Global Financial Crisis, Hedge Funds, and the Shadow Banking System

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I. Introduction: Hedge Funds as a Part of the Shadow Banking System

As the global financial crisis triggered by the subprime mortgage problem in the U.S. spreads, nontraditional financial institutions and transactions outside the banking system that we know well are attracting growing interest. Although they include what are called hedge funds and alternative investment, I here would like to use the term “the shadow banking system” to describe these nontraditional financial operations as in other recent discussions on the same subject (e.g. Diamond and Rajan 2009, Gorton 2008, Lo 2008a). In the context of current policy discussions, the shadow banking system may be taken as including hedge funds, private equity funds, structured investment vehicles known as SIVs, and sovereign funds, other than commercial banks subject to strict monitoring and regulations. The border is sometimes not so clear between the shadow banking system and the traditional banking system including commercial banks.

The shadow banking system is identical to what Treasury Secretary Tim Geithner called the “parallel system” when he was governor of the Federal Reserve Bank of New York (Geithner 2008). As explained by Geithner, the shadow banking system amounts to a parallel universe (like in science fiction) for average Americans who are not so well versed in finance. US public had barely aware of the presence of such a financial sub-system and had little interest in it several years ago. Since 2007, however, ordinary US citizens have had no choice but to face the presence of the huge financial universe neighboring the traditional universe or banking system where they live. Developments in the parallel universe have begun to seriously and inevitably affect the lives of average Americans. Abbreviations such as CDS (credit...

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*1 In preparing this report, I am particullary benefited from the presentations on global financial crisis by Shinichiro Shiraki, Hidenao Miyajima and other practitioners at Ministry of Finance between December 2008 and March 2009. Discussions with Kazuhiko Ohashi and Toshiki Honda, are also very helpful. So were comments by Seki Obata (discussant), Takatoshi Ito (chairman), Nick Benes, Masayuki Goto, Kenneth Kuttner and Takehiko Nakao at a MOF Policy Research Institute conference on March 24, 2009. I thank all these people. Most statistical analyses in the report had been prepared for my course at the Graduate School of International Corporate Strategy, Hitotsubashi University. I thank students participated my course (winter 2009) for making questions and comments. This article is based on a study first reported in the Iwaisako(2009), ‘America hatsu Sekai Kinyuu Kiki to Hedge Fund, Kage no Kinyuu Shisutemu’, Financial Review, Vol.95, pp.119-137 (in Japanese).The views expressed in this report are the author’s own and are not necessarily those of the Ministry of Finance.

*2 When writing this report, the author was an associate professor, Institute of Economic Research, Hitotsubashi University.
default swap), MBS (mortgage-backed securities) and SIV (structured investment vehicle) are mysterious codes for most people other than a limited range of experts in the United States as well as in Japan.

The shadow banking system has featured banking operations conducted in a space outside the full reach of surveillance and regulations by central banks and other financial regulatory authorities. This point is closely linked to anonymity and imperfect information accompanying financial transactions within the shadow banking system. The anonymity and imperfect information are the source of huge profits yielded by transactions in the parallel universe and have allowed the shadow banking system to outperform the traditional banking system and expand rapidly over the past two decades.

The most important problem is that the rapid expansion of financial transactions associated with anonymity and imperfect information has made it difficult for U.S. investment banks, the largest hedge funds and other major financial market players as well as regulators to grasp the whole picture of the shadow banking system. This implies that it has become more and more difficult for everyone to assess systemic risks contained in the shadow banking system. This is one of the most important aspects of the current global financial crisis and the main theme of this report.

Mainly continental European countries have called for considerably tough, urgent regulations on hedge funds as the most important component of the shadow banking system. However, hasty new regulations on something about which we have limited knowledge may not necessarily bring about desirable results. As far as anonymity characterizes the shadow banking system, available information or data on the system are extremely limited. It may be impossible to analyze all details of the system. Nevertheless, abstract theories alone are insufficient for analyzing economic problems in real world including financial ones for policy discussions. Quantitative data must be obtained to some extent. This report focuses on the hedge fund industry and uses available data to identify what has happened in this industry. The report then analyzes the roles hedge funds have played in the global financial crisis. Based on the analysis, the report discusses what specific measures should be taken to reduce systemic risks for designing a future banking system.

II. What Are Hedge Funds?

Before hedge funds are discussed, they must be defined clearly. However, it is difficult to strictly define such technical financial terms as hedge funds and private equities. Particularly, characteristics of dominant hedge fund strategies have dramatically changed from time to time, as reviewed later. First, I would like to quote a somewhat cynical definition made after the 1998 Long-term Capital Management crisis:

“Hedge funds are investment pools that are relatively unconstrained in what they do. They are relatively unregulated (for now), charge very high fees, will not necessarily give you your money back when you want it, and will generally not tell you what they do. They are supposed to make money all the

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1) See Dunber (2001) and Lowenstein (2001) for details of the LTCM crisis.
time, and when they fail at this, their investors redeem and go to someone else who has recently been making money. Every three or four years they deliver a one-in-a-hundred year flood. They are generally run for rich people in Geneva, Switzerland, by rich people in Greenwich, Connecticut (Asness, 2004).”

The quotation above, except geographical names, still meets the conditions of today’s hedge funds. Hedge funds as investment pools are characterized as (1) highly anonymous, (2) largely unregulated, and (3) managing large amount of money for investment.

However, it is very difficult to define hedge funds more specifically. Behaviors and investment styles of investment pools interpreted as hedge funds have changed from time to time and grown more diversified. Figure 1 shows a breakdown of total investment pools by hedge fund investment strategy, based on the data from Credit Suisse/Tremont Hedge Fund Index²). This graph alone suggest us many important things.

