

## V. Foreign exchange markets

### Highlights

Over most of 2006 and the first four months of 2007, the US dollar depreciated gradually on a nominal trade-weighted basis while the euro appreciated. The yen depreciated to a greater extent than the US dollar. Many other European currencies, including the Czech koruna, the Swedish krona and sterling, also appreciated over 2006, both in trade-weighted terms and against the euro, but have weakened somewhat since. The main exception has been the Swiss franc, which broadly depreciated throughout the period under review. Some currencies in the Asian region, most notably the Thai baht, appreciated in trade-weighted terms. The appreciation of the renminbi against the US dollar picked up pace in the second half of 2006, but was considerably more moderate when measured in trade-weighted terms.

Overall, foreign exchange markets were characterised by high levels of trading activity and historically low volatility. There were, however, two episodes of higher volatility. The first was in May and June 2006: in this episode, the most significant consequences were generally felt by emerging market currencies, such as the Brazilian real, and the currencies of countries experiencing a combination of high interest rates and large current account deficits, such as the Australian and New Zealand dollars. The second episode started at the end of February 2007: a broad range of currencies experienced an increase in volatility, which began to recede in mid-March.

Three main factors influenced exchange rate developments during the period under review. First, reflecting the macroeconomic outlook and its implications for monetary policy, interest rate differentials continued to affect movements in a number of currency pairs. Against the background of low exchange rate volatility, the continuing build-up of carry trades was an important mechanism through which interest rate differentials played a role. Second, consistent with a trend that started in the late 1990s, the accumulation of official foreign exchange reserves increased significantly in 2006, limiting the effects of upward pressure on currencies in the Asian region and in a number of oil-exporting countries. In some cases, notably China, Korea, Malaysia and Thailand, changes in capital controls were also introduced with a view to easing this upward pressure. Third, global imbalances remained a feature of the environment in which exchange rates were being determined. Large fiscal or current account deficits may have affected the extent to which some currencies responded to episodes of increased volatility across financial markets. At the same time, the US current account deficit seemed to attract less attention from market participants as an explanation of developments in the US dollar than in previous periods.

The final section of this chapter explores some trends in reserve management practices which potentially have significant implications for financial markets, including foreign exchange markets. A number of factors underlying these trends are discussed, including the large accumulation of reserves by some countries, advances in financial technology and the development of financial markets, and changes in the external governance environment in which central banks operate. The section then discusses some of the challenges posed by these changes.

## Developments in foreign exchange markets

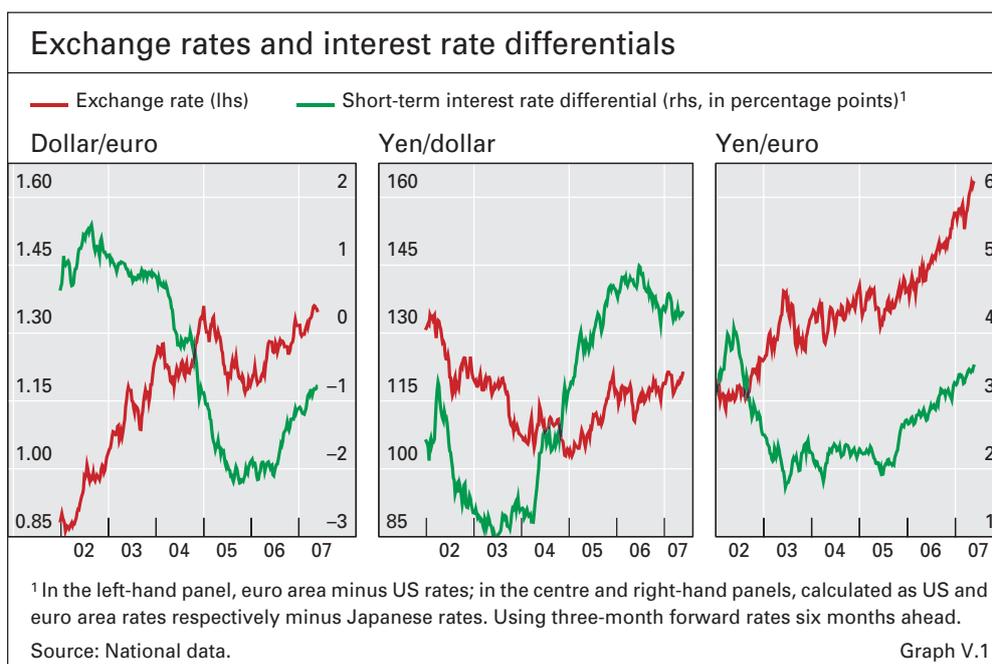
Over 2006 and the first four months of 2007, most currencies followed broadly unbroken trends. However, there was evidence of a distinct break in the prevailing trend for some currencies at the beginning of 2007.

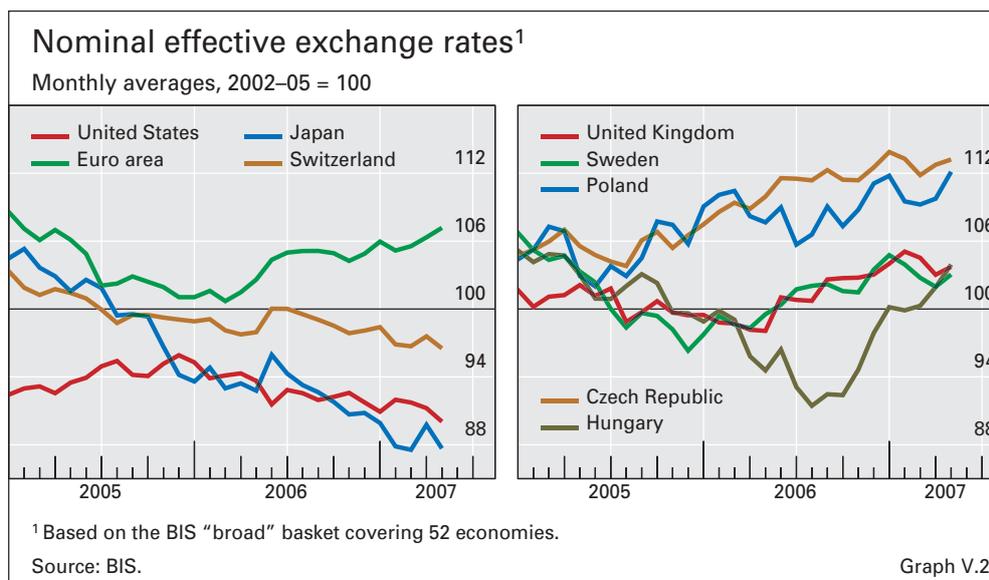
In 2006 and the first four months of 2007, the US dollar broadly depreciated, falling almost 6% in nominal effective terms. Against the euro, it depreciated by around 15%, losing most of the ground it had gained over the course of 2005 (Graph V.1). During 2006, the US dollar also depreciated against several other European currencies (most notably sterling), the Australian dollar and the currencies of a number of emerging economies in Asia. In contrast, following a sharp depreciation in May 2006, the US dollar appreciated against the yen over the remainder of the year. In general, there appears to have been a break around the beginning of 2007 in the behaviour of US dollar exchange rates: in some cases the earlier trend appears to have reversed, while in others the US dollar appears to have stabilised somewhat.

