Investor Heterogeneity and Asymmetric Volatility under Short Sale Constraints : Evidence from Korean Fund Market

Sohn, Pando
Department of Business Administration
School of Business, Dong-A University
Bumin Dong 2Ga 1, Se-Gu, Busan City
604-714 Korea
Phone: 051-200-7424
E-mail: pdsohn@dau.ac.kr

Investor Heterogeneity and Asymmetric Volatility under Short Sale Constraint : Evidence from Korean Fund Market

Sohn, Pando(Dong-A University)*

November 2011

Abstract

This paper investigates whether there is the heterogeneity for fund manager as investor and an asymmetric volatility under short-sales constraints and if so, which factors are driving for it in Korean fund market using fund return data over period of 2002-2008. Specifically, with short-sales constrains we test the hypothesis of the difference of opinion developed by Chen, Hong, and Stein (2001) and Hong and Stein (2003). It is a unique opportunity for us to directly test the differences of opinions among fund managers in that fund manager operates the fund money under short-sales constraints in asset allocating strategy. The result from GJR-GARCH model shows that there is an asymmetric volatility in return and as increase differences of opinion among fund managers, the extent to an asymmetric volatility increases as well. Furthermore, the evidence of this paper is consistent with the model of Hong and Stein (2003), which predicts that negative asymmetries are more likely to occur when there are large differences of opinion among fund managers. Therefore, our result implies that the overvaluation effect is more remarkable for funds for which wider dispersion of fund manager opinions exists, indicating these findings are consistent with Miller's (1977) intuition and Hong and Stein(2003) model prediction. In addition, the our result also supports stochastic bubble hypothesis and is consistent with Blanchard and Watson(1982), and Wu(1997) even after controlling for fund characteristic variables.

Keywords: Heterogeneity, Asymmetric volatility, Return skewness, Short sale, Turnover

JEL Classification Codes: G12, G14

---

* Assistant Professor of Finance from School of Business, Dong-A University. E-mail: pdsohn@dau.ac.kr, Phone: 051-200-7424.

I. Introduction

How do short sale constraints influence stock return? Over past two decades, this question has been long debated in financial economics. Also many concern apparent asymmetry in the relationship between stock return and its volatility. Prior literatures have been demonstrated that actually asymmetric volatility is inherently related to the negative skewness of market returns. Understanding the sources and magnitude of asymmetric volatility may help our explaining of the sources of negative skewness and the equity premium it commands.

Identifying the sources of asymmetric volatility also has important implications for asset pricing and portfolio risk management as well as managing fund asset in aimed increasing more profit and decreasing fund risk. In related to asymmetric volatility, Harvey and Siddique (2000) develop an asset pricing model in which individual asset returns have systematic skewness and their expected returns are rewarded for this risk. They show that conditional skewness helps explain the cross-sectional variation in expected returns across assets.

It is a unique opportunity for us to directly test the difference of fund manager's opinions in that fund manager operates the fund money under short-sales constraints in asset allocating strategy. Chen, Hong, and Stein (2001) mention that the constrained investor of short selling can be thought of as mutual funds, whose charters typically prohibit them from taking short positions; the unconstrained investors can be thought of as hedge funds or other arbitrageurs.

In practical view and law, many fund managers in Korean fund market field confirm that short selling is restricted in operating fund portfolio from fund investor's money[1]. This situation allows us to test differences of opinion under short sale constraint developed by Chen, Hong, and Stein (2001). Thus we implement testing the difference of opinion with short sale constraints in fund market.

In this paper, we examine how short-sales constraints in Korean fund market influence to the asymmetric volatility as proxy of fund return risk and in turn, we analyze the existence of asymmetric volatility using conditional mean and volatility model which is incorporated into the asymmetric volatility parameters as GJR-GARCH model during 2002-2008. Also this study investigates the role of opinion dispersions among fund managers with short sales

[1] Under the law, short selling is prohibited in operating fund money.

constraints in relation to the cross section of fund return. Equivalently in testing the effect of short-sale constraint on fund returns, it is focusing on the differences of opinions among fund manager suggested by Hong and Stein (2003). The asymmetric volatility or equivalently negative skewness means a tendency for volatility to go up with negative fund returns.