First, the fact that data collection was initiated in 1994 indicates that the hedge fund industry had grown to a sufficient size and attracted public attention (at least in Western countries) in the early 1990s. Second, investment styles in the hedge fund industry have greatly changed from time to time. Even today, the term hedge funds may automatically remind many people of George Soros. When the data collection started in 1994, in fact, the Global Macro, the investment strategy represented by Quantum Fund of Soros, accounted for nearly 70% of the hedge fund industry. Later, however, the share for the Global Macro had continued to decline throughout the 1990s. Particularly, share decline accelerated on the 1997 Asian currency crisis and the 1998 LTCM crisis and has stood at around 10% since the beginning of the 21st century. Instead, the Event Driven and Long/Short Equity strategies expanded their respective shares from the late 1990s. The Equity Market Neutral strategy also increased its share. However, the expansion of the Long/Short Equity share stopped after the information technology stock market bubble burst in 2000. Then, the Event Drive share expanded. Around 2003, however, the Multi-Strategy share cut into the Even Driven share sharply.

The changes in dominant investment strategies met major qualitative shifts accompanying the rapid expansion of the hedge fund industry. The investment strategy of Global Macro bases trading actions on macroeconomic forecasts and judgments on government policy failures (such as the British pound crisis) by such genius investors as Soros. The strategy is said to depend so much on the talent of investment managers so that it is difficult to describe its details. Hence, it is difficult to imitate and the barrier to entry in the strategy is high. In contrast, the Event Driven and Long/Short Equity strategies, which expanded their respective shares in the second half of the 1990s, have clearer investment concepts. Many funds might have adopted their basic concepts for investment management, although details of their strategies might have been different. These relatively newer investment strategies have thus featured clear basic concepts and have been convenient for copycats.

²) Data are available at the following website: http://www.hedgeindex.com/hedgeindex/
Lastly, investment strategy shares have changed greatly as the U.S.-originated global financial crisis has grown more serious since the second half of 2007. The Global Macro and Event Driven strategies have expanded their respective shares, while all other strategies have reduced their shares. Given that the global financial crisis is a major event and that investment managers’ market forecasts play a key role at the current juncture, the recent changes in these shares are reasonable.

III. Characteristics of Hedge Fund Returns

Next, I would like to consider the characteristics of hedge fund returns as compared with the that on the benchmark of stock market portfolio. Figure 2 plots annual returns on the Credit Suisse/Tremont Hedge Fund Index and the S&P 500, a representative U.S. stock index. The hedge fund return did not necessarily exceed the benchmark S&P 500 return every year. Relatively, however, the hedge fund return has been higher than the S&P return. Between 2000 and 2002, particularly, the hedge fund index staged a conspicuously successful escape from the IT bubble burst in contrast with the benchmark S&P that posted a negative return. In 2008 alone, the S&P 500 registered a 40% loss while the hedge fund index limited its loss to 20%. The hedge fund index has thus performed relatively better than the S&P 500.

In this report, however, no adjustments are made for data bias problems that inevitably accompany empirical analyses of hedge funds. The first problem is how hedge funds reporting data for the Credit Suisse/Tremont Hedge Fund Index are representative. The second problem is related to the reliability of data reported for the index. Hedge funds can be suspected of smoothing losses or having discontinued reporting data. These problems may apparently allow the characteristics of hedge fund returns to be

![Figure 1 Breakdown of Hedge Funds by Investment Strategy](image)
overestimated in the following analysis. See Lo (2008a) and Baba and Goko (2009) as in-depth analyses of the data bias problems.

Figure 2 Annual Returns on Credit Suisse/Tremont Hedge Fund Index and S&P 500

Source: Credit Suisse/Tremont Hedge Fund Index

Figure 3 plots annual hedge fund returns for some representative investment strategies. These graphs indicate that hedge fund returns vary depending on investment strategies. This means that any statistical analysis of hedge funds as one investor category is inappropriate. A combination of these graphs and Figure 1 suggests that hedge fund performances have been closely linked to money inflows into hedge funds. An apparent reason for a decline in the share for the Global Macro in the late 1990s was that hedge funds adopting the strategy posted heavy losses in 1998 on the Asian currency and LTCM crises and failed to take advantage of the 1998-2000 U.S. stock market upsurge while the Long/Short Equity strategy staged far better performances. In 2001 and 2002, however, the Global Macro strategy fell short of recovering the past share while getting around the impact of the IT bubble burst and enjoying the best performance among strategies.
Table 1 presents the basic statistics (average return, standard deviation, correlation with S&P500, the first-order autocorrelation, kurtosis and skewness), and CAPM Beta and Sharpe ratios for the monthly S&P 500, the hedge fund index and each investment strategy\(^3\). Panel A represents a subsample between 1994 and 2006. Panel B represents a comprehensive sample covering the 1994-2008 period including the two latest years when the subprime crisis emerged.

Table 1 can immediately indicate additional statistical characteristics of hedge fund returns. First, Panel A indicates that Sharpe ratios for most of the hedge fund strategies were higher than that for the benchmark S&P 500 index. On average, hedge funds outperformed passive equity investment, as confirmed for individual hedge fund strategies. Second, higher performances for hedge funds measured by Sharpe ratios are not necessarily attributable to higher returns. An average return on the S&P 500 index between 1994 and 2006 stood at 0.8% per month, compared with 0.8% for the Equity Market Neutral strategy, 1.0% for the Long/Short Equity strategy and 1.11% for the Event Driven strategy. Rather, the lower volatility of hedge funds and each hedge fund strategy’s low correlation with the S&P 500

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\(^3\) In calculation of the Sharpe ratio, the six-month Treasury bill yield is used as a risk-free rate.
market portfolio are noteworthy. Specifically, the standard deviation for the Equity Market Neutral strategy stood at only 0.83% and the strategy’s correlation with the market portfolio was only 37%. Similarly, the standard deviation and the correlation with the market portfolio were limited to 2.9% and 60% for the Long/Short Equity strategy and to 1.6% and 56% for the Event Driven strategy. Given that the standard deviation for the S&P 500 index was 4.11%, we can find that most of investors’ benefits from these investment strategies (including the Equity Market Neutral strategy) came from profit on diversified investment that was gained from the low volatility and the low correlation with the market portfolio, rather than any high return.