European currencies generally appreciated in nominal effective terms over 2006. The euro gained almost 5%; the Czech koruna, the Swedish krona and sterling also posted strong gains (Graph V.2). In addition, the Hungarian

The US dollar broadly depreciated

Most European currencies appreciated

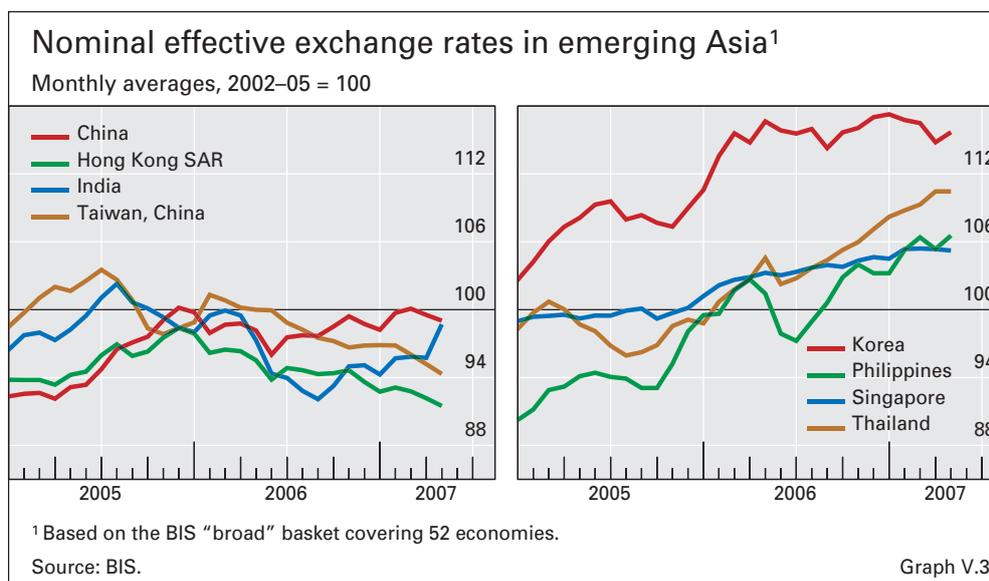


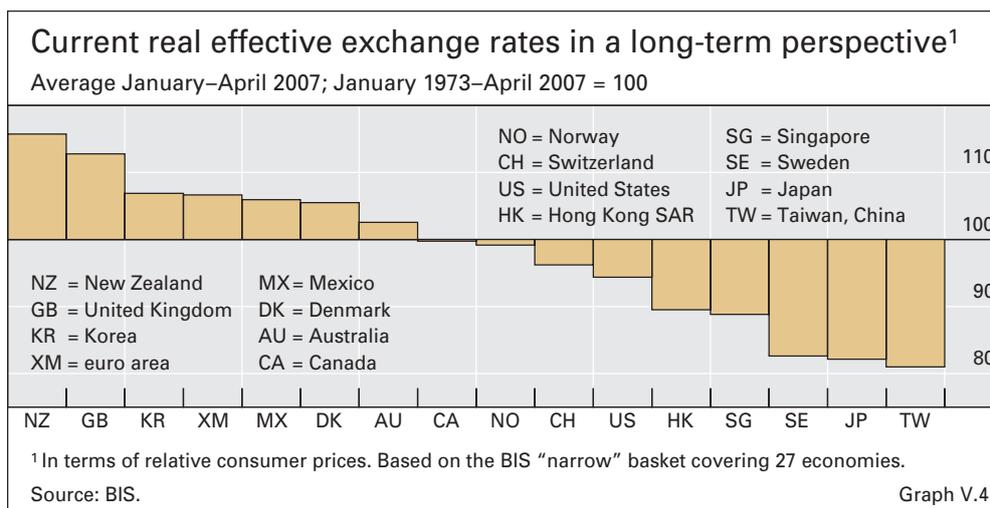


forint and the Polish zloty appreciated in the second half of 2006. However, in early 2007, some of these trends reversed. The Swiss franc was a notable exception, as it remained relatively stable in nominal effective terms in the first half of 2006 but depreciated over the remainder of the period under review.

Currencies in the Asian region followed divergent paths and tended to move less synchronously against the US dollar and in effective terms than in previous years. The yen depreciated in nominal effective terms over 2006 and into 2007, as did the Hong Kong and New Taiwan dollars, although the yen appreciated somewhat in May 2006 and March 2007. In contrast, the Philippine peso and the Thai baht appreciated significantly (Graph V.3). Although the Korean won did not appreciate to the same extent as some other Asian currencies in 2006, it remained at a high level following an appreciation of

Asian currencies followed diverging trends





15% in nominal effective terms over the previous 18 months. In the first four months of 2007, however, the won depreciated by a little over 1%. The pace of appreciation of the renminbi against the US dollar roughly doubled between the first half of 2006 and the period end-June 2006 to end-February 2007, to an annualised rate of almost 5%, but was more muted in trade-weighted terms. In March and April 2007, the renminbi was broadly stable against the US dollar, but depreciated by over 1% in trade-weighted terms.

*Exchange rate levels from a longer-term perspective*

One way of assessing the prevailing levels of exchange rates in a longer-term context is to compare real effective exchange rates with their long-term averages. Over the period under review, the position of most currencies against this benchmark did not change substantially. On average over the first four months of 2007, the real effective exchange rates of the US dollar and euro were within 7% of their long-run averages (Graph V.4). Several currencies in Asia, most notably the New Taiwan dollar and the yen, were more than 10% below. The same was true for the Swedish krona. At the other end of the spectrum, the New Zealand dollar and sterling were significantly higher.

Some currencies at levels significantly different from their long-term averages

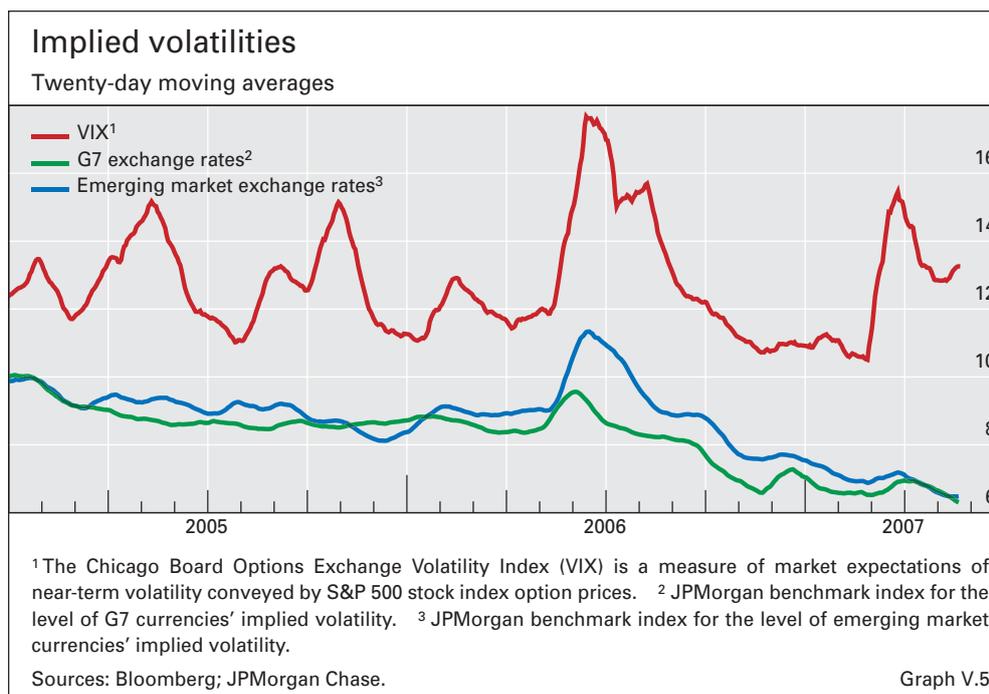
*Conditions in foreign exchange markets*

Overall, foreign exchange markets were characterised by high levels of turnover and historically low volatility, consistent with a broad downward trend in volatility across all financial markets (Graph V.5; see also Chapter VI). There were two episodes of higher volatility in foreign exchange markets, which also coincided with more general increases across financial markets. The increase in volatility during these episodes was, however, modest in size and not widespread.