Specifically, this study empirically identifies an asymmetric a volatility fact and look at the determinants of the volatility asymmetry of stock return in Korean fund market. Both of differences of fund manager's opinions and short sale constraint are considered. That is, as employed in Varian(1989), Harris & Raviv(1993), Kandel & Pearson(1995), Odean(1998), and Chen, Hong, and Stein(2001), we use fund monthly turnover ratio as a proxy for the differences of fund manager opinion using GJR-GARCH model and show the extent to investor heterogeneity. Furthermore, to identify the extent to the asymmetric volatility and differences of opinions among fund managers according to business cycle, also we separate whole sample into sub sample 1 as boon period and sub sample 2 as recession period.

We believe that it is first implemented to explore the role of differences of fund manager's difference opinions in explaining asymmetric volatility in domestic and abroad.

Our results show that in whole and boom period, the differences of opinions are supported and these results are consistent with Hong and Stein(2003) and Chen, Hong, and Stein(2001). However, interestingly, we do not find the evidences of difference opinions among fund managers in recession period. These results are robust even after controlling for additional variables in regression analysis.

This paper makes three contributions to the finance literature: (1) empirically, this paper identifies the phenomena of asymmetric volatility of return in fund market, (2) it finds the evidence of Hong and Stein (2003) theory under short sales constraints, and (3) based on separated sample, it shows the distinct of the extent to differences of opinions among fund managers during normal, boon and recession period.

The remainder of this paper is organized as follows. In section II, we review prior empirical results about investor heterogeneity, short sales constraints, and an asymmetric volatility. In section III, the empirical design is shown, and in section IV, we describe the sample data and characteristics for variables. In section V, the empirical results are apparent, and finally in section VI, the conclusion is reached.

Ⅱ. Related Literature

2.1 Investor heterogeneity and short sales constraints

In an earlier paper, Miller (1977) theorizes that in the presence of short sales constraints stock price tends to reflect a more optimistic valuation than the opinion of investors, on average and thus tend to be upward biased(Chang, Cheng, & Yu, 2007). That is, because short sales constraints keep more pessimistic investors out of the market, stock price tends to a more optimistic valuation than they otherwise would (Jarrow, 1980), which is called overvaluation hypothesis. This overvaluation hypothesis is based on two conditions. First, short sale of stock is either banded or costly and second, potential investors have heterogonous beliefs or information about the stock value as in Chang, Cheng and Yu (2007).

Thus Miller (1977) insists that the combination of binding short sale constraints and significant differences of opinion among potential investors results in share price overvaluation. This is due to stock prices determined by the consensus opinion of participating investors. If bearish investors are bailed out of market by prohibiting short sale constraints, then the distribution of opinions is censored from below and the consensus opinion becomes more optimistic.

Jarrow (1980) and Figlewski (1981) build up model in incorporating Miller's (1977) idea rigorously into a static CPAM framework using general equilibrium analysis. Jarrow (1980) shows that the total effect on restricting short sales may be quite complex. In developing a theory of market crashes based on differences of opinion among investors, Hong and Stein (2003) show that the big price changes are more likely to be decreases rather than increases. They provide this fact that by looking directly at past stock return, nine were declines among the ten biggest one-day movements in the S&P 500[2].

Furthermore, they find that option prices are at odds with the lognormal distribution assumed in the B-S model, and can only be rationalized with an implied distribution that is strongly and negatively skewed. As provided in Bakshi, Cao, and Chen (1997), and Dumas, Fleming, and Whaley (1998), Chen, Hong, and Stein (2001), Hong and Stein (2003), this phenomena, which is called as smirk, in index option implied volatilities has been the normal since the stock market crash of 1987. Chen, Hong, and Stein (2001) explain the asymmetrical distribution of aggregate stock market return and measure this asymmetry in several ways

[2] For Korean fund return, we identify that seven are declines from the ten biggest movements in one day.

such as Stock market crash and smirk of implied volatility distribution.

In contract to Miller (1977) intuition, some studies look at the relationship between differences of potential investors' opinion and cross sectional stock return. For example, Diether, Malloy, and Scherbina (2002) demonstrate that by using the dispersion of analysts' earnings forecasts to measure the degree of divergence of investor opinion, they show that stocks with higher dispersion earn lower future returns than otherwise similar stocks(Chang, Cheng, and Yu, 2007). They insist that the incentive structure of analysts could serve as additional frictions that prevent the revelation of negative opinion. In line with this, Boehme, Danielsen, and Sorescu (2006) present that short sales constraints and high dispersion of investor are both required of encourage overvaluation. These results support the intuition of Miller (1977).