Third, returns for almost all investment strategies exhibit positive serial correlations, indicating that these returns have stronger serial correlations than the S&P 500. Usually, serial correlations are considered as the evidence of market inefficiency in empirical studies on finance. However, the fact that strong serial correlations are found for returns for hedge funds which are expected to pursue efficiency may indicate the low liquidity of hedge funds’ investment positions rather than their inefficiency (Getmansky, Lo and Makarov 2004; Lo, 2008b). Fourth, some of the hedge fund investment strategies have large negative skewness, including the Event Driven and Fixed Income Arbitrage strategies. Fifth, many investment strategies show excess skewness, meaning their head-tailed distribution or the possibility of extremely large positive or negative returns.

Table 1 Monthly Return Statistics, Sharpe Ratios and CAPM Beta for Hedge Fund Investment Strategies

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<tbody>
<tr>
<td>Average return</td>
<td>0.80%</td>
<td>0.99%</td>
<td>0.73%</td>
<td>-0.08%</td>
<td>0.85%</td>
<td>0.80%</td>
<td>0.94%</td>
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<td>0.53%</td>
<td>1.11%</td>
<td>1.00%</td>
<td>0.58%</td>
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<td>Standard deviation</td>
<td>4.11%</td>
<td>2.21%</td>
<td>1.33%</td>
<td>4.90%</td>
<td>4.62%</td>
<td>0.83%</td>
<td>1.60%</td>
<td>1.85%</td>
<td>1.72%</td>
<td>1.19%</td>
<td>1.06%</td>
<td>3.10%</td>
<td>2.90%</td>
<td>3.42%</td>
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<tr>
<td>Serial correlation</td>
<td>-1.2%</td>
<td>11.9%</td>
<td>56.9%</td>
<td>11.7%</td>
<td>29.4%</td>
<td>30.0%</td>
<td>33.1%</td>
<td>28.7%</td>
<td>32.1%</td>
<td>25.6%</td>
<td>38.9%</td>
<td>5.6%</td>
<td>16.5%</td>
<td>5.0%</td>
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<tr>
<td>Correlation with S&amp;P 500</td>
<td>100.0%</td>
<td>48.7%</td>
<td>14.3%</td>
<td>-75.6%</td>
<td>48.2%</td>
<td>36.8%</td>
<td>56.2%</td>
<td>54.9%</td>
<td>49.0%</td>
<td>44.4%</td>
<td>3.5%</td>
<td>23.5%</td>
<td>59.3%</td>
<td>-13.9%</td>
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<td>Skewness</td>
<td>-0.61</td>
<td>0.10</td>
<td>-1.37</td>
<td>0.84</td>
<td>-0.70</td>
<td>0.33</td>
<td>-3.45</td>
<td>-2.94</td>
<td>-2.57</td>
<td>-1.19</td>
<td>-3.11</td>
<td>0.03</td>
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<td>0.03</td>
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<td>Kurtosis</td>
<td>0.84</td>
<td>2.47</td>
<td>3.39</td>
<td>2.15</td>
<td>4.90</td>
<td>0.43</td>
<td>25.06</td>
<td>19.72</td>
<td>17.19</td>
<td>6.60</td>
<td>17.07</td>
<td>3.13</td>
<td>4.03</td>
<td>0.40</td>
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<tr>
<td>Sharpe ratio</td>
<td>0.12</td>
<td>0.26</td>
<td>0.31</td>
<td>-0.08</td>
<td>0.11</td>
<td>0.60</td>
<td>0.39</td>
<td>0.42</td>
<td>0.26</td>
<td>0.26</td>
<td>0.20</td>
<td>0.26</td>
<td>0.25</td>
<td>0.08</td>
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<tr>
<td>Beta ratio</td>
<td>1</td>
<td>0.26</td>
<td>0.04</td>
<td>-0.90</td>
<td>0.54</td>
<td>0.07</td>
<td>0.22</td>
<td>0.24</td>
<td>0.20</td>
<td>0.12</td>
<td>0.01</td>
<td>0.17</td>
<td>0.41</td>
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<tbody>
<tr>
<td>Average return</td>
<td>0.46%</td>
<td>0.79%</td>
<td>0.46%</td>
<td>0.05%</td>
<td>0.69%</td>
<td>0.52%</td>
<td>0.78%</td>
<td>0.86%</td>
<td>0.75%</td>
<td>0.58%</td>
<td>0.30%</td>
<td>1.03%</td>
<td>0.32%</td>
<td>0.64%</td>
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<tr>
<td>Standard deviation</td>
<td>4.32%</td>
<td>2.30%</td>
<td>1.98%</td>
<td>4.90%</td>
<td>4.58%</td>
<td>3.18%</td>
<td>1.76%</td>
<td>1.95%</td>
<td>1.88%</td>
<td>1.24%</td>
<td>1.73%</td>
<td>3.09%</td>
<td>2.95%</td>
<td>3.44%</td>
</tr>
<tr>
<td>Serial correlation</td>
<td>10.2%</td>
<td>21.8%</td>
<td>57.3%</td>
<td>9.3%</td>
<td>32.6%</td>
<td>8.5%</td>
<td>39.2%</td>
<td>40.6%</td>
<td>33.6%</td>
<td>31.0%</td>
<td>51.2%</td>
<td>9.7%</td>
<td>22.0%</td>
<td>7.0%</td>
</tr>
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<td>Correlation with S&amp;P 500</td>
<td>100.0%</td>
<td>55.0%</td>
<td>36.6%</td>
<td>-73.2%</td>
<td>52.4%</td>
<td>24.3%</td>
<td>61.3%</td>
<td>60.8%</td>
<td>54.4%</td>
<td>49.6%</td>
<td>32.9%</td>
<td>26.2%</td>
<td>63.3%</td>
<td>-15.2%</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.81</td>
<td>-0.18</td>
<td>-3.56</td>
<td>0.78</td>
<td>-0.74</td>
<td>-12.02</td>
<td>-2.70</td>
<td>-2.39</td>
<td>-2.07</td>
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<td>-4.63</td>
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<td>0.02</td>
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<td>Kurtosis</td>
<td>1.45</td>
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<td>4.64</td>
<td>155.46</td>
<td>14.79</td>
<td>12.38</td>
<td>10.70</td>
<td>5.07</td>
<td>29.96</td>
<td>3.04</td>
<td>3.53</td>
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<tr>
<td>Sharpe ratio</td>
<td>0.04</td>
<td>0.18</td>
<td>0.08</td>
<td>-0.05</td>
<td>0.07</td>
<td>0.27</td>
<td>0.28</td>
<td>0.24</td>
<td>0.22</td>
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<td>Beta ratio</td>
<td>1</td>
<td>0.29</td>
<td>0.16</td>
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<td>0.13</td>
<td>0.43</td>
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The first point indicates that hedge fund strategies outperform conventional investment strategies in terms of the performance measure such as Sharpe ratio, while the third, fourth and fifth points suggest that hedge funds have potentially taken risks in aspects that cannot be measured by such conventional measures. Underlying assumption for using Sharpe ratio as performance measure is that the multivariate normal distribution can approximate the asset return distribution. Therefore, modifications are required when investment positions do not satisfy underlying assumption are assessed. See Getmansky, Lo and Makarov (2004) that made such attempts to modify investment performance measures giving considerations to serial correlations.