High turnover and low volatility

During the first episode in May and June 2006, both implied and realised volatility in the yen/dollar and yen/euro markets picked up briefly. Volatility displayed a particularly pronounced spike for some emerging market currencies, such as the Brazilian real and the South African rand, and increased, though to a lesser extent, for currencies of countries with high

Two episodes of higher volatility



interest rates and large current account deficits, such as the Australian and New Zealand dollars. The prevailing trends of exchange rate appreciation were interrupted temporarily. The second episode occurred in late February and early March 2007. The volatility of a number of currency pairs rose as volatility again picked up markedly across financial markets more generally, and foreign exchange market turnover increased.

### Determinants of exchange rate movements

There have been three main drivers of exchange rate developments over the past year or so: the macroeconomic outlook, with its implications for monetary policy and interest rate differentials; exchange rate policies and associated intervention, particularly in emerging market countries in Asia; and global external imbalances. In addition, commodity price movements have influenced the dynamics of specific currencies.

#### *Interest rate differentials and the role of carry trades*

As in previous years, changes in actual and expected interest rate differentials reflecting market participants' assessment of macroeconomic conditions and their implications for monetary policy appear to have had a major influence on exchange rate movements. The behaviour of the dollar/euro rate is an important example. Evidence from implied forward rates, derived from interest rate forward contracts, suggests that markets expected the ECB to continue normalising interest rates throughout the period under review but considered the Federal Reserve to be close to the peak of its tightening cycle (Graph V.1). This is consistent with the trend appreciation of the euro against the dollar over 2006 and early 2007.

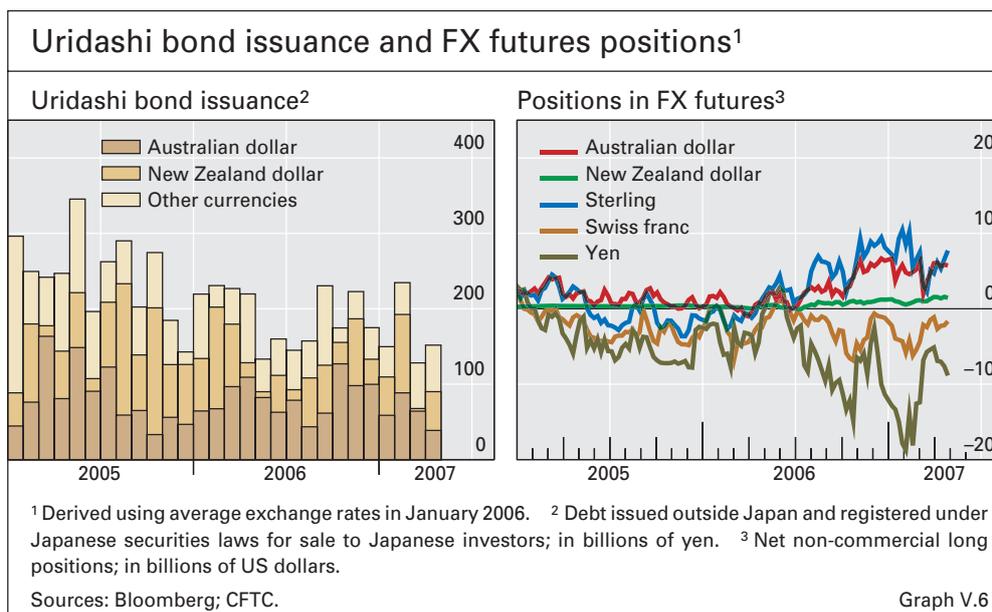
Interest rate differentials were an important driver of exchange rate movements

In addition, low volatility and large interest rate differentials underpinned significant cross-currency flows in the form of carry trades. Conventionally, the label “carry trade” is used to describe speculative activities by financial players such as hedge funds and commodity trading advisers. These trades involve simultaneously going short the funding currency and long the target currency, typically through the derivatives market. They are profitable as long as the gains from interest rate differentials are not offset by exchange rate movements. Consequently, they are sensitive to increases in exchange rate volatility or sudden changes in interest rate expectations. The investors involved are often highly leveraged, and could be forced to unwind positions very quickly in response to changing market conditions. This might have a large impact on exchange rates, especially in smaller markets. The sudden collapse of the dollar against the yen in October 1998 suggests that even large market segments can be affected by a sudden unwinding of carry trade positions.

Significant role for carry trades

In order to assess the role of carry trades, it is useful to distinguish them from two other types of cross-currency flows that present some similarities. One such flow is generated by domestic retail investors purchasing higher-yielding assets denominated in foreign currency. An example that has attracted much attention is the purchase of foreign currency bonds by retail investors in Japan, which has arguably been supported by a growing tolerance for risk accompanying faster domestic output growth. Given that Japanese retail investors hold the bulk of their wealth in yen, they are not as sensitive to the risk of a sudden rise in the value of the yen as leveraged investors who short the currency. They are therefore less likely to unwind their foreign currency investments during episodes of exchange rate volatility. Indeed, market commentary suggests that Japanese retail investors took advantage of the yen appreciation associated with the most recent rise in volatility to increase their exposure to high-yielding overseas assets. However, even

Retail investor activity also of importance



changes in these exposures can potentially have a significant impact on exchange rates, if they occur on a sufficiently large scale.

Indirect evidence suggests that, over the period under review, retail investors' purchases of foreign currency assets were substantial. Data on foreign currency bonds purchased by Japanese individual investors reveal ongoing outflows from Japanese yen to high-yielding currencies over 2006, particularly to the Australian and New Zealand dollars (Graph V.6). Market reports pointed to official but informal estimates for Japan suggesting that Japanese retail investors' exposure to foreign securities could be around \$150 billion.

A second cross-currency flow with similarities to the carry trade involves residents of a high interest rate country borrowing in a low-yielding currency to purchase domestic assets. Market commentary over the period under review focused on households in central and eastern Europe funding mortgages in euros and Swiss francs. The resulting currency mismatches can make the domestic currency vulnerable if they are large enough, as the Asian crisis of 1997–98 highlighted. However, the available evidence suggests that these investments are not that large and, unlike leveraged carry trade activity, are not likely to be unwound quickly. Moreover, most lending in central and eastern Europe is, in any event, carried out by banks from western Europe with diversified exposures.

