-term return-oriented objectives.

Investment in new instruments has become an important feature of reserve management in several Asian countries. The investment spectrum, which was mostly limited to time deposits and government bonds until a few

years ago, now includes: (i) other interest rate products, such as interest rate derivatives and debt instruments bearing a spread over US Treasuries (e.g. BIS instruments, corporate bonds and government-linked issues such as those of the US agencies); and (ii) sometimes even equities. One approach adopted in order to foster diversification along the yield curve and across asset classes, is to split foreign reserves into a liquidity portfolio and an investment portfolio. The Hong Kong Monetary Authority, for example, has kept all foreign reserves under one roof at the central bank but has separated the funds into distinct portfolios with different objectives, risk profiles, time horizons and eligible instruments. In Korea, foreign reserve assets to an initial value of USD 20 billion (out of a total of USD 205 billion) started to be managed by an independent entity, the Korean Investment Corporation (KIC), on 1 July 2005, with the aim of seeking higher yields. The funds were shifted from the Bank of Korea’s reserves (which contributed USD 17 billion) and the Foreign Exchange Stabilisation Fund of the Ministry of Finance (which provided USD 3 billion). The Bank of Korea will, however, maintain the option to recall its assets in the event of an emergency, i.e. the funds are retained as international reserves while being entrusted to the KIC for management. The KIC partly resembles the model of the Government of Singapore Investment Corporation (GIC), which was established in the 1990s in response to the rapid growth of Singapore’s foreign reserve holdings. The GIC currently has around USD 100 billion under management for non-intervention-related purposes, which is clearly disentangled from the country’s reserves. The main objectives of these moves are to achieve higher long-term returns and to preserve the assets’ value for future generations (hence the funds are sometimes referred to as “future generation” or “heritage” funds). The pool of eligible instruments used to invest these funds often differs quite substantially from the one

<sup>14</sup> It should be borne in mind that in Russia, unlike in most of the other economies reviewed in this paper, the euro plays an increasingly important role in exchange rate policy and the process of reserve accumulation.

Table 4 Official foreign exchange reserves: currency shares

(as a percentage of total identified holdings; end-of-year values expressed in US dollars)

	1999	2000	2001	2002	2003	2004	2005 <sup>1)</sup>
<b>All countries<sup>2)</sup></b>							
US dollar	71.0	70.5	70.7	66.5	65.8	66.0	66.4
Euro	17.9	18.8	19.8	24.2	25.3	24.9	24.3
Japanese yen	6.4	6.3	5.2	4.5	4.1	3.8	3.7
Pound sterling	2.9	2.8	2.7	2.9	2.6	3.2	3.6
Swiss franc	0.2	0.3	0.3	0.4	0.2	0.2	0.1
Other currencies	1.6	1.4	1.2	1.4	1.9	1.9	1.9

Source: IMF.

1) End-of-September data.

2) Shares are calculated only for the group of countries reporting reserve currency composition to the IMF, which account for around 70% of world reserve holdings.

used by traditional reserve managers, and includes, for example, equities, corporate bonds and special forms of investment. Such institutions, moreover, often also have other objectives, such as fostering the domestic asset management industry (Korea) and the domestic capital market (Singapore and Hong Kong S.A.R.).

Despite these developments, however, this diversification into new instrument types, although impressive for its rapidity, has not yet altered the picture significantly since, given safety and liquidity constraints, the bulk of reserve assets is still government or quasi-government bonds, and the percentage of foreign reserves not invested in interest rate products is still negligible. Hence, while the changes in foreign reserve management have been significant, they do not appear to have kept pace with reserve accumulation.

Turning to currency diversification, IMF data expressed in US dollars point to broad stability in the shares of reserve currencies in global foreign exchange assets in recent years, with the US dollar still accounting for the bulk (66.4% as at the end of September 2005) and the euro increasing its weight from 18% in 1999 to 24.3% in 2004, partly owing to positive valuation effects recorded in the period 2002-04<sup>15</sup> (see Table 4).

The US dollar is still by far the most dominant reserve currency, especially in Asia. There are in fact several, mutually reinforcing reasons related to asset management which seem to play a significant role in the US dollar's predominance:

- the breadth, depth and liquidity of US fixed income markets (and US financial markets in general) compared with those of the euro area and Japan (see Table 5);
- the fact that all the largest reserve accumulators can be expected, at least for the time being, to continue to use the US dollar as a vehicle for intervention, either primarily or exclusively;
- the increasing use of derivatives by central bank portfolio managers, which allows for more flexibility than in the past (e.g. by investing in one currency while shouldering the interest rate risk in a different market, for instance by using foreign exchange swaps).

The trends in instrument and currency diversification described above are confirmed by the evidence on investment of foreign reserves in US assets, for which more data is available. While comprehensive *stock*

<sup>15</sup> These shares, however, are calculated only for the group of countries reporting reserve currency composition to the IMF, which account for around 70% of world reserve holdings. This group does not include some of the major reserve accumulators.



**Table 5 Nominal value of outstanding bonds at the end of 2003**

(USD billions)

Year 2003	Total outstanding	% World bond mkt	Total government (sovereign and quasi-sovereign) issues							
			Total	% of total	government		agencies		other <sup>1)</sup>	
					Total	% of total	Total	% of total	Total	% of total
US	21,351	47.6	10,405	48.7	2,646	12.4	2,608	12.2	5,151	24.1
Japan	7,164	16.0	5,838	81.5	4,631	64.7	-	-	1,206	16.8
Euro area <sup>2)</sup>	10,306	23.0	4,639	44.8	4,639	44.8	-	-	-	-

Year 2003	Total corporate		Total foreign		Total eurobond	
	Total	% of total	Total	% of total	Total	% of total
US	6,456	30	385	2	4,106	19
Japan	837	12	57	1	432	6
Euro area <sup>2)</sup>	3,998	43.3			1,669	11.9

Source: Merrill Lynch (Size & Structure of the World Bond Market: 2004).

1) Includes mortgage securities and municipals in the US and municipals, government guaranteed and private placement in Japan.

2) In the euro area, covered bonds are included in the corporate category. Exchange rate = JPY 107.116/USD; EUR 0.7936/USD.

statistics covering all types of instrument are not available, data are made public on holdings of marketable US Treasury bonds, notes and bills held by foreign official institutions, which amounted to almost USD 1,230 billion (nearly 60% of total foreign holdings of US Treasury securities, or 32.5% of the total amount outstanding) at end-September 2005.

Turning to flow data, it is interesting to look at the available evidence for 2004 and draw some initial inferences from the, as yet incomplete, 2005 statistics. In 2004 foreign official institutions are estimated to have purchased US government-linked assets (including federal agency bonds) amounting to over USD 254 billion, whereas investment in corporate bonds and equities amounted to only USD 13 billion. Reserve accumulation resulted in significantly larger US dollar positions of foreign central banks in the United States in the same year. Four types of investment can be distinguished according to aggregate data disclosed by the US Treasury, anecdotal information and data disclosed by individual central banks, such as the Bank of Japan:

- First, in 2004 a large part of foreign exchange reserves was invested in US

Treasury securities, including T-bills. Foreign official institutions are estimated to have purchased US Treasury notes and bonds with a net face value of USD 201 billion<sup>16</sup>, amounting to 70% of the total net issuance of US Treasury notes and bonds during this period. Total US Treasury securities purchases – including bills – amounted to around USD 234 billion, representing almost two-thirds of the net issuance of these securities.

- Second, foreign official investors also purchased federal agency bonds bearing high yields. According to the Treasury, the stock of these bonds held by foreigners increased by USD 20 billion in 2004<sup>17</sup>.

16 Estimate based on the US Treasury's international capital report (TIC).

17 According to Federal Reserve System data, the proportion of US federal agency bonds held in custody for foreign official institutions by the US Federal Reserve System shows an upward trend over the last few years, reaching around 20% of total foreign official institutions' custody holdings in 2004 compared with around 12% in 2000. These data, however, are not consistent with those of the US Treasury as there is a significant discrepancy between TIC system (Treasury) and Statistical Release H.4.1 (Federal Reserve) data in this respect. According to the latter, the 2004 increase in federal agency securities held by foreign official investors was much larger (i.e. USD 60 billion).

- Third, a significant part of reserves was also held in time deposits – especially in the periods immediately following large foreign currency purchases in the context of intervention activity. Information on this third component is available only for Japan, which, at the end of 2004, held 15% of its total foreign exchange reserves in time deposits.
- Fourth, only a minor part of reserves was invested in corporate bonds and equities. In 2004, these purchases amounted to USD 13 billion, and were mainly purchases of US corporate bonds. It is, however, likely that the relative importance of these instruments will grow over time. For instance, the Bank of Korea highlighted this trend in a report submitted to the Korean National Assembly's Finance and Economy Committee on 24 February 2005.

Chart 4, which is based on US Treasury data, compares the total amount of US government and agencies' longer-term securities with the amount of T-bills, corporate bonds and equities purchased by foreign official institutions. The US Treasury, however, does not report data on official investment in US time deposits.

Preliminary data for 2005 point, on the whole, to a significant decrease in the share of foreign official institutions in the financing of the US current account deficit by comparison with 2004 (down to less than one-third from around two-thirds, on a net basis). Some substitution of private for public investors is therefore likely to have occurred. A further explanation may, however, be that during 2005 oil exporters have been replacing the Asian countries as the group of countries with the largest current account surplus. Their ensuing accumulation of foreign assets is, however, unlikely to have taken the form of traditional reserve accumulation for the most part, but would rather have been a build-up of assets abroad by state-owned oil funds. As Chart 5 illustrates, this may have been reflected in a dramatic increase in the net portfolio outflows

**Chart 4 Net purchases of US Treasury securities, federal agency bonds, corporate bonds and equities by foreign official institutions**

(2000-2004; USD billions)



Sources: US Treasury and ECB staff estimates for US Treasury bills.

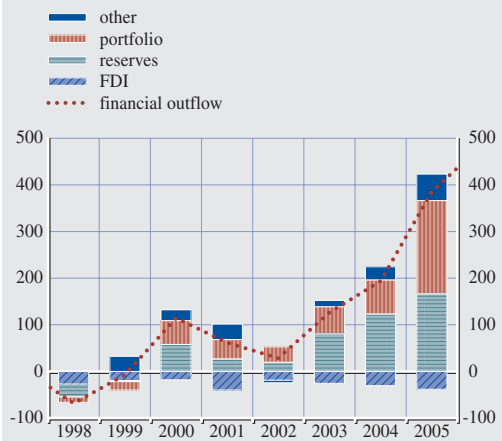
of oil-exporting countries<sup>18</sup>, which is not recorded as reserve accumulation but nor is it private investment. The importance of this development argues greater transparency in statistics on portfolio investment by oil funds. Moreover, apart from the aggregate information discussed above, the exact amounts of individual central banks' reserve holdings denominated in US dollars and invested in the United States is not known due to the US Treasury's duty of confidentiality in its reporting, which is largely derived from custodians-based information.

Regarding investment in euro-denominated instruments, the data available are much less comprehensive than those from the United States, which limits the scope of the analysis. The Eurosystem is in fact only able to track between 15% and 30% of foreign reserve investment in euro-denominated assets. While it can be inferred that official holdings of foreign reserve assets denominated in euro, which amount to approximately USD 740 billion, are, to a large extent, held in German

18 In Chart 5 the oil exporters include Saudi Arabia, Russia, Norway, Iran, Algeria, the United Arab Emirates, Venezuela, Nigeria, Kuwait, Mexico, Libya and Qatar (selected and ranked on the basis of the size of their 2005 oil balance surpluses expressed in US dollars).

**Chart 5 Oil exporters' net financial outflows**

(USD billions; positive sign means net outflows)



Sources: IMF WEO and ECB staff calculations.

and French long-term securities, no conclusions can be drawn as regards the geographical distribution of the central banks and other institutions holding euro-denominated foreign reserve assets.

## 5 ALTERNATIVE USES OF ACCUMULATED FOREIGN ASSETS

An important development in recent years has been the increasing use of part of the foreign assets accumulated by the public sector for alternative purposes, such as the aforementioned creation of oil funds in several countries, the recapitalisation of state-owned banks in China, the repayment of external debt in Russia, and the funding of investment in Taiwan. The IMF does not, of course, count such “innovative” uses of foreign assets as reserves since they are not related to foreign exchange policy targets<sup>19</sup>.

The main rationale for setting up oil funds in recent years is that oil prices are highly volatile and unpredictable. Hence, revenues often differ greatly from budget projections, requiring either fiscal adjustment or public financing for any shortfalls. As a result, not only have several oil-exporting countries

established such funds (e.g. Russia, Norway, Venezuela, Kuwait and Oman), but other oil exporters are also considering doing so. Oil funds can be classified into two categories: while the majority are designed to address the aforementioned problems created by the volatility and unpredictability of oil revenues (stabilisation funds), some are also used to save part of the oil revenues for future generations (savings funds). Some funds have both objectives. In the case of stabilisation funds, when oil prices are high a portion of the revenue is channelled from the government budget to the stabilisation fund; when oil revenues are low, the fund makes up the shortfall. There is some debate about the effectiveness of these funds in stabilising government spending. Empirical research from the IMF on past experience with oil stabilisation funds suggests that, except in Norway, oil funds did not significantly affect the relationship between oil export earnings and government expenditure. The policy implication is that an oil stabilisation fund can be no substitute for sound, medium-term-oriented fiscal policies<sup>20</sup>.

In early January 2004 China's central bank announced that it had injected USD 45 billion from the country's foreign exchange reserves into the Bank of China and the Construction Bank of China to increase their capital base. In 2005, a similar injection, though for the lower amount of USD 15 billion, was carried out for the Industrial and Commercial Bank of China. In the former case, the two state-owned banks – which are considered to be the flagships of the bank reform process – had already started to raise their capital adequacy ratios through various subordinate bond issues in 2003. It is important to note that the transfer of foreign exchange assets was not converted into

<sup>19</sup> The same applies to the heritage funds discussed in Section 4.

<sup>20</sup> However, it should be noted that in Russia foreign assets amounting to USD 15 billion held in an oil stabilisation fund have been used to repay Soviet-era debt ahead of schedule. The agreement between Russia and the Paris Club was reached in May 2005 and marks the biggest ever buy-back of Paris Club debt by any debtor country.

domestic currency and, therefore, exerted no pressure on the value of the renminbi. The government also retained control over the management of these transferred assets through a newly created investment company run jointly by the central bank, the ministry of finance and the State Administration for Foreign Exchange. Even so, the move was unprecedented, as in the past the government's strategy for restructuring state-owned commercial banks had relied on increasing its liabilities rather than transferring its assets. Since high non-performing loan ratios were hindering the banks' efforts to raise their capital adequacy ratios, this capital injection made it easier for them to reach the 8% capital ratio target. However, it exposed the banks' capital base to currency risks, since the capital injection was denominated in US dollars.

Finally, in Taiwan USD 15 billion has been allocated to banks for use in major investment projects to foster domestic growth.

The effects of these innovative ways of using foreign assets are still to be fully appreciated, as, depending on the origin of the foreign assets and the objectives pursued, they create unprecedented bridge from monetary and exchange rate policy to fiscal policy, from the macroeconomic to the micro-prudential dimensions of economic policy, and from central bank management of foreign exchange market risks to management of portfolio instruments outside the realm of foreign reserve assets by other entities. At the same time, converting short-term monetary or financial assets into long-term wealth holdings – possibly including non-financial assets – may provide certain countries with a meaningful vehicle for diversifying their risk exposure to US dollar assets in a gradual and orderly way.

## 6 IMPACT ON YIELDS AND ASSET PRICES

A majority of market participants, academics and policy-makers believe that reserve accumulation may have contributed to abnormally low yields in mature economies.

From a qualitative viewpoint, given the sheer size of foreign reserves transactions, their concentration in the US Treasury market and their relative price insensitivity, there are reasons to believe that reserve accumulation has contributed to lowering US long-term interest rates. However, the supporting empirical evidence is not clear-cut. Estimates range, as shown in Table 6, from 30 basis points (Merrill Lynch and JP Morgan) to 200 basis points (N. Roubini), though admittedly estimates in the high part of the range lack empirical support and are mainly based on the judgement of experts. One well-known contribution is that of Bernanke, Reinhart and Sack of the US Federal Reserve System, who find evidence that Japan's interventions between 2000 and the first quarter of 2004 had a significant impact on the yields of Treasury notes and bonds<sup>21</sup>, while there is no such evidence for Treasury bills.

Despite the abundant literature, the lack of high quality data on foreign official institutions' net purchases makes the empirical evidence supporting the link between interventions and US yields not particularly robust. In this context, views denying any effect have also been put forward. According to an analysis by the Vanguard Group, cessation of Chinese net purchases of US government bonds would have virtually no effect on any of the US Treasury's yields. B. McCauley (2004) identifies only an unstable relationship between foreign official institutions' net purchases of US government bonds and Treasury yields, existing for very limited periods (i.e. a few weeks). Furthermore, the US Federal Reserve System's weekly release on foreign official institutions' custody holdings is found to have no effect on Treasury market rates.

A study presented in Annex 6 provides an econometric quantification of the impact of purchases of US Treasury securities by foreign

<sup>21</sup> See Bernanke, B., Reinhart V. and Sack, B. (2004): "Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment", Finance and Economics Discussion Series, Federal Reserve Board.

**Table 6 Estimates of the effect of reserve accumulation on US Treasury yields**

(basis points)		
Source	Approach	Estimated reduction
Merrill Lynch	-	30
JP Morgan	-	30-50
Goldman Sachs	-	40
Edwin Truman	General estimate based on assumed equivalence of reserve accumulation and reduction of fiscal deficit	75
Patrick Artus	Regression of yield changes on fiscal deficit, current account and foreign net Treasury purchases	75
Ben Bernanke et al.	Regression of yield changes on intervention estimates, interpretation of yield disequilibria as a response to demand shocks	50-100
Bill Gross	-	100
Banque de France	Error correction model: estimating the long and short-term relationship between Treasury yields, fiscal deficit and measures of foreign official and foreign private net Treasury purchases	125
Stephen Roach	-	100-150
Nouriel Roubini et al.	General estimate based on correction of conventional estimates taking into account possible downward biases stemming from methodological limitations to statistical analysis	200
McCauley (BIS)	Regression of yield changes on changes in foreign central banks' custody holdings of Treasuries with the US Federal Reserve System	Significant, but unstable and short-lived relation
Vanguard Group	VAR regression: dynamic relationship between different Treasury maturities, outstanding government debt, and foreign net Treasury purchases	no long-term effect

Source: Eurosystem.

Note: Dash (-) indicates that the method used for the estimate has not been published.

official institutions. It finds that purchases of US Treasuries by Asian monetary authorities (particularly Japan) had an impact on the level and dynamics of their yields, but this is empirically supported only for short to medium-term maturities. In particular, Japanese purchases of US Treasuries, at the time of most sizeable interventions, might have had an impact of 65 basis points on three-year US Treasury yields. Regarding developments in the long end of the yield curve, the study identifies a downward structural change in the determination of interest rates since the turn of the millennium, but on the other hand does not find clear-cut evidence that purchases of US Treasuries by Asian monetary authorities was one of the main factors in the decreased yield.

More specifically, the approach followed in the contribution presented in Annex 6 is based on an estimation of the long and short-term relationship between Treasury yields, monetary stance, inflation expectations, fiscal

deficits and foreign official purchases of Treasuries. The estimates are, as mentioned, supportive of the notion that purchases by Asian monetary authorities – especially Japanese intervention – have had an impact on the short to medium end of the Treasury yield curve since 1999, in terms of both levels and changes in levels. Regarding long-term government bond<sup>22</sup> yields, the paper argues that there seems to be a downward bias in current interest rates, which is in line with the idea of the “long-term interest rate conundrum”. According to the empirical evidence provided in the study, however, the interventions conducted by Asian central banks cannot be shown to be responsible for the low yield level reached, although they have certainly played a

<sup>22</sup> Little evidence could be found regarding the impact of purchases by Asian central banks on the price level and market dynamics of corporate bonds, agency bonds and equities with different maturities. This is not surprising since, as discussed in Section 4, the amounts that central banks invest in these market segments are a tiny proportion of both their overall investment and the markets concerned.

role in explaining shorter-term dynamics. Over a longer-term horizon, the paper identifies, in line with the literature, a fundamental change in the behaviour of US bond yields since the turn of the millennium. In this regard, it should be born in mind that in recent years the large central bank purchases of US Treasuries occurred at the same time as demand from pension funds and life insurance companies was increasing.