Next, let us turn to the characteristics of performances and returns in Panel B including samples for 2007 and 2008. The addition of the data for the two latest years lowered the Sharpe ratio for the S&P 500 by 0.08 from 0.12 to 0.04. However, the Sharpe ratio fell more steeply for some hedge fund investment strategies (Convertible Arbitrage, Distress, Fixed Income) than for the benchmark S&P 500. For some strategies (Convertible Arbitrage and Equity Market Neutral), kurtosis and negative skewness values expanded substantially. Generally, CAPM beta and the correlations/autocorrelations with the S&P 500 increased. Among investment strategies taken up for Panel A, the Equity Market Neutral strategy saw its standard deviation rising from 0.83% in Panel A to 3.2% in Panel B and its correlation with the S&P 500 falling from 37% to 24%. The Long/Short Equity strategy saw its standard deviation increasing from 2.9% to 2.95% and its correlation with the S&P 500 rising from 60% to 63.3%. For the Event Driven strategy, the standard deviation soared from 1.6% to 1.76% and the correlation with the S&P 500 from 56% to 61.3%. The Equity Market Neutral strategy thus increased volatility conspicuously, while the other two remarkably increased their correlations with the S&P 500.

The above analysis indicates that the returns for some hedge fund strategies have option-like characteristics in their returns’ relations with the market portfolio are concerned. Specifically, this means that hedge fund investment is very similar to writing a put option in terms of returns, as illustrated in Figure 44). When the market remains relatively stable, the Equity Market Neutral and Long/Short Equity strategies post stable returns independent from market developments, although such returns are not so large. The returns correspond to premiums gained on writing a put option. This means that the alpha value attributed to personal capabilities of fund managers will be positive and significant under the usual market situation within the framework of investment performance assessment through the mean-variance analysis. As seen in the summer of 2007, however, hedge fund returns decline rapidly as markets fall through critical points. The fall, though meaning declines in return levels themselves in some cases, but can be indicated by a sharp increase of volatility or a increase in returns’ correlations with market portfolios in other cases. This point was already pointed out when we discussed individual investment strategies in Table 1. Since the statistical characteristics of returns change greatly on a market regime shift, hedge fund investment performances could be overestimated in based on its returns in the period of normal market condition within the mean-variance analysis framework. Based on the above general

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analysis, I would like to discuss the role that hedge funds and the overall shadow banking system have played in spreading and amplifying the U.S. oriented financial crisis to the world.

![Figure 4 Option-like Property of Hedge Fund Returns](image)

Figure 4 Option-like Property of Hedge Fund Returns

IV. Meltdown in August 2007?– Performance of Hedge Fund and Market Liquidity

IV.1. Development of multifactor models and spread of quantitative investment strategies

The nominal trigger that developed the U.S. financial crisis into a global one was reportedly an announcement by PNB Paribas on August 6, 2007 to suspend three of its funds for the reason that it had become impossible to calculate the net asset value of the funds (Greenlaw, Hatzius, Kashyap, and Shin 2008). The event has generally been called the “Paribas shock.” Around the Paribas shock, or mainly on August 9 (Thursday), huge losses were incurred by hedge funds classified as adopting the Equity Market Neutral strategy to simultaneously buy and sell shares in order to earn profit without being affected by market developments. As shown in Table 1 and Figure 3, however, performances of the Equity Market Neutral strategy for the whole of 2007 were not necessarily poor. Before and after the one-month August meltdown, the strategy actually posted competent profit (Shiraki 2008; Khandani and Lo 2008).

Equity Market Neutral and other quantitative investment strategies that boosted their market shares substantially since the 1990s take advantage of distortions or “habits” in the market to build portfolios combining long and short positions and highly leverage these positions to earn profit. Used for such strategy has been a quantitative asset pricing model called the multi-factor model, based the research by Fama and French published in the beginning of 1990s – Fama and French (1991, 1993 and 1995). Their research had great academic and practical influences, bringing about a major paradigm shift in stock portfolio investment strategies. Since the basic idea of their analysis seems to be closely related to the basis of quantitative investment strategies which have grown rapidly since the beginning of this century, I would like to discuss outline of their study for the readers not familiar with this topic.
The Fama-French study replaced the Sharpe-Lintner CAPM (capital asset pricing model) as the industry standard immediately after its release and has remained the benchmark model in this area for more than 15 years. However, its idea is very simple. The Fama and French started with the fact that the market portfolio as the only risk factor within the Sharpe-Lintner CAPM framework failed to empirically explain patterns of cross sections of price-earnings ratios. In order to solve the problem, Fama and French proposed the introduction of two new factors in addition to the market portfolio. First, they sorted individual issues on the stock market by two standards and built a portfolio based on the sortings. The first sorting standard was the corporate size as measured empirically by market capitalization. This is understood as based on the “small size effect,” which means that small-size issues perform better than big-size issues. The second standard is the book-to-market ratio. This is understood as based on the so-called value stock effect, which means that returns are relatively high on issues whose market prices are lower than their book prices.

