

## Changes in Hedge Fund Investment Behavior and the Impact on Financial Markets

### *Position Concentration, Expanded Scope, and Market Liquidity Risk*

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Hedge funds have changed their investment behavior in recent years stimulated, among other things, by large inflows of money and rising stock prices around the world. Database<sup>1</sup> analyses indicate that they are expanding their long positions in equity markets, increasing their investments in emerging markets and commodities markets, and exhibiting higher degrees of correlation between strategies. Hedge funds have an influential presence in the financial markets as suppliers of liquidity, and they contribute to improving efficiency of markets. On the other hand, they also have the potential to amplify market price fluctuations if their investment behavior becomes one-sided or if they concentrate on specific markets, especially small-sized and low-liquidity markets. Bias in investment behavior or concentration on specific markets has the potential to impact investors investing in hedge funds such as reducing risk-diversification benefits. In this perspective, central banks need to appropriately monitor changes in hedge fund investment behavior and keep close contact with market participants in order to fulfill their roles, which include to support adequate market liquidity during market distress.

### Preface

With the rise in global equity prices which began in mid-2003<sup>2</sup>, many hedge funds began seeking to earn profits by expanding net long positions particularly in equity markets. Several factors are conceivably behind the changes in their investment behavior. For one, the financial environment of rising equity prices was favorable. Second, large amounts of money were invested in hedge funds. Third, profit opportunities through arbitrage declined in markets, partly as an outcome of higher efficiency in markets through arbitrage activities of hedge funds.

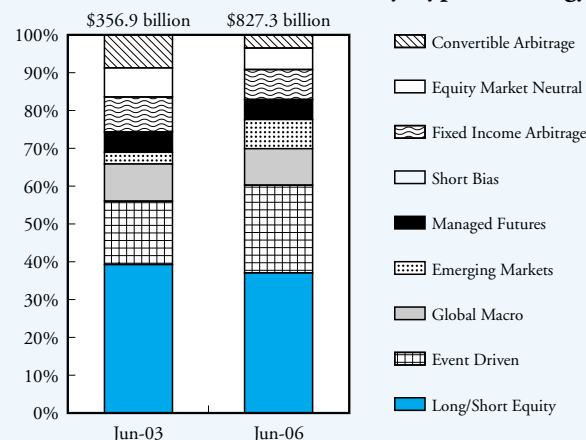
Hedge funds reportedly have 1.2 trillion dollars<sup>3</sup> in assets under management and they often use leverages<sup>4</sup> to improve performance or trade with high frequency. It makes sense for investors, whether they are hedge funds or other investors, to be keen on markets developments and their directions, and actively invest in rising markets. However, if they were to move in the same direction, there might be an impact on both price formation in the financial markets and the risk profiles of investors investing in hedge funds. This review uses information on databases and other sources to confirm changes in hedge fund investment behavior and observe the impact that these changes have on financial markets and investors.

### Changes in hedge fund investment behavior

*(Breakdown by investment strategies)*

Looking at the outstanding amount of assets under management by hedge funds by investment strategy as of the end of June 2006 (Tremont Capital Management; excluding Multi-Strategy funds), four strategies account for more than three-quarters of the whole: Long/Short Equity (the highest at almost 40%), Event Driven, Global Macro, and Emerging Markets. Meanwhile, compared to the end of June 2003, there has been a decline in share of hedge funds exercising arbitrage strategies, specifically Convertible Arbitrage funds, Equity Market Neutral funds, and Fixed Income Arbitrage funds (See Chart 1).

