

Hedge fund activity and carry trades

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Abstract

In recent years, hedge funds have been increasingly active in carry trades, which typically involve considerable exposure to exchange rate movements. The lack of available data leads us to use less direct sources such as international bank lending data from the Bank for International Settlements (BIS) to infer some broad conclusions about recent developments related to hedge fund activities and carry trades. We find that the interest earnings of such trades have narrowed noticeably and have become inherently more risky. The unwinding of existing positions could prove to be disruptive for financial markets and appears to have contributed to volatility in currencies which are the destination for borrowed funds as well as the funding currencies themselves.

1. Introduction

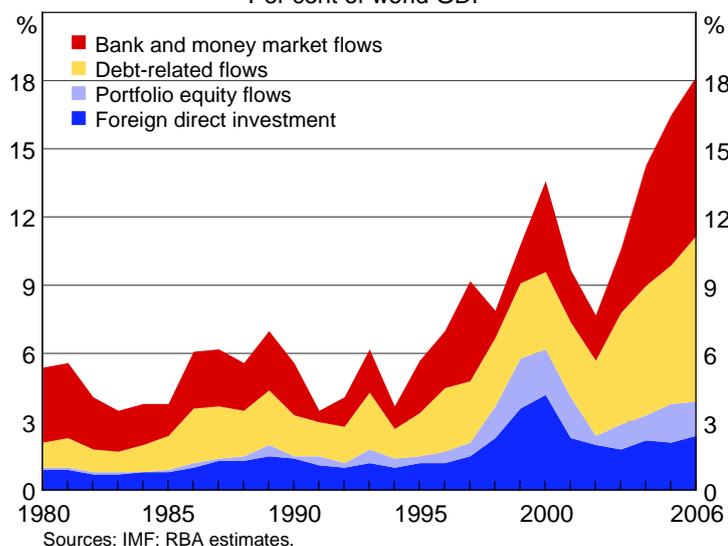
Following a period of relative stability from 1980 to 1995, gross international capital mobility began to increase considerably relative to world output. While a number of distinct cycles around this general upward trend are evident, the most recent upswing in international capital movements is characterised by acceleration in bank lending and debt-related flows (Figure 1).¹

The acceleration in debt-related flows is probably associated with the much discussed accumulation of reserve assets by countries in Asia and oil exporting countries, but the sharp rise in cross-border bank lending has received somewhat less attention. In part, these developments reflect opportunities brought about by unusually low nominal and real interest rates, as well as robust world economic growth in recent years. This has encouraged a greater degree of leverage and risk taking, reflected in the sharp rise in bank and money market capital flows. One example of these flows is the proliferation of carry trades, where funds are borrowed in low interest rate countries, such as Japan and Switzerland, and invested in markets where returns are higher, such as Australia, New Zealand, and a number of less developed countries.

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¹ Recent developments in global capital flows are discussed in Battellino (2006).

Figure 1
Gross International Capital Movements
 Per cent of world GDP



Hedge funds have been very active in carry trades and more generally foreign exchange as an asset class in recent years, as the opportunities in more traditional markets were curtailed by compressed volatility and generally low returns. While there is little direct data available on the activities of hedge funds, we use bank lending data published by the BIS to supplement information from Hedge Fund Research for the purpose of this paper.

Several aspects of hedge fund activities may be of interest to policy makers. If it is correct that carry trades have been an important driver of cross-border bank lending, then a considerable portion of open positions currently in place are likely to have a greater than usual exposure to exchange rate fluctuations. As highly leveraged speculative positions can be more prone to sudden reversals than more fundamentally based investments, these might have a range of undesirable financial market and systemic consequences. The risks surrounding such outcomes are partly related to the prospects for theoretically appealing relationships such as uncovered interest parity to re-exert themselves.

In this paper we bring together several data sources to gauge the current state of the hedge fund industry and focus particularly on some of the issues surrounding carry trade activities. The remainder of the paper is organised in the following way. Section 2 provides some background on the hedge fund industry. We briefly highlight recent growth in investor capital and leverage. Section 3 uses data from the BIS to estimate the carry a hedge fund borrowing in low interest rate countries is able to earn when investing in Australian and New Zealand fixed income. Section 4 raises some considerations with respect to exchange rate implications that may arise. Finally, Section 5 offers some brief concluding remarks. An appendix discusses how carry trades may be financed through derivatives.

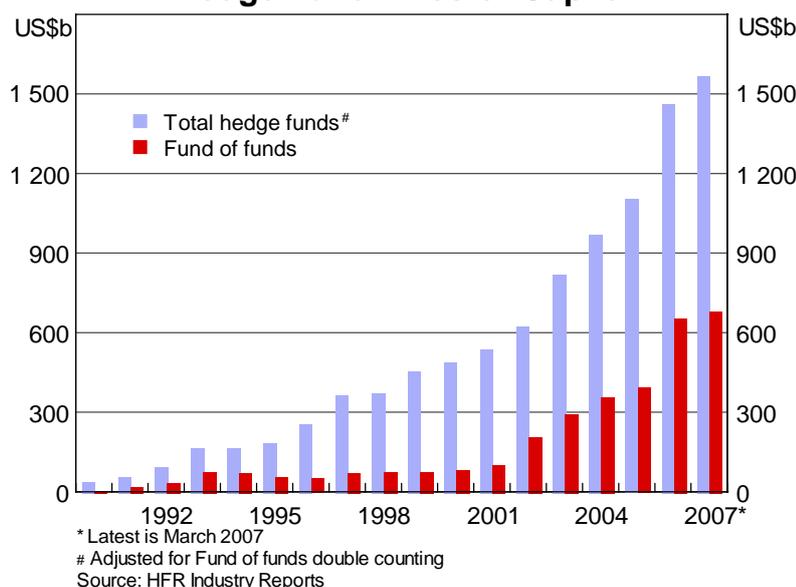
2. Recent developments in the hedge fund industry

Special purpose vehicles and hedge funds often locate themselves in offshore banking centres.² This is partly why reliable information about their activities is difficult to obtain, complicating the monitoring and regulation of the industry. As a result, indirect information is generally used for the most up-to-date indications of hedge fund activity. In the sections below, we use international bank lending data from the BIS to supplement data from Hedge Fund Research to make a number of broad analytical points about the industry.

2.1 Growth in the hedge fund industry

While hedge funds' capital under management (ie investor capital) remains modest in comparison with the more traditional investment vehicles, such as pension and mutual funds, the comparatively active trading style of some funds and their extensive use of leverage has meant that their market impact can be important.³ As systemically important institutions are the counterparties to hedge fund transactions, the industry's activities also pose questions related to financial stability. Particularly strong growth in hedge fund capital under management has occurred in recent years. Investor capital has increased almost threefold between 2002 and March 2007, to well over US\$1½ trillion. This has been accompanied by strong growth in 'fund of funds', which now account for around one-third of total hedge fund capital (Figure 2).