Interest rate differentials, external imbalances and exchange rate volatility						
	Interest rate differential <sup>1</sup>	Current account <sup>2</sup>	Exchange rate <sup>3, 4</sup>		Implied volatility <sup>4, 5</sup>	
	2006	2006	Episode 1 <sup>6</sup>	Episode 2 <sup>7</sup>	Episode 1 <sup>6</sup>	Episode 2 <sup>7</sup>
Brazil	9.8	1.3	-8.7	-1.7	7.2	4.3
New Zealand	2.7	-8.8	-1.7	-2.4	-0.1	1.9
South Africa	2.5	-6.4	-10.9	-4.1	10.5	2.5
Mexico	2.4	-0.2	-4.1	-2.1	4.5	0.6
Hungary	2.1	-6.9	-2.8	0.0	0.8	0.4
Australia	1.1	-5.4	-2.3	-0.7	0.2	1.1
Chile	0.1	3.8	-4.8	0.4	4.3	0.7
United Kingdom	-0.0	-2.9	0.7	-2.0	0.4	0.3
Korea	-0.4	0.7	-2.2	-1.4	-0.7	0.6
Poland	-0.7	-2.1	-4.2	0.1	1.7	-0.0
Canada	-0.8	1.7	1.3	-0.6	1.0	0.0
Norway	-1.7	16.7	-0.2	-0.6	-0.0	0.2
Euro area	-1.8	-0.3	-0.0	0.4	-0.1	0.5
Sweden	-2.6	7.4	0.8	-1.5	0.0	0.6
Taiwan, China	-3.1	7.1	-2.6	0.2	-0.1	0.7
Switzerland	-3.4	18.5	0.8	1.7	0.0	1.2
Japan	-4.5	3.9	-0.9	4.8	-0.7	2.4
<i>Memo: VIX</i>	.	.	.	.	9.1	11.7

<sup>1</sup> Three-month interest rate relative to US rate. <sup>2</sup> Current account balance as a percentage of GDP. <sup>3</sup> Changes, in per cent. An increase denotes an appreciation against the US dollar. <sup>4</sup> Between the average level in the month before the volatility episode began and the level when VIX volatility peaked. <sup>5</sup> Percentage point difference. One-month implied volatility against the US dollar. <sup>6</sup> Beginning 17 May 2006 with a peak on 13 June 2006. <sup>7</sup> Beginning 27 February 2007 with a peak on 5 March 2007.

Sources: IMF; Bloomberg; Datastream; JPMorgan Chase; national data.

Table V.1

During the period under review, market commentary pointed to the yen and Swiss franc as the main funding currencies for carry trades, and the Australian and New Zealand dollars, sterling and some emerging market currencies – including the Brazilian real, Hungarian forint and South African rand – as the main target currencies. Carry trades arguably supported appreciating trends of the target currencies. In May–June 2006 and February 2007, however, an unwinding of these strategies might have contributed to the weakening of the target currencies and the strengthening of the funding ones (Table V.1). Given that the increase in volatility was fairly modest and short-lived, this effect was small and temporary, and did not spread to other currency markets.

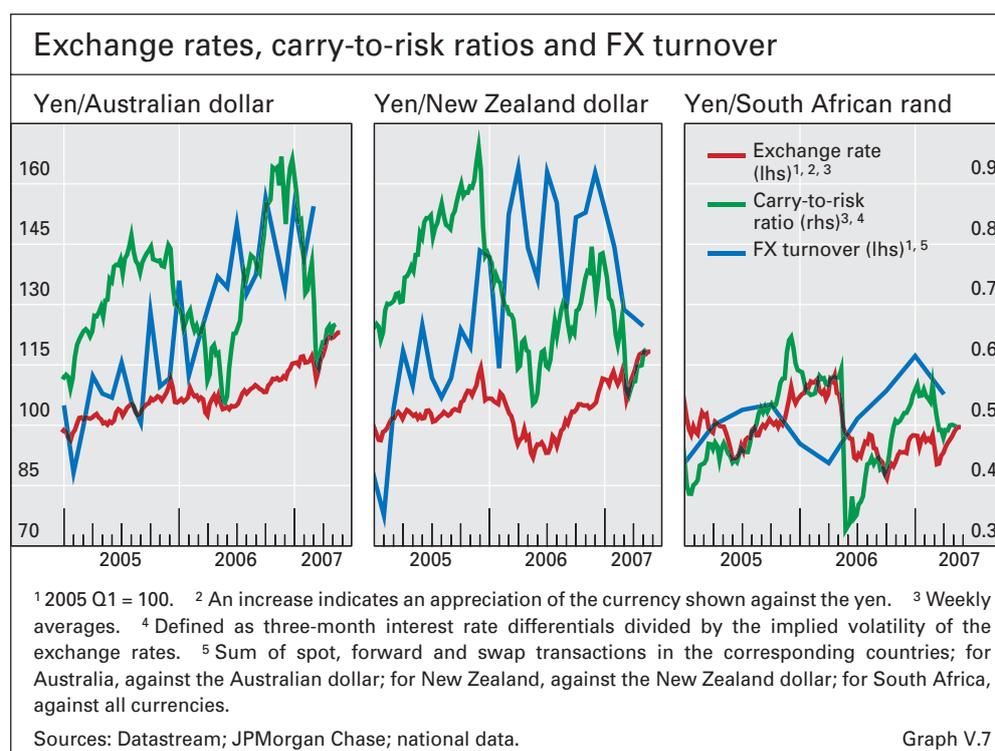
Carry trades important for some currencies ...

Measures designed to capture the ex ante or ex post performance of carry trades highlight that, for most of 2006 and early 2007, these strategies were generally profitable on a risk-adjusted basis. Carry-to-risk ratios, for example, which measure interest rate differentials adjusted for the expected risks implied by currency options, suggest that carry trades funded by the yen were particularly attractive in 2006, benefiting from sustained interest rate differentials and low exchange rate volatility (Graph V.7). Profitability fell in May–June 2006 and February 2007, however, in reaction to a rise in the perceived risk of carry trades during periods of heightened financial market volatility.

... and profitable

Estimating the size of carry trades and assessing their impact on exchange rates is notoriously difficult. In the absence of publicly available data on positions in foreign exchange markets, several alternative indirect measures are typically used. These include: data on the open interest of speculators in currency futures; different variables capturing trading activity in foreign exchange markets; style analysis of hedge fund returns; and the BIS international banking statistics. Overall, when matched with measures of carry

Alternative approaches to measuring carry trades:



trade profitability, they all suggest that these strategies could have played a significant role in exchange rate developments during the period under review.

open interest  
in futures  
markets ...

A widely used measure is derived from data on open positions in foreign exchange futures traded on the Chicago Mercantile Exchange. These distinguish between commercial and non-commercial (speculative) traders, as well as long and short positions. Data on net non-commercial open interest – particularly net short open interest in the yen and net long open interest in sterling and the Australian dollar – are consistent with carry trade volumes rising sharply in 2005 and 2006 but falling at the end of February 2007, at a time when exchange rate volatility increased (Graph V.6). There is less evidence of an increase in speculative net short positions in the Swiss franc in the course of 2006. At the same time, these conclusions should be treated with caution for a number of reasons. First, data from the BIS Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity suggest that only a small fraction of foreign exchange trading goes through futures markets. Second, the classification of currency trades into commercial and non-commercial is somewhat arbitrary. Third, some of the trades identified as speculative might not result from carry trades.