**Chart 1: Ratio of Assets under Management by Type of Strategy**



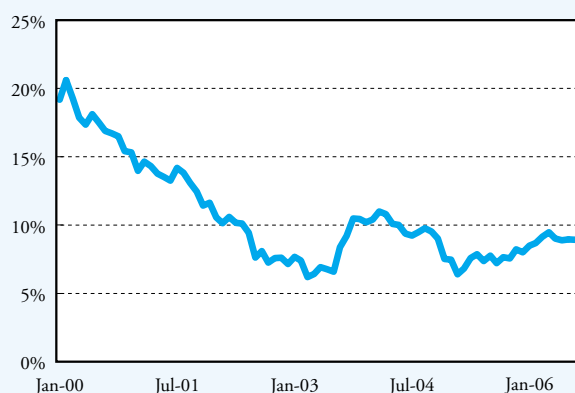
## Reference: Outline of Strategies

Strategy	Description
Long/Short Equity	Seeks to earn profits while controlling for the impact of overall market volatility by using a combination of long positions (purchases) of equities with relatively strong upside potential and short positions (sales) of equities with relatively strong downside potential.
Event Driven	Seeks to earn profits by capturing price changes caused by corporate mergers, reorganizations, realignments, liquidations, bankruptcies, and other events.
Global Macro	Seeks investment opportunities from price formation distortions and trends in global markets for equities, bonds, foreign exchange, commodities, and derivatives.
Emerging Markets	Primary investments are equities and bonds in emerging markets.
Managed Futures	Invests in futures (equities, interest rates, commodities, and currency) markets. Notable for the relatively high presence of funds that engage in systematic trading based on prices and technical indexes.
Short Bias	Maintains a net short position, investing primarily in spot equities and derivatives.
Fixed Income Arbitrage	Focuses on distortions in price formation between multiple vehicles such as bonds, and seeks to earn profits in the process of conversion to rational price levels. Primary investments are public and private bonds, MBS and other asset-backed securities, and derivatives such as swaps.
Equity Market Neutral	Basically maintains long and short positions of the same size, seeking to earn profits from distortions in price formation for individual issues.
Convertible Arbitrage	Seeks profit opportunities from the price relationships between CBs and other securities issued by the same company. The typical investment technique is to take a long position in a company's CBs and a short position in its common stock.

### *(Expansion of long positions in the equity markets)*

The rate of return for hedge funds is lower than it was prior to 2000, but still remains around 10% (see Chart 2). However, the nature of these returns may have changed.

**Chart 2: Hedge Fund Index Rate of Return**



Note: 60-month backward moving average.  
Source: Credit Suisse/Tremont

We observed the sensitivity ( $\beta^5$ ) of the monthly rate of return of the hedge fund index of each strategy to that of the MSCI World Equity Index, a representative equity index. We found that sensitivity has risen sharply for Long/Short Equity strategy and Emerging Markets strategy (see Chart 3). This conforms with the market perceptions that many hedge funds have expanded net long positions on the back of the rising trend in equity markets.

Sensitivity is close to zero for other strategies such as Equity Market Neutral, which generally maintains a net neutral position in equity markets, or Fixed Income Arbitrage, which presumably has little, if any, exposure to equity markets.

The expansion of hedge funds' net long positions in equity markets can be considered to lead to an increase in the correlation between monthly rates of return for hedge funds and equity markets. Data confirms that the correlation has increased since mid-2003 and has been

over 0.9 since February 2005 (see Chart 4).

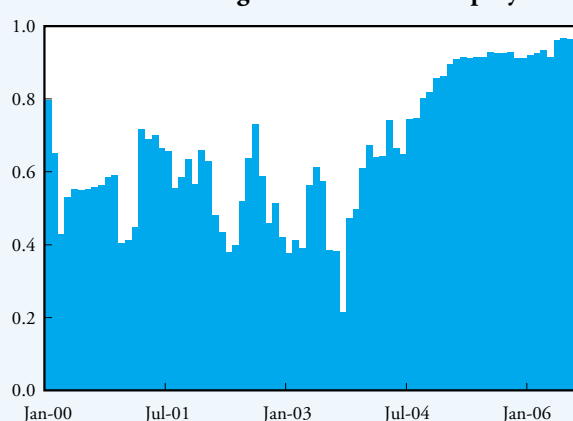
**Chart 3: Sensitivity ( $\beta$ ) of Return of Individual Hedge Fund Strategy to Equity Index**