Figure 2
Hedge Fund Investor Capital



Solid net investor inflows from 2002 to 2004 may partly be a reflection of the global 'search for yield' over this period.⁴ The view that investments in hedge funds can provide diversification benefits to more traditional portfolios also appears to have become more

² Hedge Fund Research data indicate that in mid-2006 around one-third of hedge funds were registered in the United States, with most of the remaining two-thirds domiciled in offshore banking centres.

³ The Securities and Exchange Commission (SEC) in the United States recognised as far back as the late 1960s that hedge funds 'may raise special concerns with respect to their impact on securities markets' (see SEC (2003)).

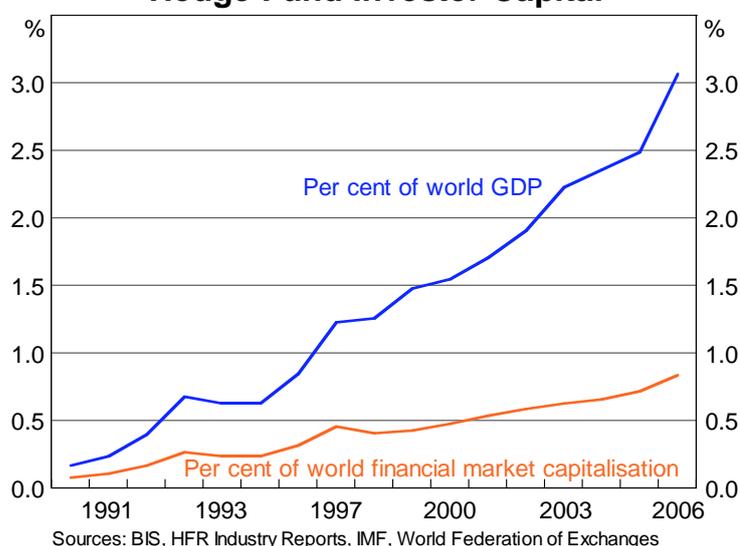
⁴ See also RBA (2005).

widespread, supporting the acceptance of hedge funds as a more mainstream investment. This is demonstrated by the substantial increase in the proportion of major global investors adding hedge fund investments to their portfolios.⁵ However, re-invested returns have contributed the largest proportion to the increase in investor capital since 2002.

There has also been strong growth in the number of hedge funds, with little noticeable change in the average fund size since the late 1990s despite strong growth in investor capital. In part, this is likely to be the result of ‘closed end funds’ that place limits on the investor capital that is accepted. The fragmentation of the industry has meant that there are probably fewer very large funds in operation than was the case 10 years ago. Insofar as it may be undesirable to have individual funds exert considerable influence over market prices, the average size of funds would appear to be less of an issue. Also, while the industry has become more important over the past 15 years, its investor capital remains less than one per cent of the total value of the world’s financial markets (Figure 3).⁶ While this may suggest that the actions of individual funds are somewhat less of a concern, it may still be a problem that groups of smaller funds follow similar investment models and thus act collectively – even if not collusively.

Figure 3

Hedge Fund Investor Capital



In fact, however, over time the investment strategies of hedge funds appear to have become more diverse (Table 1). The outright importance of macro and equity non-hedge investment strategies has declined over time as mandates centring on equity hedge, event driven, and relative value arbitrage have become more prominent.⁷ Nonetheless, the size of leverage, the dominance of hedge funds in the market for certain financial instruments (eg credit default swaps), and the link across strategies provided by the emergence of fund of funds complicate the analysis. If, for example, fund of funds were to only invest in managers pursuing macro strategies, then the importance of those strategies would not have changed as noticeably over the past decade.

⁵ See for example the Russell Survey on Alternative Investing, comprising data from 327 pension funds, endowments, and other tax-exempt institutions (Russell (2006)).

⁶ The size of world financial markets is defined here by the total market value of government, corporate, and international bonds on issue, market capitalisation of world equities, and the value of total credit outstanding.

⁷ Appendix A briefly describes what each of these strategies purports to achieve.

Table 1
Hedge Fund Investor Capital by Strategy
 Percentage of total investor capital

	1996	2006
Equity hedge	7.3	27.9
Event driven	4.6	13.2
Relative value arbitrage	1.5	12.9
Macro	53.3	11.6
Fixed income	5.7	8.1
Sector	1.1	5.2
Distressed securities	1.3	4.8
Equity non-hedge	12.0	4.0
Emerging markets	8.0	4.3
Convertible arbitrage	0.5	3.1
Equity market neutral	1.6	2.5
Merger arbitrage	0.6	1.5
Market timing	0.6	0.3
Short selling	0.2	0.3
Regulation D	0.1	0.2
Fund of funds	20.5	44.8

Memorandum items:

Total investor capital was US\$257 billion in 1996 and US\$1,465 billion in 2006.

Source: Hedge Fund Research.

2.2 Hedge fund leverage

Hedge funds generally use leverage to increase the return on the investor capital that they manage. While this strategy can multiply returns, it also multiplies risk by the same factor in the event that market prices move against the investment strategy. A hedge fund can achieve leverage in two main ways. The first is by borrowing outright, which is often known as 'on-balance sheet' leverage. The second is by using derivatives and other financial instruments to obtain exposure to an asset for a smaller outlay than the value of that asset, often referred to as 'off-balance sheet' leverage (eg margin and futures trading).

Leverage is an important consideration when monitoring hedge fund activities for two main reasons. The first is that leverage increases the funds available for investment. Given the rapid growth in investor capital available to hedge funds, additional borrowing raises the potential market impact that positions could have. This is not to say that leveraged hedge fund investment would always and everywhere constitute a reason for concern. Secondly, since hedge funds may at times pursue very aggressive strategies to maximise profits (ie alpha) this may involve very high gearing ratios that expose funds to market movements that impose substantial losses. The concern here lies less with preventing a given fund from becoming insolvent, but rather with the deleterious impact that may be suffered by counterparties. Since systemically important organisations that fall within the net of prudential oversight are often the prime brokers or lenders to hedge funds, this issue is important from a financial stability perspective.

The use of leverage by hedge funds has attracted particular attention since the collapse of Long Term Capital Management (LTCM). In early 1998 LTCM had investor capital of US\$4.7 billion, direct borrowings of US\$129 billion, and off-balance sheet derivatives positions mainly in fixed income instruments with a notional value of US\$1,250 billion. By late 1998, LTCM had lost US\$4.6 billion in capital in the wake of the Russian debt default as this sudden unforeseen event drove market prices sharply against their outstanding positions. The high leverage of the fund was a key factor in its demise. Highlighting the broader systemic implications of the distressed fund, the Federal Reserve stepped in to mediate an organised dissolution of the fund between LTCM's counterparties and prime brokers.