## ANNEXES

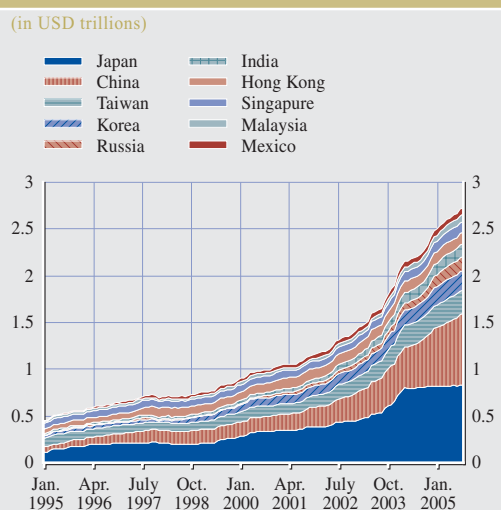
### ANNEX I STYLISED FACTS OF THE ACCUMULATION OF FOREIGN EXCHANGE RESERVES<sup>1</sup>

#### I INDIVIDUAL COUNTRIES AND REGIONS

On a global scale, foreign exchange reserves have risen sharply during the last decade, with the build-up accelerating until 2004 and most of the increase occurring in emerging market economies. Foreign exchange reserves rose from USD 1.2 trillion in January 1995 to USD 4.0 trillion in September 2005.<sup>2</sup> The share of such reserves held by Asian countries relative to the world total increased from 45% in January 1995 to 67% in August 2005. Conversely, the share of the Latin American countries as a group decreased from 8% in January 1995 to 5% in August 2005.

Looking at the amounts outstanding, eight Asian economies are among the ten largest reserve holders: Japan, the People's Republic of China, the Taiwan Province of China, Korea, India, Hong Kong SAR, Singapore and Malaysia (Chart 6).

Chart 6 Top 10 reserve-accumulating countries: 1995-2005



Source: IMF.

Singapore has the highest percentage of reserves to GDP (104.4%), followed by Taiwan (78.2%), Hong Kong (75.1%) and Malaysia (55.5%). Japan is the world's largest reserve holder and also the only industrial economy within the top ten reserve-holding economies to have actively increased its reserve holdings until recently (March 2004). The Japanese authorities purchased a total of USD 177 billion in 2003 and USD 138 billion in the first quarter of 2004. The People's Republic of China has also been, and still is, increasing its reserves considerably. In December 2005 reserves stood at USD 818 billion (equivalent to 36% of Chinese GDP). Specifically, since 2003 China's reserve accumulation has also been associated with non-foreign direct investment (FDI) in the form of private capital inflows as international investors have been expecting a revaluation of the Chinese currency. In 2004 FDI inflows and the trade surplus together accounted for only 55% of the increase in reserves (compared with 78% in 2003 and 125% in 2002), but this share rose again in 2005 (75%).

Oil-exporting countries in Africa and the Middle East also increased their stocks of reserves in keeping with the oil price rise. In Africa reserves increased from USD 39 billion at the end of January 1995 to USD 147 billion at the end of June 2005. The largest reserve holder in Africa is Algeria, while other important reserve holders include Libya, Nigeria, Morocco, Egypt and South Africa. During the same period, foreign exchange reserves in the Middle East rose from USD 33 billion to USD 92 billion<sup>3</sup>. However, it is likely that the amount of foreign exchange reserve holdings in OPEC member countries is underestimated, as several oil-exporting countries channel part of

1 Prepared by F. Comelli (European Central Bank), with inputs from J. Routava (Suomen Pankki – Finlands Bank).

2 As reported by the IMF in its latest update of the database on Currency Composition of Official Foreign Exchange Reserves.

3 The Middle East region includes the following countries: Israel, Saudi Arabia, Kuwait, the United Arab Emirates, Oman, Qatar, Bahrain, Yemen, Jordan and Lebanon. Foreign exchange reserves holdings for Iran and Iraq are not available.

their oil revenues into oil funds (see next section) without reporting these funds to the IMF. In addition, according to the Bank for International Settlements (2005a) the increase in total financial outflows from OPEC member countries, which was triggered by rising oil revenues, is not fully reflected in available counterparty data.<sup>4</sup> There are several possible explanations for the current large gap between rising outflows from OPEC member countries and counterparty data. First, the available counterparty data do not capture offshore purchases of securities. For example, the estimate of OPEC's cumulative net purchases of US securities based on the data from the US Treasury International Capital (TIC) system would tend to underestimate the total by an amount equivalent to purchases of these securities in London or other financial centres outside the United States. Second, cross-border investment in regional stock and bond markets is likely to have become a more important outlet for petrodollars than before. Many countries in the Middle East are, experiencing an economic boom; the stock market indices in Saudi Arabia, Kuwait and the United Arab Emirates more than quadrupled between the end of 2001 and the end of June 2005. Finally, there is some evidence that petrodollars are being invested more broadly – more diversified geographically and across the asset spectrum – than they once were. For instance, hedge funds and private equity funds, which have experienced large inflows worldwide in recent years but which are not required to release information on the positions of their investor base, are one possible home for these investments.

In Russia, the devaluation of the rouble in 1998 and rising commodity prices led to current account surpluses, reaching 10% of GDP in 2004. Previously, significant outflows hindered the growth of reserves, but in 2003–2004 rising oil revenues and more balanced capital flows led to a considerable accumulation of reserve assets. In Latin America, finally, reserves rose from USD 95 billion (January 1995) to USD 239 billion

(August 2005). Mexico and Brazil are the two largest reserve holders in the region.

## 2 RESERVES CHANNELLED INTO OIL AND HERITAGE FUNDS

In some countries, part of the foreign currency-denominated oil revenues is invested directly in foreign assets without the need for intervention and sterilisation by central banks. Specifically, some oil-exporting countries have established oil funds in order to smooth fiscal revenues. Since oil prices and revenues are highly volatile and unpredictable, actual fiscal revenues in oil exporting countries often differ greatly from budget projections, meaning that, in the case of shortfalls, either fiscal adjustment or financing is required. Oil funds can be classified in one of two categories: stabilisation funds, designed to address the problems created by the volatility of oil revenues, and savings funds, established to save part of the oil revenues for future generations. In the case of stabilisation funds, when oil prices are high a portion of oil revenues is channelled from the government budget to the stabilisation fund. Conversely, when oil revenues are low the stabilisation fund finances the oil revenue shortfall. In this context, a debate has developed about the effectiveness of stabilisation funds in smoothing government spending.

In Norway the authorities established the Government Petroleum Fund (GPF) in 1990. The GPF, formally a government account at the central bank, receives most of the petroleum revenue and invests it in foreign financial assets. It can, therefore, insulate the budget from changes in petroleum income and preserve the assets for use by future generations (Skancke, 2003). One such use is to finance the increase in old-age pensions, and in 2005 the Norwegian government proposed that the GPF be formally linked to old-age pensions. No transfers to the GPF took place until 1995 because of low net oil income and

<sup>4</sup> See the BIS Quarterly Review, December 2005.

large oil-related expenditures. Since then, however, the assets of the GPF have increased rapidly, as oil production and prices have picked up and the government's oil-related investment has declined. At the beginning of 2005 the market value of the GPF was 78% of mainland GDP. The 2005 budget projects that the market value of the fund could reach 128% of mainland GDP in 2010. In 2001 (effective for the 2002 budget) the policy of saving petroleum revenue for the future was formally added to the fiscal guidelines. Within these guidelines, the key rule sets the non-oil central government structural deficit to the same level as the long-run real return on the GPF, assumed to be 4%. The guidelines allow temporary deviations from the rule over the business cycle and in the event of extraordinary changes in the value of the GPF. The guidelines were meant to serve a number of purposes, namely to preserve the capital of the GPF for future generations, ensure that some petroleum revenue is spent now, and insulate the budget against sharp changes in petroleum revenues.

In Russia the authorities established the Russian Oil Stabilisation Fund (ROSF) to manage the increasing volume of oil revenues in February 2004. The Central Bank of Russia manages the ROSF and may invest the fund's resources in both cash and securities. A beneficial side effect is that investment in the ROSF helps to curb excessive money supply growth and to control inflation. Finally, some oil-producing countries in the Persian Gulf region, such as Kuwait, have also established oil stabilisation funds. However, the largest oil-producer, Saudi Arabia, has so far refrained from doing so.

Some economies with large reserve holdings have set up heritage funds. These funds manage reserves in order to achieve higher long-term returns than central banks and to preserve the value of reserves for future generations. However, heritage funds can also have short-term objectives in terms of fostering activity in domestic financial centres. In addition they often serve as a second line of defence when

intervention is required in the context of a currency crisis. Recent country experiences include the Government of Singapore Investment Corporation and the Korean Investment Corporation.

## **ANNEX 2**

### **MAIN DRIVERS OF RESERVE ACCUMULATION: A REVIEW OF THE LITERATURE<sup>5</sup>**

#### **I BACKGROUND**

In past years the accumulation of international reserves has shown rather unusual patterns, as described earlier in this paper. In particular, traditional indicators for "reserve adequacy" indicate that the stock of international reserves is substantially in excess in a number of emerging markets, notably in Asia. This raises the possibility that other factors might be driving the rapid accumulation of foreign reserves.

Consequently, considerable attention has been focused on the extent to which this development can continue. In order to evaluate the sustainability of the factors behind reserve accumulation, this annex evaluates the main drivers for emerging markets to accumulate reserves (i.e. to have an exchange rate target, ranging from just smoothing out volatility to more formal objectives). We broadly distinguish the following issues: first, international reserves are essential in coping with often volatile capital flows. In such cases, higher uncertainty implies a higher optimal level of reserves. Second, international developments (such as financial globalisation) or country-specific factors (such as demographic issues or temporarily higher revenues, e.g. from oil exports) can contribute to the build-up. However, these factors are not sufficient to explain the build-up: as long as

5 Prepared by P. Maier (De Nederlandsche Bank). Information on reserve adequacy has been provided by F. Comelli (European Central Bank). Helpful input from the DNB's Financial Stability Division, P. Cavelaars, M. Admiraal, and other ESCB colleagues is gratefully acknowledged.

currencies are freely floating, sustained accumulation of foreign reserves (i.e. beyond a certain minimum level) is unnecessary and potentially costly. Hence, there are strong indications that where the accumulation of foreign reserves occurs very rapidly and the stock of reserves is very high, it might result in exchange rates being managed. For instance, if countries keep their exchange rates undervalued as part of an export-led growth strategy, accumulation of foreign reserves will continue until the exchange rate is in line with that required by economic fundamentals.

In particular with regard to policy choices, it is important to realise that clear differences may exist between the objectives of private and public sector investors. For private investors, the objective is to maximise expected returns relative to perceived risk. In contrast, central banks buy and sell foreign assets for policy reasons that might go beyond trying to maximise risk-adjusted returns.<sup>6</sup> Acknowledging the distinct difference between private and public sector investors is essential, in that the medium and long-term sustainability of a certain policy is not necessarily impaired if it is economically not fully optimal. For instance, central banks might be willing to increase their foreign dollar reserves for political reasons, even if purely economic reasoning calls for a slower reserve accumulation, e.g. if the value of the reserve currency comes under pressure.

In the following sections we examine first the extent to which current reserve holdings can be explained by “insurance” considerations (Section 2). Section 3 examines the impact of financial globalisation. Section 3 discusses policy choices, notably management of the exchange rate as a means to boost exports. The last section discusses the main findings and provides a brief review of the costs associated with the build-up of international reserves.

## 2 PRECAUTIONARY MOTIVES

### INSURANCE AGAINST CURRENCY DEPRECIATION

One of the traditional motives for central banks to accumulate international reserves is that they need foreign currency to weather potential turbulence on currency markets. In the face of a deficit in the balance of payments, countries have various options (use of one or more of these policies is not mutually exclusive): first, they can engage in expenditure-switching policies, such as accepting a lower exchange rate or imposing tariffs or import quotas. Second, they can impose expenditure-reducing policies, effectively reducing economic growth. Third, they can engage in policies to stimulate exports. And last, they can finance it by losing reserves to smooth out short-run payment imbalances.<sup>7</sup>

Turbulence on currency markets occurs when private capital flows suddenly threaten to bring unwelcome changes in the country’s exchange rate. When private capital outflows threaten to weaken the currency, the central bank can sell reserves and buy domestic assets. When speculators are suddenly putting upward pressure on the currency by buying domestic currency assets, the central bank can attempt to contain that pressure by selling domestic currency and accumulating foreign reserves.

The typical example is that foreign investors suddenly fear that a currency is overvalued and rush to convert domestic currency assets into dollars or other reserve currencies. The attempt to satisfy this demand can sharply reduce the central bank’s reserve holdings (effectively redoubling investor incentives to buy foreign assets before the domestic currency weakens). Larger amounts of international reserves can

6 Central banks may also take “traditional” investment considerations into account when managing their reserve portfolio. The larger the reserve holdings, the more reserve managers are distinguishing between a liquidity portfolio (designed to offset exchange rate pressures) and an investment portfolio. According to a recent study, fourteen of twenty central banks surveyed now rely on private fund managers to allocate at least some of their reserve holdings (International Monetary Fund, 2004).

7 See also Bahmani-Oskooee and Brown (2002).

imply that countries can avoid costly liquidation of assets and can serve as a public demonstration of a commitment to exchange rate stability. Moreover, just when an emerging market most needs reserves – in a crisis – it can be shut out of the international capital markets because of sovereign risk concerns. Additionally, countries may wish to reduce their dependency on institutions such as the IMF, if they “do not regard conditional borrowing rights at the IMF and owned reserves as perfect substitutes” (Crockett, 1978).

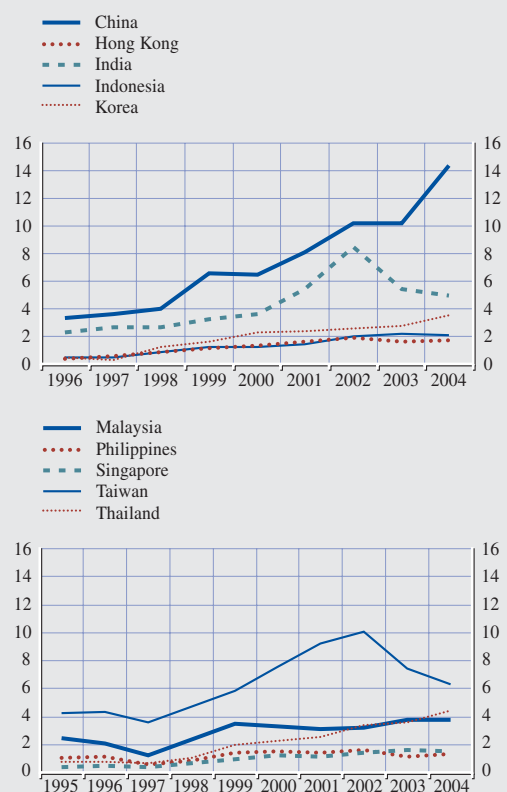
A related problem in this context is that net capital inflows to developing countries are largely due to external factors that they cannot influence (such as reductions in world interest rates). Although it is not always straightforward to disentangle “push” from “pull” factors as determinants for capital flows, the literature suggests that domestic factors – such as country-specific productivity shocks or domestic demand shocks – are relatively less important (Kim, 2000), though this feature is likely to have abated in recent years. Countries might thus suddenly experience capital inflows or outflows without adequate domestic policies to deal with them.

Holding foreign reserves as self-insurance against a currency crisis is especially important if a currency is overvalued. Mexico, Korea and Russia, for example, all share relatively recent experiences with destabilising runs on their currency during a financial crisis. Against this backdrop, it should not come as a surprise that these countries might attach a high value to the protection derived from large accumulation of foreign reserves. This argument is less relevant, however, for undervalued currencies such as those in most Asian countries (although it is not always evident whether a currency is over or undervalued, as e.g. estimates of “equilibrium exchange rates” can differ vastly across models).

### CAN PRECAUTIONARY MOTIVES FULLY EXPLAIN RECENT RESERVE ACCUMULATION?

Although reserves may be useful as a tool to avoid crises, there is a limit to the reserves needed to prevent financial turbulence (particularly as holding large currency reserves can imply costs). Were reserve accumulation purely driven by precautionary motives, it should slow down once the “optimal” level of reserves has been reached. However, this does not seem to be the case. The main indicator for gauging the adequacy of foreign exchange reserve assets is the ratio of foreign assets to short-term external debt (de Beaufort Wijnholds et al., 2001). This indicator – also known as the Greenspan-Guidotti rule – reflects a country’s ability to service its existing short-term external debt (debt maturing within one year) in the event of a

Chart 7 Ratio of reserves to short-term foreign debt



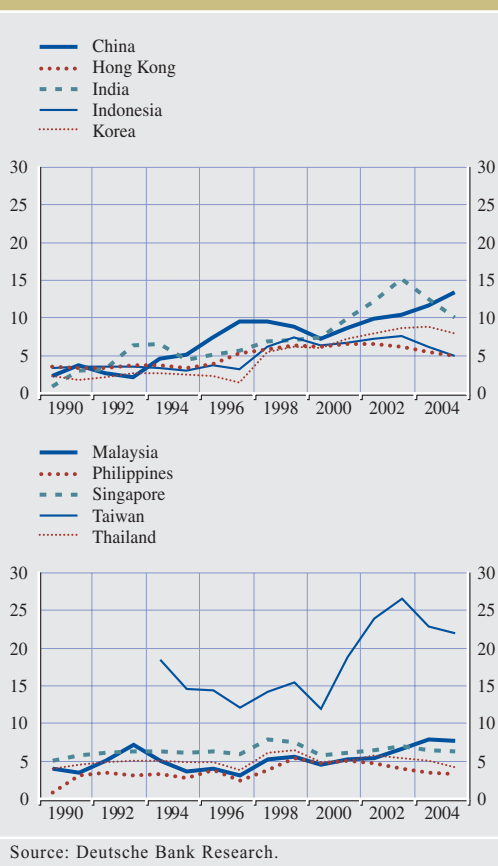
Source: BIS.

sharp deterioration in the external financing conditions. Typically, a country is considered prudent if it holds foreign currency reserves in the amount of its total external debt maturing within one year (Rodrik and Velasco, 1999 and Garcia Soto, 2004). Asian countries have also been improving their positions in terms of reserves to short-term debt since 1997, albeit to different degrees (see Chart 7). One can argue that part of the accumulation of foreign reserves that occurred after the Asian currency crisis was intended to bring the level of reserves back to the optimal level. Currently, however, the reserves to short-term external debt ratios of all the Asian countries considered are well above one – China, India and Taiwan, in particular, have very high ratios.<sup>8</sup>

While the ratio of short-term debt to foreign assets is the most popular indicator of reserve adequacy, it is not the only one. The following ratios can also be used:

- the ratio of international reserves to imports, which represents the number of months for which a country could support its current level of imports if all other capital flows were to stop. As a rule of thumb, countries should hold foreign reserve assets in order to cover their imports for three to four months. All Asian countries appear to be well above the threshold (see Chart 8), with the possible exception of the Philippines where the ratio was four at the end of 2004. In particular, according to the reserve to import indicator for Taiwan, if all capital inflows were suddenly to stop, this country would be able to finance nearly two years of imports with its existing stock of foreign exchange reserve assets.
- the ratio of reserves to broad money, which reflects the potential for resident-based capital flight from the domestic currency. If the ratio is very close to zero, broad money largely exceeds foreign exchange reserves. In the presence of an exchange rate peg, the higher the increase in monetary aggregates relative to the stock of foreign reserve

Chart 8 Ratio of reserves to imports



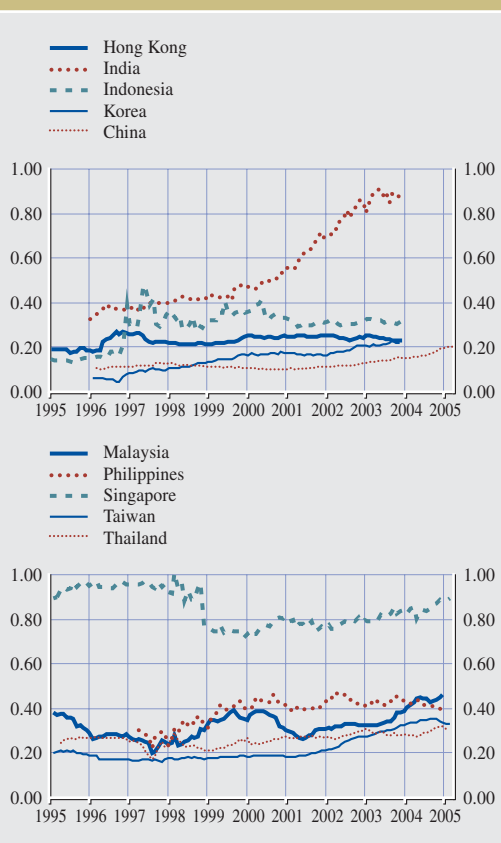
assets, the higher the potential for capital flight in the event of negative money demand shocks. This ratio has also increased for most Asian countries since the 1997 financial crisis, albeit with considerable variation at the country level (see Chart 9).

Hence, all three methods employed indicate that international reserves might be in excess in various Asian economies. More detailed econometric analysis confirms this picture (Table 1 provides an overview of recent studies): until about the late 1990s, reserve accumulation in Asian emerging economies could be explained by standard economic

<sup>8</sup> It should be stressed that the values of these indicators depend on the database used. Using the IMF database yields different values, but it still shows that the reserves to short-term external debt ratio is well above 1.