For testing asymmetric volatility, recently Chen, Hong, and Stein (2001) show that stock daily return reveal negative asymmetry or negative skewness in U.S. stock market. Their empirical result is supported by Hong and Stein (2003). That is, Hong and Stein (2003) develop a theory to demonstrate the question of why stock markets tend to reveal negative skewness and exposed to market crashes based on the difference of opinion hypothesis. Their model argues that bearish investors do not initially engage in the market and their information is not revealed in price because of short-sales constraints as well as the existence of difference of opinion. Therefore, given on divergence of opinion among investors and short-sale constraint, their model predicts that negative skewness is most pronounced if short sale constraint is prohibited and the difference of opinion among investors is high. Furthermore it predicts that the returns will be more negatively skewed conditional on high trading volume.

Although the model in Hong and Stein (2003) is conditioned on two necessary and sufficient key assumptions, but in Chang, Chen, and Yu (2007), their model only controls the short sales constraints of the stocks and ignoring the second condition as of the need of different opinions among investors. Chang, Chen, and Yu (2007) investigate whether stock returns are more negatively skewed when sort sales are constrained using Hong Kong stock market. However, in contrast to many prior studies' result, they find inconsistent evidence that the returns of individual stocks exhibit more negative skewness when short selling is allowed to trade in market.

2.2 The Determinants of Asymmetric Volatility

After finding the asymmetric volatility in stock market, many researchers in financial economics have been challenged to identify the sources of negative asymmetries. As a result, prior studies find the determinants of an asymmetric volatility and give us the source of them as follows[3]: (1) leverage effect, (2) volatility feedback, (3) stochastic bubble, (4) the difference of opinion. In a broadly sense, leverage, volatility feedback, and stochastic bubble hypothesis are based on representative investor model, whereas the difference of investor opinion hypothesis is incorporated into investor heterogeneity. In identifying the source of the asymmetric volatility, while the existence of negative asymmetric volatility of stock returns is generally accepted, it is less clear what underlying economic mechanism these asymmetries reflect (Chen, Hong, and Stein, 2001).

It is well known that the leverage effect hypothesis is the most acceptable theory for explaining the asymmetric volatility (black, 1976; Christie, 1982). Early Black (1976) and Christie (1982) show that the relationship between an asymmetric volatility and return is associated with changing financial leverage (or debt-to-equity ratios) or operating leverage. The leverage effect hypothesis implies that as in Bae, Lim, and Wei (2006), when a stock price is crashed deeply, the financial leverage of the firm rises, which increases the subsequent its volatility, while a stock price increases, the financial leverage of the firm declines, which decreases subsequent its volatility.

With a negative return the firm value declines[4], making the equity riskier and increasing its volatility, Schwert (1989) argues that the leverage causes the negative relation between returns and volatility to be more pronounced during recessions. Thus the leverage causes firms to appear riskier and have higher volatility when stock prices decline.

However, the leverage effect hypothesis has been still questioned. The magnitude of the leverage effect on drop in current prices on future volatilities seems too large to be explained solely by changes in leverage (Figlewski and Wang, 2001). Schwert (1989), and Bekaert and

---

[3] Besides Pindyck (1984), French, Schwert, and Stambaugh (1987), and Campbell and Hentschel (1992) argue that an anticipated increase in volatility raises the required return on equities, thereby causing an immediate stock price decline. In contract to the leverage effect hypothesis, it suggests that volatility changes cause stock price changes. Furthermore, recent discretionary disclosure hypothesis is suggested in explaining the difference of opinion. This hypothesis argues that managers behavior the extent of discretion on the disclosure of information, indicating that they prefer to announce good news immediately but allow bad news to leak out slowly. This behavior of manager make stock returns more skewness.

[4] Fama and Schwert (1977), and Breen, Glosten, and Jagannathan (1989) find evidence to the contrary while French, Schwert, and Stambaugh (1987); and Campbell and Hentschel (1922) support the positive relation.

Wu (2000) point out that the leverage effect cannot fully account for the volatility response to stock price changes.

Second, due to debating above, volatility feedback hypothesis, which explains asymmetric volatility, is suggested by Pindyck(1984), French, Schwert, and Stambaugh (1987), Campbell and Hentschel(1992), and Beakert and Wu (2000). The volatility-feedback hypothesis argues that when either bad news or good news arrives, it signal that market volatility will be increased, which in turn this increasing pushes up a risk premium as well. Also the increased risk premium offsets partially the direct positive effect of the good news. Oppositely the negative effect of the bad news is magnified.