2.2.1 Evidence of stricter lending practices

Research by the BIS provides comprehensive estimates of total leverage of a subset of hedge funds.⁸ The authors suggest their estimates of leverage to be most useful as a guide to trends in leverage over time rather than as a measure of actual levels, and conclude that leverage tended to be highest around 1997–98 but is now noticeably lower. These findings are consistent with reports that prime brokers required hedge funds to provide more collateral and imposed more stringent disclosure requirements starting in the late 1990s.⁹ The lengthening in the maturity profile of lending to offshore banking centres where hedge funds are prominent lends further support to the view that lending practices have become more discerning.

2.2.2 Maturity profile of leverage

Further useful information is to be gained by examining the maturity profile of the claims reported by the BIS. Since the mid-1990s, the maturity of borrowings has lengthened somewhat.¹⁰ While around 60 per cent of claims were of a maturity of only up to and including one year in 1996, this share declined to less than 50 per cent at the beginning of 2006 (Figure 4). Notably, the shift did not occur gradually over time, but relatively quickly in 1998–99.

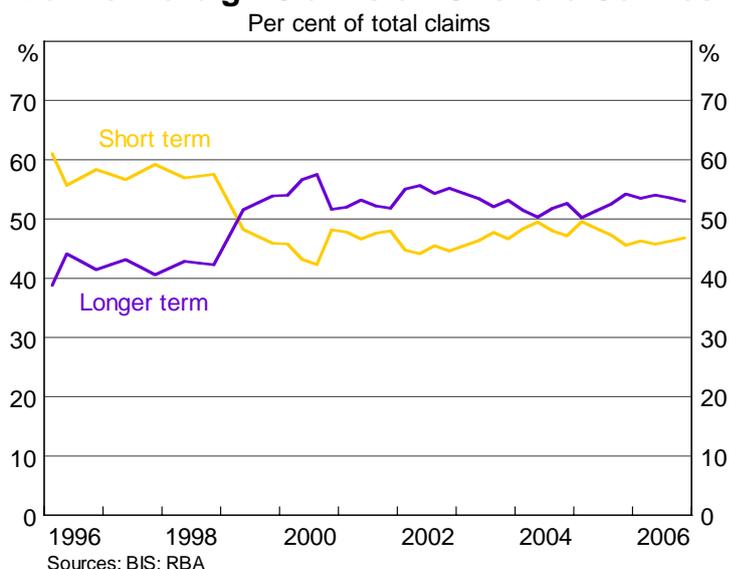
It seems feasible that the end of financial turbulence following the Asian financial crisis and Russian debt default, which also coincides with the prominent failure of LTCM, contributed to this change. This may be because the more aggressive funds exited the industry, thereby changing the composition of finance, or that the investment behaviour of the industry changed for one reason or another. An important factor may also have been the tightening of lending criteria at around that time.

⁸ See McGuire et al (2005).

⁹ Lenders would usually assess their potential exposure to hedge funds by calculating value at risk (VaR) for a typical period of 10 days, and set loss limits with a confidence interval of between 95 per cent and 99 per cent. Margin limits may also apply depending on factors such as liquidity, concentrations and how positions relate to the prime broker's overall book. As funds engaged in fixed interest tend to have more counterparties to deal with, collateral arrangements may only cover losses at the 95 per cent interval. On the other hand, it would not be uncommon for prime brokers, who are typically more involved with equity markets, to maintain less than a one per cent uncollateralised exposure. For a more detailed description, refer to IMF (2004).

¹⁰ The BIS report maturity as (i) less than or equal to one year, (ii) greater than one year but less than or equal to two years, and (iii) greater than two years. We apportion the sizable 'unallocated' component equally among the three categories and define 'short-term' as being loans with maturity of less than or equal to one year. All remaining claims are deemed to be 'longer-term'.

Figure 4
Banks' Foreign Claims on Offshore Centres



2.2.3 Indirect measures of on-balance sheet leverage

Given the scarcity of data relating to the notional value of derivatives outstanding, it is very difficult to make sensible estimates of the likely extent of off-balance sheet leverage at the disposal of hedge funds (Appendix B discusses the relationship between Japanese banks' derivatives and financing of carry trades). However, the foreign claims of BIS reporting banks on offshore banking centres can be used as a broad indication of the on-balance sheet leverage of hedge funds.¹¹ The main countries' lending to areas where hedge funds are domiciled accelerated sharply at the beginning of 2004 (Figure 5).¹²

To put this into context, bank lending to Caribbean and European offshore banking centres increased by around US\$370 billion, from US\$880 billion to US\$1,247 billion between 2004 and 2006 (Table 2). Alternatively, this can be thought of as lending to hedge funds at an average annualised rate exceeding 25 per cent. At this rapid rate, the claims of BIS reporting banks on offshore centres increased in importance to the total foreign claims of these banks. In 2004 claims on offshore centres were around 4½ per cent of total claims, but this share had risen to 5½ per cent by the beginning of 2006.

¹¹ While it is true that direct lending to hedge funds is best captured by the non-bank segment, it is also likely that some lending to banks in offshore centres is then channelled into hedge funds. As a result, we do not make a distinction between lending to banks and non-banks for the purpose of this paper. A detailed discussion of institutions domiciled in offshore centres and their activities is given in Dixon (2001).

¹² Note that we convert the BIS data from US dollars into Special Drawing Rights (SDR) to avoid possible distortions emanating from trends in the US dollar. Given the pronounced weakness in the US dollar over 2003, the point of inflection shown would be shifted forward in time to early 2003.