Chart 9 Ratio of reserves to broad money



Source: IMF.

factors such as economic size and current and capital account vulnerability. Since the Asian crisis, models based on the standard economic explanatory variables have underestimated the reserve holdings of several key Asian countries. This unusual accumulation is a sign that factors other than purely precautionary motives might play an important role.<sup>9</sup>

Taken altogether, the evidence suggests that limiting vulnerability has probably not been the primary motive for recent reserve accumulation in most economies. It should be noted, however, that determining the “optimal” level of currency reserves is not straightforward: in fact, it might also depend on institutional factors, such as the degree of capital mobility or financial liberalisation. Hence, the indicators presented above might, at least to some degree, underestimate the optimal level of foreign reserves, as the following considerations show.

#### FINANCIAL GLOBALISATION

In a narrow sense, the role of international reserves as a buffer to smooth shocks to the balance of payments has not changed. However, the economic environment wherein emerging economies operate has undergone substantial transformation in recent decades: the capital account of emerging market economies often displays high volatility, and countries differ in their conduct of monetary policy and exchange rate policy. This can impact on a country’s ability to deal with sudden capital inflows or outflows, and hence influence the desired stock of foreign reserves. In addition, the rapid pace of financial globalisation provides countries with new possibilities of diversifying risks or spreading

<sup>9</sup> While reserve accumulation in Asia might over time have become disproportionate to the actual threat faced by certain countries, this does not seem to be the case in most Latin American emerging market debtor economies. Given their nature as “original sinners”, these countries are unable to borrow in domestic currency and, as such, have a particular incentive to accumulate reserves to self-insure against future loss of access to international capital markets.

Table I Are international reserves in Asian countries excessive? Econometric evidence

Study	Key findings
IMF (2003)	Reserves in various Asian countries are currently in excess. A ratio of reserves to short-term foreign debt much above one does not further reduce the risk of a crisis.
Aizenman & Marion (2003)	Reserve holdings in the period 1980–1996 can be explained by “traditional factors”, but have been significantly underestimated since the Asian crisis.
Bahmani-Oskooee & Brown (2004)	The demand for international reserves may be difficult to estimate correctly as it experiences structural instability (in particular in the face of shocks).

savings geographically in ways that were not possible several decades ago. And lastly, other factors can (structurally) exert downward pressure on a country's exchange rate, e.g. demographic developments.

### CAPITAL MOBILITY AND FINANCIAL LIBERALISATION

When estimating a country's demand for foreign reserves, empirical studies search for variables other than the reserves to short-term debt ratio, which can reduce the probability of a currency crisis. Good macroeconomic fundamentals are an important and necessary condition for avoiding currency crises, albeit an insufficient one. As economies that are more open to trade are relatively more vulnerable, empirical studies such as Lane and Burke (2001) or Edwards (2004) generally find that trade openness is a very important variable in explaining cross-country variation at the level of international reserves. Moreover, there is a link between a country's financial system and capital mobility on the one hand and the build-up of foreign reserves on the other. High capital mobility can be a cause of current account instability (Wong and Carranza, 1999), and with greater financial integration governments accumulate more international reserves (Mody and Murshid, 2005). One explanation is that opening the capital account while maintaining an inflexible exchange rate regime can be a precursor to a crisis, as e.g. the "tequila crisis" of 1995 or the Asian/Russian crises of 1997/98 have shown.<sup>10</sup>

The link between financial deregulation and the capital account on the one hand and (speculative) currency inflows on the other has been recognised since the Asian crisis (Kawai 1998). In Thailand, for instance, the combination of *de facto* fixed exchange rates and high interest rates generated excessive capital inflows. This led to too much liquidity chasing bad investments. The build-up of short-term, unhedged debt left East Asian economies vulnerable to a sudden collapse of confidence. Rapid capital outflows and the consequent depreciation of currencies

exacerbated the strains on private sector balance sheets.

### 3 THE "GLOBAL SAVINGS GLUT"

Recent empirical evidence points to an increasing erosion of the home bias in savings (International Monetary Fund 2005b). In a closed economy, investment equals saving in each period; but in a world of financial globalisation, countries have more ample possibilities to smooth consumption over time or to finance investment in the face of insufficient domestic savings. Hence, as saving can cross international borders, a country's domestic investment and domestic saving need not be equal in each period.

In the view of Bernanke (2005), recent economic and demographic developments in many industrialised countries have contributed to a "global savings glut". Declining birth rates and an ageing population will result in a pronounced increase in the proportion of the elderly to the active population in all industrialised countries. In contrast, the population structure in most developing Asian countries is pyramidal, reflecting their younger population (to some extent China is an exception). Such differences in population developments will affect international capital flows. First, everything else being equal (e.g. assuming stable monetary policy, etc.), the population ageing in industrialised countries is likely to lead to an increase in savings by the younger generation in the short to medium term. If these higher savings by the young are not offset by dissaving on the part of the elderly, or if the proportion of elderly people in the population is not above a certain threshold, a country's saving rate is likely to increase.

<sup>10</sup> Capital restrictions, however, are not likely to alter the picture substantially. Glick and Hutchinson (2005) find that restrictions on capital flows do not effectively insulate economies from currency problems; rather, countries with less restrictive capital controls and more flexible exchange rate regimes appear to be less prone to speculative attacks. This holds even after controlling for macroeconomic, political and institutional characteristics that influence the probability of a currency crisis.

Second, in industrialised countries the ageing population (and the associated slowdown in labour force growth) is likely to exert downward pressure on the return to capital, relative to that of labour.

Lastly, it is worth noting that sudden changes in revenues from oil exports can also influence savings of oil-exporting countries. As oil revenues are highly volatile and unpredictable, several oil exporters have set up funds to smooth revenue flows over time or to save part of the oil revenues for future generations. This provides an additional explanation as to why countries such as Russia and Norway have increased their stock of international reserves.

#### 4 MANAGEMENT OF EXCHANGE RATES

We have seen so far that emerging markets may want to accumulate reserves to counter turbulence on currency markets and that the optimal stock of reserves might actually be relatively high, given the increase in capital mobility, the weaknesses of the domestic banking system, etc. In addition, there are factors such as demographic developments that provide additional explanations for existing capital movements. That said, these last factors, as well as current account surpluses, do not necessarily lead to a build-up of foreign reserves, provided that the exchange rate is fully flexible. In other words, the fact that the accumulation of reserves has occurred over a long period and has reached very high levels, and the speed with which those reserves were built up, indicates that the exchange rates were managed, i.e. not floating freely.

##### KEEPING THE EXCHANGE RATE UNDERVALUED

Various Asian countries ran sizeable current account surpluses in the early 2000s, and many also received substantial net private capital inflows. If regional central banks had not offset these foreign exchange inflows with official outflows – i.e. reserve purchases – Asian currencies would have strengthened.<sup>11</sup> Dooley et al. (2003) argue that various Asian countries keep their exchange rates deliberately

undervalued as part of a development strategy (the so-called “Bretton Woods II” system of fixed exchange rates). By keeping their currency undervalued, emerging countries deliberately stimulate export growth, which in turn fosters economic growth (e.g. by building up a competitive domestic capital stock). Given that Asia trades mostly with the United States, the choice of the US dollar as the primary reserve currency is not surprising.

This hypothesis has generated considerable controversy (see e.g. Roubini and Setser, 2005). A fixed or relatively rigid exchange rate system can yield benefits in terms of macroeconomic stability, especially to low-income countries where financial market development is limited and the capital market closed (Rogoff et al., 2004). Although most authors agree that various Asian countries follow policies to keep their currency undervalued, much of the controversy is related to the question of whether this is optimal and whether such policies can be sustained for a prolonged period. China, for example, has a rural population of 200 million underemployed workers yet to be absorbed into the modern sector. Eichengreen (2004) estimates that China can accomplish this at the rate of only 10 million to 20 million a year.<sup>12</sup> In his view, the possibility exists that China could attempt to stick to its strategy of export-led growth for a decade or more.

#### 5 COSTS OF MANAGING EXCHANGE RATES, AND “SOCIALISATION” OF EXCHANGE RATE RISK

In theory, central banks can deliberately (“structurally”) keep their currency undervalued over a sustained period. However,

11 For economies pegged to the US dollar, reserve accumulation has resulted automatically from the authorities’ pledge to buy foreign currency as necessary to maintain the fixed rate. How much stronger the currencies might have been without recent large reserve purchases is unclear (Higgins and Klitgaard 2004).

12 In making these calculations, Eichengreen does not account for other possible sources of Chinese income growth (e.g. from favourable productivity developments), which may bias his estimates.

it is far from clear whether such a strategy is economically optimal over the medium and long term. For instance, it has been pointed out that domestic financial market structures have undergone substantial changes since the Bretton Woods period: financial deregulation has limited the scope for funneling forced saving into capital formation in specific sectors. Moreover, maintenance of a fixed exchange rate regime can be difficult in practice, and its benefits may erode over time, while exchange rate flexibility becomes more valuable as economies mature and become integrated with global markets.

Maintenance of a fixed exchange rate regime can often mask underlying policy and institutional weaknesses, and result in the build-up of various sorts of imbalances. For instance, not letting one's currency appreciate implies that tradable goods are too cheap on world markets, which inflates the returns on investment for tradable goods. This can result in overinvestment, in particular in the tradable goods sector. These problems can be exacerbated by an open capital account, as e.g. domestic firms and financial institutions may react to the perception of limited foreign exchange rate risk by taking on foreign currency debt.

If a country becomes an international creditor, its external assets may remain largely denominated in foreign currency but mismatches in national balance sheets will emerge. As holdings of liquid assets in US currency are not balanced on the liability side, any significant appreciation of the domestic currency vis-à-vis the US dollar would imply (potentially sizeable) capital losses. For instance, Roubini and Setser (2005) estimate that if adjustment were postponed, China's capital loss could easily exceed 20 percent of its GDP by 2008.<sup>13</sup>

Lastly, if at some point a revaluation becomes necessary, valuation losses on foreign currency holdings occur.

Some of these risks – e.g. valuation losses or mismatches in balance sheets – can be shifted from the private sector to the central bank by means of reserve accumulation. Hence, building up international reserves can also be used as a means of “socialising” the negative consequences of currency and interest rate movements, i.e. preventing the negative implications of capital flows on the private sector.<sup>14</sup> In such cases, central banks effectively act as financial intermediaries, channelling domestic saving away from local uses and into international capital markets. This can be because domestic financial systems are ill-equipped to deal with flexible exchange rates (Prasad et al., 2005), or because weak or underdeveloped financial systems do not provide sufficient tools to hedge against currency movements (McKinnon and Schnabl, 2003).<sup>15</sup>

## 6 UNCONVENTIONAL MONETARY POLICIES

Reserve accumulation can also occur in the form of unconventional monetary policy measures. In Japan, for instance, conventional monetary policy has been rendered ineffective by the zero interest bound and bad loan problems in the banking sector (Garton, 2005). Moreover, the country's economic performance has been negatively affected by deflation. In such circumstances, monetary policy can essentially only be conducted by managing the country's exchange rate. An appreciating currency would have enhanced downward pressure on the country's inflation rate. By keeping the exchange rate stable, or

<sup>13</sup> The People's Bank of China is not simply lending China's current account surplus back to the United States. Around 75% of China's reserve accumulation in 2003-04 was financed by capital inflows, not China's current account surplus (Roubini and Setser, 2005).

<sup>14</sup> Foreign reserves can also be used to recapitalise (state-owned) banks, as in China in 2003 and 2005.

<sup>15</sup> China's approach of opening up to FDI rather than other types of capital inflows has helped to insulate it from many of the risks associated with capital account liberalisation. But the dominance of FDI in China's total capital inflows has declined markedly in recent years, implying that the composition of inflows is likely to be increasingly driven by market forces rather than the desires of policymakers (Prasad et al., 2005).

even allowing for a gradual weakening of its domestic currency by accumulating foreign reserves, the effectiveness of monetary policy can be increased.

### ANNEX 3 RISKS TO AND CHALLENGES FOR THE CONDUCT OF MONETARY POLICY<sup>16</sup>

#### I BACKGROUND

Reserve accumulation harbours a number of risks for the conduct of monetary policy. First, inconsistencies among monetary policy objectives (price versus exchange rate stability) can evolve. Second, reserve accumulation may also entail risks for the financial sector and medium-term growth prospects. In addition, quasi-fiscal costs of sterilisation, defined here as the difference between the yields received for holding foreign assets and yields paid on domestic liabilities issued for sterilisation purposes, may arise.

Particularly in the presence of continuous net capital inflows, interventions on currency markets to prevent exchange rate appreciation may lead to an excessive easing of domestic monetary conditions which could then threaten price stability. The underlying reason is that if such interventions are not fully sterilised, the monetary base rises and the resulting additional liquidity increases the ability and willingness of commercial banks to supply credit. With interventions as large and persistent as those recently observed in Asia, however, it might become more difficult to find eligible instruments with which to absorb the intervention-related rise in the liquidity reserves of the banking system. One possibility is the issuance of new government securities or central bank paper.<sup>17</sup> Another possibility could be a drastic increase in reserve requirements, which would reduce the amount of banks' excess liquidity.<sup>18</sup> Moreover, in connection with capital inflows, monetary policy might be hindered by a snowball effect. Continued intervention to prevent exchange rate

appreciation might give rise to expectations of exchange rate appreciation and further encourage capital inflows. In addition, sterilisation – considered in isolation – keeps domestic interest rates elevated, thereby attracting even higher capital inflows. For this reason, there is only limited leeway for discretionary interest rates hikes in order to rein in excessive credit growth. This implies that, under such conditions, the central bank might have to accumulate more and more reserves in order to offset upwards pressures on the exchange rate.

Reserve accumulation may also facilitate the emergence of domestic imbalances, specifically if interventions are not fully sterilised and excessive liquidity is generated. On the credit supply side, in the presence of abundant liquidity domestic financial intermediaries might be encouraged to grant credit more easily and to relax their assessment of borrowers' creditworthiness. On the credit demand side, lax monetary conditions exert downward pressure on interest rates and may encourage excessive domestic investment, either in the tradable or in the real estate sector. In this context, domestic imbalances may result and the implications for medium-term economic growth are negative, posing a significant challenge for monetary policy-makers. Finally, continuous reserve accumulation might also imply quasi-fiscal costs, which are here defined as the difference between the yields received for holding foreign assets and the yields paid on domestic liabilities issued for sterilisation purposes. Specifically, these costs may entail losses for reserve-accumulating central banks if an unfavourable foreign-domestic interest rate differential develops.

<sup>16</sup> Prepared by G. Leichtlein and A. Kreye (Deutsche Bundesbank).

<sup>17</sup> In some Asian countries (China, Singapore, Taiwan and Korea) part of the sterilisation effort has been carried out via the issuance of central bank paper.

<sup>18</sup> However, raising reserve requirements is not a costless option as it could put commercial banks at a competitive disadvantage vis-à-vis non-bank institutions. The share of intermediation handled by the banking sector might decrease.

## 2 INSTITUTIONAL CHARACTERISTICS AND MONETARY POLICY RESPONSES IN SOME MAJOR RESERVE-ACCUMULATING ECONOMIES

### JAPAN

Interventions on currency markets are carried out by the Bank of Japan (BoJ) on behalf of the Ministry of Finance (MoF). The MoF finances the purchase of foreign assets by selling Financial Bills (FBs) via auctions to market participants. Thus the effect on the monetary base is virtually neutral. However, for a limited period of time, the central bank can directly underwrite FBs from the MoF before they are auctioned to the markets.<sup>19</sup> Therefore, the effects of reserve accumulation on the monetary base in Japan are kept under control.

### HONG KONG SAR

Hong Kong is among the largest holders of foreign exchange reserves but its reserves have changed only slightly since 2000. The exchange rate regime adopted in Hong Kong is a currency board system, which requires that both stock and flows of the monetary base are fully backed by US dollars held in Hong Kong's Exchange Fund. The link between the Hong Kong dollar and the US dollar is maintained through an automatic interest rate adjustment mechanism, whereby interest rates adjust to inflows or outflows of funds, creating the monetary conditions that counteract the original capital movement. On 18 May 2005 the Hong Kong Monetary Authority announced a "refinement" of the exchange rate system. The former link of HKD 7.8 to one US dollar was gradually changed into a fluctuation band with HKD 7.75 and HKD 7.85 as margins. The introduction of the convertibility zone around HKD 7.8 was aimed at removing uncertainty about the extent to which the exchange rate may appreciate and should also reduce the usage of the Hong Kong dollar as a vehicle for speculation on a revaluation of the Chinese currency. Under this new system, when the HKD/USD rate approaches the upper boundary (HKD 7.75), investors should have the confidence to sell US dollars for Hong Kong

dollars if they believe in the central bank's commitment to buy all available US dollars in the market at the upper boundary. In this case, domestic interest rates should move to close the gap with US rates.

### PEOPLE'S REPUBLIC OF CHINA

Given the considerable pace of reserve accumulation, the People's Bank of China (PBC) has been countering current account surpluses, foreign direct investment and speculative inflows with sterilisation and additional measures. Sterilisation in the presence of continuous inflows might, under certain circumstances, become costly. For instance, in 2004 the PBC had to resort increasingly to currency interventions and, in order to sterilise the ensuing domestic monetary expansion, conducted large-scale open market operations. Specifically, the issuance of central bank securities for sterilisation purposes reached 15% of M0 in 2004, up from 5% in 2003.

On 21 July 2005 the PBC announced a reform of the exchange rate regime that came into effect the next day. The reform included an immediate appreciation of 2% to 8.11 renminbi per US dollar. For the US dollar the band of  $\pm 0.3\%$  around the central parity is maintained, while for other currencies the daily band has been widened to  $\pm 3\%$  (from  $\pm 1.5\%$ ) around the central parity. For the US dollar the central parity rate is determined by a weighted average of market opening bid prices from market makers before 9:15 am on the same trading day.<sup>20</sup> This implies that the opening price may be different – possibly outside the  $\pm 0.3\%$  band – from the closing price of the previous business day. In addition, the exchange rate of the renminbi is determined by "a managed floating exchange rate regime based on market

<sup>19</sup> Such operations would smooth the potential disturbance of the money market arising from a large-scale issuance of FBs within a short period of time. Moreover, for the public, it conceals the scale of interventions. FBs underwritten by the BoJ must be redeemed by the government as quickly as possible.

<sup>20</sup> Previously the US dollar central parity rate was based on the previous day's closing price.



supply and demand with reference to a basket of currencies” (People’s Bank of China, 2005). However, despite this reform the build up of foreign exchange reserves has been continuing in a context of large basic balance surpluses. Prior to the exchange rate reform, the PBC had raised the reserve requirements ratio and employed interest rate policy measures, including the increase in benchmark deposit rates and lending rates. Moreover, the authorities also tried to slow investment growth through administrative measures to curb excessive credit growth. In parallel, several measures to ease capital outflows have been introduced since October 2003.<sup>21</sup>

#### INDIA

In India reserve accumulation amounted to roughly USD 30 billion in 2003. In 2004 foreign exchange reserves grew further and reached about USD 125 billion at year-end. In 2002 and 2003 the Reserve Bank of India (RBI) sterilised about 70% and 60% of the intervention-related increase in reserve money respectively. The stock of government securities available to the RBI for sterilisation purposes declined progressively. In order to enable liquidity absorption, at the beginning of 2004 it was decided that the Government would issue treasury bills and dated securities to be used exclusively for sterilising purposes. As in China, the authorities in India adopted administrative measures to discourage capital inflows, including a tightening of the requirements on external commercial borrowing. To ease outflows, restrictions on overseas investment and lending were loosened and the prepayment of foreign loans was simplified. However, persistent inflationary pressures and sterilisation costs, which add to high fiscal deficits, make it more difficult for the Indian authorities to reconcile their external and domestic policy objectives.

#### REPUBLIC OF KOREA

In Korea, the management of foreign exchange reserves lies with the Ministry of Finance and Economy (MoFE), but is partly delegated to other authorities, including the Bank of Korea

(BOK). The BOK manages the bulk of the country’s foreign exchange reserves. In its role of undertaking matters relating to the issuance and redemption of government bonds, the BOK is entrusted by the MoFE with the operation and management of Foreign Exchange Stabilisation Fund bonds. The central bank *inter alia* issues Monetary Stabilisation Bonds (MSBs) to control money supply. Sterilisation of the intervention-related growth in the monetary base has increased over the past years. In 2002 nearly 60% was sterilised while in 2003 the additional liquidity generated by interventions was almost completely sterilised. In 2004 Korea’s foreign exchange reserves rose by USD 43.7 billion, the bulk of which (USD 25 billion) was accumulated during the fourth quarter. Nevertheless, in the same quarter the Korean won appreciated by 10% against the US dollar. As the outstanding amount of MSBs increased considerably in 2004, all the liquidity caused by foreign exchange intervention has been sterilised. In 2004 the BOK posted a loss of 150.2 billion won, its first loss since 1994. The deficit was largely the result of interest payments on MSBs being higher than returns earned on foreign assets and of exchange rate losses which were marked to market.