... turnover in  
foreign exchange  
markets ...

Data on turnover in foreign exchange markets support the conclusions derived from an analysis of futures markets. The strong growth in foreign exchange turnover in the Australian and New Zealand dollars, as well as a number of emerging market currencies, is consistent with the growth of carry trade activity targeting these currencies over the course of 2006 (Graph V.7). The high levels of aggregate turnover following a sharp contraction in the carry-to-risk ratios appear to be a reflection of the unwinding of carry trades in response to a rise in exchange rate volatility. At the same time, these turnover data can provide only indirect evidence since they do not identify the nature of the trades or the counterparties involved. OTC derivatives market surveys conducted semiannually, which suffer similar limitations, also provide some evidence on the rising activity in several carry trade target currencies, as well as funding currencies such as the yen and Swiss franc.

... style analysis of  
hedge funds ...

An alternative approach to assessing the role of carry trades, based on a style analysis of a large set of hedge fund returns, also broadly confirms the importance of carry trade strategies for a number of currencies. Style analysis is based on regressions of returns from a panel of hedge funds on measures of the payoffs from specific carry trade strategies, controlling for the performance of broad market indices. Applying this technique to the past two years of data for a few hundred hedge funds helps to assess whether returns were sensitive to such payoffs. The results indicate that carry trade strategies involving currencies such as the Australian dollar or the Brazilian real have some statistically significant, albeit modest, explanatory power for the performance of different types of hedge funds. While this style analysis may be useful in highlighting the broad significance of carry trade strategies for hedge funds in the medium term, it is difficult to infer with any precision what happened to these investments during episodes of heightened volatility.

... and the BIS  
banking statistics

BIS international banking statistics provide more mixed evidence on the importance of carry trades. These statistics can be useful to the extent that

carry trades are implemented, at least in part, through outright borrowing and lending. A change in claims on residents in financial centres as opposed to other locations could be interpreted as indicating a change in carry trade activity, given that many hedge funds or proprietary trading desks are located in those centres. These data actually show a fall in the stock of outstanding yen-denominated claims in 2006, including a drop in credit to residents of the United Kingdom and offshore centres. This finding seems consistent with a decline in carry trade activity involving the yen as funding currency. By contrast, Swiss franc claims grew in the first half of 2006, suggesting an increasing role of the franc as a funding currency, although claims on borrowers in the United Kingdom and offshore financial centres remained relatively small. These results also have to be interpreted with caution, since global claim flows respond to a variety of influences other than carry trade activity.

### *Exchange rate policy*

As in previous years, a sizeable accumulation of foreign exchange reserves indicates that intervention was an important factor in foreign exchange markets in 2006. Official foreign exchange reserves held by monetary authorities increased by around \$850 billion, double the amount recorded in 2005 (Table V.2). The accumulation mainly, but not entirely, reflected intervention in foreign exchange markets in response to upward pressure on exchange rates due to strong inflows into domestic capital markets, often combined with large current account surpluses. Valuation effects arising from significant exchange rate movements together with income flows are also likely to have boosted reserves measured in US dollars.

Significant increase in official foreign exchange reserves

In addition to the growth in official foreign exchange reserves on central banks' balance sheets, there has been significant growth in the foreign exchange reserves managed by sovereign wealth funds. In some cases, these funds have been set up to neutralise the effects of volatile commodity prices on the domestic economy, and have therefore increased with high and rising commodity prices. For example, the Government Pension Fund in Norway, which is one of the most transparent sovereign wealth funds, has tripled in size since 2002 with the increase in oil prices. Other sovereign wealth funds are an alternative destination for current account surpluses in economies with managed exchange rates. The ongoing accumulation of official reserves, and the recent announcement that some of China's official foreign reserves would be used to create a separate investment-oriented fund, suggest that reserves managed by sovereign wealth funds will grow further.

China continued to show the largest accumulation of foreign exchange reserves in absolute terms, despite moving to a more flexible exchange rate regime in 2005. Russia registered the second largest increase, double that of 2005. Brazil and India also recorded large increases in foreign exchange reserve accumulation, mainly as a result of exchange rate intervention.

Foreign exchange intervention was not sufficient to offset upward pressure on exchange rates in a number of Asian countries, with the result that some exchange rates still appreciated significantly (Graph V.3). In many cases, including China, India, Korea, Malaysia and the Philippines, intervention was supplemented by a liberalisation of capital outflows. For example, Korea eased

Changes in capital controls also affected exchange rates

## Annual changes in official foreign exchange reserves

In billions of US dollars

	2001	2002	2003	2004	2005	2006	<i>Memo: Amounts outstanding (Dec 2006)</i>
	At current exchange rates						
Total	113.2	358.7	616.8	723.2	426.1	859.8	5,034.2
Industrial countries	6.3	116.1	215.5	197.3	-23.3	99.9	1,394.9
United States	-2.3	4.8	5.9	3.0	-4.9	3.1	40.9
Euro area	-10.8	8.0	-27.6	-7.0	-14.0	16.9	184.0
Japan	40.5	63.7	201.3	171.5	4.5	46.1	874.9
Asia	76.2	174.0	263.8	363.8	250.0	396.3	2,217.5
China	46.6	74.2	116.8	206.7	208.9	247.5	1,066.3
Hong Kong SAR	3.6	0.7	6.5	5.2	0.7	8.9	133.2
India	8.0	21.7	30.6	27.5	5.9	39.2	170.2
Indonesia	-1.2	3.7	4.0	-0.0	-1.9	7.9	40.7
Korea	6.6	18.3	33.7	43.7	11.8	28.4	238.4
Malaysia	1.2	3.8	10.4	22.1	4.5	12.4	81.7
Philippines	0.4	-0.2	0.3	-0.5	2.8	4.1	19.9
Singapore	-4.8	6.5	13.6	16.5	3.8	20.5	135.8
Taiwan, China	15.5	39.4	45.0	35.1	11.6	12.9	266.1
Thailand	0.4	5.7	2.9	7.5	2.0	14.6	65.1
Latin America <sup>1</sup>	-0.3	4.2	30.6	21.1	25.4	53.7	271.0
Argentina	-9.9	-4.1	2.7	4.9	4.7	7.7	30.4
Brazil	3.2	1.7	11.7	3.6	0.8	32.0	85.6
Chile	-0.6	0.8	0.4	0.3	1.2	2.5	19.2
Mexico	9.2	5.5	7.8	5.0	10.2	2.4	75.4
Venezuela	-3.8	-0.8	7.5	2.3	5.6	5.5	28.9
CEE <sup>2</sup>	4.0	24.2	21.1	21.4	15.3	26.0	181.3
Middle East <sup>3</sup>	1.9	0.7	5.7	12.8	17.0	26.2	101.4
Russia	8.3	11.5	29.1	47.6	54.9	119.6	295.3
<i>Memo: net oil exporters<sup>4</sup></i>	17.6	27.7	67.0	100.0	114.8	219.0	706.5

<sup>1</sup> Countries shown plus Colombia and Peru. <sup>2</sup> Central and eastern Europe: Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. <sup>3</sup> Kuwait, Libya, Qatar and Saudi Arabia. For Saudi Arabia, excluding investment in foreign securities. <sup>4</sup> Algeria, Angola, Kazakhstan, Mexico, Nigeria, Norway, Russia, Venezuela and the Middle East. For Nigeria, 2006 data to November.