Figure 5
Banks' Foreign Claims on Offshore Centres

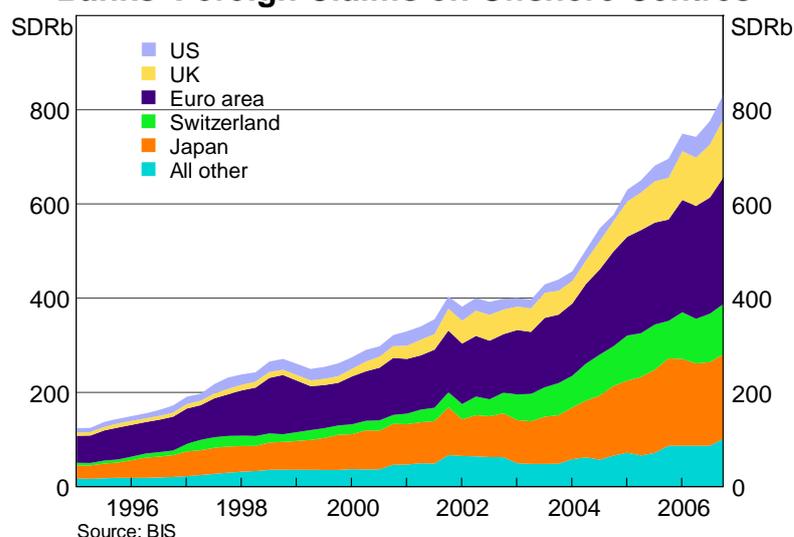


Table 2
BIS Banks' Foreign Claims on Offshore Banking Centres
US\$ billion

	March 2004	December 2006
Euro area	306.8	402.9
Japan	225.0	267.7
Switzerland	127.5	159.6
United Kingdom	97.6	184.9
United States	20.6	77.4
Other banks' claims	102.4	154.2
Total	880.0	1,246.8

Memorandum items:

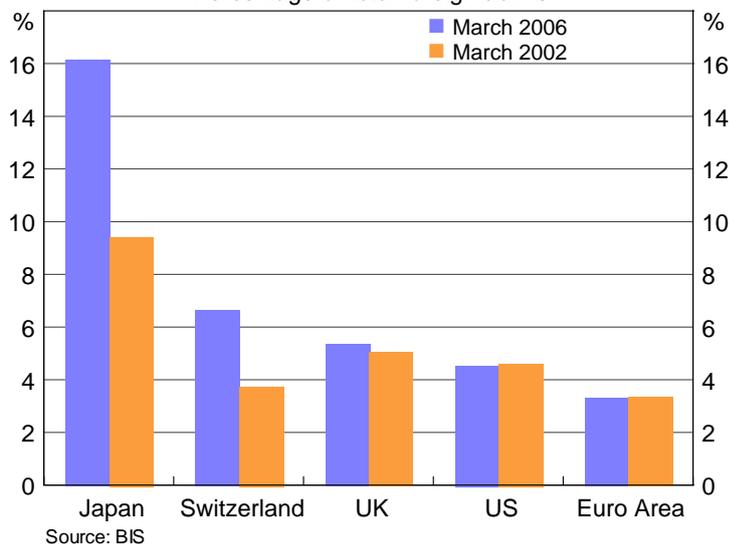
Offshore banking centres are defined here to encompass Aruba, Bahamas, Bermuda, Cayman Islands, Netherland Antilles, Panama, West Indies UK, Gibraltar, Guernsey, Isle of Man, and Jersey. These figures therefore exclude foreign claims on Hong Kong SAR and Singapore, which together amounted to US\$546 billion in December 2006. Also excluded are the much smaller centres of Lebanon, Macau SAR, Mauritius, Samoa, Singapore, and Vanuatu.

Source: Hedge Fund Research.

Notwithstanding that there have been large increases in lending to offshore centres from banks located in the euro area, the United Kingdom and the United States, this lending does not represent an increase in the relative importance of hedge fund financing for these countries (Figure 6). That is, overall cross-border lending by banks has grown at the same rate as lending to offshore banking centres. Only for Japan and Switzerland has lending to offshore banking centres gained a significantly more prominent share of total cross-border lending undertaken by banks in those countries.

We infer from the unusually low policy and lending rates that have persisted in Japan and Switzerland for some time that these findings are to be expected. Furthermore, these data are consistent with sizable carry trades financed by borrowing in Japanese yen and Swiss francs.¹³

Figure 6
Share of Foreign Claims Accounted for by Offshore Banking Centres
 Percentage of total foreign claims



2.2.4 Investor capital and leverage

The data available from Hedge Fund Research on the investor capital of offshore hedge funds provides a close approximation of the subset of funds not domiciled in the United States, for which BIS lending data is available.¹⁴ The contribution made by using this data is to provide an approximation of the actual level of on-balance sheet leverage. Thereby we also derive a better calibration of the size of positions held by hedge funds.

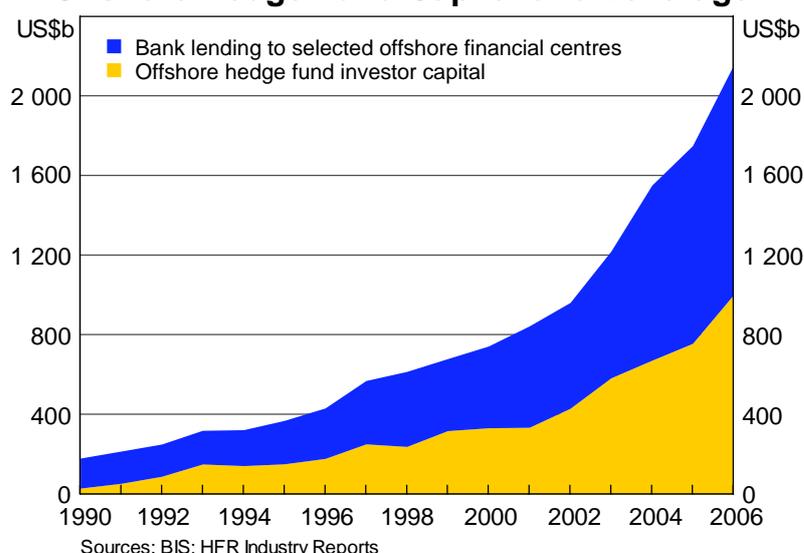
Figure 7 shows lending to offshore banking centres and offshore hedge funds' investor capital. There is some evidence to suggest that leverage expands broadly in line with investor capital, with the ratio of total borrowings to total investor capital little changed since the mid—1990s. However, it is instructive to note that this ratio tended to be around the highest in 1997 and 1998, which is similar to the findings of the BIS in McGuire et al (2005).

Together, the bank lending figures and investor capital of offshore hedge funds provide a conservative estimate of the total funds invested by offshore hedge funds. As at the end of 2006 this figure was over US\$2 trillion, showing that offshore hedge funds were investing in assets far in excess of their investor capital of US\$1,150 billion at that time. Taking into account that additional funds are domiciled in the United States, and the industry's aggressive use of off-balance sheet leverage, the total positions managed by hedge funds is likely to exceed these estimates substantially.

¹³ Lending by banks not domiciled in Japan or Switzerland, but denominated in yen and francs, strengthens this result.

¹⁴ A little under 90 per cent of these funds are domiciled in the same set of countries as the offshore banking centres from the BIS dataset.

Figure 7
Offshore Hedge Fund Capital and Leverage



3. The cost of finance and carry trade activity

Given that little information is available on carry trade-related capital movements, we attempt to calculate some of the key decision variables to gain an understanding of hedge fund behaviour. This is of particular interest as the profitability of carry trades directly violates the theoretical underpinnings of uncovered interest parity (UIP).