	2002-03	2003-04	2004-05	2005-06
Emerging Markets	0.28	0.40	0.36	1.05
Long/Short Equity	0.11	0.39	0.55	0.80
Managed Futures	-0.33	0.72	0.83	0.79
Event Driven	0.07	0.14	0.35	0.38
Global Macro	0.04	0.04	0.17	0.38
Multi-Strategy	0.04	0.18	0.27	0.35
Convertible Arbitrage	-0.03	0.10	0.36	0.12
Equity Market Neutral	0.02	0.07	0.04	0.06
Fixed Income Arbitrage	-0.01	0.01	0.15	0.03
Short Bias	-0.58	-1.12	-1.37	-0.86
General Index	0.05	0.22	0.36	0.51

Note: Calculated from monthly data for the period from September to August of the next year (12 months).

Sources: Credit Suisse/Tremont, Bloomberg, Bank of Japan

**Chart 4: Correlation of Monthly Rates of Return between Hedge Fund Index and Equity Index**



Note: 12-month backward moving average.

Sources: Credit Suisse/Tremont, Bloomberg, Bank of Japan

### *(Expanding investments in emerging markets)*

Hedge funds have also expanded their investments in emerging markets. According to the Tremont Asset Flows Report, assets under management of hedge funds adopting Emerging Markets strategy rose from 11.3 billion dollars as of the end of June 2003 to 64.4 billion

dollars as of the end of June 2006.<sup>6</sup> Behind the increase in investments in the emerging markets is the improvement in emerging countries fundamentals, which has reduced investment risks, combined with the potential for higher growth than developed countries.

Generally, emerging markets are smaller<sup>7</sup> and less liquid than markets in developed countries. Their derivatives markets are commonly not mature and place restrictions on investment activities. These constraints often pose difficulty in creating short positions and engaging in cross-border transactions.

Using data of hedge funds investing in equities of certain countries and regions, we analyzed the sensitivity of monthly rate of returns of hedge funds to the price movements in that country or region's equity indexes, and the correlation of hedge fund returns and equity index returns. The result indicates that, overall, sensitivity and correlation tend to be higher for funds investing in emerging markets than in developed countries' markets (see Chart 5). For example, for funds investing in Japan, the correlation of returns between hedge funds and the Japanese equity index is 0.58, while for funds investing in emerging Asian countries it is 0.86. This result suggests that hedge funds may be expanding their long positions in emerging markets more than in developed countries' markets partly because of the difficulty in creating short positions in emerging markets.

**Chart 5: Sensitivity ( $\beta$ ) and Correlation of Return between National/Regional Hedge Funds and Equity Indexes**

	Sensitivity ( $\beta$ )	Correlation
Japan	0.24	0.58
United States	0.43	0.84
United Kingdom	0.14	0.48
Emerging Asia	0.43	0.86
Latin America	0.62	0.58
Eastern Europe	0.42	0.84

Note: Calculated from monthly data for the period Jan-03 to Aug-06.  
Sources: Lipper TASS Database, Bloomberg, Bank of Japan

*(Expanding investments in commodities markets)*

Of the 4,310 hedge funds registered in the database as of the end of August 2006 (including Funds of Hedge Funds<sup>8</sup>), 792<sup>9</sup> included commodities in their scope of investment (18.4% of the total number). However, only a very small number of funds (23) invested exclusively in commodities; the majority included equities, bonds, and other assets in their scope.

Hedge funds also seem to be gradually increasing investments in the commodities markets. According to the Tremont Asset Flows Report, assets under management in Managed Futures strategy funds, a leading strategy for hedge funds that include commodities investments, rose from 17.5 billion dollars