#### SINGAPORE

Foreign exchange interventions by the Monetary Authority of Singapore (MAS) amounted to USD 16.5 billion in 2004, of which USD 10.2 billion took place in the fourth quarter. The MAS manages the Singapore dollar against a trade-weighted basket of currencies of Singapore’s major trading partners. In April 2004 the MAS shifted its stance from zero appreciation of the nominal effective exchange rate to a modest and gradual appreciation, with the aim of reducing the risk of imported inflation. The central bank’s money market operations do not target a policy

<sup>21</sup> For example, China liberalised exchange restrictions on individual overseas travel, encouraged certain types of domestic firms to invest abroad, and initiated a scheme to induce domestic institutional investors to increase their outward investment. In addition, the regulation of foreign currency holdings for certain enterprises has been relaxed.

interest rate but aim at providing liquidity for the banking system that is sufficient for banks to maintain the minimum reserve requirement ratio of 3%. According to the MAS (2001), in order to smooth short-run volatility in the exchange rate, the central bank intervenes in currency markets from time to time. The intervention operations aim to keep the trade-weighted value of the Singapore dollar within a specified band. Institutional features that have supported the effectiveness of the MAS' intervention are the government's fiscal surpluses and the surpluses of the Central Provident Fund.<sup>22</sup> These surpluses are placed in deposits with the MAS, thereby withdrawing liquidity and putting upwards pressures on the exchange rate. The MAS engages in either money market operations or (non-sterilised) foreign currency interventions to offset this liquidity withdrawal.

#### TAIWAN, PROVINCE OF CHINA

The Central Bank of China (CBC) has intervened significantly on foreign exchange markets in recent years. In 2002 and 2003 the CBC absorbed liquidity by more than the intervention-related expansion in the monetary base. Sterilisation was lower in 2004 at 85%. The intermediate target for monetary policy in Taiwan is M2. Thus, a surge of broad monetary aggregates should induce the CBC to carry out offsetting operations. The main instruments are certificates of deposits, issuance of which grew much less in 2004 than in the two preceding years, with much of the increase taking place in the first two quarters.

#### ANNEX 4 THE FOREIGN POSITIONS OF SEVEN ASIAN CENTRAL BANKS: TRENDS AND POTENTIAL RISKS<sup>23</sup>

##### I BACKGROUND

The building up of foreign exchange reserves creates an exposure to foreign currency-related risks. The larger the absolute level of reserves, the larger the potential risks and the need for

appropriate risk management. Given the often dominant role, in reserve-accumulating countries, of the US dollar as the denominator of most foreign transactions and the anchor for exchange rate policy, foreign exchange reserves are usually mostly denominated in this currency. The related risks that monetary authorities face are largely similar to those faced by private agents with currency exposure, and can be classified into (i) market (i.e. currency and interest rate) risk, (ii) credit risk and (iii) liquidity risk. The main market risk is given by the potential for valuation losses on the securities denominated in the international anchor currency. In fact, if authorities were to abandon or modify their link to this currency and/or be forced into domestic currency appreciation, they would experience an immediate loss on the asset side of their balance sheet.

When assessing the trends in net foreign assets in the balance sheet of central banks, two preliminary aspects have to be borne in mind. First, the growth in foreign currency reserves is not always fully reflected in central bank balance sheets. Japan, where the Ministry of Finance holds the greatest share of foreign exchange reserves, is a case in point, as illustrated below. Moreover, in countries such as China the central bank is not independent of the government<sup>24</sup>. Second, foreign assets have to be assessed net of foreign liabilities. Since both components may vary widely, including in terms of relative weight, the net foreign position is the most comprehensive measure of the external exposure of central banks and, therefore, the appropriate variable to assess the related risks.

<sup>22</sup> The Central Provident Fund is a mandatory-defined contribution savings scheme for Singapore residents.

<sup>23</sup> Prepared by M. Soudan (Nationale Bank van België/Banque Nationale de Belgique).

<sup>24</sup> A short description of the different institutional arrangements underlying the management of foreign exchange assets for the seven countries surveyed in this paper is provided in Section 4 of this annex.

## 2 TRENDS IN THE NET FOREIGN POSITION OF SEVEN ASIAN CENTRAL BANKS

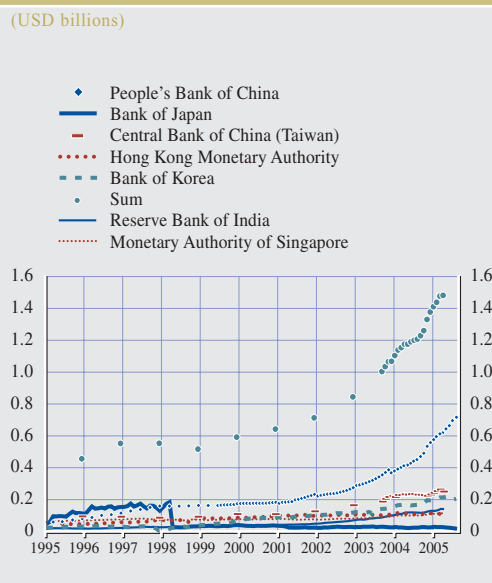
Chart 10 plots the net foreign position of seven Asian central banks on a monthly basis from January 1995 to April 2005, and shows that those banks built up substantial net foreign assets in this period. At the end of 1995 the total sum of net foreign assets within this group was USD 458 billion. The yearly growth rate of the net foreign position increased from about 10% in 2000-01 to 29% in the period ending in December 2004. The net foreign assets of these central banks totalled USD 1,484.9 billion at the end of April 2005, thereby having tripled in only eight years.

Chart 11 shows that not all of these central banks have contributed in equal measure to the rise in net foreign assets. The share of the Bank of Japan (BoJ) declined from 24.7% of the total at the end of 1995 to 1.8% in April 2005. In fact, the BoJ significantly reduced its net holdings of foreign assets in April 1998 (to USD 27.2 billion from USD 183.8 billion at the end of March 1998) in line with the arrangements with

the MoF. The Monetary Authority of Singapore (MAS) and the Hong Kong Monetary Authority (HKMA) also witnessed a decreasing share, the former from 15.0% at the end of 1995 to 7.7% in April 2005 and the latter from 10.6% to 7.6% in the same period. Conversely, three central banks increased their share in total net foreign assets: the People's Bank of China (PBC), the Bank of Korea (BoK) and the Reserve Bank of India (RBI). Their combined share rose from 29% at the end of 1995 to 66% in April 2005. While in 1995 the BoJ was, in our sample, the central bank with the highest net foreign assets on its balance sheet, in April 2005 it was the PBC that held the highest share.

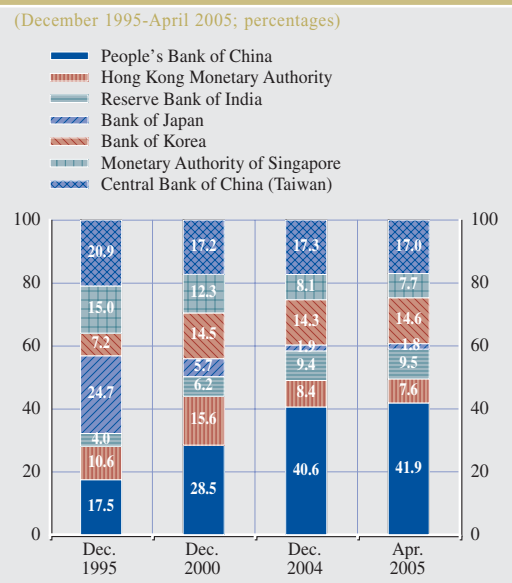
Table 1 shows the ratio of net foreign assets to central banks' total assets, the latter as reported on their balance sheets. The table points to a rise in the importance of net foreign assets in the total assets of all considered Asian central banks, except for the BoJ and the MAS. At the end of 2004 the net foreign assets of the six central banks excluding the BoJ represented, on average, 73% of total assets, with a 15 percentage point increase in five years. The rise

**Chart 10 Net foreign position of seven Asian central banks**



Source: IMF, except for Taiwan Province of China, for which the source is the Central Bank of China.

**Chart 11 Relative net foreign asset positions of seven Asian central banks**



Source: IMF, except for Taiwan Province of China, for which the source is the Central Bank of China.

**Table 1 Net foreign asset as a percentage of total assets in the balance sheets of seven Asian central banks**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
China	N/A	N/A	N/A	N/A	41	39	45	45	49	59
Hong Kong	82	87	86	74	69	77	80	87	86	85
Taiwan	84	82	86	84	84	89	88	88	88	90
India	28	29	39	38	43	46	50	63	74	89
Japan	N/A	N/A	N/A	4	4	4	3	3	2	2
Korea	36	40	9	35	60	73	79	81	85	82
Singapore	99	100	100	100	98	95	95	95	95	96
<b>Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>29</b>	<b>32</b>	<b>35</b>	<b>37</b>	<b>38</b>	<b>42</b>
<b>Total (excl. Japan)</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>58</b>	<b>59</b>	<b>63</b>	<b>64</b>	<b>68</b>	<b>73</b>

Source: IMF, except for Taiwan Province of China, for which the source is the Central Bank of China.

Notes: End-of year data except for Reserve Bank of India (mid-year data). Because of data limitations some data points are missing.

was particularly rapid in the cases of the RBI, BoK and PBC.

Summing up, the central banks of China, Korea and India experienced a sharp rise in their net foreign asset positions in the period 1995-2004, while the positions of other central banks remained more stable or declined, thus leading to greater concentration of net foreign assets in a few central banks. Those central banks also experienced an increase in the relative importance of foreign assets in their balance sheets, thereby affecting the potential for foreign currency-related risks.

### 3 POTENTIAL COSTS OF NET FOREIGN ASSET HOLDINGS

The rising importance of net foreign assets in the balance sheet of a central bank increases its exposure to currency risk, which, ideally, should be mitigated with a commensurate increase in the capital base. It is true that, in principle, central banks do not need capital as they issue currency on which no interest payment or other payments need to be made. If, however, a central bank is potentially subject to large profits and losses, an adequate capital base might prove desirable as it would allow running (foreign exchange-related) losses for a sustained period of time without the need for recapitalisation through a transfer of public funds. A substantial capital base thereby contributes to central bank financial independence.

In Table 2 the central bank capital base has been calculated as the sum of paid-up capital, reserves, and accumulated profits minus losses and provisions for foreign exchange losses; these items have been properly identified in publicly available sources.<sup>25</sup> The table reports the central bank capital base in terms of the balance sheet total for the period 1995-2004, and shows that the relative importance of the capital base fluctuates greatly across the seven Asian central banks observed. Excluding the BoJ, the capital/balance sheet ratio remained stable at 9.0% to 9.5% between 1995 and 2003, but fell to 6.9% in 2004 mainly due to a drop in the capital base of the BoK<sup>26</sup> and in the net worth of the Central Bank of China (Taiwan), coupled with a very rapid rise in total assets. A closer examination of the balance sheets reveals that some central banks (RBI, CBC, HKMA and MAS) have increased their capital base, whereas others have refrained from doing so.

The dissimilar trends in the capital base, combined with the diverse speeds at which central banks have been accumulating foreign assets, have led to very different rates at which net foreign assets are covered by capital and reserves. Table 3 provides an overview and shows that the importance of net foreign assets

25 A short description of the calculation of the capital base for each central bank is provided in Section 4 of this annex.

26 The observed volatility of the capital base of the BoK in the period 1997-2004 is entirely caused by the fluctuations in the Exchange Revaluation Reserve (see Section 4).

**Table 2 Capital base as a percentage of the total balance sheet total of seven Asian central banks**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
China	N/A	N/A	N/A	N/A	1.0	0.9	0.8	0.4	0.4	0.3
Hong Kong	34.8	32.3	29.9	26.6	29.0	30.0	30.9	34.3	38.0	39.9
Taiwan	4.5	6.1	15.6	16.3	10.1	12.3	14.5	14.8	14.7	9.7
India	9.5	12.3	11.4	15.7	16.2	18.0	17.7	23.4	21.9	20.5
Japan	N/A	N/A	N/A	5.5	4.6	4.5	4.3	4.1	4.0	3.7
Korea	N/A	N/A	31.5	13.5	9.7	12.8	12.8	7.9	9.4	2.3
Singapore	N/A	4.9	7.2	9.7	10.7	9.6	8.2	10.4	9.6	9.2
<b>Sum</b>	N/A	N/A	N/A	N/A	<b>6.7</b>	<b>7.1</b>	<b>7.1</b>	<b>6.9</b>	<b>6.9</b>	<b>5.5</b>
<b>Sum (excl. Japan)</b>	N/A	N/A	N/A	N/A	<b>9.1</b>	<b>9.6</b>	<b>9.5</b>	<b>9.1</b>	<b>9.2</b>	<b>6.9</b>

Source: IMF, except for Taiwan Province of China, for which the source is the Central Bank of China.

Notes: Figures for the Reserve Bank of India are mid-year figures. Figures for the Monetary Authority of Singapore are March figures in the subsequent year. All other figures are end-of-year figures.

in relation to the capital base has been increasing since 1995, especially during 2004. Excluding the BoJ, the sum of net foreign assets for the other six Asian central banks was almost 11 times larger than their combined capital base at the end of 2004.

Chart 12 plots the ratios to nominal GDP of net foreign assets in the balance sheets of the seven Asian central banks. These ratios have risen since 1995, once again with the exception of the BoJ. Excluding this central bank, the others held, on average, net foreign assets equivalent to 37% of GDP at the end of 2004, compared with only 17% in 1998. The relative importance of net foreign assets vis-à-vis GDP has

increased not only in small open economies but also in the two larger economies of China and Korea, and at the end of 2004 it reached its highest level since 1995. Net foreign assets in the balance sheets of the PBC and the BoK represented 34% and 27% of GDP respectively at the end of 2004.

Summing up, the following conclusions can be drawn. First, the capital base of most reserve-accumulating Asian central banks relative to the total balance sheet remained stable during the period 1995-2003 but decreased in 2004. Second, net foreign assets are currently greater than the capital base in all the central banks under review, excluding the BoJ.

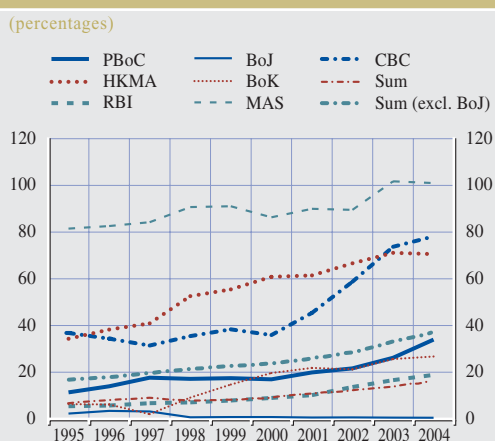
**Table 3 Ratio of net foreign assets over capital base for seven Asian central banks**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
China	N/A	N/A	N/A	N/A	39.4	42.6	54.5	103.8	139.5	211.0
Hong Kong	2.4	2.7	2.9	2.8	2.4	2.6	2.6	2.5	2.3	2.1
Taiwan	18.7	13.5	5.5	5.1	8.3	7.2	6.1	5.9	6.0	9.3
India	3.0	2.3	3.4	2.4	2.6	2.5	2.8	2.7	3.4	4.4
Japan	N/A	N/A	N/A	0.8	0.8	0.9	0.6	0.7	0.5	0.5
Korea	N/A	N/A	0.3	2.6	6.2	5.7	6.2	10.2	9.0	35.8
Singapore	N/A	20.5	13.9	10.2	9.1	10.0	11.6	9.5	10.0	10.3
<b>Sum</b>	N/A	N/A	N/A	N/A	<b>4.3</b>	<b>4.6</b>	<b>5.0</b>	<b>5.3</b>	<b>5.6</b>	<b>7.7</b>
<b>Sum (excl. Japan)</b>	N/A	N/A	N/A	N/A	<b>6.3</b>	<b>6.2</b>	<b>6.7</b>	<b>7.0</b>	<b>7.4</b>	<b>10.6</b>

Source: IMF, except for Taiwan Province of China, for which the source is the Central Bank of China.

Notes: Figures for the Reserve Bank of India are mid-year figures. Figures for the Monetary Authority of Singapore are March figures for the following year (e.g. the ratio of 20.5 in the "1996" column for the MAS is actually a March 1997 figure). All other figures are end-of-year figures.

**Chart 12 Net foreign assets of seven Asian central banks in percentage of GDP**



Sources: IMF, except for Taiwan Province of China, for which the source is Central Bank of China.

#### 4 INSTITUTIONAL ARRANGEMENTS RELATED TO THE MANAGEMENT OF FOREIGN CURRENCY RESERVES

In order to better assess the risks related to the foreign exchange exposure of reserve-accumulating Asian central banks, this final section summarises the institutional arrangements underlying the management of foreign exchange reserves in each of the seven countries under scrutiny. Specifically, the section examines whether balance sheet risks related to a country's foreign exchange reserves are borne by the monetary authority or the Ministry of Finance, and to what extent. Where available, this section also provides information on whether foreign currency-denominated financial instruments are marked to market or valued at cost.

##### JAPAN

The Japanese Ministry of Finance (JMoF) is responsible for exchange rate policy and the management of foreign assets in the Foreign Exchange Fund Special Account (FEFSA) system. The FEFSA system consists of two elements: the Foreign Exchange Fund and the Foreign Exchange Fund Special Account. The former is a fund established for foreign

exchange trading by the government and is financed by the issuance of short-term government financing bills. Funds in the FEFSA are used to conduct interventions in the foreign exchange market. The financial results of foreign exchange trading, such as profits or losses and payment or receipt of interest, are recorded in the Foreign Exchange Fund Special Account and are, therefore, part of overall government revenues and expenses. Interventions are executed by the BoJ, which acts as the agent of the JMoF. The BoJ does normally not take part in the financing of foreign exchange operations. However, from January to March 2004 the BoJ entered into an agreement with the JMoF to purchase foreign securities held by the FEFSA in order to provide yen for FEFSA operations. Purchases by the BoJ were conditional on their repurchase within three months. Total purchases by the BoJ were limited to JPY 10 trillion (slightly under USD 100 billion). The agreement was initiated because the FEFSA had, at that time, virtually exhausted the room for short-term borrowing under budgetary appropriations. The capital base of the BoJ has in this section been calculated in accordance with the definition in the BoJ's 2004 Annual Report, namely as the sum of capital, special and legal reserves, as well as provisions. The BoJ is only liable for valuation gains/losses on foreign assets and liabilities recorded in its own balance sheet. At the end of 2004 the net foreign assets of the BoJ represented only 3% of total foreign exchange reserves in Japan.

##### PEOPLE'S REPUBLIC OF CHINA

The State Council is in charge of approving the monetary and exchange rate policy of China. The PBC carries out monetary policy and oversees the exchange rate policy implemented by the State Administration of Foreign Exchange (SAFE), which is also responsible for regulating foreign exchange transactions, managing the country's foreign exchange reserves and developing its foreign exchange market. The SAFE is a government agency directly reporting to the PBC.



## REPUBLIC OF KOREA

The formulation of foreign exchange policy is a shared responsibility of the Ministry of Finance and Economy (MOFE) and the BoK. The MOFE is responsible for the overall foreign exchange policy and is empowered to set guidelines on the pursued external value of the won and to decide foreign exchange intervention accordingly. The formulation of foreign exchange policy is also, to a certain extent, delegated to the (BoK) in keeping with its inflation targeting rule. Foreign exchange interventions are executed by the BoK, which holds and manages the nation's foreign exchange reserves together with the MOFE and Korea Investment Corporation. Losses and gains made on BoK transactions are recorded in its income statement. The capital base of the BoK has been calculated as the sum of capital (i.e. the sum of the legal reserve, voluntary reserve and net profit for the period) and the Exchange Revaluation Reserve (ERR). Valuation losses on foreign exchange holdings are not recorded in the income statement, but are accounted for directly in the balance sheet of the BoK through the ERR, which is part of the item "Other current liabilities".

## TAIWAN PROVINCE OF CHINA<sup>27</sup>

Exchange rate policy is normally formulated and executed by the CBC. The central government may restrict the foreign currency operations in the event of severe balance of payments deficits or when the stability of the domestic economy is endangered. The Taiwan Ministry of Finance is in charge of the government foreign exchange transactions, including the management of foreign debt. Rules relating to the settlement of foreign exchange transactions are set jointly by the CBC and the Ministry of Finance. In 1989 Taiwan moved to a regime of managed float. Although the bilateral exchange rate of the new Taiwan dollar (NTD) vis-à-vis the US dollar is in principle set by the market, the central bank intervenes to avoid currency volatility and to maintain orderly foreign exchange market conditions.