3.1 Calculating the cost of finance

Using the BIS data on the value and maturity of Japanese and Swiss bank claims on the Cayman Islands, we construct a weighted average cost at which hedge funds may finance carry trades.¹⁵ We restrict the exercise to Japan and Switzerland since the increase in their lending to offshore banking centres has increased noticeably as a share of their total international claims. Furthermore, we are more confident that their lending to offshore centres is largely denominated in their local currency (ie yen and francs) given their low

¹⁵ The simple arithmetic for this calculation is given by: $i_t = \sum_j \beta_t^j [\alpha_t S_t^j + (1 - \alpha) L_t^j]$

where:

i_t = the weighted average rate at which banks in Japan and Switzerland lend to hedge funds in the Cayman Islands at time t .

j = the two financing countries, Japan and Switzerland.

β_t^j = country j 's share in total lending to the Cayman Islands by Japan and Switzerland at time t .

α_t = the share of total claims on the Cayman Islands that is short-term (ie less than one year).

S_t^j = a representative short-term interest rate (three-month) for country j at time t .

L_t^j = a representative long-term interest rate (two-year) for country j at time t .

interest rates compared with other countries in recent years. While banks in Europe and the United States have also substantially increased their lending to hedge funds, we are less certain of the currency denomination of that lending. The weighted average rate at which banks in Japan and Switzerland lend to borrowers in the Cayman Islands is shown in Figure 8.

Figure 8
Hedge Fund Financing Cost



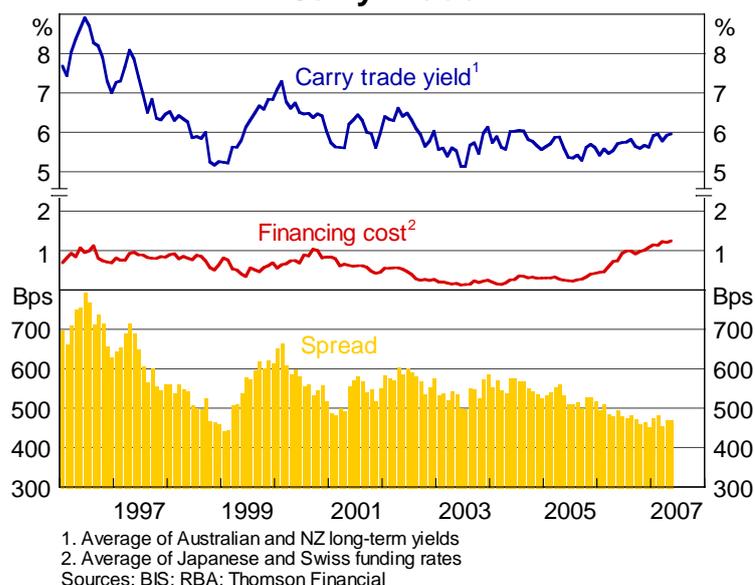
After fluctuating between $\frac{3}{4}$ to 1 per cent in the mid-1990s, interest rates began to decline in 1998—99, before rising back to 1 per cent in late 2000. From then, a gradual fall in interest rates began that saw a trough below 0.2 per cent in mid-2003. In 2004 and into 2005, average interest rates in Japan and Switzerland remained unusually low at around $\frac{1}{4}$ of one percentage point. Following the general pick up in economic activity and to a lesser extent inflation over the last two years, central banks in Japan and Switzerland began to normalise policy rates, leading to the gradual increase in rates observed to date. Accordingly, the financing cost faced by hedge funds has now risen above $1\frac{1}{4}$ per cent for the first time in more than a decade.

3.2 Carry against Australia and New Zealand

Given the resilience of the Australian and New Zealand economies to the global downturn in this cycle, interest rates in these countries were not cut to the unusually low levels that prevailed in other industrialised countries. As a result, Australia, New Zealand, and a number of less developed countries were natural destinations for carry trade investments over recent years. To calculate a yield that hedge funds may have earned on carry trades, we take the unweighted average of 10-year government bond yields in Australia and New Zealand.¹⁶ This carry trade yield and the associated financing cost, along with the corresponding spread (ie the 'carry') are presented in Figure 9.

¹⁶ The resulting spread includes the duration risk implicit from borrowing at the short end of the yield curve to finance investment at the long end. While this may have important implications for the investment, we leave these aside for the purposes of this paper.

**Figure 9
Carry Trade**



In the second half of the 1990s, the carry was primarily driven by developments in the yield that could be earned rather than the cost of finance. However, the persistent decline in the financing cost began to boost returns from around 2001. Most notable is that since mid-2005 the carry has fallen significantly, not because of a decline in the yields earned, but mainly because the financing cost has risen considerably.

4. Exchange rate considerations

An important aspect of the nature of carry trades is that the foreign currency exposure resulting from raising a liability in one currency to fund an investment in another is either not hedged at all against exchange rate changes, or hedged less than the usual cross-border debt exposure.¹⁷ As a result, the risk to carry trade positions implied by exchange rate changes is substantial and can vary significantly over time. This risk is amplified further by the high degree of leverage employed by hedge funds, which can mean that even a small narrowing in spreads or exchange rate movements will trigger margin calls. Conversely, the capital flows associated with substantial carry trade positions can have important implications for exchange rates themselves.

4.1 Carry trade exposure to exchange rate changes

Persistent interest rate differentials are not competed away by the free movement of capital between the countries in question – not even in the long term. However, this observation is insufficient to explain the ex ante expectation that carry trades would be profitable. That is, if we subscribe to the theoretical idea of UIP, where interest rate differentials can only persist if

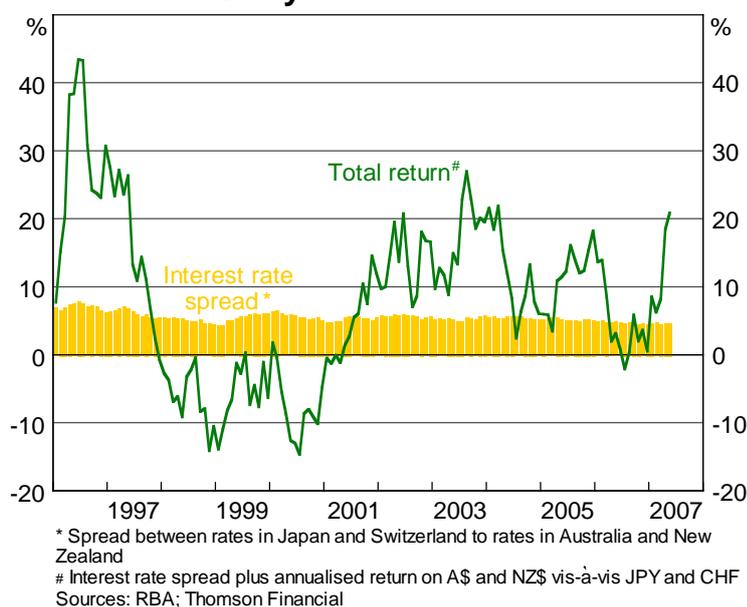
¹⁷ Fully hedging the foreign exchange exposure would involve giving up the carry earned on the debt investment. For a detailed explanation of foreign exchange hedging practices and exposures, see Becker and Fabbro (2006).