As a result, stock prices are crashed more in the arrival of bad news rather than of good news into market even if the process driving news is symmetric. Then this relationship leads to negatively skewed stock returns. Bekaert and Wu(2000) insist that the volatility feedback effect dominates the leverage effect empirically. Campbell and Hentschel (1992) show that using conditional volatility model with a Quadratic GARCH, the volatility feedback has an important effect on return only during high volatility period

Even if the volatility feedback story is more attractive than the leverage effects, the empirical results remain in mixed or counter argued evidence. For instance, Nelson (1991), Engle and Ng (1993), Glosten, Jagannathan, and Runkle (1993) have found that although volatility increases more following negative returns than positive returns, the relationship between expected returns and volatility is not significant. In addition, as addressed by Poterba & Summers (1986), the most shocks to market volatility are very short-lived, and hence these shocks cannot lead to a large impact on risk premia.

Third, for alternative explaining volatility asymmetry, the stochastic bubble hypothesis is suggested by Blanchard and Watson (1982), and Wu (1997). In this hypothesis, the asymmetry is due to the popping of the bubble, which generates very large negative returns with a low probability event. Blanchard and Watson (1982) show that internet bubbles burst causes negative skewness. Wu (1997) provides some evidence that rational stochastic asset bubbles can help explain the excess volatility of stock prices using the Kalman filter in examining the relationship of U.S. stock-price volatility.

Fourth, in determining asymmetric volatility as recent model, the difference of opinion model is developed empirically and theoretically by Chen, Hong, and Stein (2001), Stein and Hong (2003). It is argued that differences of opinion may be due to different information sets, different prior or different ways of updating belief. As matter of fact, Investor heterogeneity is the key reason for negative skewed returns. Hong and Stein (2003) theorize that in predicting market crashes based on differences of opinion among investors, the return will be more negatively skewed conditional on high trading volume. Chen, Hong, and Stein (2001) find that negative skewness is most pronounced in stocks that have experienced an increase volume relative to trend over the prior six months. This result is consistent with Hong and Stein (2003)'s prediction.

For volatility of Korean stock return, even though prior studies suggest that there is the asymmetric volatility, they demonstrate many mixed results for causes of asymmetric volatility (Gu, 2000; Cheong & Jeong, 2002; Park, 2006). In general, leverage effect dominants feedback effect. These papers just investigate stock market volatility, not fund market with short sale constraint.

Overall, although there are several factors in determining the asymmetric volatility, in this paper, we focus on the differences of opinion among fund managers under constraint of short selling. So far, we think that nobody has been examined the differences of investor opinions predicted by Hong and Stein (2003) using trading volume (turnover) as a proxy of fund manager's heterogeneity when short sales are under constraint.

Ⅲ. The Empirical Design

In this section, we make the empirical design to show the fact and extent of asymmetric volatility. Specifically, we identify the degree of the trading volume (TURNOVER) from the highest difference (Quintile 1) to the lowest difference (Quintile 5) as the proxy of differences of opinion among fund managers. Specifically, in the empirical process, we implement pure GJR-GARCH (1,1) and extended GJR-GARCH (1,1) to find existence of the asymmetric volatility fund return and clarify differences of opinion from fund managers. For sample, to acknowledge this asymmetric effect and differences of opinion among fund managers, we separate whole sample into two samples: sub-period 1 defined as recession and sub-period 2 defined as boom.

3.1 An Asymmetric Volatility Model

To identify the asymmetric volatility of fund return, we employ the GJR-GARCH model as asymmetric GARCH, which is also known as GJR model proposed by Glosten, Jagannathan & Runkle (1993). Among many asymmetric GARCH models such as EGARCH, QGARCH, TGARCH, and GJR-GARCH, it is well known that GJR-GARCH model has best fitted superior predictive power for the asymmetric effect of volatility of return (Gu, 2000; Engle and Ng, 1993). As this result, we adapt the GJR-GARCH model in this paper. The conditional variance of fund return is based on as follows GJR-GARCH model with AR(1), which is called vanilla GJR-GARCH(1,1) with AR(1):

$$r_t = \Phi_0 + \Phi_1 r_{t-1} + \varepsilon_t \tag{1}$$

$$\varepsilon_t = \sqrt{\sigma_t} \cdot e_t,\ e_t \sim iid(0,1)$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2 \tag{2}$$

where α , β and γ are constant parameters and I_t is an following indicator dummy variable:

$$I_{t-1} = \begin{cases} 1 & if\ \varepsilon_{t-1} < 0 \\ 0 & if\ \varepsilon_{t-1} > 0 \end{cases}$$