## INDIA

The RBI is responsible for formulating and executing foreign exchange policy, in consultation and close cooperation with the government. The RBI's foreign exchange policy is communicated through regular policy statements and speeches by the Governor or other high-ranking officials. The current exchange rate policy can be described as a managed float: the RBI does not have a fixed exchange rate target, but intervenes in the foreign exchange market to dampen excessive volatility when necessary. The RBI also holds and manages the nation's foreign exchange reserves, which are part of its balance sheet. In this section, the capital base of the RBI has been defined as the sum of capital paid-up, the reserve fund, the contingency reserve, the currency and gold revaluation account and the exchange equalisation account. Gains and losses on the valuation of foreign currency assets and gold due to movements in the exchange rate and/or prices of gold are not booked on the profit and loss account but instead accumulated on the balance sheet under the name Currency and Gold Revaluation Account (CGRA). The balance in the CGRA at the end of June 2004 was positive, equivalent to 11.5% of the foreign currency assets and gold holdings of the RBI, compared with 13.4% at the end of June 2003. Foreign securities held by the RBI other than treasury bills are valued at the lowest of book value and market price. Depreciations are adjusted against current income.

## HONG KONG SAR

Exchange rate policy is formally set by the Financial Secretary of Hong Kong SAR and is executed through the Exchange Fund operated by the HKMA. The latter also executes the necessary monetary policy operations to safeguard HKD convertibility. Reserve assets

<sup>27</sup> The CBC does not provide information on how it deals with profits or losses on foreign exchange transactions, nor does it provide information on how foreign assets and liabilities are valued in its books. The capital base of the CBC has been defined as the net worth of the CBC.

are, therefore, an integral part of the balance sheet of the HKMA. Reserves in the Exchange Fund are managed as two portfolios: the Backing Portfolio and the Investment Portfolio. The Backing Portfolio is used to back the monetary base of Hong Kong. The Investment Portfolio is used to preserve the value and long-term purchasing power of assets. The capital base of the HKMA as it has been defined in this section equals the Exchange Fund equity. According to the notes included with the balance sheet in the HKMA Annual Report, exchange gains and losses on foreign currency conversions (very small because of the fixed peg) are included in the income and expenditure account in “Net exchange gains/losses”. More importantly, foreign securities are stated on the balance sheet at fair value at the balance sheet date. The fair value of a financial instrument represents its market price where there is a published price quotation in an active securities market. Where such a market price is not available, the fair value of a financial instrument represents its valuation according to a price matrix of discounted cash flows using applicable interest rates for discounting. Changes in the fair value of these investments are recognised in the income and expenditure account in “Net realised and revaluation gains/losses on other investments in securities” as they arise. In 2004 they accounted for 34.3% of total income and 50.7% of the surplus for the year.

### SINGAPORE

The foreign exchange reserves of Singapore are managed by the MAS, which also sets exchange rate policy. Singapore operates a managed float regime along the lines of a so-called “band-basket-crawl” arrangement, the aim of which is to limit currency volatility and secure domestic price stability. The exchange rate policy targets the nominal effective exchange rate (NEER), but the exact composition of the basket that is used to calculate the NEER, normally made up of the currencies of major trading partners, is not made public. In order to instil adequate confidence in its exchange rate policy, the

MAS operates a Currency Fund which holds foreign exchange reserves at least as large as the total of domestic currency in circulation. The bulk of Singapore’s reserves are held in the General Reserve Fund. Together, these two funds make up the financial assets and liabilities of the MAS. The capital base of the MAS has been defined as the sum of the balance sheet items issued and paid-up capital, general reserve fund and currency fund reserves. Gold and foreign assets, including derivative instruments, are stated on the balance sheet of the MAS at the lower of cost and market value on an individual investment basis, except for shareholdings in the BIS and S.W.I.F.T. Gains in the market value of foreign assets are not recorded on the balance sheet.

## ANNEX 5 DEVELOPMENTS IN CENTRAL BANK RESERVE MANAGEMENT AND THEIR POSSIBLE MARKET IMPLICATIONS<sup>28</sup>

### I BACKGROUND

The increase in the size of foreign reserves in recent years has made the choice of an adequate reserve management framework an important issue for central banks. It is necessary for such a framework to: i) be consistent with the exchange rate policy features; ii) seek an efficient risk-return trade-off; and iii) avoid market distortions. Against this backdrop, this annex reviews developments in foreign exchange reserves and their composition, in terms of both currency and instrument allocation. It also elaborates on the various frameworks for reserve management methods observed among the ten largest holders of foreign reserves, and compares the US and euro area bond markets in order to find out whether there are differences that could limit a potential currency diversification. Finally, the annex outlines how the accumulation of foreign reserve might affect bond market dynamics.

<sup>28</sup> Prepared by A. Lagerblom (European Central Bank) and G. Levy-Rueff (Banque de France).

## 2 MAIN TRENDS IN RESERVE MANAGEMENT SINCE 1999: DIVERSIFICATION, BUT TO WHAT EXTENT?

Given the accumulation of foreign reserves over the past years, there is a trend among reserve managers towards a diversification of their portfolios. Diversification, however, can take place in two dimensions, namely across currencies and across asset classes.

### DIVERSIFICATION IN TERMS OF CURRENCY COMPOSITION: A MARKET VIEW

The underlying principles, as outlined in the Box, support the view that changes in the currency composition of foreign reserves are likely to occur very gradually. This is due to the fact that the reasons determining a specific choice of currency composition, including the role of the dominant international foreign reserve currency (which has changed over time but is currently clearly considered to be the US

dollar), are unlikely to change rapidly. According to Eichengreen (1998 and 2005) for example, the importance of the depth, breadth and stability of the financial markets and the degree of international transactions have always played a decisive role when determining reserve currencies. In that respect, the incumbent world reserve currency holds an advantage in term of network externality. This is particularly the case in Asia, given the role of the de facto dollar zone.<sup>29</sup> In addition, central banks in general try to avoid swift changes in the main characteristics of their foreign reserve management framework, since they can be a source of market disturbances.

When trying to carry out a more detailed analysis of recent currency composition trends, one is confronted with the fact that the information available on currency composition

<sup>29</sup> In this regard, see also Genberg, McCauley, Park and Persaud (2005) and Ho, Ma and McCauley (in BIS, 2005b).

#### Box

#### POSSIBLE FACTORS DETERMINING THE CURRENCY COMPOSITION OF FOREIGN RESERVES

- The currency composition of reserves usually reflects a country's exchange rate regime and, if the exchange rate regime is not a pure float, is closely linked to the choice of an anchor currency or basket.
- One issue specific to Asia is the de facto existence of a dollar zone (in the strong or weak sense) in the region with many Asian currencies more or less strictly linked to the dollar. Given the strong inter-twinning commercial links in the region, this makes the weight of the dollar in the foreign exchange policy of Asian countries more important than the simple weight of the United States.
- Official reserves, in particular in developing countries with fragile access to international capital markets, are considered to be a cushion for paying for imports and ensuring the servicing of external debt in foreign currencies. Therefore, the reserve currency composition is often linked to the composition of trade and financial flows.
- Moreover, risk management considerations and optimal asset allocation approaches seem to have gained in importance recently.
- Finally, central banks also take into consideration, to the extent that it is compatible with their other objectives, the "market neutrality principle", as prescribed by the IMF.

is generally vague and that, if it is published, it is only with a substantial time lag (to avoid any negative market impacts). This is particularly true for most Asian countries.

IMF data are still the most relevant statistics which are publicly available. They show gradual changes in the currency composition of foreign reserves since 1999, with the share of US dollar holdings, at a global level, at its peak with 71% in 1999.<sup>30</sup> Since then, however, the share of US dollar holdings has declined, standing at 65.9% at the end of 2004. When limiting the analysis to developing countries, the share of the US dollar seems to be slightly lower, i.e. 59.8% at the end of September 2005. The aggregated share of euro holdings increased from 17.9% in 1999 to 24.3% at the end of September 2005 according to the latest available data from the IMF *Currency Composition of Official Foreign Exchange Reserves* (COFER) database (with the specific trend in developing countries being very similar to the general picture). However, as regards the share of euro holdings, the appreciation of the euro also contributed to positive valuation effects in recent years.<sup>31</sup> These shares, however, are calculated only for the group of countries reporting reserve currency composition to the IMF, accounting for around 70% of world reserve holdings (excluding important reserve accumulating countries).

The gradually increasing use of the euro in global foreign reserves has been supported by the smooth functioning of the euro area and the euro's appreciation against other international currencies in recent years.<sup>32</sup> It is noteworthy that, according to the recent survey of trends in reserve management conducted by Central Banking Publications in 2004 (Pringle and Carver, 2005), 70% of the sample group reported an increase in euro exposure. Of the 50% of the sample that reported a reduction in US dollar exposure, 93% reported that their exposure to the euro had increased. One stated reason for this trend is the advantage of diversification in terms of an improvement in

the risk-return trade-off. While a precise country or regional breakdown for all currencies in foreign reserves is not available, partial evidence suggests that the bulk of reserves of the ten largest holders are in US dollar-denominated financial assets.

Overall, the concentration of foreign reserve holdings in US dollar assets remains significant, particularly in Asia. This is related to the foreign exchange regimes adopted in several Asian countries, often characterised by de facto pegs against the US dollar, and the composition of their external trade, dominated by links with the United States and the dollar zone.<sup>33</sup> However, it is also related to a different reason: the desire to improve the risk-return trade-off through diversification, not just at the level of the central bank but at the aggregate country level. A diversification advantage at the aggregate national level might exist when the central bank invests part of the national savings – which are otherwise invested in the domestic currency because of the home bias in domestic financial markets – in US dollar assets. Home bias is decreasing as shown in the IMF April 2005 World Economic Outlook (2005b), but it remains significant, in particular in certain countries. For example, in China<sup>34</sup> the home bias can be extreme because of regulatory constraints. The central bank might therefore perceive an advantage in accumulating foreign assets on behalf of the rest of the Chinese economy and see only a

30 See the IMF's Annual Report 2005, which shows some significantly revised data for the currency composition of official foreign exchange reserves over the past years. Please note that in the IMF's own admission, these data are not fully reliable. It should also be noted that the IMF introduced a new presentation regarding the estimation of the currency composition of reserves in 2005, which makes any direct comparison with the old presentation impossible.

31 A more accurate way of analysing the relative change is to look at the ratio of quantities for all countries: in 1999 there were 3.9 times more dollars held than euro, but at the end of 2003 reserve managers held only 2.6 dollars per euro.

32 See the Review of the international role of the euro, ECB, January 2005.

33 Genberg et al. (2005), for example, argue that the dollar share of foreign reserves is not out of line with the share of the dollar zone measured in the world GDP.

34 China is not covered in this specific IMF WEO analysis, which focuses mainly on developed countries.

limited advantage in diversifying out of the dollar into other foreign currencies at this stage, since a good part of the benefit of diversification is already obtained by investing in dollars for the entire country, while further currency diversification would only add marginally to this first order effect. This supports the idea that a possible diversification of foreign reserves out of the US dollar in China could only be implemented at a slow pace.

As regards possible market impacts, central banks with large foreign reserve holdings are aware that some of their moves might generate volatility in the US dollar or international bond markets, even if doing so would also inflict significant losses on them.<sup>35</sup> The fact that the authorities might stop purchasing US dollars and US Treasuries (even without talking about net selling) is seen by market participants as a risk for volatile US dollar movements and higher US bond yields.

#### **DIVERSIFICATION IN TERMS OF INSTRUMENT COMPOSITION: A MARKET VIEW**

The instruments in which reserve managers invest the bulk of their foreign reserves have also changed to a certain degree over the last decade. On the one hand, changing financial markets (e.g. the shrinking stock of outstanding US Treasuries at the end of the 1990s and in the early part of the 2000s) forced, to some extent, traditionally conservative reserve managers to enlarge the eligible asset class spectrum for their portfolios. Better portfolio management skills, technical know-how and risk management tools have also helped to promote a diversification of foreign reserve portfolios towards new instrument classes given the advantages of this diversification in terms of decreasing risks and enhancing returns. However, the changes have been slow. Most foreign reserve management activities, compared with private portfolio management activities, still seem to have specific features which may make them more likely to have an impact on the market.<sup>36</sup>

As McCauley and Fung (BIS, 2003a) summed up, the reserve manager's choice of instrument has showed three successive phases. In the mid-1970s, reserve managers began to diversify their short-term holdings out of US Treasury bills into private money market instruments or BIS instruments to obtain higher yields, which consequently also meant accepting greater credit risk. In a second phase, the maturity of their reserve holdings was extended, thus accepting larger market risk. Although comprehensive data on the maturity structure of US Treasuries held in foreign reserves are not available, the findings of McCauley and Fung are corroborated by the views of other market participants. In addition to the desire for more diversification, the market context, characterised by declining yields in the 1990s, led reserve managers to wish to enhance returns by purchasing US Treasuries with longer maturities. More structurally, numerous researchers have found that, for investors with a medium to long-term investment horizon, extending the duration generally allows a positive term premium to be earned (of course at the price of greater profit and loss volatility).

In the last and most recent phase, which started at the end of the 1990s, reserve managers shifted some of their longer-term securities away from US Treasuries into securities with higher credit risk, in order to earn the additional yield spread pick-up. Hence, for example, the securities issued by government-sponsored enterprises (GSEs), also referred to as US agencies, were not only used by reserve managers as a substitute for the shrinking US Treasury market, but also to enhance returns in a relatively low-yield environment. However,

<sup>35</sup> For example, rumours regarding the possible diversification of reserves by the Bank of Korea in February 2005 triggered a 2% appreciation of the Korean won against the US dollar, which meant a 2% loss for the Bank of Korea's reserve holdings (valued in KRW terms).

<sup>36</sup> Official institutions including central banks are often scrutinised by market participants because the amounts that they trade are large and because the investment strategy of such institutions can change abruptly and independently of interest rate levels (in contrast to the behaviour of private foreign investors).





their assets continue to be concentrated in traditional instruments such as bank deposits, BIS instruments and US Treasuries (as well as agency securities, though to a lesser extent). It can be concluded that, while the changes in the management of foreign reserves have been significant, they do not seem as important as the magnitude of reserve accumulation.

### **3 THE COEXISTENCE OF VARIOUS FOREIGN RESERVE MANAGEMENT FRAMEWORKS**

Given the rapid growth of foreign reserve holdings over the past years and the risks and costs associated with it, greater focus has been given to the management framework for such foreign reserve portfolios. Central banks have been and are still diversifying along the yield curve and across asset classes, by taking on more interest rate and credit risk in search of higher yields, but they are doing this to different extents. In addition, in some countries with large reserve holdings, not all reserves are invested in highly liquid and secure sovereign issues.

For example, natural-resource-based stabilisation funds have been created, like Norway's Government Petroleum Fund and the newly established Russian Stabilisation Fund. These funds are typically thought of as a by-product of national budget surpluses, with excess budget revenues coming from the export of natural resources. In contrast to the Norwegian Government Petroleum Fund, which in addition to providing short-term fiscal stabilisation across the oil price cycle acts as a mechanism for transferring wealth from current resource exploitation to future generations, the Russian Stabilisation Fund is designed almost solely to serve short-term purposes (i.e. fiscal targets). The assets of such stabilisation funds are not accounted for in a country's reserve holdings, since they do not come from and are not being used for foreign exchange intervention. They might appear, in some cases, on a central bank's balance sheet as a separate "foreign assets" item, but their origin is not foreign exchange intervention.

More generally, parts of the reserve holdings are sometimes transferred to separate institutions. This set-up has already been in place in some countries for several years, as is the case with the Government of Singapore Investment Corporation (GIC), and it is being put in place in countries such as Korea<sup>38</sup>. Such separate institutions can, to some extent, be seen as external managers mandated by the respective central bank, with the foreign reserve assets remaining on the balance sheet of the central bank. The Bank of Korea, for example, retains the option to recall the assets in the event of an emergency, meaning that the funds would effectively be retained by the central bank as international reserves while being entrusted to the KIC for management. However, in the case of the GIC, some of the inflows come from accumulated budget surpluses and workers contributions to the Singapore Central Provident Fund (CPF), a national pension scheme, i.e. they are not related to the central bank's foreign reserves. The main objective of these institutions is, in general, to achieve higher long-term returns in order to preserve the value of the assets for future generations (hence they are sometimes referred to as "future generation or heritage funds").

### **4 US AND EURO AREA FIXED INCOME MARKETS: CAN DIFFERENCES LIMIT CURRENCY DIVERSIFICATION?**

How could the differences between US and euro area fixed income markets limit currency diversification? On the other hand, if such diversification were to take place abruptly, could this mean a specific impact on euro area bond markets?

#### **A BRIEF COMPARISON OF THE US AND EUROPEAN FIXED INCOME MARKETS**

According to the 2005 Global Financial Stability Review published by the IMF, the size of the US bond market is close to USD 20,500 billion compared with USD 13,500 billion for

<sup>38</sup> The Korea Investment Corporation (KIC) began its operations on 1 July 2005.

the euro area. Of these totals, government debt amounts to USD 5,000 billion in the United States compared with USD 5,500 billion in the euro area (with, however, some fragmentation since the Italian government debt market is close to USD 1,500 billion, France and Germany are close to USD 1,000 billion each and Spain is close to USD 500 billion according to the BIS quarterly review of March 2005). Finally, non-government debt securities (e.g. corporate debt securities, asset-backed securities, etc.) amount to USD 15,500 billion in the United States compared with USD 8,000 billion in the euro area.

In brief, it should also be observed that the European secondary bond market, in contrast to the European primary market, is still relatively narrow compared with the US secondary bond market. Interviewees surveyed for a study carried out by BearingPoint<sup>39</sup> estimated that the average daily turnover of the secondary fixed income market in the euro area falls in a range between €60 and 65 billion. More than 70% of the average daily turnover (approx. €44-50 billion) takes place in the German, Italian and French government bond markets. Compared with the US Treasury market, this represents only 1/4 of the average daily turnover (about USD 250 billion), as estimated by the Federal Reserve Bank of New York. The US agency securities market on its own seems to be almost comparable, in terms of turnover, to the size of the European government bond market, with an average daily turnover of approximately USD 45 billion.

Due to the difference in market sizes and depths, large cash investors are therefore inclined to favour the US bond market over the euro area market. Differences in market liquidity also tend to attract investors first towards the US bond market before they diversify into the euro area market. Based on an informal survey of nearly a dozen of the main market makers in the US and euro area bond markets, the US market indeed remains somewhat more liquid in terms of bid-offer spreads and the standard size of transactions.

However, the differences are not that large, and nor are they similar for all bonds (e.g. depending on their maturity; on-the-run compared with off-the-run US Treasuries; government debt compared with agency or corporate debt; etc.).<sup>40</sup>

In fact, according to the central bank survey carried out in autumn 2004 (Pringle and Carver, 2005), the importance of the euro area as an international investment centre is growing and this is making the fixed income markets in particular ever more attractive to many reserve managers. Over half of the respondents to the survey indicated indeed that euro area markets are now as attractive to invest in as those in the United States.

The growing use of derivatives, e.g. futures or interest rate swaps, also means that the liquidity of cash instruments is now less important since trading can be disentangled from liquidity management. In general, the derivative markets have a very good depth and liquidity, both in the euro area and in the United States.<sup>41</sup>

Therefore, the difference in size and structure between US and euro area markets should be neither overestimated nor underestimated. While only 37% of international bonds and notes are denominated in US dollars, the fact that they are, in general, traded in more homogeneous and liquid markets than other currencies certainly provides a partial reason for the concentration of dollar assets and the limited diversification into the euro by Asian

<sup>39</sup> See BearingPoint, *The electronic bond market 2005*, Study Documentation, Frankfurt, 2005.

<sup>40</sup> The difference seems to be the largest in the money market area, with the six-month US Treasury bill bid-offer spread announced at between 0.25 and 1 basis point, while a spread on similar instruments in the euro area is shown between 1 and 2 basis points (or even 4 basis points for one counterparty). For ten-year benchmark government bonds, several counterparties show similar spreads in the US and euro area markets (or even tighter spreads in the euro area, but the dispersion seems higher there with several counterparties also showing significantly worse spreads than for US markets).

<sup>41</sup> See, for example, Jones G., *Citigroup saga highlights the need for change*, Financial News, 5 September 2004.

central banks. It also means that there is an additional potential risk of distortion for euro area long-term interest rates, should Asian central banks invest more in euro area markets.

#### **BACKGROUND DATA ON THE MAJOR HOLDERS OF US AND EUROPEAN FINANCIAL SECURITIES**

As pointed out earlier, there is a range of data sources that track foreign official investments and holdings in US assets. However, no comparable data are available for the euro area market as a whole, due to its – in this sense – fragmented structure. Only limited data can be retrieved from national debt agency offices or central banks, and from these data only rough conclusions can be drawn as regards the holders of euro area financial securities.

In the United States, the estimated share of total long-term securities in total outstanding stock (debt instruments and equities) held by foreigners has increased from 9.7% in March 2000 to 14.3% (i.e. an amount of USD 5,418 billion) as of June 2004.<sup>42</sup> In comparison, approximately USD 588 billion worth of short-term securities are held by foreigners. No split is provided here between official and private foreign holdings. However, according to the US Treasury, the share of foreign official holdings in total foreign portfolio investment in the United States was quite high in the period from 1974 to 1984, when it stood at around 40%, compared with the figure of approximately 24% (or USD 1,320 billion) published in June 2005. This drop can probably be explained by the fact that the increase in foreign official holdings has been outpaced by the increase in foreign private holdings. From 1984 onwards the percentage of foreign official holdings fell steadily, but it has rebounded slightly in the last two surveys.