expected exchange rate changes offset them fully, then carry trades should not be profitable.¹⁸

Part of the explanation of why investors continue to pursue carry trades may be that there is a very wide dispersion of expectations about the direction, timing and magnitude of exchange rate changes. Short- to medium-term deviations from UIP may therefore give rise to the capital flows that seek to profit from the combination of interest rate and exchange rate movements. Interestingly, unhedged capital flows from low to high interest rate countries place upward pressure on the exchange rate of the high interest rate country. Once again, this is in direct conflict with UIP, where interest rate differentials are often interpreted as an indication of expected depreciation in the high interest rate country's exchange rate.¹⁹ The 2003 experience in the Australian and New Zealand dollars provides a convenient example of the violation of UIP (Figure 10). While there was a large interest rate differential favouring Australia and New Zealand over Japan and Switzerland, and UIP would predict either for that differential to be competed away or for the high interest rate currencies to depreciate against the low interest rate currencies, neither happened. The interest rate differential of around 5 percentage points in 2003 was further supplemented by the appreciation of the Australian and New Zealand dollars of around 15 per cent. In that year carry trades were very profitable and UIP failed.

More recently, notwithstanding the ongoing narrowing in interest rate differentials, carry trades have again become very profitable due to weakness in the Japanese yen and strength in the Australian and New Zealand dollars. As the speculative positions of traders get longer in these currencies, their value continues to move against UIP.

Figure 10
Carry Trade Returns



¹⁸ As a reminder, UIP postulates that the domestic interest rate is equal to the foreign interest rate adjusted for expected exchange rate changes ($i^d = i^* + \Delta s^e$).

¹⁹ Refer to Plantin and Shin (2006) for a detailed examination of how asset prices whose value is sensitive to the flow of funds into the market may be driven further away from fundamentals.

However, because hedge funds characteristically employ a very active management style for their leveraged investments, a number of other considerations affect their carry trade decisions. Thus, while it is likely that there will be persistent interest rate differentials between countries like Australia and Japan, the attractiveness of a carry trade opportunity will diminish as the total return declines. Therefore, carry trade activity will be sensitive to 'changes' in the rate of return, as well as the return itself. As a result, those hedge funds whose investments are most sensitive to returns will commence the unwinding of their carry trade positions as total returns begin to narrow.

Narrowing returns and increased exchange rate volatility in the past 12 months have seen risks begin to move against carry trades. In order to gauge the risk exposure of hedge funds to exchange rate movements, the average absolute percentage change of a number of currencies against the Japanese yen, one of the main funding currencies, is shown in Table 3.

Table 3
Volatility of the Japanese Yen
Average absolute percentage change, 1995 to 2005

	Daily	Monthly	Quarterly	Yearly
A\$ per Yen	0.6	2.9	5.4	9.9
NZ\$ per Yen	0.6	2.8	5.3	12.0
US\$ per Yen	0.5	2.5	4.8	9.6

Sources: RBA and Reuters.

The current 'annualised' carry calculated earlier is around 4¾ percentage points. Since the Japanese yen moves half of one percentage point over an average day, this annualised return could be offset by the exchange rate in just 10 days if the yen were to gather upward momentum. Even if there is no strong uptrend in the yen, within the scope of the average month exchange rate movements can substantially reduce the profitability of an existing position. However, the importance of volatility has some notable asymmetric characteristics. While funds are probably willing to tolerate rising volatility around a trend in the exchange rate that moves in their favour, they are more likely to be constrained by volatility at times when UIP is widely expected to reassert itself.

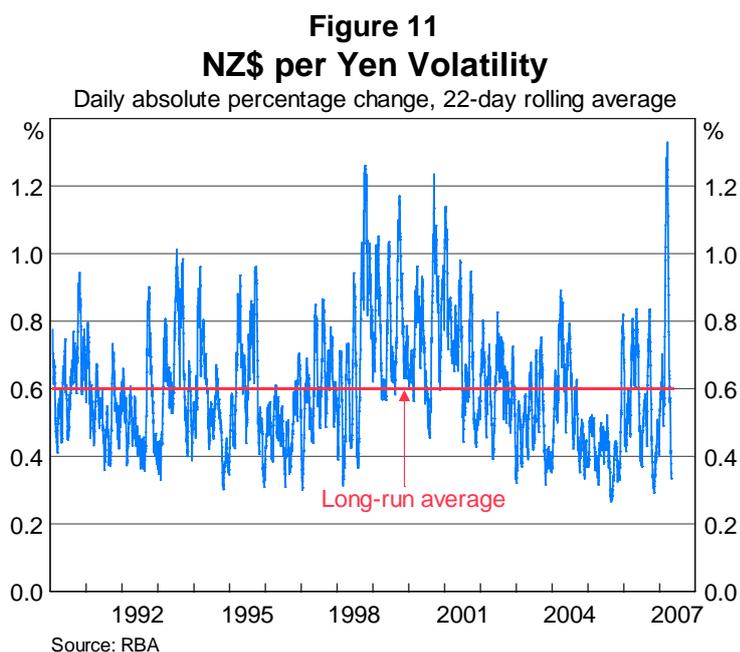
4.2 Carry trades as a source of exchange rate changes

While hedge funds have an exposure to exchange rate variations, their positions in themselves are at times sufficiently large to cause volatility in foreign exchange markets. This is usually most evident when substantial positions that have built up over a period of time are reversed quickly. This may come about when aforementioned unfavourable exchange rate or interest rate changes trigger some repatriation of investments. Since these flows tend to further push the exchange rate against the profitability of carry trades, they often trigger additional liquidations, and so on. Another reason for such reversals may be an event that triggers a bout of general risk aversion. In such situations, the unruly unwinding of positions by speculative accounts may result in or exacerbate undesirable financial market volatility.

In March 2006, this type of scenario appeared to play out as hedge funds reversed substantial carry trade positions. The New Zealand dollar, Icelandic krona, and the

currencies of a number of less developed countries were most affected.²⁰ Since these currencies are significantly less liquid than the major six currencies in the world, the movements were further exacerbated.²¹ Exchange rate volatility therefore represents an important risk for the profitability of carry trades, and in turn the large international capital movements involved also have implications for exchange rate volatility itself.