Fama and French divided individual issues into five groups based on market size and another five groups based on book-to-market, resulting in 25 portfolios. Then, they determined a variable by subtracting a return on a portfolio of big-size issues from that on a portfolio of small-size issues and called it the “small-minus-big (SMB)” factor. Similarly, they determined a variable by subtracting a return on issues with low book-to-market ratios from that on issues with high ratios and called it the “high-minus-low (HML)” factor. Then, they estimated a multi-factor model using the three factors of the market portfolio, SMB and HML and indicated that the model would perform far better than the Sharpe-Lintner CAPM.

Although various discussions exist over the rationale of “Fama-French three-factor model,” I would like to point to the following in the context of this report. First, it is clear that the SMB and HML factors were not devised exclusively by Fama and French. The SMB factor apparently represented an attempt to systematically use the long-argued anomaly of the small-size effect. Behind the HML factor called the “value factor” has been the long-standing value stock investment strategy to buy at lows and sell at highs. In the context of long-term investment, this is similar to the investment philosophy advocated by Warren Buffet. However, there is a major difference in that Buffet determined investment targets based on detailed consideration of annual reports and in-depth evaluation of business quality of the firms, while the Fama and French framework depended only on the book-to-market ratio for an almost automatic selection of portfolios. Second, the SMB and HML factors advocated by Fama and French have been criticized for lacking any clear theoretical base while the conventional CAPM has been an equilibrium model (Black 1993).

Following the Fama and French three-factor model, some new factors to capture market distortions have been proposed, including the “Momentum” factor to follow upward or downward trends of stock prices and the “Contrarian” factor to sell at highs and buy at lows (Lakonishok, Shleifer, and Vishny 1994; Jegadeesh and Titman 1993). Technically, the dramatic advancement of computer and statistical software capacity has led to a fast spread of investment strategies that use several dozen or more than 100 factors. Such strategies are now used for daily or intraday frequent transactions in stock market.
IV.2. August 2007 meltdown – depletion of liquidity and destabilization of the factor structure

Portfolio investment strategies based on quantitative analysis continued to generate small but stable returns amid a peacetime market after the second half of the 1990s, though showing slightly poorer performances on the IT bubble burst. As a result, many hedge funds took advantage of leverages to have similar positions (see Sections II and III). For more details, I more or less have to depend on magazine articles and market participants’ statements in interviews. Anyway, there was a general perception that an increasing number of market participants were using similar investment strategies based on quantitative methods. At the same time, each fund probably have paid full attention to the impact of other funds’ actions on the market and to the liquidity of its own positions (Shiraki 2008).

Nevertheless, the spread of the financial crisis, triggered by defaults on subprime mortgages in the U.S. real estate market, quickly damaged the Equity Market Neutral strategy far more seriously than predicted by hedge funds and market participants in August 2007. Seemingly, the strategy had nothing to do with the subprime mortgage problem. Since the Equity Market Neutral strategy selected highly liquid public issues and pursued profit opportunities having little correlations with market developments, the fast spread of the Paribas shock was outside of the expectations for hedge funds adopting this strategy.

According to Khandani and Lo (2008) and other analyses, the moves of the factors as input for the Equity Market Neutral and Long/Short Equity strategies had been considerably destabilized since a month before the August 2007 meltdown. Even before the August 6 Paribas shock directly triggered the meltdown, some large funds and investment banks investing in multiple markets or adopting multiple investment strategies, in a bid to make up for subprime mortgage-related losses and meet investors’ withdrawals, were unwinding profitable positions that had nothing to do with the mortgage market. Large-scale selling to unwind positions on the external shock led factors to work reversely in a temporary manner. Such moves forced other funds to liquidate other positions, resulting in further destabilization of factor structure and widespread losses on funds adopting similar strategies in the weeklong meltdown (Shiraki 2008, Khandani and Lo 2008).

While leaving the in-depth quantitative market analysis for this period to Khandani and Lo (2008), I here would like to discuss destabilization of factors in regard to the Fama-French multi-factor model as explained in the previous section. Figure 5 plots the correlation coefficient between daily returns on the SMB and HML factors and the S&P 500 market portfolio in past six months. The correlation coefficients between the two factors and the market portfolio remained negative and extremely stable in the 1980s and 1990s. However, the SMB-related coefficient began to destabilize around the IT bubble burst and accelerated the destabilization from around 2004. Furthermore, the HML-related coefficient began to destabilize in 2004. In and after mid-2007, the HML strengthened its positive correlation with the market portfolio rapidly. Meanwhile, the SMB’s correlation with the market portfolio turned negative again at that time. In this way, the factor structure among those used in the multi-factor model has further destabilized since the beginning of this century. Particularly, the HML factor’s stability during the 1980s and 1990s contrasts remarkably with its fast destabilization in the second half of the 2000s.
IV.3. What has been learned from the August 2007 meltdown?

The Equity Market Neutral strategy meltdown in August 2007 indicates some implications of the roles that hedge funds played in the spread of U.S.-originated financial crisis to the world wide. First, I would like to emphasize again that hedge funds are essentially based on investment strategies to find temporary market distortions and take advantage of their reversion to normal conditions to make profits⁵. They cannot make profit in the absence of market distortions. For example, an exchange rate misalignment can be considered as a market distortion. Hedge funds’ attacks on particular currencies upon the 1992 pound crisis and the 1997 Asian currency crisis will be interpreted as their attempts to take advantage of the process exchange rate of particular currencies go back to their “normal” levels.