The report further confirms that foreign officials invest primarily in US Treasury debt, but that they have also increasingly invested in US agency and corporate debt. Foreign private investors still hold the bulk of their US investments in equities, with the share in US Treasury pretty much unchanged. Finally, and

more specifically, as of June 2004 foreign holdings of US Treasury securities represented 52% of the total US Treasury debt outstanding, up from 35% in March 2000, with the majority (around 63%) held by foreign official institutions.

When looking at the maturity structure of US debt held by foreign official investors, the US Treasury report shows that, as of June 2004, over 73% was held in securities maturing in five years or less, with a concentration in issues maturing in one to three years. The picture is similar when focusing only on US Treasury bonds. However, this is very much in line with the maturity structure of outstanding marketable US Treasuries in 2004, with only 34% of marketable public debt outstanding held in securities with maturities of more than five years. In short, foreign official portfolios seem to concentrate on short to medium-term maturities rather than the longer end of the curve, which, however, corresponds to the maturity structure of outstanding debt.<sup>43</sup>

Focusing on US Treasury securities only, the US Treasury also publishes, on a monthly basis, the major foreign holders split by country or between foreign official and foreign non-official holdings. However, any conclusions about foreign ownership are to be drawn cautiously, as the US Treasury itself points out that the data are imperfect.<sup>44</sup>

Based on this data, Japan's US Treasury holdings in 2004 were more than three times the

<sup>42</sup> See US Treasury (2005), Report on foreign portfolio holdings of US securities as of 30 June 2004, Department of the Treasury, Federal Reserve Bank of New York, June 2005.

<sup>43</sup> It should be borne in mind that the same market risk is obtained through an investment of USD 1 billion in ten-year notes or around USD 15 billion in six-month bills.

<sup>44</sup> For example, the "custodial bias" contributes to the large recorded holdings in major financial centres, including Belgium, the Caribbean, Luxembourg, Switzerland, and the United Kingdom, as some foreign owners entrust the safekeeping of their securities to institutions that are neither in the United States nor in the owner's country of residence. The UK and Caribbean holdings of US Treasuries are difficult to analyse, as the data represent a mixture of foreign central bank activities, petrodollar recycling and global hedge fund activities.

amount of the second largest holder (mainland China). Hence, Japan was responsible for over half of all US Treasury foreign purchases during the whole of 2004, although the vast majority of those purchases took place within the first half of 2004. Japan's position as a consistently large buyer of US Treasury securities is a function of its foreign exchange interventions to prevent appreciation of the Japanese yen: the Japanese monetary authorities do not dynamically adjust the currency composition of their reserves, so most of the proceeds remain in US dollars. When comparing the TIC data with the data published by the Japanese Ministry of Finance (MoF), 85% of the stock of Japanese foreign exchange reserves is invested in foreign securities, with the bulk held in US Treasuries. Therefore, Japanese authorities hold a particularly large amount of US Treasuries compared with other foreign institutions.

China's demand for US assets arises from foreign exchange interventions like in the same way as for Japan, and China's foreign asset purchases were, until July 2005, somewhat more automatic than Japan's due to the renminbi's fixed exchange rate against the US dollar. Therefore, one of the most common assumptions is that China has also been allocating large amounts of foreign currency reserves into US Treasuries. However, the TIC data do not support this assumption, probably given the "custodial bias" (see footnote 45), which may understate the actual US Treasury holdings by mainland China. Furthermore, China's exposure to the US dollar is only partially shown by the TIC data since, unlike the MoF, the People's Bank of China invests in a more diversified asset base. Finally, the consequences of the change in the Chinese currency regime in 2005 will need to be monitored. For the time being it is too early to expect swift significant changes since the renminbi de facto continues to be closely pegged to the dollar. But the Chinese authorities have now more freedom i) to let the renminbi float over time, and hence to buy less foreign currencies, ii) to shift the currency composition of their purchases in order to

decrease the focus on the US dollar, and iii) to change their foreign reserve management framework more generally.

For the euro area, the IMF's Coordinated Portfolio Investment Survey (CPIS), based on end-2002 data, shows that the United States held the largest portfolio claims on the euro area, followed by the United Kingdom, Japan and Switzerland. While the United States held mainly equities, the United Kingdom and Japan held mainly debt securities. However, the CPIS data do not provide any geographical breakdown for securities held as reserve assets and international organisations' portfolio investment holdings. The IMF therefore conducts two complementary surveys to establish a geographical breakdown of securities held as reserve assets. In 2003, for example, 55% of the securities held as reserve assets or in international organisations' investment portfolios were issued by US residents, while only 28% were issued by euro area residents even though, compared with 1997, assets issued by US residents have declined at the expense of assets issued by euro area residents (which is in line with the development in the currency composition of reserve portfolios). The split between short and long-term debt in US assets was 30%/70%, while in euro area assets 80% were accounted for by long-term debt and the remaining 20% by short-term debt.<sup>45</sup> While it can be presumed that official holdings of foreign reserve assets denominated in euro, which amount to approximately USD 740 billion, are to a large extent held in German and French long-term securities, no conclusions can be drawn as regards the geographical breakdown of the central banks and institutional organisations holding such euro area foreign reserve assets.

Although this brief analysis is far from exhaustive, it should be noted that no other reliable data source was found that would show a decomposition of major holders of Italian,

<sup>45</sup> In the euro area, more specifically, the majority of assets (over 78%) held by official institutions are assets issued by Germany and France.

German and French government debt. None of the countries analysed publishes a breakdown of non-resident official and non-resident private holders of sovereign debt, and hence it is difficult to draw conclusions as clear as those in the analysis provided for the US Treasury debt market. In brief, however, it can be concluded that, compared with the US Treasury market, only a minor share of euro area government debt securities are held as reserve assets, with the large bulk held by euro area resident investors (e.g. insurance companies, mutual funds and other financial institutions).

## 5 MARKET IMPLICATIONS OF EXCESSIVE FOREIGN RESERVE ACCUMULATION IN TERMS OF POSSIBLE DISTORTIONS OF CURRENT BOND MARKET DYNAMICS

Overall, this contribution has shown that there is evidence that foreign reserve portfolios are still managed under much stricter constraints than private portfolios; investment decisions regarding foreign reserves are also less price-sensitive than those made by private portfolio managers. Therefore, the two types of portfolio are not completely interchangeable, which might explain their different market impacts. An additional set of arguments supporting the view that central banks' foreign reserve investment might have a market impact lies in the behaviour of investment banks reacting to the actions of central banks themselves. First, in line with experience and the order flow approach (which shows that such flows can sometimes have a greater impact than economic fundamentals), there is every reason to believe that market makers profit from their information regarding the action of central banks and, in particular, their US Treasury purchases. In this context, they have a bias towards trading on the expensive side of the market. Second, market participants often perceive changes in central bank foreign reserve strategy as partly policy-related and, therefore, containing specific information (also because reserve management often lacks transparency); this can trigger specific market moves or magnify market volatility.

Any market impact is also likely to depend on the context in which it takes place. In recent years large purchases of US Treasuries by Asian central banks have coincided with increasing demand from pension funds and life insurance companies. In addition, both the US monetary and fiscal policy stances have significantly changed and impacted markets during that period with, in particular, the decrease in US Treasury supply given the budget surpluses around the turn of the century and the deflation fears of 2002-03. Therefore, it is difficult to disentangle all the various factors which have contributed to low interest rates.

## ANNEX 6 THE IMPACT OF ASIAN RESERVE ACCUMULATION ON ASSET PRICES<sup>46</sup>

### I BACKGROUND

Long-term interest rates in the United States have remained low or even decreased in recent years, defying expectations of significantly higher rates associated with robust nominal GDP growth, increasing public deficits and, perhaps more surprisingly, the gradual but persistent tightening in official interest rates which began in June 2004. The persistently low levels of yields and the atypical behaviour depicted by the increasing path of short-term rates versus stable or decreasing long-term rates have been given names such as the bond puzzle or the interest rate conundrum<sup>47</sup>. The possibility of an interest rate misalignment, which could add to mounting disequilibria and ultimately lead to a disorderly correction of imbalances, has raised concerns.

However, despite the extensive literature developed to explain this puzzle, the question

<sup>46</sup> This contribution has been prepared by Teresa Balcao Reis (Banco de Portugal) and Emiliano González Mota (Banco de España), with input from Lucia Cuadro-Sáez and Sergio Gavilá (Banco de España).

<sup>47</sup> The expression *conundrum* refers to long-term yields and was introduced in Chairman Alan Greenspan's semi-annual Monetary Policy Report to the Congress before the Committee on Banking, Housing, and Urban Affairs (US Senate).



remains controversial of whether the persistence of yields below currently assessed fair value has been due to a change in the economic and financial fundamentals underpinning bond prices or to special factors which may be impeding the correct functioning of financial markets. This contribution aims to assess the extent to which interest rates are below expected equilibrium values because of the “captive demand” for US Treasuries arising from foreign exchange interventions by Asian central banks.

## 2 THE ROLE OF CHANGES IN THE RELATIVE SUPPLY OF TREASURIES ON YIELDS: A REVIEW OF AVAILABLE EVIDENCE

### “HIGH FREQUENCY” DATA

Under the assumptions of frictionless financial markets and perfect substitution among asset classes, changes in the relative supply of securities do not affect their relative returns. Returns would be determined by the joint action of “fundamentals” and arbitrage operations which would guarantee that no misalignment among asset returns occurs. The majority view among financial economists is in line with the behaviour described by the frictionless model. Accordingly, pricing of assets in the US financial markets should not be affected by changes in their relative supply. For the purposes of this contribution, if these assumptions were to hold, even large reductions in the net supply of Treasuries (because of strong demand from Asian central banks) should not have an impact on interest rates.

However, some studies<sup>48</sup> support the hypothesis of imperfect substitution among asset classes so that changes in the relative supply of assets have an impact on returns. Indeed, Bernanke, Reinhart and Sack (2004) present some evidence supporting the view that financial assets are not perfect substitutes and that changes in the relative supplies of securities do matter for their relative returns. They present an event study in which three episodes<sup>49</sup> leading to changes in the expected

relative supply of Treasury securities affected long-term yields. The second episode, i.e. the massive foreign official purchases of US Treasury securities by the Bank of Japan, is intimately related to the aim of this contribution. Bernanke et al. (2004) show, using daily data, that Japanese interventions from 3 January 2000 to 3 March 2004 had an impact on two, five and ten-year Treasury yields on dates around the Japanese interventions. These results clearly support a role for changes in the relative asset supply of assets in the determination of yields. Moreover, it is interesting to note that these results hold even if all days with major US data releases are excluded from the sample. Thus, a common econometric difficulty in this kind of exercises, i.e. a possible joint endogeneity of variables, is to a great extent circumvented in their estimations. However, this study considers only the very short-term impact of Japanese interventions on yields, i.e. the impact on the days surrounding the interventions (from t-2 to t+2). An immediate question related to their exercise is what effect remains, if any, after this very short period is over.

### “LOW FREQUENCY” DATA

Alternative studies have examined the extent to which Asian reserve accumulation plays a role in explaining the low levels of the changes in long-term interest rates in the United States with a longer perspective. Unfortunately, available evidence linking foreign official purchases of Treasuries and US yields is rather inconclusive. The estimates of the impact differ substantially and are subject in most cases to econometric caveats. The range of the results is quite ample, from negligible effects to sizable effects as big as 200 basis points.

48 See Roley (1982), Friedmann and Kuttner (1998).

49 These episodes are 1) the announcement of debt buybacks that followed the emergence of budget surpluses in the United States in the late 1990s; 2) the massive foreign official purchases of US Treasury securities by the Bank of Japan; and 3) the apparent expectations among market participants in 2003 that the Federal Reserve was likely to embark on targeted bond purchases.



The methodology used by those who support their assessments with time series analysis consists of regressing either changes in US bond yields or the discrepancy between current rates and estimated equilibrium rates, on measures of intervention or foreign official Treasury purchases. The list of studies is quite extensive and the most relevant ones are summarised in Table 6 of the main part of the Task Force's report at the beginning of this paper.

### 3 A MODEL TO EXPLAIN THE IMPACT OF ASIAN RESERVE ACCUMULATION ON TEN-YEAR TREASURY YIELDS

The model presented hereafter builds on previous works and presents a reduced form of the so-called fundamental bond yield model, which will be used to regress the discrepancy between the model results and current yields on Asian official net purchases of Treasuries.<sup>50</sup>

In the long-term relationship, US ten-year interest rates are explained as a function of monetary policy stance, inflation expectations and fiscal deficits. Thus, bond yields depend on a set of current fundamentals and a measure of likely changes in the relative supply of Treasuries. Moreover, the base relationship implicitly admits the principle of imperfect substitution among financial assets. Otherwise, changes in the relative supply of Treasuries arising from public deficits or from captive purchases of Treasuries from Asian central banks would have no effects on yields. Afterwards, the behaviour of the short-term relationship is obtained by using an error correction model.

The model differs from others because it explicitly incorporates the role of inflation expectations in the determination of long-term interest rates, whereas other models use the three-month interest rate compound in a single variable, the actual monetary stance and expectations for GDP growth and inflation. As a consequence, the introduction of the variable "fiscal balance" in this model is aimed at

exclusively grasping changes in the relative supply of Treasuries and, in principle, does not convey any additional information on the expected future path of interest rates. Therefore, the role of the fiscal variable is similar to that of official foreign purchases of Treasuries, i.e. changes in the relative supply of Treasuries and bonds. Fiscal balances are used as a percentage of GDP. In particular, the estimated long-term relationship will be checked to see if it holds or not for the period in which the strong accumulation of reserves has taken place (from 1999 onwards). Last but not least, the estimation technique used is Generalised Least Squares in order to correct the autocorrelation in the residuals that would be obtained if Ordinary Least Squares were applied.

*The long-run equation<sup>51</sup> in our model is given by:*

$$\begin{aligned} \text{US 10yr yield} = & a_0 + a_1 \text{ monetary stance} \\ & + a_2 \text{ inflation expectations} \\ & + a_3 \text{ US public balance} + \text{a residual} \end{aligned}$$

The results are shown in Table 1.

In a second step, several measures were included to gauge the impact of Asian reserve accumulation on long term interest rates. The variables considered are Japanese net purchases of Treasuries, aggregate Japanese plus Chinese plus Malaysian net purchases of Treasuries, and total Foreign Official net purchases.<sup>52</sup>

None of the *long-run equations* show any statistically significant impact of any of the

<sup>50</sup> See Iankova, Lefeuvre and Teiletche (2004), Artus (2005), Moëc and Frey (2005) and Deutsche Bank (2005). Of these works, the approach presented by Moëc and Frey seems particularly appealing.

<sup>51</sup> The Fed funds rate is used as a measure for the actual stance of monetary policy and the consumer expenditure index (core) as a measure of inflation expectations. Public balances are measured as a percentage of GDP. The baseline time span considered is from 1994 onwards, though wider horizons (the widest begins in 1990) were also considered and obtained similar results.

<sup>52</sup> The data are provided by the Treasury International Capital System (TICS).

Table 1 Regressions for 1994-2004

(dependent variable: US ten year Treasury bond yield)

Period: 1994Q1-2004Q4 Variable	Baseline		Japan		Asia		Fgn. official inst.	
	Long run	Short run	Long run	Short run	Long run	Short run	Long run	Short run
USBBs	-0.140 <sup>3)</sup>		-0.139 <sup>3)</sup>		-0.135 <sup>2)</sup>		-0.140 <sup>3)</sup>	
FEDFUNDS	0.516 <sup>3)</sup>		0.515 <sup>3)</sup>		0.507 <sup>3)</sup>		0.502 <sup>3)</sup>	
PCE_core	0.764 <sup>3)</sup>		0.764 <sup>3)</sup>		0.775 <sup>3)</sup>		0.743 <sup>3)</sup>	
LD.BOND10Y		0.256		0.305		0.272		0.280
D.USBBs		0.044		0.112		0.096		0.043
D.FEDFUNDS		0.680 <sup>3)</sup>		0.669 <sup>3)</sup>		0.662 <sup>3)</sup>		0.584 <sup>3)</sup>
D.PCE_core		0.077		0.104		0.211		0.025
L.residual		-0.919 <sup>3)</sup>		-0.956 <sup>3)</sup>		-0.953 <sup>3)</sup>		-0.854 <sup>3)</sup>
NP			-0.006		-0.036		-0.112	
D.NP				-0.195 <sup>1)</sup>		-0.163 <sup>1)</sup>		-1.196 <sup>3)</sup>
CONSTANT	1.888 <sup>3)</sup>	0.000	1.896 <sup>3)</sup>	-0.005	1.932 <sup>3)</sup>	0.001	2.015 <sup>4)</sup>	0.003
OBS.	44	44	44	44	44	44	44	44
R-SQUARE	0.718	0.426	0.717	0.477	0.715	0.467	0.710	0.437
ADJ. R-SQUARE	0.697	0.351	0.688	0.393	0.686	0.380	0.680	0.345
DURBIN-WATSON	1.607	1.726	1.604	1.645	1.597	1.685	1.582	1.765
SCHWARZ I.C.	51.922	48.217	55.704	49.421	55.643	49.742	55.272	50.640

Source: Calculations provided by Banco de España.

Notes: USBB stands for public budget balance, FEDFUNDS stands for the quarterly average of Fed funds, PCE core stands for the core component of the expenditure consumer price index, LD BOND10Y stands for the first lag in the ten-year interest rate, D. stands for differences, and NP stands for net purchases of US Treasuries according to TICs data.

1) p&lt;.15

2) p&lt;.10

3) p&lt;.05

measures of the Asian reserve accumulation on US yields. In other words, Asian purchases of Treasuries do not add any additional information to explain interest rate levels to that contained in the sum of monetary stance, inflation expectations and public deficits in the extended time-horizon considered.

Afterwards we used the error correction model technique to estimate a *short-run relationship*. The results support the view that Foreign Official net purchases of Treasuries help to explain the changes of US ten-year yields at a 95% confidence level and that Asian purchases, mainly because of Japanese purchases, are statistically significant at an 85% confidence level.

According to the coefficients obtained for the extended period 1994-2004, current long-term government yields are around 80 to 85 basis points below that suggested by fair value estimates. Equilibrium long-term interest rates in the United States would be in the range of

5.15% to 5.25%. However, Asian official purchases of Treasuries obtained from TICS data are not responsible for this misalignment although, according to the short-term relationship estimated, they help to explain changes in yields.

The exercise is repeated for a shorter time span (1999-2004) just after the Asian crisis when, among other things, the strong pace of accumulation of foreign reserves by Asian countries took place. The results are shown in Table 2.

Since 1999, the estimation of the model has shown a structural change in the determination of long-term interest rates in the United States. The public deficit and the consumer price index variables are not statistically significant, whereas other factors, apart from official interest rates, have become more important because the coefficient estimated for the constant term of the equation is higher and statistically significant at a 95% confidence

**Table 2 Regressions for 1999-2004**

(dependent variable: US ten year Treasury bond yield)

Period: 1999Q1-2004Q4 Variable	Baseline		Japan		Asia		Fgn. official inst.	
	Long run	Short run	Long run	Short run	Long run	Short run	Long run	Short run
USBBs	0.046		0.075		0.081		0.043	
FEDFUNDS	0.276 <sup>3)</sup>		0.206 <sup>1)</sup>		0.180		0.251 <sup>3)</sup>	
PCE_core	0.369		0.264		0.360		0.265	
LD.BOND10Y		0.395 <sup>1)</sup>		0.297		0.251		0.453 <sup>2)</sup>
D.USBBs		-0.056		0.128		0.139		-0.026
D.FEDFUNDS		0.332 <sup>2)</sup>		0.252		0.263 <sup>2)</sup>		0.256 <sup>1)</sup>
D.PCE_core		0.321		0.265		0.549 <sup>1)</sup>		0.244
L.residual		-0.767 <sup>3)</sup>		-0.771 <sup>3)</sup>		-0.788 <sup>3)</sup>		-0.697 <sup>3)</sup>
NP			-0.230		-0.254		-0.170	
D.NP				-0.441 <sup>3)</sup>		-0.432 <sup>3)</sup>		-0.307 <sup>1)</sup>
CONSTANT	3.510 <sup>3)</sup>	0.021	4.018 <sup>3)</sup>	0.046	4.000 <sup>3)</sup>	0.053	3.790 <sup>3)</sup>	0.029
OBS.	24	24	24	24	24	24	24	24
R-SQUARE	0.761	0.459	0.761	0.534	0.765	0.526	0.758	0.483
ADJ. R-SQUARE	0.726	0.309	0.711	0.369	0.716	0.359	0.707	0.300
DURBIN-WATSON	1.661	2.012	1.450	1.819	1.507	1.869	1.599	2.027
SCHWARZ I.C.	24.119	26.241	25.664	24.445	25.069	24.331	26.652	28.314

Source: Calculations provided by Banco de España.