The impact of ε_t^2 on the conditional variance σ_t^2 in equation (2) is different when ε_t^2 is positive or negative. The negative innovation, which means bad news, has a higher impact than positive ones. When ε_{t-1} is positive, the total contribution to the volatility of innovation is $\alpha\varepsilon_{t-1}^2$ whereas the total contribution to the volatility of innovation is when ε_{t-1} is negative. This implies that the negative impact adds up more volatility shock to model. Thus we expect γ to be positive, so that the "bad news" has larger impacts[5]. The GJR-GARCH(1,1) model is asymmetric as long as $\gamma \neq 0$. As suggested by Ling & McAleer (2002), the regularity conditional for the existence of the second moment of GJR-GARCH(1,1) model is under $(\alpha + \beta) + \gamma/2 < 1$.

We also employ extended GJR-GARCH(1,1) with AR(1) to control for characteristic variable related to equity fund. This estimation model is given by

Mean Equation:

[5] In general, it is called a leverage effect.

$$r_t = \Phi_0 + \Phi_1 r_{t-1} + b_1 Cumreturn_t + b_2 Ln(NAV)_t + b_3 Newgrowth_t + \varepsilon_t \quad (3)$$

Variance Equation:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2 + \omega_1 M_{d_t} + \omega_2 Turnover_t \quad (4)$$
$$+\omega_3 Leverage_t + \omega_4 Ln(freq)_t + \omega_5 Ln(NAV)_t$$

where r is fund excess return as fund daily return minus risk free rate(Treasury note with maturity of 3 years), Cumreturn is cumulative fund excess return of daily based on past 6 months using rolling window, Ln(NAV) is logarithm of net asset value of fund, Newgrowth is new money growth. In addition, we include time dummy as month (TimeDummy) in mean equation (3). In variance equation (4), we include Monday dummy (M_d) to control for Monday effect and leverage is computed as $\sum_{i=1}^{N} w_{i,t}(Leverage_{i,t})$ where $w_{i,t}$ is the value weight of stock i in fund portfolio f at each day and Ln(freq) is the number of portfolio holdings held in each fund.

In model (3) and (4), the determinants of asymmetric volatility are controlled to make sure the differences of opinion among investors. First, we set up the proxy of differences of opinion. In this empirical analysis, we construct this variable as following way: $TURNOVER_{i,t}$ is daily turnover for each fund i in sample period t and is measured as following way: $Turnover_t = \frac{Min(Sell_t, Buy_t)}{NAV_t}$ where sell and buy are selling and buying amount, respectively. Thus it is used as a proxy for differences of opinion in this paper.

With its focus on differences of opinion, Chen, Hong, and Stein (2001), Hong and Stein model (2003) have distinctive empirical implications that are not shared by the representative investor theories. In particular, their model predicts that negative skewness in returns will be most pronounced around periods of heavy trading volume. This is because – like in many models with differences of opinion – trading volume proxies for the intensity of disagreement (Varian, 1989; Harris and Raviv, 1993; Kandel and Pearson, 1995; and Odean, 1998).

Regarding to differences of opinion among investors, as addressed in Hong and Stein (2003), when disagreement (and hence trading volume) is high, it is more likely that bearish investors will wind up at a corner, with their information incompletely revealed in prices. And it is precisely this hiding of information that sets the stage for negative skewness in subsequent rounds of trade, when the arrival of bad news to other, previously more-bullish investors can force the hidden information to come out.

3.2 Test of Asymmetry

To investigate further the existence of asymmetric effect on the volatility of return, the asymmetric GARCH, called GJR-GARCH model will be estimated. According to Engle and NG (1993), we conduct testing on the residuals from a asymmetric GJR-GARCH(1,1) model with AR(1). If the asymmetric GJR-GARCH(1,1) is a sufficient model for the returns, the residuals generated from such model will display any sign bias, negative size bias or positive size bias. Then it would be justifiable to use an asymmetric conditional volatility model. The joint test for asymmetry as proposed in Engle & Ng (1993) is as follow:

Sign bias: $$e_t^2 = b_0 + b_1 S_{t-1}^{-} + v_t \quad (5)$$

Negative sign bias: $$e_t^2 = b_0 + b_1 S_{t-1}^{-} e_{t-1} + v_t \quad (6)$$

Positive sign bias: $$e_t^2 = b_0 + b_1 S_{t-1}^{+} e_{t-1} + v_t \quad (7)$$

Joint test: $$e_t^2 = b_0 + + b_1 S_{t-1}^{-} + b_2 S_{t-1}^{-} e_{t-1} + b_3 S_{t-1}^{+} e_{t-1} + v_t \quad (8)$$

where S_{t-1}^{-} is an indicator dummy variable that takes the value of one if $e_{t-1} < 0$ and zero otherwise and $S_{t-1}^{+} = 1 - S_{t-1}^{-}$.