Sources: IMF; Datastream; national data.

Table V.2

restrictions on overseas investment and provided incentives to invest in foreign securities and real estate assets. In China, further measures to encourage capital outflows included raising limits on corporate and individual purchases of foreign currency, allowing banks and insurance companies to invest in offshore fixed income assets, and permitting qualified managers to accumulate foreign currency funds and invest offshore. In contrast, to meet the same objective, the Bank of Thailand increased controls on capital inflows, following several other attempts to curb the appreciation of the baht (see Chapter III).

Changes in currency composition did not have a large effect

In addition to the rapid accumulation of reserves, changes in their currency composition and their potential impact on exchange rates also received some attention. However, it is hard to detect any firm evidence for them having any effect. There were several announcements about actual or

possible changes in the currency denomination of foreign exchange reserves throughout 2006. They mostly pointed to a switch towards euro- and sterling-denominated reserves and out of the US dollar. To the extent that these announcements had an effect on exchange rates, it was short-lived, possibly because the size of the reserves involved was generally not large. This explanation is supported by aggregate data from the IMF. While partial, these data indicate that the shares of official foreign exchange reserves denominated in US dollars and euros remained more or less stable between 2005 and 2006, at two thirds and one quarter of the total, respectively. The only trend change in composition of any significance has been an increase in the share of sterling and a decline in the share of the yen. It should be noted, however, that the currency composition of reserves is not available for all countries, most importantly China, which limits the usefulness of these statistics. In addition, these data do not cover sovereign wealth funds, and little is known about the currency composition of their assets.

### *Global imbalances*

The trends in global current account imbalances stabilised somewhat over 2006, but there were no strong indications that they would reverse substantially in the near future (see Chapter II). While the US current account deficit widened further over the course of 2006, it narrowed marginally in early 2007 relative to GDP. Overall, the current account surplus for the Asian region edged up relative to GDP, while the surpluses in net oil-exporting countries stabilised as oil prices fell in the second half of 2006. The region that experienced the most pronounced deterioration in its current account position was central and eastern Europe.

Global imbalances stabilised

External imbalances did not appear to have a first-order effect on G3 exchange rate movements. While it could be argued that the trend depreciation of the US dollar reflects markets' underlying concern about the large US current account deficit, the substantial depreciation of the yen is not consistent with the Japanese current account position. This suggests that interest differentials have been more important than longer-term considerations over the period under review, as discussed above.

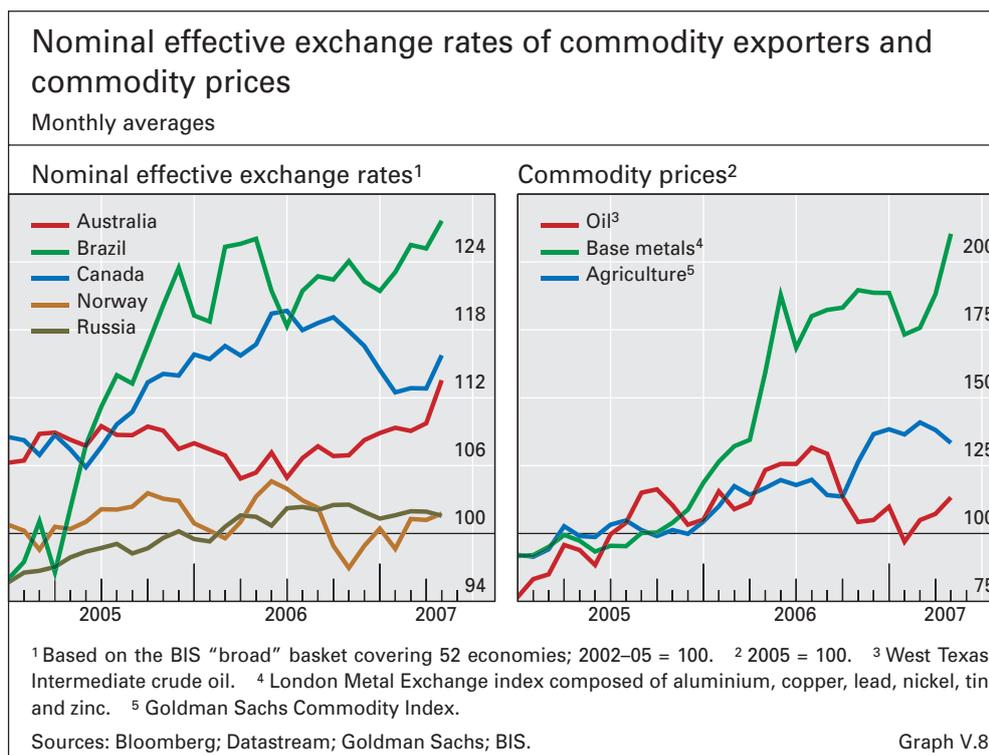
No major effect on G3 exchange rates ...

Large current account deficits did appear to make the currencies of some smaller economies vulnerable to an increase in risk aversion, particularly during the episode of volatility in May and June 2006. At the same time, there is a strong negative correlation between the ratios of current account balances to GDP and the levels of domestic interest rates (Table V.1). In particular, a number of carry trade target economies have large current account deficits. Regressions of exchange rate volatility on both these factors over the past six years indicate that interest rates have been more important. If so, this could suggest that vulnerability to a reversal of speculative flows, rather than structural imbalances, has been more relevant over the period under review.

... but some on less traded currencies

Whether recent experience is a reliable guide to what may happen to exchange rates if external imbalances persist is an open question. Financial market volatility has been very low by historical standards: even in episodes where volatility has increased, the peaks have been modest. This suggests the possibility

Recent experience may not be a good guide to future events



of more pronounced exchange rate movements for the currencies of countries with large current account deficits if volatility increases more significantly.

#### Commodity prices

Over the period under review, the exchange rates of commodity-exporting countries in nearly all cases reflected developments in the relevant commodity prices, which were less synchronised than they had been in the recent past. The exchange rates of energy exporters such as Canada and Norway closely mirrored developments in crude oil prices, appreciating in the first half of 2006 and depreciating in the second (Graph V.8). Both countries' currencies appreciated again over the first four months of 2007, following the recovery of oil prices. The exchange rates of a number of other commodity exporters depreciated following the dip in most non-oil commodity prices during the market turbulence of May 2006. However, the exchange rates of diversified commodity exporters such as Australia and Brazil recovered relatively quickly. Moreover, they remained around historically high levels as the confluence of tightness of supply and strong demand conditions led many commodity prices to rebound, in some cases to new peaks. The Russian rouble benefited both from the strength of oil prices in the first half of 2006 and from Russia being a diversified commodity exporter in the second.

#### Reserve accumulation and reserve management practices

The size and concentration of official foreign exchange reserves after years of continued expansion, especially since the Asian crisis, have led to renewed interest in the way reserve management decisions are taken and in their possible impact on financial markets. For example, a heated debate has been

Exchange rates of commodity exporters followed diverging trends

Changes in reserve management practices potentially affect financial markets ...

taking place surrounding the effect of official purchases of US dollar debt in holding down US government bond yields (see Chapter VI). Looking forward, questions can also be asked about the possible market implications of any further significant changes in the asset composition of reserves, perhaps as part of broader efforts to increase returns.