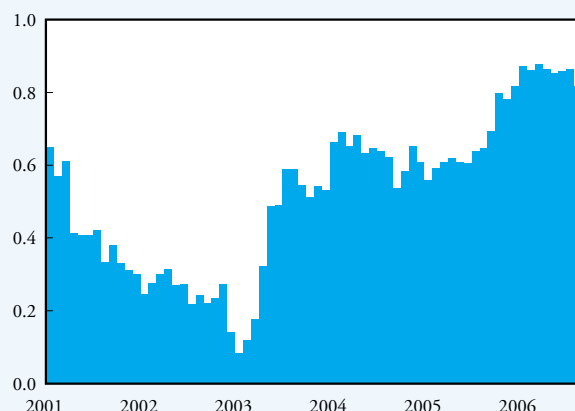
as of the end of June 2003 to 41.7 billion dollars as of the end of June 2006. During the same period, the crude oil futures positions of non-commercial traders on the New York Mercantile Exchange (published by CFTC; sum of long and short positions held) rose from 3.5 billion dollars as of the end of June 2003 (13% of all positions on the exchange) to 22.6 billion dollars as of the end of June 2006 (17% of all positions on the exchange).

Commodities markets are characterized by a majority of trades being in futures which are often leveraged, and by low liquidity of some products.

*(Increase in correlation between strategies)*

There is a growing perception among market participants that the investment behavior of hedge funds is gradually becoming more homogenous. An analysis using the hedge fund index shows that the mean correlation among the monthly rates of return for the four top strategies in terms of assets under management (Multi-Strategies excluded) rose to about 0.8 (see Chart 6).

**Chart 6: Correlation between Hedge Fund Strategies**



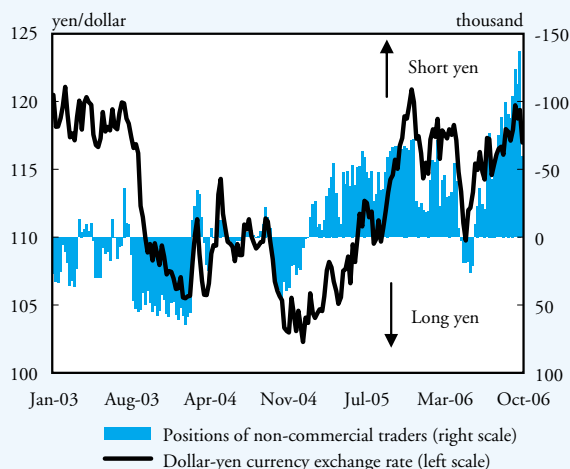
Note: 12-month backward moving average. Average correlation for monthly rates of return between 6 pairs of 4 strategies: Long/Short Equity, Event Driven, Global Macro, and Emerging Markets.  
Sources: Credit Suisse/Tremont, Bloomberg, Bank of Japan

*(Accumulation of yen short positions on the foreign exchange markets)*

Since 2005, while FRB and ECB were raising policy rates, there was a widely held view that the Bank of Japan would not be raising its policy rates in the near term. This, combined with the stable, low volatility on the foreign exchange markets may have caused hedge funds to expand trades attempting to earn profits from interest-rate differentials. The dollar-yen IMM positions of non-commercial traders on the Chicago Mercantile Exchange are one example. Short positions expanded to 100,000 contracts (about 1.3 trillion yen) by mid-October, a new high (see Chart 7).<sup>10</sup>

These types of trades commonly involve foreign exchange swaps in addition to currency futures.

**Chart 7: IMM Position of Dollar-Yen Currency Futures Contracts**



Source: Bloomberg

### Impact of changes in hedge fund investment behavior

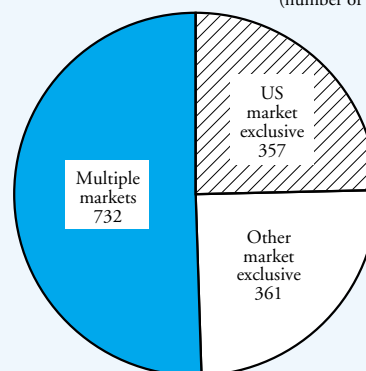
*(Concentration of positions and potential for simultaneous price drops in multiple markets)*

As an impact of these changes in hedge fund investment behavior, the potential amplification of price changes in financial markets can be raised. If hedge funds expand their long positions on specific markets (for example, equities) or if a large number of funds create similar investment positions, combined with the increase in assets under management and the use of leverage, there is the possibility that they would accelerate the pace with which prices rise or increase the extent of their falls. This is especially true if the positions taken are large in comparison to the market's liquidity or size, because if those positions are suddenly unwound they have the potential to cause large swings in market prices over a short period of time. Likewise, if a number of hedge funds simultaneously sell off positions that they have taken across multiple asset classes in order to pay dividends to their investors, there is the potential for simultaneous price fluctuations even in the markets that normally have little correlation in prices.