In the Sign Bias Test, the squared standardized residuals are regressed on a constant and a dummy variable, denoted S_{t-1}^{-}. The Sign Bias Test Statistic is the t-statistic for the coefficient on S_{t-1}^{-}. This test shows whether positive and negative innovations affect future volatility differently from the prediction of the model.

In the Negative Size Bias Test, the squared standardized residuals are regressed on a constant and $S_{t-1}^{-} e_{t-1}$. This test shows whether larger negative innovations are correlated with larger biases in predicted volatility.

In the Positive Size Bias Test, the squared standardized residuals are regressed on a constant and $S_{t-1}^{+} e_{t-1}$. The Positive Size Bias Test Statistic is the t-statistic for the coefficient on $S_{t-1}^{+} e_{t-1}$. This test shows whether larger positive innovations are correlated with larger biases in predicted volatility

3.3 Construction of controlling variables

To isolate the effects of turnover as a proxy of differences of opinion, we specify including several number of control variables as in Harvey and Siddique (2000); and Chen, Hong, and Stein (2001); and Bae, Lim, and Wei(2006). We control for the variables related to fund characteristics

First, the most key variable is the past cumulative daily return (CUMRET) for each fund i in the prior 6 months using rolling window. We expect that the skewness seem to become more negative when past returns have been high. Furthermore, this variable is suggested by models of stochastic bubbles, implying that high past returns indicate that the bubble has been building up for a long time (Chen, Hong, and Stein, 2001).

Second, Ln(NAV) is the Logarithm of fund net asset value based on daily fund asset to control for fund size(similar to firm size). Third, new money growth (NG) is measured as $\left[NAV_t - NAV_{t-1} \times (1+r_t)\right]/NAV_{t-1}$, where r_t is monthly fund return at time t and NAV is total net asset value. Fourth, Ln(Freq) is measured as logarithm of portfolio holdings. It is predicted that these two variables increase conditional volatility as number of portfolio and fund size increase. Thus it is expected that two variables influence to positive effect on fund return.

Fifth, leverage (Lev) is calculated as $\sum_{j=1}^{N} W_{j,t}\left[D_{j,t-1}/E_{j,t-1}\right]$ where $W_{j,t}$ is the relative weight value of stock j held by each fund i at the end of period t and $D_{j,t-1}$ is total debt of firm j held by each fund i at the end of year (t-1), and $E_{j,t-1}$ is total equity of firm j held by each fund i at the end of year (t-1). As leverage rises, conditional volatility also increases.

IV. Data and Characteristics of variables

Sample data used in empirical test is collected from ZeroIn Fund Evulation Company Data base. This data base contains the portfolio information at monthly level related to fund such as portfolio holding, fund cost, fund age, and so on. However, because of no information of individual firm held in fund, we employ KisValue Data base and FnGuide Data base to collect firm level information. For sample of the empirical test, we use only well managed equity funds, which includes above 70% of stock share. In addition, we exclude funds with outlier return and also we discard funds which are below 15 trading day, but we do not control for total net asset of fund in empirical test. Finally, the numbers of total fund used as final sample are 1,588. Furthermore, we separate whole sample into two sample such as boom period sample (sub-period 1) and recession period sample (sub-period 2) in order to decompose the extent of differences of opinion among fund managers.

Table 1 reports summary statistics of daily fund return during each period. During whole period, daily mean fund return is 0.03% and annualized return based on daily compounding is 7.79% whereas daily mean fund returns during boom and recession period are 0.07% and -0.17% respectively, indicating that annualized returns based on daily compounding are 19.12% and -34.65% respectively.