The evolution of volatility in the New Zealand dollar over recent years is therefore likely to be at least in part due to capital flows that seek the higher rate of return of local debt instruments. Following a period of below average volatility in 2004 and 2005, the New Zealand dollar began to fluctuate more widely against the Japanese yen (Figure 11). Around this time, it was evident that speculative activity was playing an important part in dictating the direction of the exchange rate.²² The gross turnover in capital flows at around this time was large relative to the size of the New Zealand market, and caused some significant exchange rate movements.



At around the same time, volatility in the Australian dollar against the Japanese yen began to rise from its lows to more normal levels. However, there is less evidence of significant or persistent volatility (Figure 12). Perhaps the Australian dollar's high liquidity in global foreign exchange markets was among a number of mitigating factors.²³

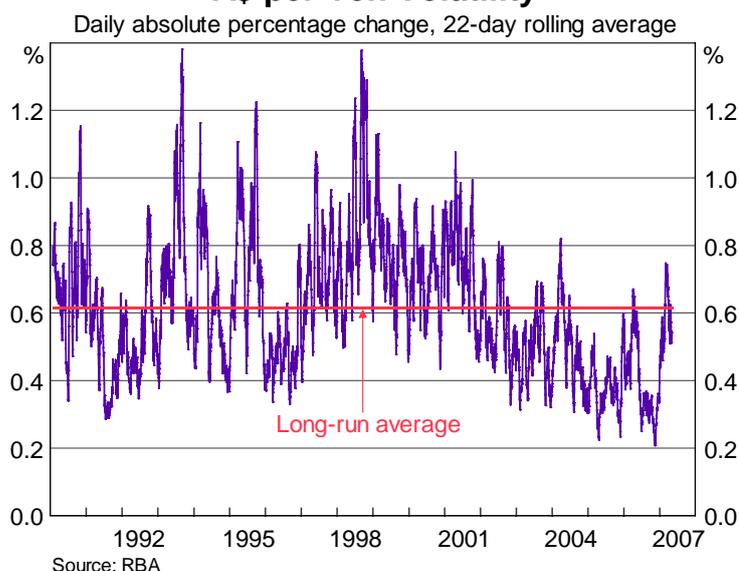
²⁰ For a description, see RBA (2006).

²¹ In order of importance, the major six currency pairs against the US dollar in 2004 were European euro, Japanese yen, United Kingdom pound sterling, Australian dollar, Swiss franc, and Canadian dollar. See also BIS (2005).

²² In the case of New Zealand and Australia, the flow of unhedged retail investments from Japan into local currency denominated debt instruments ('uridashi') are also an important type of capital flow. However, since these funds are rarely borrowed, they are somewhat different to the carry trades discussed here.

²³ Importantly, the episode of volatility that followed in March 2007 was mainly driven by factors influencing the Japanese yen rather than the destination currencies. General risk retrenchment at around that time saw unwinding of carry trades that gave rise to volatility in the USD/JPY rate and the NZD/USD rate. The AUD/USD rate, on the other hand, remained relatively unaffected.

Figure 12
A\$ per Yen Volatility



Another important aspect of how the risk profile of carry trades has evolved concerns the implicit guarantees that were in place as a result of expansionary policies in some countries. This was especially the case in Japan. For domestic policy reasons, the Bank of Japan had long enunciated its commitment to maintaining the policy rate at zero to ensure an end to domestic deflation. This also ensured that the financing cost for carry trades was reliably tied to evidence that the Japanese economy was recovering. Furthermore, as the Japanese authorities undertook substantial exchange rate intervention to prevent the appreciation of the yen against the US dollar in 2003 and 2004, another guarantee had been put in place to mitigate the risk of entering into carry trades. For a while, carry trades financed in Japanese yen were almost a one-way bet as the authorities appeared to limit both the interest rate and currency risk. Both of these implicit guarantees have since been removed.

5. Conclusion

Narrowing returns on carry trades may make it increasingly difficult for highly leveraged hedge funds to sustain their current positions. As a result, the risk of an unruly unwinding of positions has risen. If this process is rapid or extensive enough, then it could cause some disruption to global financial markets.

Anecdotal evidence indicates that the unwinding of carry trade positions may have already had a significant impact on foreign exchange markets. Much of the depreciation seen in the Australian, New Zealand, and Icelandic currencies in March 2006 was directly related to this type of activity.

Appendix A: ‘Hedge Fund Research’ strategy groups

Convertible arbitrage – involves purchasing a portfolio of convertible securities, generally convertible bonds, and hedging a portion of the equity risk by selling short the underlying common stock.

Distressed securities – strategies invest in, and may sell short, the securities of companies where the security's price has been, or is expected to be, affected by a distressed situation. This may involve reorganisations, bankruptcies, distressed sales, and other corporate restructurings.

Emerging markets – funds invest in securities of companies or the sovereign debt of developing or emerging countries. Investments are primarily long. Emerging markets include countries in Latin America, Eastern Europe, the former Soviet Union, Africa, and parts of Asia.

Equity hedge – investing consists of a core holding of long equities hedged at all times with short sales of stocks and/or stock index options. Some managers maintain a substantial portion of assets within a hedged structure and commonly employ leverage. Conservative funds mitigate market risk by maintaining market exposure from zero to 100 per cent. Aggressive funds may magnify market risk by exceeding 100 per cent exposure and, in some instances, maintain a short exposure. In addition to equities, some funds may have limited assets invested in other types of securities.

Equity market neutral – investing seeks to profit by exploiting pricing inefficiencies between related equity securities, neutralising exposure to market risk by combining long and short positions.

Equity non-hedge – funds are predominately long equities although they have the ability to hedge with short sales of stocks and/or stock index options. These funds are commonly known as ‘stock-pickers’. The important distinction between equity non-hedge funds and equity hedge funds is that equity non-hedge funds do not always have a hedge in place. In addition to equities, some funds may have limited assets invested in other types of securities.

Event-driven – is also known as ‘corporate life cycle’ investing. This involves investing in opportunities created by significant transactional events, such as spin-offs, mergers and acquisitions, bankruptcy reorganisations, recapitalisations, and share buybacks. Instruments include long and short common and preferred stocks, as well as debt securities and options.

Fixed income: arbitrage – a market neutral hedging strategy that seeks to profit by exploiting pricing inefficiencies between related fixed income securities while neutralising exposure to interest rate risk.

Fixed income: convertible bonds – these funds are primarily long only convertible bonds. Convertible bonds have both fixed income and equity characteristics.