The difference in how to take advantage of market distortions separates new type of investment strategies that have grown and expanded rapidly since the second half of the 1990s from Soros and other old-generation hedge funds. While “Global Macro” strategies represented by Soros sometimes actively “attack” markets on a large scale, Equity Market Neutral and Long/Short Equity strategies automatically repeat operations to systematically pick up small market distortions through quantitative analyses and to construct portfolios to make profit in the process in which the distortions are resolved. As indicated by Panels A and B of Figure 6, these quantitative investment strategies bet on a small profit opportunities emerging in the market stabilization process. Therefore, returns on funds adopting such strategies are not so high. However, they are extremely stable and risks are limited⁶. These quantitative strategies contrast with the Global Macro strategies that occasionally shake and destabilize markets by themselves to make profit.

⁵ George Soros in his book uses the term of “reflexibility” to explain his own investment philosophy. The word reflexivity originates from sociology and is used by Soros primarily to describe patterns of investors’ behaviors. As far as implications for investment strategies are concerned, however, the word is taken as indicating the mean-reversion of asset prices or the effectiveness of the contrarian strategy.

⁶ See Yotsuzuka (2002) as well.

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Figure 5 Correlations between Fama-French Factors and S&P 500

Data: Ken French’s homepage.
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html
Figure 6 Quantitative Hedge Fund Strategies’ Profit-making Process

Panel A: Market Distortions and Reversion to Long-term equilibrium

Panel B: Investment Strategies of Quantitative Hedge Funds such as Equity Market Neutral and Long/Short Equity

Panel C: Rare Event and Amplification of Negative Shock
In a bid to generate huge profit from positions that provide stable but small returns, these quantitative investment strategies make large scale use of leverages. Therefore, they are vulnerable to unexpected market fluctuations or “rare events.” An obvious example is the convergence arbitrage strategy adopted by LTCM, which was developed by John Meriwether who headed the bond division at Salomon Brothers in the 1980s. The main strategy for LTCM bets on the process in which abnormal bond yield spreads are eliminated and go back to average levels. The Russian debt default came as a rare event in the case of LTCM. The default caused investment money’s flight to quality, leading yield spreads between low and high grade bonds as well as between emerging market and U.S. bonds to expand suddenly. This forced LTCM into bankruptcy as it bet on the elimination or convergence of the spreads.

The situation was more complicated for the meltdown of Equity Market Neutral strategy in August 2007. LTCM failed when a major external shock came to the bond market where it participated directly. During the 2007 crisis, however, the shock spilled over to hedge funds through channels that none had anticipated. A real estate transaction loss in California impacted some funds of an investment bank in Paris and the impact led to huge losses at hedge funds engaged in advanced equity transactions throughout the world. The spillover of the shock through characteristically different, geographically distant markets must have been a thunderbolt for quants for relevant hedge funds. A more abstract or general explanation will be as follows: quantitative hedge fund investment strategies use leverages in betting on the elimination of temporal distortions in the market. However, when a rare event further expand existing market distortions, in a direction opposite to hedge funds’ expectations, their leverage work reversely, to cause huge losses (Panel C, Figure 6). The worst results from such development were the LTCM failure and the August 2007 meltdown.

Several factors closely related with each other behind the meltdown of Equity Market Neutral funds in August 2007. First, the growing share for multi-strategy funds or funds of funds that adopt multiple strategies simultaneously, as seen in Table 1, caused new correlation channels between different investment strategy positions. Second, the exposure of developed economies’ banking system to potential risks for the alternative investment asset class increased dramatically as banks, pension funds and other traditional financial institutions expanded investment in hedge funds rapidly in conjunction with globalization of financial transactions over a decade from 1997 to 2008.

Third, market uncertainties increased over the decade as investment strategies grew more complex. LTCM’s convergence arbitrage strategy paid attention to yield spreads between bond issues of different risk classes and was far simpler than later strategies based on the fast investment technology advancement. Therefore, the strategy has been easy to imitate and potential profit opportunities might have been used up over the decade. In contrast, the stock market features a greater number of assets for trading than the bond market and contains more market distortions or profit opportunities that have yet to be exploited. This situation prompted many funds and investment money to adopt strategies for stock investment since the beginning of the 21st century. Apparently, these strategies have been so complex that it has grown to be more and more difficult to identify the positions of specific funds and the involvement of traditional financial institutions to hedge fund investments.
Fourth, investment strategies that prospered in the second half of the 1990s were quantitative and specific in methodology. Their principles were easy to imitate. The Equity Market Neutral and Long/Short Equity strategies, which diffused fast since the beginning of the 2000s, though not as simple as the convergence arbitrage strategy, were adopted by a growing number of investment funds. As a result, a rising number of hedge funds adopted essentially similar investment strategies, albeit with small differences. Each market participant recognized a rising value of similar positions, while facing difficulties in estimating any actual value. The four factors above were combined to expand the entire banking system’s exposure to risks for hedge fund investment strategies and make it uncertain how far problems would expand in response to an external shock of a similar size and to market conditions.

V. Systemic Risk Management after Global Financial Crisis

V.1. Global financial crisis in historical perspectives

The discussions so far indicate that the shadow banking system’s rapid expansion over the recent years as well as dynamic changes in the financial industry were behind the global financial crisis that originated from the U.S. subprime mortgage problem. They also point to a problem that regulatory authorities and market participants have failed to fully recognize growing global systemic risks and new channels for spillovers, because of the shadow banking system’s characteristics such as the anonymity and imperfect of information. However, they might have had some concerns about potential systemic risk in the market and something wrong had been going on. Two important factors have contributed to this trend. First one is rather unique to the crisis this time: the financial technology or “financial engineering” have progressed so rapidly and have spread worldwide so quickly in last twenty years. Everything has happened just too fast even for the financial institutions themselves as well as regulatory bodies. Second one is more historic: animal spirits have been and will continue to be an essential part of capitalism, especially financial markets both in a good way and in a bad way. Any discussion on either factor alone may fail to bring about constructive lessons for designing a future banking system.