When we see skewness value shown in Table 1, fund return series, in fact, are negatively skewed in common sense for whole period. However, surprisingly, fund return series are more negative skewed in boom period rather than in recession period, suggesting that it is contrast to normal fact related to stock return. That is, the values of skewness for each boom and recession period are -0.3493 and -0.1876 respectively, indicating almost double negative skewed value in boom period more than in recession period. This phenomenon is very interesting fact in fund return series or it could be puzzle. We believe that it might be cause from fund manager's active ability for fund money operation. Our interpretation may be possibility in that a negatively skewed distribution is caused by a relatively few fund manager with very low performance in boom period rather than in recession period because fund managers, who manage money actively and effectively, may outperform market return in good investment time while fund managers resistant from loss of actively managed money through well managing fund money or rebalancing fund portfolio in bad investment time.

For average return, it has been known that fund managers demand higher return for more negatively skewed returns, and this could be one of most reasons why the average fund return is much higher in the boom period rather than in the recession period. Apparently, fund returns during whole period became much more negatively skewed.

<Insert Table 1>

Table 2 represents summary statistics of fund characteristic variables. The average of total net asset valuation (Ln(NAV)) is 6.75(unit: 10 million Korean Won). For leverage of firm held in fund, the average and median are 212% and 216%. The average and median for the number of stock held in each fund, Ln(freq) is 3.86 and 3.89, which indicate 47 and 49 of stock share in each fund.

<Insert Table 2>

Table 3 reports Pearson correlation among fund characteristic variables. We find that on average, excess return of fund is not significant to fund characteristic variables and thus is not correlated to all. However, cumulative excess return is negatively correlated to total net asset (LnNAV) and new growth (NG) significantly, but positively correlated to turnover (Turnover), leverage (Lev), and number of stock share held in fund (Ln(freq)) significantly.

<Insert Table 3>

V. The Empirical Results

4.1 An asymmetric effect of return on volatility

First of all, we test the existence of asymmetric effect of fund return on volatility using GJR-GARCH(1,1) for daily fund return series. The GJR-GARCH (1,1) and extended GJR-GARCH(1,1) based on separated sample data such as whole period, sub period 1, and sub period 2, respectively are employed. As mentioned above, to identify asymmetric effect on volatility, we use equation from (1) to (4).

Table 4 presents the result of GJR-GARCH(1,1) model in finding the existence of asymmetric effect on volatility. In Panel A, asymmetric coefficient, γ is significant at the 1% and positive value regardless of any specification. This result makes sure that fund return series have asymmetric effect on volatility. Moreover, the positive innovation would indicate a higher next period conditional variance than negative innovations of the same sign, implying that the existence of leverage effect is not observed in returns of the Korean fund market. Our result is consistent with Bekaert and Wu (2000) who rejects leverage effect in equity market.

In comparing degree of asymmetric effect for each period, the asymmetric coefficient value of γ is 0.1536 from GJR-GARCH and 0.2127 extended GJR-GARCH for boom, but 0.2487 from GJR-GARCH and 0.2390 from extended GJR-GARCH. These values are higher in recession rather than in boom, implying that the degree or impact of asymmetric effect during recession period is higher than during boom period.

According to Ling & McAleer (2002), the regularity condition is $\alpha + \beta + \gamma/2 < 1$, and it is satisfied for all models. Namely, we have 0.9618 and 0.9544 for whole period, and 0.9581 and 0.9285 for boom period, and 0.9729 and 0.9438 for recession period.

In Panel B, the result for test of asymmetry is shown. First, the results for the joint test for asymmetry show strong evidence for existence of asymmetry in the Korean fund returns during whole and boom period, but weak evidence for existence of asymmetry in fund returns during recession period. However, in negative bias test, all coefficients are significant at 1% and negative values regardless of model and period. This significant negative bias test statistic indicates that big negative innovations cause more volatility than the model can explain.

<Insert Table 4>

Figure 1 illustrates conditional volatility from GJR-GARCH. It shows that condition volatility is high about 2004, 2007, and 2008 year.

<Insert Figure 1>

Regarding to asymmetry on volatility illustrated by Figure 1, the news impact curve helps explain and figure out asymmetric idea. The news impact curve measures how new information is incorporated into volatility estimates. It appears from the figure that the news impact curve allows good news and bad news to have different impact on volatility. The negative side of the curve is steeper than its positive side, which indicates that bad news has a greater impact on volatility than good news.

Figure 2 pictures asymmetric effect from GJR-GARCH (1,1). Obviously new impact curves in Panel A, B, and C show that news at time (t-1) has asymmetric impact on volatility at t. This result confirms the result of GJR-GARCH(1,1) model.