It is possible that changes in the investment behavior of hedge funds played a role in the price declines in global equity and commodities markets in

May and June of 2006. In this period, price declines spread from emerging markets and commodities markets to the equity markets of other major countries including Japan. Given the growing tendency of hedge funds to invest across a wide spectrum of emerging and commodities markets, one of the factors in this decline may have been the rapid unwinding of increasingly large net long positions of hedge funds reflecting falls in market prices. Looking in more detail at the volatility and price swings in financial markets during May and June, the increase in volatility and the size of the price drops were generally very large on emerging and commodities markets, where the inflow of funds was large in comparison with market size and price rose rapidly from the middle of 2005 (see Chart 8). Another point is the possibility that investor positions on these markets may have been concentrated in certain transactions ("crowded trades"). During the same period, rates of return significantly deteriorated<sup>11</sup> for hedge funds investing in developed and emerging markets and commodities markets, such as Long/Short Equity funds, Emerging Markets funds, and Managed Futures funds. For these funds, accumulation of long positions probably exacerbated the losses when markets declined. Using the database information to identify factors in the widespread, simultaneous price adjustments, we confirmed that more than half of the funds had been engaged in investments across multiple markets (see Chart 9).

**Chart 9: Distribution of Equity Hedge Fund Investment Regions**  
(number of funds)



Source: Lipper TASS Database

**Chart 8: Volatility and Price Change Rate in May-June 2006**

	Developed Country Equity Index				Emerging Country (Region) MSCI Equity Index			Commodities			
	TOPIX	S&P 500	DAX (Germany)	FT 100 (UK)	Latin America	Asia	Europe/Middle East	Crude Oil	Gold	Silver	Copper
Annualized standard deviation of daily return (Jan-Oct 2006)	19.6%	10.3%	16.0%	13.1%	21.6%	15.5%	25.2%	27.4%	24.9%	45.8%	40.5%
Annualized standard deviation of daily return (May-Jun 2006)	24.1%	14.0%	22.9%	20.5%	30.8%	24.8%	40.5%	27.0%	34.4%	57.1%	60.4%
May-Jun 2006 high	1755.03	1325.76	6140.72	6105.6	54005.71	499.95	4615.15	74.61	721.5	14.846	8,600
May-Jun 2006 low	1458.30	1223.69	5292.14	5506.8	41332.71	406.58	3388.36	68.53	562.3	9.625	6,570
Rate of decline	-16.9%	-7.7%	-13.8%	-9.8%	-23.5%	-18.7%	-26.6%	-8.1%	-22.1%	-35.2%	-23.6%

Note: Prices for crude oil, gold, and silver are NYMEX nearby contract prices. Price for copper is LME price of contract for delivery in 3 months.  
Source: Bloomberg

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The sharp price declines observed in the natural gas market in mid-September of 2006 may also have been amplified by the unwinding of positions that had become large in comparison to market size. According to news reports, a hedge fund that had built a large position in the natural gas market incurred a loss of roughly 6.0 billion dollars. The fund apparently took this large position in anticipation of both price rises and expanding contract-month spreads in natural-gas futures prices. However, the market did not move as expected and the fund took a large loss instead. The natural gas market is relatively low in liquidity<sup>12</sup> compared to crude oil and other markets. Taking large positions in low-liquidity markets mean that it is difficult to quickly unwind the position when prices begin to fall, which exacerbated the losses. To cover the losses from rapid price declines in the natural gas market and to make repayments to investors, according to some sources, the fund had to sell other assets on the gold, crude oil, and European credit markets. These markets are fairly liquid, so there was no serious spread of risk, but had the fund sold assets on the other, less-liquid markets, there is a possibility that price declines would have spread to other markets.