Fixed income: diversified – these funds may invest in a variety of fixed income strategies. While many invest in multiple strategies, others may focus on a single strategy less followed by most fixed income hedge funds. Areas of focus include municipal bonds, corporate bonds, and global fixed income securities.

Fixed income: high-yield – these managers invest in non-investment grade debt. Objectives may range from high current income to acquisition of undervalued instruments. Emphasis is placed on assessing credit risk of the issuer.

Fixed income: mortgage-backed – these funds invest in mortgage-backed securities. Many funds focus solely on AAA-rated bonds.

Macro – involves investing by making leveraged bets on anticipated price movements of stock markets, interest rates, foreign exchange, and physical commodities. Macro managers employ a ‘top-down’ global approach, and may invest in any markets using any instruments

to participate in expected market movements. These movements may result from forecasted shifts in world economies, political fortunes, or global supply and demand for resources, both physical and financial.

Market timing – involves allocating assets among investments by switching into investments that appear to be beginning an uptrend, and switching out of investments that appear to be starting a downtrend. This primarily consists of switching between mutual funds and money markets. Typically, technical trend-following indicators are used to determine the direction of a fund and identify buy and sell signals.

Merger arbitrage – sometimes called risk arbitrage, involves investment in event-driven situations such as leveraged buy-outs, mergers, and hostile takeovers.

Regulation D – invest in Regulation D securities, sometimes referred to as structured discount convertibles. The securities are privately offered to the investment manager by companies in need of timely financing and the terms are negotiated. Once a deal is closed, there is a waiting period for the private share offering to be registered with the SEC. The manager can only convert into private shares and cannot trade them publicly during this period; therefore their investment is illiquid until it becomes registered. Managers will hedge with common stock until the registration becomes effective and then liquidate the position gradually.

Relative value arbitrage – attempts to take advantage of relative pricing discrepancies between instruments including equities, debt, options, and futures. Managers may use mathematical, fundamental, or technical analysis to determine misvaluations. Securities may be mispriced relative to the underlying security, related securities, groups of securities, or the overall market.

Source: **Hedge Fund Research**, 'HFR Industry Reports', *various issues*, www.hedgefundresearch.com.

Appendix B: A possible link between Japanese banks' balance sheets and derivatives-based financing of carry trades

As is the case in most other developed countries, banks in Japan fully hedge their on-balance sheet foreign currency exposure.²⁴ While there are no direct data available on off-balance sheet derivatives, trends in on-balance sheet items can be used to infer some important aspects of how Japanese banks choose to lend.²⁵

In recent years, an important trend that has developed is that Japanese banks have substantially added to their external net long-term asset position denominated in foreign currency (Figure B1). This has more than offset their external net liability position in short-term foreign currency instruments. Consequently, Japanese banks have accumulated a widening overall external net asset position.

²⁴ Compliance with Basel accords ensures that capital is set against open foreign currency positions to cover risk. However, this tends to be relatively expensive and banks generally opt to hedge their foreign exchange exposures through natural hedges or derivatives. See also Becker and Fabbro (2006).

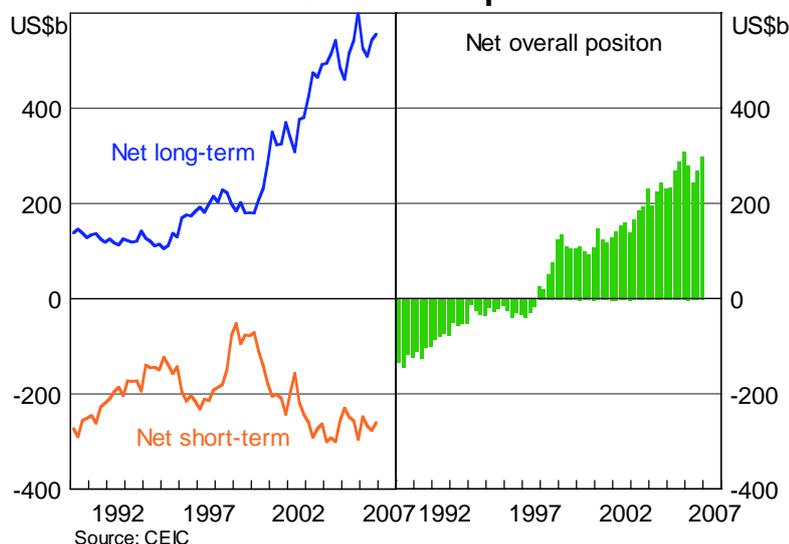
²⁵ The source of yen for the rest of the world must be the Japanese banking system or the Bank of Japan. Even if the yen are not directly sourced from Japanese residents, they have to originate from a transaction in Japan.

This open foreign currency position implies exposure to movements in the Japanese yen, which is unlikely to exist because banks hedge these exposures.²⁶ An investigation of how Japanese banks are accumulating foreign currency assets, while hedging the implied exposure to movements in the yen, yields important indirect evidence of the use of derivatives in funding yen denominated lending to non-residents.

Japanese banks could be issuing foreign currency debt to fund their acquisition of foreign currency assets. This would imply equal amounts of foreign currency assets and liabilities which provide a hedge against foreign exchange risk. However, this cannot be the case because the net asset position indicates that assets exceed liabilities.

Alternatively, Japanese banks awash with domestic liquidity could be converting yen in the foreign exchange spot market to acquire foreign assets and then hedge these through derivative transactions in forwards or options. Again, this seems unlikely as these types of hedges provide only an imperfect and high cost offset to foreign exchange risk.

Figure B1
External Foreign Currency Position
of Banks in Japan



We therefore suggest that Japanese banks are swapping their ample yen liquidity into foreign currencies, thereby selling yen in the near leg of the swap and repurchasing it in the far leg. This amounts to a yen denominated loan for the duration of the foreign exchange swap taken out by the counterparty to the transaction (eg a prime broker to hedge funds). Simultaneously, Japanese banks therefore borrow foreign currency for the duration of the swap and invest the proceeds in long-term foreign assets (eg US bonds). Importantly, since the terms of the second leg of the swap and the exchange rate are agreed at the time the contract is entered into, Japanese banks are not taking on the foreign exchange risk associated with fluctuations in the yen for the duration of the swap.

This explanation is appealing because it accounts for how yen liquidity is converted into foreign currency, how foreign assets are accumulated, and how this apparently open foreign currency position is in fact hedged against fluctuations in the yen. It also happens to be consistent with carry trade financing for which there is little evidence to be found in traditional measures that rely on on-balance sheet measures such as bank lending and capital flows.

²⁶ There is no indication that Japanese banks are setting aside more capital against open foreign currency positions (despite the rising proportion of assets held in foreign currencies), which implies that these positions are hedged to comply with regulatory standards (see Bank of Japan (2007)).

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