Ironically, the latest financial crisis itself dramatically reduced the possibility of another crisis in near future by triggering large structural changes in the global financial system. First, the latest crisis must have led market participants and policy authorities to realize the potential scale of systemic risks contained in the shadow banking system and the need for measures to manage the risks. Both government and private sectors are seriously examining how to manage potential risk hidden in the shadow banking system.

Second, not a small number of experts linked the cause of the latest global financial crisis directly to the U.S. investment bank business model represented by such as Goldman Sachs and Lehman Brothers (Bookstaber 2007, Kuratsu 2008, Obata 2008). Needless to say, U.S. investment banks have been central players in the latest global financial crisis. They straddled both the traditional investment banking business and the shadow banking system, and demonstrated strong initiative in the world’s financial markets for most of the period after World War II. However, most of them have disappeared. Lehman
Brothers and Bear Stearns went bankrupt, while Goldman Sachs, and Merrill Lynch became commercial banks subject to tougher regulations. In the world financial market, there is no longer any private investment entity that can use its own funds to set up a financial transaction as big as deals done by a U.S. investment bank before the crisis and relatively free from regulations by financial authorities. Rather, the problem over a short term is that the rapid and sustained depletion of liquidity on deleveraging amid the disappearance of the U.S. investment bank business model has directly caused a slump in asset prices on various financial markets in the world. Also, even though commercial and other traditional financial institutions had been prepared to become investment banks and come closer to the shadow banking system until just before the financial crisis, such trend may be restricted for the immediate future. After the latest global financial crisis is overcome with U.S. investment banks disappearing, any similar problem of growing systemic risks on expanding leverages is unlikely to emerge in the near future.

Regarding the second point, we have to carefully consider the relationship between the shadow banking system, including hedge funds, and the traditional system, and the roles that the shadow and traditional banking systems played in the latest global financial crisis. Hedge funds must have eventually contributed to the spillover of the shock to a wide range of areas and to the amplification of losses. This spillover mechanism should be analyzed in detail. The transformation of the traditional banking system into the shadow system over recent years, as discussed above, is a potentially important problem. However, as discussed in the previous section’s analysis of the August 2007 meltdown, the problem is attributable not to the hedge fund business model itself, but to the fast increase in the entire banking system’s exposure to risks of hedge funds that came as hedge funds expanded rapidly on inflow of money from throughout the world and deepened their relationship with the traditional banking system. Hedge funds were significant as the shock spillover channel and the amplifier of the financial crisis. However, any conclusion viewing hedge funds as the main culprit of the global financial crisis is nearsighted.

From a long-term viewpoint, in its start, the shadow banking system represented by hedge funds was a byproduct of the U.S. Glass-Steagall Act and other efforts in developed economies to increase the transparency of and toughen regulations on the banking system based on experiences with the Great Depression in the 1930s. As Soros and other financial entrepreneurs pursued profit in areas outside the regulated banking system, the shadow banking system emerged as a subsystem behind the traditional banking system. As the subsystem expanded on the strength of high profitability, however, the wall between the traditional and shadow banking systems began to collapse practically and institutionally in the 1990s. If the latest global financial crisis is interpreted as the result of such collapse, the so-called

7) The Glass-Steagall Act, which was enacted amid the Great Depression in 1933, provided for separating banking services (including deposit-taking services) from securities and investment banking services (including underwriting and broker/dealer services). The wall between the financial services began to collapse in the 1970s. In 1999, the Gramm-Leach-Bliley Financial Services Modernization Act was enacted to remove the wall almost completely (Hubbard 2007, Chapter 14). Prominent liberal economists, including Paul Krugman and Joseph Stiglitz, have made remarks viewing the GLB Act as one of the major factors behind the latest financial crisis. But whether this view is well founded academically is uncertain. Democrat financial and economic experts, including Bradford Delong, have doubted the view.
reregulation efforts to toughen regulations again may be expected to lead new financial innovations to emerge and pursue profit in new manners to get around regulations. It is very important to pay attention to this point for any reform to make regulations effective.

V.2. Feasibility of hedge fund regulation reform in U.S. and G20

In the first actual step to toughen regulations on hedge funds, leaders from the Group of 20 major industrial and emerging countries at their meeting in early April 2009 agreed to take regulatory measures including the registration of major funds and tougher regulations on tax havens (see Appendix). Hedge fund regulations are certain to be strengthened to some extent in line with the agreement. While France and Germany have strongly advocated tougher regulations on tax havens, however, the United States and Britain, where most hedge fund headquarters are located, have been less positive about such tougher regulations. Behind the nominal consensus, major countries are apparently divided. Even Germany and France, while being tough on hedge fund regulations, reportedly exploited their bargaining power through the European Commission to force more flexible application of international accounting standards to help reduce reported losses at their financial institutions in the autumn of 2008. It is clear that political considerations exist behind their sound arguments8). Therefore, we have no choice but to be cautious about how the G20 agreement will be implemented.

I would like to emphasize two issues regarding the implementation of more strict regulations. While new regulations are expected to require hedge funds to disclose information, the first problem is that it would not be easy to decide on the extent to which specific information should be disclosed. One of the executives of major hedge funds who gave testimony to Congress in November 2008, described that a requirement for hedge funds to impose complete transparency is akin to the government suddenly requiring Coca-Cola to disclose the secret Coke formula for free to all competitors. In the world of financial transactions where no patent exists, information disclosure could deprive funds of their competitiveness9). Therefore, thorough hedge fund regulations could suffocate the hedge fund industry that features anonymity and information gaps. Some people may think the hedge fund industry suffocation would be acceptable or even desirable as far as the banking system is stabilized. However, as known as “Grossman’s paradox10)" in academic arguments, suppression of profit opportunites based on private information by tough regulation may completely destruct the informational role of asset prices and financial markets. Tougher regulations have both costs and benefits. Designining and implementing well-balanced financial regulations will not be an easy task for policymakers and regulatory authorities.