Foreign exchange reserve management practices have evolved substantially over the past decade or so, reflecting changes in both the economic and the broader institutional environment. These changes have affected the foreign exchange reserve management practices of a wide range of central banks, the entities primarily charged with performing this function, well beyond those managing the largest portfolios of official reserves. While some of these changes have been remarked upon, others have attracted less attention.

... and have evolved significantly in recent years

Against this background, this section documents some of the main changes in foreign exchange reserve management practices, considers the main drivers behind them and explores some of the challenges ahead, with a particular eye to those that could have a more significant impact on financial markets. For present purposes, the reasons for the accumulation of net reserves are taken as given, as they relate to broader policy decisions.

#### *Main trends in foreign exchange reserve management*

When considering the evolution of reserve management practices, at least three trends deserve particular attention. Similarly to what has happened for monetary and supervisory policy, these trends pertain to the objectives, instruments and accountability of central banks. While admittedly varying across economies in terms of intensity and timing, their incidence has been quite general. The trends are: an increased focus on returns; the adoption of a more structured approach, underpinned by a strengthening of internal governance and risk management; and a greater degree of public disclosure.

Three main trends:

The increased focus on returns has perhaps been the most visible trend, and has been manifested in a variety of ways. In some cases, separate sovereign wealth funds with a stronger mandate to focus on returns have been created. In a number of central banks, existing reserves have been subdivided into separate tranches, such as a liquidity and an investment portfolio, or mandated to external managers so as to permit a more specialised type of management. More generally, central banks have broadened the range of instruments they invest in to include assets, such as “spread products”, which promise a yield pickup over more traditional ones, either because of their liquidity characteristics or due to lower credit quality.

an increased focus on returns ...

The more structured approach to reserve management decisions has taken three highly complementary forms. They relate to the degree of vertical tiering and horizontal separation in the management processes and to the supporting risk management functions.

... a more structured approach to decision-making and risk management ...

The first way of imposing structure has been the adoption of a more top-down, vertically-tiered framework to ensure the appropriate design of the portfolio and its effective implementation. At the strategic level, much effort has been devoted to determining the appropriate risk-return trade-off for the

portfolio (“strategic asset allocation”). This has been seen as part of a broader decision about the acceptable risk-return trade-off for the institution in the light of the other functions it performs (see below). In most central banks, the definition of this strategic trade-off has formally become the responsibility of the executive level. The decision is then articulated by selecting a benchmark portfolio and defining the tolerance ranges within which the actual allocation is allowed to vary. In many central banks, a tactical asset allocation layer has been introduced between the strategic asset allocation and the portfolio managers’ position-taking, with a view to centralising decisions aimed at taking advantage of shorter-term market developments.

The second way has been to introduce a greater degree of horizontal separation in the organisation of the activities involved in reserve management. The objective has been to strengthen the integrity of the process, not least by limiting potential internal conflicts of interest. In particular, different activities, such as asset management, performance measurement, compliance with investment guidelines and settlement functions, have generally become more segregated, in terms of both their functional organisation and their reporting lines.

The third way has been to strengthen risk management processes. This has been seen as a necessary step to support an expansion in the investable universe and to implement a more disciplined approach to investing. As regards financial risks, a greater use of risk measurement and management tools has helped to design the benchmark portfolio, measure and evaluate performance, limit execution risks and ensure compliance. There has also been a trend towards greater centralisation in the management of operational risk, while its prominence within the organisation has been raised by assigning responsibility for it to higher management levels.

A greater degree of external disclosure has affected several aspects of foreign exchange reserve management activities. An increasing number of central banks are now publishing more information about the institutional framework, the assets in the investable universe and performance. Some central banks also report on the currency composition of their reserves, although those that have done so have not generally held sizeable shares of world reserves. The main exception is Russia’s central bank.

#### *Main factors behind the trends*

The trends in central bank foreign exchange reserve management identified above have been underpinned by several key developments in the economic and institutional environment. The most important among these are: the large accumulation of reserves by some countries; advances in financial technology and the development of financial markets; and changes in the external governance environment within which central banks operate.

The large accumulation of foreign exchange reserves in several countries in recent years has naturally shifted the balance towards more return-oriented strategies while at the same time putting a premium on the processes necessary to manage an increasingly large fraction of an economy’s resources. While measuring the “adequacy” of reserves with any precision is quite hard,

... and a greater degree of external disclosure

Three main driving forces:

the large accumulation of foreign exchange reserves ...

in several economies the stock of reserves does appear to be well above standard measures of adequacy based on liquidity considerations alone (Table V.3). This has especially been the case in economies where the main factor driving reserve accumulation has ceased to be a conscious effort to build up a war chest, but has rather become a by-product of attempts to lean against the appreciation of the domestic currency.

Advances in financial technology and the development of financial markets have been important, more general factors behind the main trends in reserve management practices. Much as in the private sector, advances in financial technology have provided central banks with the tools necessary for a more structured approach to risk measurement and management and, arguably, have also helped to reduce the need for pure liquidity balances. The development of financial markets has increased the range of assets that provide an acceptable level of liquidity while offering more attractive yields, such as various mortgage-backed securities. Financial markets have also improved the capacity of central banks to obtain funds at short notice by posting collateral. Increasingly, central banks have also begun to use derivative products to support their investment decisions. Prospectively, derivatives markets could also support a further broadening of the investable universe. For example, the emergence of deep markets for credit default swaps could allow central banks to manage more effectively the risks associated with entry into corporate bond markets.

Finally, the impact of changes in the external governance environment has been far-reaching and multifaceted, helping to explain the cross-country breadth of the observed trends. In particular, the global shift towards greater

... advances in financial technology and the development of financial markets ...

... and changes in the external governance environment

Foreign exchange reserves and measures of adequacy								
	Reserves outstanding <sup>1</sup>		Reserves/imports <sup>2</sup>		Reserves/broad money <sup>3</sup>		Reserves/short-term debt <sup>4</sup>	
	2000	2006	2000	2006	2000	2006	2000	2006
China	166	1,066	9	16	10	24	8	13
Japan	347	875	11	18	6	15	2	2
Taiwan, China	107	266	9	16	19	34	8	8
Russia	24	295	6	20	44	77	2	5
Korea	96	238	7	9	29	38	2	2
Other Asia <sup>5</sup>	325	647	6	7	27	30	2	2
Latin America <sup>6</sup>	136	271	5	7	23	25	1	2
Middle East <sup>7</sup>	75	178	9	8	25	30	2	2
Central and eastern Europe <sup>8</sup>	69	181	5	4	39	36	2	1
Industrial economies <sup>9</sup>	344	334	1	1	3	2	0	0

<sup>1</sup> In billions of US dollars. <sup>2</sup> Months of imports. <sup>3</sup> In per cent. <sup>4</sup> Ratio; short-term external debt defined as consolidated international claims of all BIS reporting banks on countries outside the reporting area with a maturity up to and including one year plus international debt securities outstanding with a maturity up to one year; based on outstanding year-end positions. For Libya and Saudi Arabia, excludes international securities. <sup>5</sup> Hong Kong SAR, India, Indonesia, Malaysia, the Philippines, Singapore and Thailand. <sup>6</sup> Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. <sup>7</sup> Egypt, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia and the United Arab Emirates. <sup>8</sup> Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. <sup>9</sup> Canada, the euro area, Switzerland, the United Kingdom and the United States.