*(Lower risk diversification and higher liquidity risk for investors)*

Another impact of changes in hedge fund investment behavior is the potential to change the risk profiles of hedge fund investors. Specifically, this refers to a reduction in the portfolio diversification benefits due to the increase in correlation of hedge fund investments with traditional assets (especially with equity), and the reduction in diversification benefits from Fund of Hedge Funds investments due to the higher correlations between the returns of different strategies. In our interviews with investors who invested in hedge funds as “alternatives” to traditional assets like equities and bonds expecting to achieve diversification benefits, many of them commented they would need to rethink their asset allocation if correlations with traditional assets were to exceed the ranges they originally assumed. On the other hand, some also argued that what investors are ultimately investing in is the ability of the fund manager to dynamically change sources of earnings, and a reallocation of assets because of a temporary rise in correlation with traditional assets would be inappropriate because it would undermine investment policies.

Investments in emerging and commodities markets by hedge funds have been growing, but these markets are less liquid in comparison to developed countries equity and bond markets. Markets with sufficient liquidity are able to limit the impact on prices from concentration of positions, so the risk of market

destabilization due to concentration is ultimately caused by the market’s lack of liquidity. While liquidity risks are growing in the investment targets, investors and prime brokers<sup>13</sup> are demanding that hedge funds themselves have more liquidity. Hedge funds are being required to find a new balance between the supply and demand for liquidity by shortening investment time horizon among other means. For example, when emerging market prices were declining in May and June, hedge funds were forced to sell additional assets because of stringent calls for margin payments imposed by prime brokers.

From the perspective of hedge fund risk management, the key issues are how to manage the risk of losses for individual hedge funds and how much information disclosure to require from funds. One possible solution to the first issue is to invest in Funds of Hedge Funds, a strategy adopted by many institutional investors. However, this review has already pointed out the potential increases in the correlation between the returns of the strategies, which requires investors to monitor funds more closely and adopt more appropriate asset allocations. For the second issue, disclosure requirements may be effective in making it more difficult for hedge funds to take excessive risks. However, requiring more transparency may also reduce fund performance by reducing managers’ latitude and increasing administrative costs. Investors should seek an appropriate balance in light of their investment policies.

## **In sum and the roles of central banks**

Hedge funds play an important role in today’s financial markets, improving overall liquidity and efficiency and making a wide range of risk hedges and position adjustments available to other market participants. With Japan’s equity market experiencing a down turn since around 2003 and interest rates low, Japanese investors have also valued hedge funds for the diversification benefits brought by their low correlation with traditional assets, and little vulnerability to market trends. In this way, they have provided a new option for achieving absolute returns.

On the other hand, rising global equity prices since mid-2003 may have changed the investment behavior of hedge funds, inducing them to take net long positions in equity markets and to expand the scope of their investments. Their behavior is likely to change again in the future in reaction to market developments.

As hedge fund investment behavior changes, so does the nature of the macro risks triggered by hedge funds. Advances in risk management of financial institutions are considered to have reduced the potential for widespread destabilization of financial markets as was seen in the 1998 bankruptcy of Long Term Capital Management, in which losses of an individual hedge



fund resulted in a spread of bankruptcies and losses at the financial institutions that dealt with it. An example was demonstrated in the natural-gas fund losses. Financial institutions that had transactions with the fund managed the risk appropriately and prevented a spread of risk that could have resulted in large losses. What is of more concern in recent years seems to be the accumulation of positions of hedge funds in low-liquidity markets. There is the risk of adversely impacting the entire financial system if, for some reason, price adjustments are amplified in the process of unwinding these positions.