1) p<.15.

2) p<.10.

3) p<.05.

level. This result, with all due caveats, suggests that a structural change (whose underlying factors are not identified) in the relationship between Treasury yields, public deficits and the consumer price index – a measure of inflation – has taken place. The results are robust when the time horizon is shortened further (from 2000 onwards) and the residuals show no autocorrelation. In a second step, when different measures of Asian Treasury purchases were added again, the estimates obtained did not support the view that Asian purchases of Treasuries were responsible for this structural change in the long-term relationship.

When using the error correction model technique to estimate the short-run relationship, the results strongly suggest that Asian purchases of Treasuries have an impact on changes in long-term Treasury yields, mainly because of changes in Japanese Treasury purchases. Compared with the previous results, Asian purchases become more important in explaining changes in yields, at a 95% confidence level, whereas the

significance of the aggregate of foreign official net purchases of Treasuries is lower than in the extended time horizon.

According to the newly estimated coefficients confined to the 1999-2004 period, US ten-year yields in the first quarter of 2005 were in the range of 40 to 50 basis points below that predicted by the model. However, the estimates do not support the view that this relatively modest downward bias in the levels is explained by purchases of Treasuries by Asian monetary authorities (alone). They become highly significant in explaining the short-term dynamics but not the levels.

#### 4 A MODEL TO EXPLAIN THE IMPACT OF ASIAN RESERVE ACCUMULATION ON THREE-YEAR TREASURY YIELDS

To better grasp the impact of Asian reserve accumulation on US Treasury yields, the model is rerun by substituting the three-year yield for the ten-year yield in both the extended time horizon (from 1994 onwards) and the shorter time span (from 1999 onwards). To the extent

Table 3 Regressions for 1994-2004

(dependent variable: US ten year Treasury bond yield)

Period: 1994Q1-2004Q4 Variable	Baseline		Japan		Asia		Fgn. official inst.	
	Long run	Short run	Long run	Short run	Long run	Short run	Long run	Short run
USBBs	-0.082		-0.075		-0.071		-0.089	
FEDFUNDS	0.810 <sup>3)</sup>		0.790 <sup>3)</sup>		0.777 <sup>3)</sup>		0.798 <sup>3)</sup>	
PCE_core	0.635 <sup>3)</sup>		0.637 <sup>3)</sup>		0.674 <sup>3)</sup>		0.610 <sup>3)</sup>	
LD.BOND3Y		0.168		0.216		0.175		0.195
D.USBBs		0.046		0.128		0.125		0.038
D.FEDFUNDS		1.081 <sup>3)</sup>		1.034 <sup>3)</sup>		1.016 <sup>3)</sup>		0.970 <sup>3)</sup>
D.PCE_core		0.061		0.030		0.189		0.001
L.residual		-1.048 <sup>3)</sup>		-1.037 <sup>3)</sup>		-1.016 <sup>3)</sup>		-0.985 <sup>3)</sup>
NP			-0.123		-0.143		-0.147	
D.NP				-0.269 <sup>3)</sup>		-0.263 <sup>3)</sup>		-0.230 <sup>3)</sup>
CONSTANT	0.268	-0.007	0.389	-0.010	0.410	-0.005	0.384	-0.003
OBS.	44	44	44	44	44	44	44	44
R-SQUARE	0.826	0.561	0.818	0.596	0.816	0.596	0.816	0.565
ADJ. R-SQUARE	0.812	0.504	0.799	0.531	0.797	0.530	0.797	0.495
DURBIN-WATSON	1.715	1.722	1.678	1.629	1.678	1.669	1.688	1.748
SCHWARZ I.C.	53.364	52.406	56.703	53.343	56.274	52.847	56.455	55.201

Source: Calculations provided by Banco de España.

1) p&lt;.15.

2) p&lt;.10.

3) p&lt;.05.

to which central bank portfolios are thought to be biased towards short-term maturities, the impact of a change in the relative supply of Treasuries (because of a captive demand from

foreign central banks) is likely to be more important in this part of the yield curve than for long-term bonds. The results are shown in Tables 3 and 4.

Table 4 Regressions for 1999-2004

(dependent variable: US ten year Treasury bond yield)

Period: 1999Q1-2004Q4 Variable	Baseline		Japan		Asia		Fgn. official inst.	
	Long run	Short run	Long run	Short run	Long run	Short run	Long run	Short run
USBBs	0.044		0.096		0.103		0.044	
FEDFUNDS	0.644 <sup>3)</sup>		0.526 <sup>3)</sup>		0.492 <sup>3)</sup>		0.623 <sup>3)</sup>	
PCE_core	0.355		0.255		0.422		0.286	
LD.BOND3Y		-0.021		0.194		0.110		0.029
D.USBBs		0.036		0.163 <sup>1)</sup>		0.184 <sup>2)</sup>		0.030
D.FEDFUNDS		0.819 <sup>3)</sup>		0.621 <sup>3)</sup>		0.660 <sup>3)</sup>		0.749 <sup>3)</sup>
D.PCE_core		0.150		0.138		0.541		0.101
L.residual		-0.830 <sup>1)</sup>		-0.799 <sup>2)</sup>		-0.828 <sup>2)</sup>		-0.806 <sup>1)</sup>
NP			-0.361 <sup>2)</sup>		-0.373 <sup>2)</sup>		-0.126	
D.NP				-0.538 <sup>3)</sup>		-0.533 <sup>3)</sup>		-0.185
CONSTANT	1.406	0.019	2.148 <sup>2)</sup>	0.050	2.058 <sup>2)</sup>	0.051	1.617 <sup>2)</sup>	0.020
OBS.	24	24	24	24	24	24	24	24
R-SQUARE	0.877	0.522	0.860	0.651	0.858	0.644	0.871	0.524
ADJ. R-SQUARE	0.859	0.389	0.831	0.527	0.828	0.519	0.843	0.357
DURBIN-WATSON	1.704	1.861	1.378	1.742	1.490	1.885	1.682	1.918
SCHWARZ I.C.	28.909	32.228	28.713	28.200	28.231	28.278	31.811	35.189

Source: Calculations provided by Banco de España.

1) p&lt;.15.

2) p&lt;.10.

3) p&lt;.05.

Nor surprisingly, the influence of the Fed funds on Treasury yields now becomes greater than it was in the ten-year yield estimation, at the expense of the role of the public deficit variable. With regard to foreign official purchases, they do not play a role in explaining three-year US Treasury interest rate levels in the extended horizon model, but become highly significant (at 95% confidence) in the short-term equation, which means that they do help to explain the dynamics of interest rate changes.

What it is particularly relevant for the aim of the study is that, for the latter period, estimates are highly supportive of Asian purchases (mainly because of Japanese purchases) having an impact on the short-end of the Treasury yield curve in terms of both levels and changes in levels. Net official purchases by Japan, for example, become statistically significant in explaining the low levels of three-year Treasury yields. Furthermore, changes in net purchases are also statistically significant in explaining changes in yields. Indeed, when combining the results, evidence can be found that Japanese purchases have played a role in explaining the low levels and dynamics of Treasury yields.

The short-term model shows no autocorrelation of the residuals which support the statistical significance of the coefficient estimated. Neither is there evidence of autocorrelation of the residuals in the long-term model, although admittedly the Durbin-Watson in the latter is inconclusive.<sup>53</sup> According to the estimates, Japanese purchases of US Treasuries, at the time of the greatest net purchases, might have had an impact of 65 basis points on three-year US Treasury yields. The fact that no impact was found in the ten-year maturity is consistent with the principle of imperfect substitution among US Treasuries of different maturities along the yield curve.

## 5 IMPACT ON OTHER ASSET PRICES

This section tries to assess whether the demand for US securities by Asian central banks had

any relevant implication on asset prices other than US Treasuries.<sup>54</sup> The analysis focuses mainly on US corporate and US agency debt and very briefly touches on the equity segment. Asian central bank purchases of US securities can have an impact on these asset prices via two channels: i) the direct consequences of Asian central bank purchases of agencies, corporate bonds and equity in the relative supply in these segments, and ii) the indirect effects of Asian central bank purchases of US Treasuries in the agency, corporate and equity markets.<sup>55</sup> The first consequences stem from the effects the demand for US agency and corporate debt and equity by Asian central banks can have on the level and dynamics of the prices of these assets in their own markets. Regarding US corporate and agency debt, and equity, the possible direct impact of the captive demand arising from Asian central banks purchases does not seem to be very clear. The amount of agency and corporate bonds and equity bought by official foreigners is still small, both in absolute terms and when looking at their share in their respective markets. Adding to the direct impact, there can be second-round effects. The indirect consequences would reflect the role US Treasury debt plays in other asset markets. On the one hand, agency and corporate debt markets have developments in the Treasury market as a benchmark and their respective

53 The results are in line with those obtained by Kasman and Malik (2004), even if the data source used to account for Asian reserve accumulation (TIC data) is different to theirs (Fed holdings data).

54 Besides the asset prices reviewed, the fact that, in the equity market, foreign official purchases have a very small weight in total foreign purchases (2% on average since January 1994) should also be taken into account. According to holdings data, foreign investors have only 9% of US equity and official institutions represent 7% of this (so they represent only 0.6% of the US equity market). Furthermore, the assumption made earlier that total official purchases are a good proxy for Asian central bank purchases no longer holds in the equity segment, where the share of Asian institutions in purchases and holdings of US equity is very limited.

55 As no data on official foreign purchases by type of asset with a country (or regional) breakdown are available, purchases by all official institutions were used, as a proxy to Asian central bank purchases. The error induced by including official investors from other areas should not be significant, as monetary authorities from areas other than Asia have a tiny share of official purchases and holdings of US securities.

yields are highly positively correlated. On the other hand, if we assume that the different markets are not segmented, an increase in purchases of treasuries may, in theory, divert investment from other markets.

### CORPORATE DEBT

In the corporate segment, foreign official purchases make up only a small proportion of total foreign purchases<sup>56</sup> (2% on average since January 1994). In terms of holdings, official institutions hold only 2% of total foreign holdings of corporate bonds; furthermore, foreign-owned corporate debt represents 16% of US corporate bonds outstanding.<sup>57</sup> Thus, the potential direct impact of foreign official purchases of corporate bonds on prices is rather small. Official investors' behaviour is usually closely monitored by market participants as the former are often viewed as "special" agents that have unusual utility functions and can produce specific impacts on markets. In order to assess if the behaviour of official investors can, in fact, be differentiated, one can try to identify some drivers of official and non-official corporate purchases by computing correlation coefficients.<sup>58</sup> Two different periods were considered: since 1994 and since 1999. Actual evidence of the existence of different factors playing a major role in the dynamics of these two variables is limited. In particular since 1999, correlation coefficients between the US dollar, corporate yields, corporate spreads and risk appetite, and official and non-official corporate purchases by foreigners are very similar.<sup>59</sup> Comparable calculations were made using shorter maturities (two and three years) for corporate and Treasury yields and the conclusions are very similar. Another approach to test whether official purchases have a relevant role in explaining corporate debt price developments is by running a regression. By running simple regressions, based mainly on market data, little evidence could be found that "official corporate purchases" are statistically significant.<sup>60</sup> The very small share of total corporate debt demand held by foreign official purchases may explain this result.<sup>61</sup> Another

hypothetical impact is the effect of the low interest rate environment on the soundness of US companies. The generalised improvement in the balance sheets of many US companies has almost certainly had a positive impact on corporate spreads. This is, however, more difficult to model and goes beyond the scope of this note.

### AGENCY DEBT

Regarding the agency segment, official foreign purchases do seem to hold a greater share of foreign activity than in the corporate market.<sup>62</sup> According to TIC data, official purchases represent, on average, 12% of all foreign purchases since January 2003 and 15% since January 1994. However, their weight in the agency market is still small. According to Treasury holdings data, in June 2003 official holdings were 31% of total foreign holdings and foreign-owned US government agency bonds represented around 11% of outstanding debt (so they represent 3.5% of outstanding US government agency bonds).

56 Data on flows are from the US Treasury's International Capital System (TICS).

57 As of June 2003, US Treasury Annual Survey of Foreign Holdings of US Securities, June 2004.

58 Correlation coefficients between official and non-official corporate purchases and an effective exchange rate index of the US dollar, ten-year corporate yields, spreads between ten-year corporate yields and Treasury yields, and a proxy for investors risk appetite (the Global Risk Appetite Index as computed by CSFB) were computed.

59 Correlation coefficients must be carefully interpreted and used prudently as financial data usually do not fully comply with normality conditions (see Lehman Brothers, 2005).

60 Interestingly, there is some evidence that "official Treasury purchases" might have some influence on corporate spreads (this could be justified by the indirect impact of the alternative investments argument).

61 It should be highlighted that the simple models run, based mainly on market data, tend to give poor results and are not statistically very robust.

62 To monitor this segment there are two main data sources: US Treasury TIC data and Custody Holdings at the Federal Reserve Bank of New York. Comparing changes in the amount of agency bonds held in custody and purchases by official foreign institutions (TIC data), the two sources show great differences both in terms of amounts and trends. Even when smoothing for yearly data, different trends can be identified. According to UBS (2005), the Fed data are "considered to be more reliable at identifying trends among official accounts". However, custody data have only been available since 2000, limiting their use for a comparative analysis between the period since 1994 and the period after the increasing reserve accumulation process took place.



First, several correlation coefficients were computed between official and non-official purchases, and an effective exchange rate index of the US dollar, ten-year agency yields, ten-year agency spreads and a proxy for investors' risk appetite<sup>63</sup>, trying to identify whether official and non-official foreign investors exhibit different behaviour.

Correlation coefficients computed with data since 1994 do not point to different behaviour from the two kinds of investors. Correlations with data from 2000 are not so uniform. Regarding agency yields and agency spreads, it is interesting to highlight that, although data from the TIC could lead to the conclusion that there is different behaviour, if we use the custody data as a proxy to official institutions, the correlation coefficients became negative (as with TIC non-official purchases).<sup>64</sup> All in all, there is only limited actual evidence of differentiated behaviour on the part of official and non-official investors.

In a second step several regressions were run, relating agency spreads with risk appetite, growth indicators, and demand and supply on agency and Treasury markets. These simple regressions based on market data did not entail the use of advanced econometric methods. The resulting evidence is not enough to support the view that official purchases of agencies are statistically significant in explaining agency spread behaviour (using both long and short-term yields).<sup>65</sup> Developments seen recently in the agency market, with several accounting problems arising in the main government-sponsored enterprises, may also have introduced some instability into the dynamics of this segment.

## ANNEX 7

### THE FINANCING OF THE US CURRENT ACCOUNT DEFICIT: A SHORT REVIEW OF THE LITERATURE AND SOME EVIDENCE<sup>66</sup>

#### I BACKGROUND

“The counterpart to current account surpluses in Asia and the purchases of foreign exchange assets denominated in US dollars has been large US current account deficits. Persistent deficits are reflected in a negative US international investment position, implying the United States has become a net debtor country. While these imbalances should in principle reflect the use of financial markets to allocate world savings towards the most profitable investment opportunities, it is likely that there is a limit to the amount of debt that a given country can issue before international investors begin to worry about its willingness to repay the debt. If the country in question is the United States, which issues the international reserve currency, then the rapid accumulation of assets denominated in the reserve currency might result in nominal exchange rate swings that would be much larger than those needed for an orderly rebalancing of asset positions. This could have negative implications for international financial stability.” (King 2005). The quotation shows how the growing US current account deficit has become a source of concern for policy-makers, and raises the question about what could happen if international investors were to reduce their purchases of assets denominated in US dollars.

This annex is organized as follows. In Section 2 a few selected contributions on the sustainability of the US current account deficit are reviewed, while section 3 contains a

63 Global Risk Appetite Index computed by Credit Suisse First Boston.

64 The conclusions are very similar if shorter maturities (two and three years) are used for agency and Treasury yields.

65 These conclusions should be used carefully as the simple models run tend to give poor results and are not statistically very robust.

66 By F. Comelli (European Central Bank) and M. Ghirga (Banca d'Italia).

descriptive analysis of the data on the financing of the US current account deficit.

## 2 REVIEW OF THE LITERATURE, AND LINKS WITH CURRENT POLICY ISSUES

Blanchard, Giavazzi and Sa (2005) have developed a partial equilibrium portfolio model of exchange rate and current account determination. They assume imperfect substitutability both between US and foreign goods and between US and foreign assets, which allows the presence of goods and portfolio shifts. In their model, the dollar is predicted to depreciate further in the absence of any unexpected events. This is because further shifts in investors' preferences towards dollar assets would provide only temporary relief for the currency, as higher demand for US assets would lead to an initial dollar appreciation, but the consequent deteriorating competitiveness of the United States would widen the current account deficit and increase the accumulation of foreign debt. Thus, the authors consider that the argument according to which the United States – thanks to the attractiveness of its assets – can keep running large current account deficits with no effect on the dollar appears to overlook the long-term consequences of a large accumulation of external liabilities. Similarly, an increase in US interest rates would temporarily strengthen the dollar, but eventually the depreciation needed to restore equilibrium in the current account would be even larger, both because the accumulation of foreign liabilities would accelerate and because eventually the United States would need to finance a larger flow of interest payments abroad as both interest rates and debt would be higher. The policy conclusion is that fiscal consolidation is needed in order to induce lower interest rates in the United States. This would allow the potentially higher interest rates required by foreigners to invest in the United States to be offset in the presence of dollar depreciation. In other words, fiscal tightening is needed to reduce the current account deficit, but it is not a substitute for dollar depreciation – both are needed. This

policy recommendation is very similar to that formulated by the IMF (2005a). In the April 2005 issue of the World Economic Outlook, the IMF suggests that a reduction in global imbalances will require domestic demand to grow more slowly than GDP in the United States, and to grow faster than GDP in surplus countries. This will likely need to be accompanied by a further depreciation of the dollar over the medium term, a tightening of US fiscal policy, and appreciation in a number of emerging Asia economies.

Gourinchas and Rey (2004) highlight the importance of valuation effects through exchange rate changes in improving the net external assets position of the United States. They find that, historically, an average of 31% of the international adjustment of the United States is realised through valuation effects, while 56% is realised through movements in future net exports. Therefore, valuation effects can be relevant for the external adjustment process. By absorbing about 31% of the external imbalances, valuation effects substantially relax the external budget constraint of the United States. At short to medium horizons, most of the adjustment goes through asset returns, while at longer horizons it occurs via the trade balance. It follows that the dynamics of the exchange rate play a major role in the model since it has the dual role of changing the differential in rates of return between assets and liabilities denominated in different currencies and also of affecting future net exports. The main policy implication of the paper is that, as financial globalisation increases, the United States could be able to run larger and more substantial external imbalances, provided foreign investors are willing to accumulate further holdings of depreciating dollar-denominated liabilities.

By contrast, Lane and Milesi-Ferretti (2004) argue that it is problematic to rely only on valuation effects to address adjustment problems. Even for those countries for which a one-off surprise devaluation may indeed generate a positive valuation effect that

improves the net foreign asset position, such a move would involve a reputation cost: foreign investors in the future would require a larger premium in order to compensate for the risk of subsequent devaluations. The classic time-consistency problem arises, and the standard policy recommendation is that policy-makers should take steps to commit to not using the devaluation option as a form of capital levy. While the severity of this problem is one of the underlying factors behind the prevalence of liability dollarisation and short-maturity debt among the emerging market economies, it may also be relevant for debtor industrial economies.

Obstfeld and Rogoff (2004) argue that the widening of the US current account deficit may potentially trigger a sharp depreciation of the dollar. Unlike Gourinchas and Rey (2005), the authors focus their discussion not on the consequences of growing international capital market integration, but on the relative price movements needed to preserve goods-market equilibrium during the current account adjustment. The authors find that, in a general equilibrium framework, a rebalancing of the US current account deficit may involve a trade-weighted dollar depreciation of at least 20% in the baseline scenario, while in a more extreme scenario the trade-weighted depreciation could amount to 40%. The policy implication is that the US current account adjustment would be achieved through the trade channel and not through valuation effects. The growing integration of world capital markets may at most delay the US current account adjustment, but it is likely that a sharp closing of the current account will eventually lead to large exchange rate adjustments.