8) The International Accounting Standards Board has reviewed asset valuation standards (reclassified financial assets) for “inactive markets” at the request of the EU Council of Economic and Finance Ministers. For details, see press releases (a series of releases in October 2008) at the website of the Accounting Standards Board of Japan and the Financial Accounting Standards Foundation (http://www.asb.or.jp/html/iasb/press/, and announcements on the IASB website (http://www.iasb.org/Home.htm).
The second problem is much more practical. Excessive regulations to enforce complete transparency to financial institutions will impose them large costs for disclosure of information. This is clear if we remember the impact on U.S. companies of the Sarbanes-Oxley Act that was introduced as a result of the Enron and WorldCom scandals in the beginning of this century. As noted by many hedge fund industry people, an increase of information disclosure cost under tougher regulations will first cause a further contraction of the hedge fund industry over a short-term. Over a long-term, large funds with rich resources will comply with tougher regulations, to satisfy their major customers including pension funds and commercial banks. However, given that hedge funds collect investment money through private offers, it is effectively impossible for regulatory authorities to grasp the entire picture of the hedge fund industry. If so, small and medium-sized funds that cannot withstand higher disclosure costs may become even more anonymous and underground. As a result, the hedge fund industry will be divided into two groups – large funds with greater transparency, and small and medium-sized funds that get around regulations and remain in the shadow banking system. The division may result in an increase in systemic risks for the latter group. As far as it is almost impossible to put the hedge fund industry completely under government surveillance and regulations, whether simple minded action to impose tough regulations would really lead to the greater transparency and stability of the shadow banking system is uncertain.

V.3. For better systemic risk management

What reforms should be made to implement a better management of systemic risks in the global financial system after the financial crisis of 2007-2009, to prevent another crisis in the future?

First, discussions on tougher hedge fund regulations amid the latest financial crisis have been linked to anti-American, anti-free market and anti-globalisation ideologies (The Economist 2009). However, serious financial regulation reforms for lower systemic risks should be separated from such political arguments. Second, the imperfect information and anonymity are the source of financial innovations. Their elimination may be impossible and even undesirable for the well-function of the financial market for capitalist economy. Regulators should be able to let Coca-Cola to manage business risks without requiring it to disclose the secret Coke formula. Therefore, new architecture of financial regulations must hit the balance between market participants’ incentives to pursue profits and to implement proper risk management.

More specifically, the disclosure of positions aggregated at the primary broker level and the creation of a centralized clearing house for CDS transactions, as proposed already, are expected to make financial transactions more transparent while individual hedge funds remain anonymous. These measures should be taken to provide accurate information for individual financial institutions to assess overall market condition and potential systemic risk based on their own initiatives. (For details, see Squam Lake Working Group on Financial Regulation 2009.)

Third, it is very difficult to completely eliminate every single financial crisis or near-crisis in a dynamic market environment where financial innovations take place continuously with new financial
products developed one after another. Enforcing excessive regulations aiming at complete elimination of crises, as noted earlier, may suppress financial innovations over a short-term and lead more and more financial transactions taking place outside of regulators’ reach and becoming underground, which will actually increase the likelihood of financial crises. System designs should be made on the precondition that a single fundamental institutional overhaul cannot eliminate financial crises for good. As an aircraft and railway accidents investigation commission does, a mechanism should be created to immediately analyze causes of any small scandals or market crashes and utilize analysis results for future risk management and regulatory improvements. For this purpose, finance and financial engineering experts skilled in quantitative analyses are still short. Such shortage is particularly remarkable in Japan. As far as financial transactions have been technically advanced so much, it is clear that relevant human resources should be obtained and trained for effective regulations on such transactions. Economic knowledge of college graduates are obviously insufficient. Personnel exchanges between government, business and academic sectors should be promoted along with measures to retrain human resources specialized in finance, financial engineering and relevant legal and accounting matters\textsuperscript{11}).

The regulatory reform proposals discussed above are obviously not new and may sound rather passive or negative. However, given that tax haven regulations had repeatedly been proposed, but failed to be adopted, the implementation of these proposed regulatory measures will also face various difficulties and obstacles. As noted earlier, governments should not seek large one-time for all fundamental institutional reforms that could fail more easily. Instead, well-considered regulations should be steadily implemented one by one. This is the fastest way to reduce systemic risks in the global banking system.

\textsuperscript{11}) In order to prevent regulators from giving favors to private financial institutions, tough regulations should be imposed on personnel transfers from regulatory authorities to regulated institutions, including a temporary ban on regulatory officials’ reemployment in the regulated industry.
References


Appendix: Excerpts on strengthening financial supervision and regulation in London Summit Leaders’ Statement announced on April 2, 2009

- Major failures in the financial sector and in financial regulation and supervision were fundamental causes of the crisis. We will take action to build a stronger, more globally consistent, supervisory and regulatory framework.

- We are implementing the Action Plan (agreed at the Washington Summit). We have today also issued a Declaration, Strengthening the Financial System. In particular we agree:
  - to establish a new Financial Stability Board (FSB) as a successor to the Financial Stability Forum (FSF). The FSB should collaborate with the IMF to provide early warning.
  - to extend regulation and oversight to all systemically important financial institutions, instruments and markets. This will include, for the first time, systemically important hedge funds.
  - to endorse and implement the FSF’s tough new principles on pay and compensation.
  - to take action, once recovery is assured, to improve the quality, quantity, and international consistency of capital in the banking system. In the future, regulation must prevent excessive leverage and require buffers of resources to be built up in good times.
  - to take action against non-cooperative jurisdictions, including tax havens. We stand ready to deploy sanctions to protect our public finances and financial systems. We note that the OECD has today published a list of countries assessed by the Global Forum against the international standard for exchange of tax information;
  - to improve standards on valuation and provisioning and achieve a single set of high-quality global accounting standards and to extend regulatory oversight and registration to Credit Rating Agencies.

- We instruct our Finance Ministers to complete the implementation of these decisions. We have asked the FSB and the IMF to monitor progress and to provide a report to the next meeting of our Finance Ministers in November.

Source: Ministry of Foreign Affairs Homepage
http://www.mofa.go.jp/mofaj/kaidan/s_aso/fwe_09/communique_k.html