The Bank of Japan exchanges information and opinions about global financial markets with authorities and organizations around the globe in several international conferences. For example, at “Markets Committee”<sup>14</sup> meetings held every two months at the Bank for International Settlements (BIS), the Bank of Japan exchanges information on trends in global financial markets and discuss latent risks with members from other central banks. The committee has actively discussed issues related to market liquidity risk. One of the topics discussed included large long positions being built up in some emerging-country currency futures markets and significant declines in the currency afterwards because these positions were unwound over a short period of time in the process of the May-June price adjustments. There have also been discussions of specific efforts to monitor the developments in commodities markets such as their liquidity in the same way as other financial markets because commodities have joined equities, bonds and other financial instruments as investment targets included in investor portfolios.

When hedge funds or certain other market participants close out large positions in low-liquidity markets over a short period of time, it becomes important whether the liquidity required will be provided by other market participants. Through day-to-day monitoring of market liquidity and understanding the mechanisms of supply of liquidity, central banks can share necessary information with other market participants and contribute to minimize disorders during times of shock. Maintaining and reinforcing systems for gathering information from and furnishing information to market participants is one of the important roles for central banks.

<sup>1</sup> “Database” in this review means Lipper TASS Database, which contains 4,310 hedge funds as of August 2006.

<sup>2</sup> MSCI World Equity Index rose by 51.0% from the end of September 2003 to the end of September 2006.

<sup>3</sup> Estimate by Tremont Capital Management as of the end of June 2006.

<sup>4</sup> For further discussion on the leverage used by different hedge fund strategies, see Page 36 of “Recent Developments in Hedge Funds” (June 2006) published by Bank of Japan.

<sup>5</sup> This review defines  $\beta$  (beta) as the sensitivity of the hedge fund’s monthly rate of return to that of the benchmark, calculated as (covariance of benchmark and hedge fund index rate of return) divided by (variance of benchmark rate of return).

<sup>6</sup> According to the IMF Global Financial Stability Report, between 2002 and 2005, the size of the emerging-economy equity markets rose 3.6-fold from 1.8 trillion dollars to 6.5 trillion dollars, while emerging-economy bond markets grew 1.8-fold from 2.5 trillion dollars to 4.4 trillion dollars.

<sup>7</sup> This can be seen, for example, by comparing equity market size (market capitalization): 16,570 billion dollars for the United States, 4,690 billion dollars for Japan, 590 billion dollars for Brazil, 890 billion dollars for Russia, and 710 billion dollars for India (as at October 8, 2006).

<sup>8</sup> Funds of Hedge Funds are funds that invest in more than one (usually ten or more) hedge funds. They enable investors to invest in the hedge funds that are difficult to access directly. One of the merits of investing in a Fund of Hedge Funds is that diversification limits the losses incurred from any individual hedge fund.

<sup>9</sup> In terms of investment strategies, there were 319 Funds of Hedge Funds, 195 Managed Futures funds, and 100 Global Macro funds.

<sup>10</sup> According to interviews with market participants, a wider range of non-commercial investors increasingly uses IMM, so some view that IMM data cannot necessarily be used to argue that hedge funds have expanded their yen short positions.

<sup>11</sup> Monthly rates of return for May and June 2006 (Credit Suisse/Tremont Hedge Fund Index) were -2.84% and -1.01% respectively for Long/Short Equity, -5.02% and -0.14% for Emerging Markets, and -2.70% and -2.04% for Managed Futures (the overall hedge fund index was -1.30% and -0.11% respectively).

<sup>12</sup> Daily trading volume on the natural gas and crude oil futures markets (January-October 2006 average; nearby contract) are 1.89 billion dollars and 5.99 billion dollars, respectively.

<sup>13</sup> Prime brokers typically deal with settlement and clearing of trades and lending of securities and funds.

<sup>14</sup> The “Markets Committee” is a regular meeting for financial markets personnel at central banks, providing a forum for the exchange of opinions on financial-market trends and operations. It started in 1962 as the “Committee on Gold and Foreign Exchange.” Since June 2006, it has been chaired by Director-General Hiroshi Nakaso of the Bank of Japan Financial Markets Department.

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