Sources: IMF; Datastream; BIS.

Table V.3

central bank independence has increased the emphasis on accountability and transparency. This has been one of the factors motivating a greater degree of external disclosure in reserve management and a strengthening of internal governance processes. In some countries, it has also added pressure to obtain higher returns on reserves. At the same time, there has been more focus on the importance of reputation and credibility for effective policymaking. This has heightened the sensitivity of central banks to the need for sound investment processes, in terms of both the effectiveness and security of the operations, and the management of the potential conflicts of interest involved. The role of many central banks as regulators and standard setters for the private sector, and hence their need to lead by example, has merely added to such incentives.

### *Challenges*

How challenges are addressed can affect financial markets

The major trends in reserve management just identified have presented central banks with significant challenges. While some of these challenges have implications that are largely confined to the internal organisation and running of the institution, others can have more immediate implications for financial markets and exchange rates. To illustrate this second point, it is worth exploring in more detail three issues: the choice of “numeraire” for the design of the portfolio; the definition of the appropriate risk-return trade-off for the reserves; and the appropriate degree of public disclosure. In none of these areas is there a one-size-fits-all solution or, indeed, any such thing as a “correct” answer. Rather, difficult trade-offs need to be struck between competing considerations. Even so, the way in which these issues are resolved can have potentially significant implications.

How should the numeraire currency be chosen?

At a strategic level, the choice of the numeraire currency, or basket of currencies, underlying portfolio allocation decisions – which may differ from that used for public accounting purposes – is particularly influential for the currency composition of reserves. If it is assumed that expected returns are equalised across currencies over the long term – a common assumption when deciding on the strategic asset allocation – the choice of numeraire influences the currency composition of the benchmark portfolio primarily through its impact on the measured variability of returns. Specifically, the currency composition of reserves will be heavily tilted towards currencies with higher covariance vis-à-vis the numeraire. The adoption of a more structured and formal approach to reserve management and the availability of more sophisticated financial tools have recently highlighted the importance of this choice.

How reserves are assumed to be used matters in this choice

In principle, the choice of numeraire presupposes a careful analysis of the intended uses of the reserves and of the broader institutional environment which helps to define the risk tolerance of the reserve holder. Traditionally, when reserves were held primarily for intervention purposes, an obvious candidate for (the largely implicit) numeraire was the most liquid currency used for interventions, notably the US dollar. Similarly, when capital account transactions were less important than today, the currency denomination of imports presented a natural alternative choice of numeraire. Subsequently, in cases where reserves came to be seen primarily as a hedge for external liabilities, the currency composition of those liabilities could have gained relevance.

More recently, two trends suggest that the domestic currency might be becoming increasingly attractive as the numeraire. First, especially in countries where reserves exceed liquidity needs and the investment motive dominates, the domestic currency might be seen as a better guide to whether portfolio wealth is being maximised or not. In addition, central banks may have become more sensitive to losses, insofar as they are perceived as possibly undermining their reputation and operational independence (see below), not least by eroding their capital base. If so, this would tend to increase the relevance of the exchange rate regime in influencing the currency allocation, tilting it towards the currency, or basket, against which the domestic currency is more stable.

Domestic currency is increasingly an option

The specification of the appropriate risk-return trade-off for the reserve holder is a particularly challenging task. It would be challenging if the reserve management function were considered in isolation; it is even more so when considered as part of the package of functions performed by central banks. The way in which this issue is resolved has implications for the breadth of the investable asset universe and for the degree and nature of active management.

How should the appropriate risk-return trade-off be defined?

While the shift towards a greater investment orientation in the management of reserves has naturally promoted a more return-oriented approach, there are no obvious criteria for establishing what the right balance between risk and return should be. In part, this reflects difficulties in estimating the true opportunity cost of the funds. For example, in a proximate sense, all reserves are “borrowed”, be it in domestic or foreign currency, and so the immediate financing cost is easily measured. However, an assessment of the true opportunity cost to the economy cannot shy away from general equilibrium considerations, involving a view about the counterfactual configuration of exchange and interest rates in the absence of reserve accumulation. This, in turn, would naturally depend on the alternative uses to which reserves could be put, such as infrastructure investments or reductions in taxation.

The answer depends on the opportunity costs ...

The bundling of foreign reserve management with other functions complicates matters further. Central banks, in particular, because of their heightened sensitivity to reputational risk, are generally also highly sensitive to the credit and operational risks associated with investment activities, arguably well beyond their direct impact on portfolio returns. And, as reserves grow relative to the overall central bank balance sheet, concerns about losses could paradoxically increase, and hence risk tolerance decline, reflecting the greater potential for a large, negative impact on the institution’s capital. The desire to avoid such outcomes can also have implications for the “location” of the reserve management function within the public sector. For example, these considerations provide one reason why special investment funds, not on the central bank’s balance sheet, have been established in some economies judged to have reserves in excess of liquidity needs. At the same time, the experience of Norway suggests that some of these constraints on risk preferences are highly dependent on the specific institutional environment within which the central bank operates. There, the central bank manages its own reserves as well as the Government Pension Fund along broadly similar lines.

... potential reputational consequences ...

... and other policy objectives

More generally, questions can be asked about how far a more return-oriented approach should be pushed in the first place. In an increasingly global marketplace, the shared responsibilities of public authorities for public goods such as well functioning markets and financial stability set limits on this orientation. For example, when responding to individual incentives, it is only natural for private sector agents to engage in a search for yield or, at times of turmoil, to retrench and withdraw from markets. But, in the aggregate, such behaviour, if taken too far, can contribute to financial instability.

How much disclosure is optimal?

Despite the trend towards increased transparency, considerable controversy surrounds the question of the appropriate degree of public disclosure of information on foreign reserves. In the past, much of the discussion about disclosure was concerned with the overall level of reserves and the intervention that results in changes to that stock, not its composition. However, as reserves have grown, attention has switched to their composition and the implications that changes in it could have for financial markets. This is information that central banks have traditionally been less inclined to provide.

There are trade-offs ...

External governance arrangements aside, and at the risk of some oversimplification, the optimal degree of disclosure has been seen as involving a trade-off between the efficiency-enhancing effects of providing additional information to financial markets on the one hand, and the loss of tactical room for manoeuvre for the reserve manager on the other. Differences of opinion, therefore, hinge on differences in perspective on how well markets function and on how far disclosure actually constrains the authorities' ability to pursue their objectives.

... influenced by factors such as the size of reserves involved

Factors that could reduce the willingness of reserve managers to be transparent include the size of the reserves and the nature of the exchange rate regime. If foreign exchange reserves are very large (Table V.3), then the assumption that the central bank is an atomistic player in foreign exchange markets and in the instruments it invests in is less likely to hold. Tactical considerations could play an even bigger role if information about changes in the currency composition of the reserves were interpreted as foreshadowing changes in a managed exchange rate regime. Information on currency composition could also reveal information on intervention activities by helping to identify, ex post, changes in the level of reserves due to valuation effects. More generally, changes in the currency composition of reserves technically amount to sterilised intervention on the part of the authorities whose currencies are being exchanged, and views about the impact of such transactions on exchange rates diverge considerably.