DeBelle and Galati (2005) examine episodes of current account adjustments in industrial countries over the last 30 years. They found that adjustments were generally associated with large declines in domestic growth and exchange rate depreciation. From an ex-post perspective they also found that the bulk of the financial account adjustment is achieved

through a change in private sector capital flows. The US constitutes an important exception. A comparison of the current account reversal experienced by the United States in 1987 with episodes of current account adjustment in other industrial countries shows that the role played by foreign official flows was much more significant in the US adjustment than in other countries. Finally, since the dollar is an international reserve currency, this implies that the US international investment position can benefit from positive valuation effects on net foreign liabilities. Summing up, the analysis of DeBelle and Galati suggests that, in view of a potential current account adjustment in the United States, foreign official capital flows can play an important role in the adjustment process. Finally, according to the Bank for International Settlements (2004b), an empirical analysis of the financial flows associated with current account adjustments since the mid-1970s reveals sizeable swings in a number of categories of capital flows during adjustment episodes. Nonetheless, an analysis of the experience in the United States around 1987 suggests that the pattern of adjustment of the present US external imbalance cannot be predicted with confidence. But changes in the composition of financial flows into the United States might suggest that the private sector is becoming less willing to finance the US current account deficit, and this could imply that an adjustment of the current account deficit might be happening sooner rather than later.

Recently the policy debate has focused on valuation effects on the US international investment position (IIP) and on the possible erosion of home bias in financial markets. Gourinchas and Rey's predictions seem to be in line with the data released by the US Bureau of Economic Analysis (BEA) on the US IIP at the end of 2004. According to the BEA, the US IIP at the end of 2004 was USD 2.54 trillion, up from USD 2.37 trillion at the end of 2003. Valuation gains (USD 415 billion) limited the deterioration of the US IIP by offsetting most of the increase in net capital inflows (USD 590

billion). Specifically, valuation gains were accounted for by asset price changes of around USD 145 billion and by exchange rate effects of around USD 270 billion. Asset price changes reflected relative underperformance of the US stock market compared with major foreign stock markets, which raised the value of US-owned equity holdings abroad more than the value of foreign-owned equity holdings in the United States. Exchange rate effects were due to the nominal depreciation of the US dollar against most foreign currencies. The dollar nominal depreciation raised the dollar value of US-owned assets abroad, which are mainly denominated in foreign currencies (while foreign-owned assets in the United States are denominated in US dollars). Naturally, everything else being equal, a potential nominal appreciation of the US dollar during 2005 would lead to valuation losses for the IIP. According to past internal work, the expected rise in US interest rates and its interaction with increasing stock of foreign-owned US debt would have a significantly negative effect on the US balance on income in the coming years. In a reasonably conservative scenario, the analysis shows that the US balance on income could become negative by 2006 and contribute by 0.4% of GDP to the US current account deficit in 2007.

The issue of home bias has been discussed recently by the IMF (2005b and d).

Specifically, the increase in foreign holdings of US liabilities since 1990 was motivated both by growth of US financial markets and by an erosion of the home bias, so that investors have become increasingly willing to hold more foreign assets relative to domestic assets. However, according to IMF staff calculations, global asset portfolios do not appear to be significantly overweight in US assets, relative to the United States' benchmark share in an internationally diversified portfolio. This implies that the exposure of foreign investors to US assets may still rise and that the US IIP may deteriorate again, possibly offsetting potential positive valuation effects.

### 3 A DESCRIPTIVE ANALYSIS OF US CURRENT ACCOUNT DEFICIT FINANCING

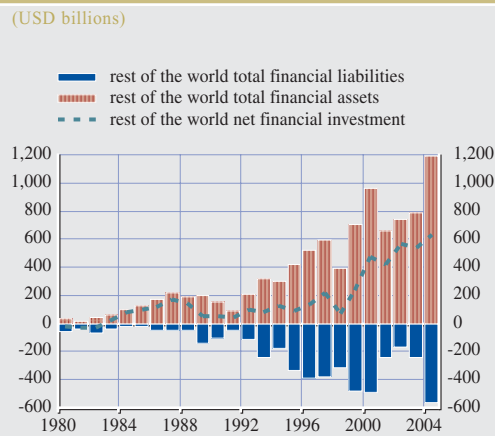
Table 1 shows data from the Flow of Funds Accounts of the United States, compiled by the Board of Governors of the Federal Reserve System. The table shows that the US current account deficit in 2004 was USD 641 billion, equivalent to approximately 5.5% of GDP. The counterpart of the US current account deficit is the deteriorating international investment position of the United States, which at the end of 2004 was equal to USD -630.8 billion. Therefore, in 2004 net capital inflows from foreign investors were USD 630.8 billion, while the remaining USD 11.8 billion accounted for the statistical discrepancy

**Table 1 Flow of Funds Accounts of the United States and the Rest of the World – Federal Reserve System**

(USD billions; March 2005)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Foreign income from the United States	1,137.2	1,217.7	1,352.2	1,430.4	1,586.0	1,875.6	1,725.7	1,764.4	1,886.1	2,217.0
Foreign outlays to the United States	1,046.2	1,117.3	1,242.1	1,243	1,312.1	1,479.0	1,355.3	1,306.8	1,375.3	1,575.7
<b>Total savings</b>	<b>91.0</b>	<b>100.4</b>	<b>110.1</b>	<b>187.4</b>	<b>273.9</b>	<b>396.6</b>	<b>370.4</b>	<b>457.6</b>	<b>510.8</b>	<b>641.3</b>
Net acquisition of financial assets	419.2	521.8	597.3	393.4	708.5	963.0	657.7	741.7	783.0	1,190.1
Net increase in liabilities	333.8	384.8	377.0	318.4	476.8	486.7	242.7	172.7	240.4	559.4
Non-produced financial assets	0.2	-0.1	-0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1
<b>Total investment</b>	<b>85.6</b>	<b>136.9</b>	<b>220.2</b>	<b>75.0</b>	<b>231.7</b>	<b>476.0</b>	<b>415.1</b>	<b>569.0</b>	<b>542.8</b>	<b>630.8</b>
<b>Discrepancy</b>	<b>6.5</b>	<b>-36.0</b>	<b>-109.1</b>	<b>113.1</b>	<b>47.0</b>	<b>-78.9</b>	<b>-43.6</b>	<b>-110.1</b>	<b>-28.8</b>	<b>11.8</b>
<i>Memo:</i>										
<b>US current account deficit</b>	<b>91.0</b>	<b>100.4</b>	<b>110.2</b>	<b>187.4</b>	<b>273.9</b>	<b>396.6</b>	<b>370.4</b>	<b>457.7</b>	<b>510.9</b>	<b>641.3</b>

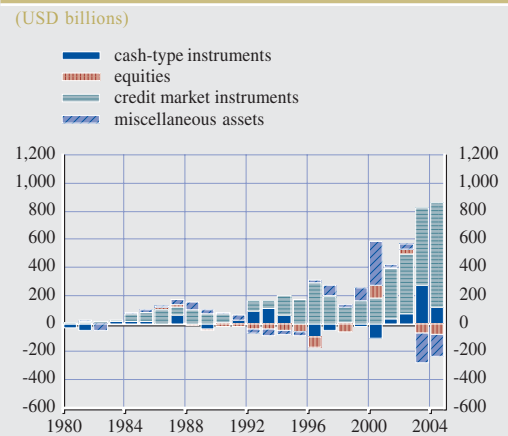
Source: Federal Reserve System.

**Chart 13 Net financial investment by foreigners in the United States**



Source: Federal Reserve System.

**Chart 14 Financial investment by foreigners in the United States: breakdown by asset classes**



Source: Federal Reserve System.

between the current account and financial account balances.<sup>67</sup>

Chart 13 shows the amounts of net financial investment made by foreign investors in the United States from 1995 onwards. The amount of net financial investment by foreigners measures the amount of net private capital inflows that the United States has been receiving from foreign investors and is expressed as the difference between the net acquisition of financial assets by foreign investors and their net liabilities. The United States has been progressively receiving growing net capital inflows from foreign investors. Chart 14 shows that in 2004 foreign investors were net buyers of credit-market instruments, which include open market paper, US Treasury securities, US Government Agency bonds, corporate bonds and loans to US corporate businesses. From 2000 until 2004, credit market instruments appear to have been the preferred asset category of foreign investors. During the same period, foreign investors were also net buyers of cash-type instruments, which include net interbank assets, bank deposits and security repurchase agreements. The data also show that, in net terms, foreign investors were net sellers of US equities in 2003 and 2004. Finally the chart

shows the amount of miscellaneous assets, which include direct investments, bank loans and trade credits.

In terms of the category of investors, most of the US current account deficit financing was provided by foreign private investors. Nevertheless, foreign official investors have been progressively more involved in financing the US current account deficit. Specifically, from 1999 onwards foreign official investors purchased growing amounts of US securities, in particular Treasury and Government agency bonds. In 2004 foreign official investors purchased a total amount of USD 290 billion in government securities, which constitutes a substantial increase compared with their 2003 purchases of USD 194.6 billion.

<sup>67</sup> These data are broadly consistent with the balance of payments data produced by the US Department of Commerce.

## REFERENCES

- Aizenman, J. and N. Marion (2003), “The High demand for International Reserves in the Far East: What is Going on?”, *Journal of the Japanese and International Economies*, 2003, 17/3, pp. 370-400.
- Artus, P. (2005), “Quel est l’effect des interventions de change sur les taux d’intérêt à long terme des Etats-Unis ?”, *CDC Ixis Flash*.
- Bahmani-Oskooee, M. and F. Brown (2002), “Demand for international reserves: A review article”, *Applied Economics* 34:129-1227.
- Bank for International Settlements (2000), “Special feature: hedge funds”, *Quarterly Review*, November 2000, Basel, Switzerland.
- Bank for International Settlements (2003a), “Choosing instruments in managing dollar foreign exchange reserves”, by R. N. McCauley and B. S. C. Fung, *Quarterly Review*, March 2003, Basel, Switzerland.
- Bank for International Settlements (2003b), “Reaching for yield: selected issues for reserve managers”, by E. M. Remolona and M. A. Schrijvers, *Quarterly Review*, September 2003, Basel, Switzerland.
- Bank for International Settlements (2004), 74<sup>th</sup> Annual Report, pp. 99-107, Basel, Switzerland.
- Bank for International Settlements (2005a), “The International Banking Market”, *Quarterly Review: International Banking and Financial Market Developments*, December 2005, Basel, Switzerland.
- Bank for International Settlements (2005b), “Trading Asian currencies”, by C. Ho, G. Ma and R. McCauley, *Quarterly Review*, March 2005, Basel, Switzerland.
- Bank for International Settlements (2005c), “1. Overview: low yields in robust economies”, by F. Packer and P. D. Woolridge, *Quarterly Review*, March 2005, Basel, Switzerland.
- Bernanke, B. S. (2005), “The Global Saving Glut and the U.S. Current Account Deficit”, *Homer Jones Lecture*, St. Louis, Missouri, 14 April 2005.
- Bernanke, B. S., V. Reinhart and P. Sack (2004), “Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment”, *Brookings Papers on Economic Activity*, 2, pp. 1-100.
- Blanchard, O., F. Giavazzi and F. Sa (2005), “The US Current Account and the Dollar”, *NBER Working Paper No 11137*, NBER, Cambridge, Massachusetts, USA.
- Crockett, A. (1978), “Control over international reserves”, *IMF Staff Papers* 25:1-25.
- De Beaufort Wijnholds, J. Onno and A. Kapteyn (2001), “Reserve adequacy in emerging market economies”, *IMF Working Paper WP/01/43*, Washington, D.C.



- Debelle, G. and G. Galati (2005), “Current account adjustment and capital flows”, *BIS Working Paper No 169*, February 2005, Bank for International Settlements, Basel, Switzerland.
- Deutsche Bank (2005), “The Bond Puzzle”, *Global Markets Research*.
- Dooley, M., D. Folkerts-Landau and P. Garber (2003), “An essay on the revived Bretton Woods system”, *NBER Working Paper No 9971*.
- Edwards, S. (2004), “Thirty years of current account imbalances, current account reversals, and sudden stops”, *IMF Staff Papers* 51:1-49.
- Eichengreen, B. (1998), “The Euro as a reserve currency”, *Journal of the Japanese and International Economies*.
- Eichengreen, B. (2004), “Global imbalances and the lessons of Bretton Woods”, *NBER Working Paper No 10497*.
- Eichengreen, B. (2005), “Sterling’s past, dollar future: historical perspectives on reserve currency composition”, *NBER Working Paper No 11336*.
- European Central Bank (2005), “Review of the international role of the euro”.
- Evans, M. and R. Lyons (2002), “Order flow and exchange rate dynamics”, *Journal of Political Economy*, Vol. 110, No 1, 2002.
- Federal Reserve Bank of New York (1998), “Foreign Ownership of U.S. Treasury Securities: What the Data Show and Do Not Show”, *Current Issues in Economics and Finance*, May 1998.
- Federal Reserve Bank of San Francisco Economic Letter (2005), “The Long-Term Interest Rate Conundrum: Not Unraveled Yet?”
- Friedman, B. and K. Kuttner (1998), “Indicator properties of the Paper-Bill Spread: Lessons from Recent Experience”, *Review of Economics and Statistics*, 80, February.
- García, P. and C. Soto (2004), “Large hoarding of international reserves: Are they worth it?”, *Central Bank of Chile Working Paper No 299*.
- Garton, P. (2005), “Foreign reserve accumulation in Asia: Can it be sustained?”, mimeo.
- Garzarelli, F. (2004), “How much is Asian buying worth?”, *Goldman Sachs*, December 2004.
- Genberg, H., R. McCauley, Y. C. Park and A. Persaud (2005), “Official reserves and currency management in Asia: Myth, reality and the future”, *Geneva Reports on the World Economy*, ICMB, CEPR.
- Glick, R. and M. M. Hutchison (2005), “Capital controls and exchange rate instability in developing economies”, *Journal of International Money and Finance*, 24:387-412.

- Goldman Sachs (2004), “How much is Asian buying worth?”, by F. Garzarelli, *Global markets research daily*, 9 December 2004.
- Goldman Sachs (2005a), “Exuberant Reserve Accumulation”, *Global Viewpoint*, 13 April 2005.
- Goldman Sachs (2005b), “Asian Central Bank Buying – the Beginning of the End?”, *Global Viewpoint*, 20 April 2005.
- Goldman Sachs (2005c), *Global Economics Paper No 124*, May.
- Gourinchas, P.-O. and H. Rey (2005), “International Financial Adjustment”, mimeo.
- Hauner, D. (2005), “A fiscal price tag for international reserves”, *IMF Working Paper WP/05/81*, Washington, D.C.
- Higgins, M. and T. Klitgaard (2004), “Reserve accumulation: Implications for global capital flows and financial markets”, in “Current Issues in Economics and Finance”, *Federal Reserve Bank of New York*.
- Hortaescu and Sareen (2005), “Order flow and the formation of dealer bids: information flows and strategic behaviour in the government of Canada securities auctions”, *NBER working paper No 11116*.
- Iankova, Lefevre and Teiletche (2004), “Un modèle de détermination économique des taux d’intérêt”, *CDC IXIS Flash*, April 2004.
- International Monetary Fund (2003), “Are foreign exchange reserves in Asia too high?”, *World Economic Outlook, September 2003*, Washington, D.C.
- International Monetary Fund (2004), “Guidelines for foreign exchange reserve management”, Washington, D.C.
- International Monetary Fund (2005a), “Norway: Selected Issues”, *IMF Country Report No 05/197*, June 2005, Washington, D.C.
- International Monetary Fund (2005b), “Globalization and external imbalances”, *World Economic Outlook, April 2005*, Washington, D.C.
- International Monetary Fund (2005c), “Annual Report 2005”, Washington, D.C.
- International Monetary Fund (2005d), “United States: Selected Issues”, *IMF Country Report No 05/258*, July 2005, Washington, D.C.
- JP Morgan (2004), “The Asian currency-policy link to US interest rates”, by B. Kasman and H. Malik, *US fixed income markets weekly*, February 2004.
- Kasman, B. and H. Malik (2004), “Special topic: the Asian currency-policy link to the US interest rates”, *JP Morgan fixed income strategy*, February 2004.

- Kawai, M. (1998), "The East Asian currency crisis: Causes and lessons", *Contemporary Economic Policy* 16:157-172.
- Kim, Y. (2000), "Causes of capital flows in developing countries", *Journal of International Money and Finance* 19:235-253.
- King, M. (2005), "The International Monetary System". *Remarks at "Advancing Enterprise 2005" conference*, London, 4 February 2005.
- Lane, P. and G. M. Milesi-Ferretti (2004), "Financial globalization and exchange rates", prepared for the "Dollars, Debt and Deficits—60 Years After Bretton Woods" International Conference co-organised by the Banco de España and the International Monetary Fund, Madrid, 12-14 June 2004.
- Lane, P. R. and D. Burke (2001), "The empirics of foreign reserves", *Open Economics Review* 12:423-434.
- Lehman Brothers (2005), "Correlation Risks: A Primer", April 2005.
- Lindert, P. (1969), "Key currencies and gold (1900–1913)", *International Finance Section*, Department of Economics, Princeton University, 1969.
- Ma, G. and R. McCauley (2003), "Opening China's capital account amid ample dollar liquidity", *BIS Working Paper No 15*, February 2003.
- McCauley, R. and G. Jiang (2004), "Treasury yields and foreign official holdings of IS bonds", *BIS Quarterly Review*, March 2004.
- McKinnon, R. and G. Schnabl (2003), "The East Asian Dollar Standard, Fear of Floating and Original Sin", mimeo.
- Merrill Lynch (2005), "The Changing Role of Central Bank Reserves (Part I and II)", *Emerging Markets Daily*, February 2005.
- Mody, A. and A. P. Murshid (2005), "Growing up with capital flows", *Journal of International Economics* 65:249-266.
- Moëc, G. and L. Frey (2005), "An econometric quantification of the impact of purchases of US Treasury securities by the foreign official sector on long-term yields in the United States", *Banque de France*, February 2005.
- Monetary Authority of Singapore (2001), "Monetary Policy Operations in Singapore", January 2001.
- Nomura (2004), "¥en alert", *Japan Insight*, 4 November 2004.
- Obstfeld, M. and K. Rogoff (2004), "The Unsustainable US Current Account Position Revisited", prepared for the NBER conference on "G-7 Current Account Imbalances: Sustainability and Adjustment", 12-13 July 2004.

- People's Bank of China (2005), "Public Announcement of the People's Bank of China on Reforming the RMB Exchange Rate Regime", 21 July 2005.
- Prasad, E. S., T. Rumbaugh and Q. Wang (2005), "Putting the cart before the horse? Capital account liberalization and exchange rate flexibility in China", *IMF Working Paper PDP/05/1*, Washington, D.C.
- Pringle, R. and N. Carver (eds.) (2003), "How countries manage reserve assets", *Central Banking Publications*, London.
- Pringle, R. and N. Carver (eds.) (2005), "Trends in reserve management – survey results", *The Royal Bank of Scotland, Reserve Management Trends 2005, Central Banking Publications*, London.
- Pritsker, M. (2002), "Large investors and liquidity: a review of the literature", *Paper prepared for the third joint central bank research conference on risk measurement and systemic risk, 7-8 March 2002, Basel*.
- Pritsker, M. (2002), "Large investors: implications for equilibrium assets returns, shock absorption and liquidity", *Board of Governors of the Federal Reserve System*, 9 October 2002.
- Rigaudy, J.-F. (2005), "Ten years of reserve management", *The Royal Bank of Scotland Reserve Management Trends 2005, Central Banking Publications*, London.
- Rodrick, D. and A. Velasco (1999), "Short-term Capital Flows", *NBER Working Paper No 7364*.
- Rogoff, K. S., A. M. Hussain, A. Mody, R. Brooks and N. Oomes (2004), "Evolution and performance of exchange rate regimes", *IMF Occasional Paper 229*, Washington, D.C.
- Roley, V. (1982), "The Effect of Federal Debt-Management Policy on Corporate Bond and Equity Yields", *Quarterly Journal of Economics*, 97.
- Roubini, N. and B. Setser (2005), "Will the Bretton Woods 2 Regime Unravel Soon?", *Symposium on the "Revived Bretton Woods System: A New Paradigm for Asian Development?"*, *Federal Reserve Bank of San Francisco and UC Berkeley, San Francisco, 4 February*.
- Skandck, M. (2003), "Fiscal Policy and Petroleum Fund Management in Norway", in *Fiscal Policy Formulation and Implementation in Oil-Producing Countries*, edited by J. M. Davis, R. Ossowski, and A. Fedelino, *International Monetary Fund*, Washington, D.C.
- The Bond Market Association (2005), "Research Quarterly", February, New York.
- Warnock, F. E. and V. C. Warnock (2005), "International Capital Flows and U.S. Interest Rates", *International Finance Discussion Papers, Number 840, September 2005, Board of Governor of the Federal Reserve System*, Washington, D.C.
- Wei, B. (2004), "China's Macro-economy and Foreign Exchange Administration under Globalization", *HSBC's 14th Global Central Bank Symposium, 24-28 October 2004*, Beijing.

Wong, C. H. and L. Carranza (1999), "Policy responses to external imbalances in emerging market economies: Further empirical results", *IMF Staff Papers* 46:225-237, Washington, D.C.

UBS Investment Research (2005), "Special Report: Foreign Flows: What in the world is going on?", 31 January 2005.

US Treasury (2004), "Annual Survey of Foreign Holdings of US Securities", June 2004.

US Treasury (2005), "Report on foreign portfolio holdings of US securities", June 2004.

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