<Insert Figure 2>

4.2 The Result of Differences of Opinion

We examine the differences of opinion (hereafter DO) among fund managers by using turnover as the proxy of it. We construct the portfolio based on the quintile of turnover such as quintile 1 as lowest DO, quintile 2…, quintile 5 as highest DO. First, we implement without control variables, which is GJR-GARCH model. Second, we confirm the result of first testing after including control variables, which is extended GJR-GARCH model. Also we report the result of difference of opinion from separated period time.

Table 5 shows the result of differences of opinion from whole period. The asymmetric coefficients, γ all are significant at the 1%. Interestingly, as we expected, it is shown that as difference of opinion increases to highest from lowest, the degree of asymmetric volatility also increases gradually. Specifically, γ value is changed from lowest level with 0.1589 to highest level with 0.1798 increasingly. This result supports the difference of opinion suggested by Hong and Stein (2003), and Stein, Hong, and Stein (2001). Obviously it turns out that funds that experience larger increases in turnover relative to trend are indeed predicted to have more negative skewness; moreover, the effect of turnover is strongly statistically and economically significant. To confirm this result, we add up several control variables into GJR-GARCH model. Table 8 reports the strong result of difference of opinion. The result in shown is also consistent with the result of Table 5, implying that our result is robust after controlling for fund characteristic variables.

Additionally, we examine whether there is difference of opinion during boom and recession period. For boom period, the results are shown in Table 6 and Table 9. These results are also similar to Table 5 and Table 8, indicating that even in boom time, the differences of opinions among fund managers exist. These evidences are strong and robust after controlling for variables related to fund in Table 9. Thus we conclude that even during boom period, the difference of opinion is supported, suggesting that fund with more difference of opinion has more negative skewness.

We investigate whether these evidences will be apparent during recession. The results of difference of opinion are provided in Table 7 and Table 10. Interestingly, Table 7 without control variable presents the some fact for investor heterogeneity weakly. The degree of asymmetric volatility is not consistent over the level of difference of opinion. That is, quintile 3 and quintile 4 have very big depth of divergence of opinion from fund managers. When we include controlling for variables in Table 10, this phenomenon is also not consistent over difference of opinion. Thus it is clarified that the difference of opinion is not supported during recession time. This means that there is no investor heterogeneity at recession period. This result is very interesting and needed to scrutiny something in more detail deeply. Here we remain in next study.

In conclusion, we find the differences of opinion among fund managers during whole and boom periods

4.3 Robustness Checks

An earlier analysis in this paper provided the results without controlling for variables related to fund characteristics using portfolio approach and thus these evidences could be not robust. Thus, two measures are directly introduced as proxies for measure of fund return asymmetry.

Additionally, to isolate the effect of differences of opinion on the skewness of fund returns, our models include a number of control variables. In estimating cross-section regression, GMM method is employed[6]. Thus, our estimation equation is as follows:

$$\begin{aligned}\mathbf{Skewness}_{f,t} = \alpha + \beta_1\mathbf{Volatility}_{f,t} + \beta_2\mathbf{Turnover}_{f,t} + \beta_3\mathbf{Leverage}_{f,t} \\ + \beta_4\mathbf{CReturn}_{f,t} + \beta_5\mathbf{Ln(\#of\ holdings)}_{f,t} + \beta_6\mathbf{Ln(NAV)}_{f,t} \\ + \beta_7\mathbf{TimeD} + \varepsilon_{f,t} \qquad (9)\end{aligned}$$

where two measures of NCSKEW and SK_{dnup} are used as skewness proxy. Also

[6] In estimating our model specification, cross section-time series GMM technique is employed because our estimation at contemporaneous time may have an endogeneity problem. The instrumental variables employed in estimating model are lagged independent variables and we provide J-statistics for overidentification of instrumental variables, which is under null hypothesis that instrumental variables used are overidentification.

$\mathbf{Leverage_{f,t}} = \sum_{i=1}^{N} \mathbf{w_{i,t}(Leverage_{i,t})}$, $\mathbf{volatility_{f,t}} = \sigma_{f,t} \cdot \sqrt{\mathbf{TradingDay}}$ where $\mathbf{w_{i,t}}$ is the value weight of stock i in fund portfolio f at the end of each month and $\sigma_{f,t}$ is, $\mathbf{Leverage_{i,t}} = \frac{\mathbf{Debt_{i,t}}}{\mathbf{Equity_{i,t}}}$, $\sigma_{f,t}$ is the standard deviation of daily return in fund f, $\sqrt{\textit{Trading}}$ is number of trading days at that month, $\mathbf{CReturn_{f,t}}$ is cumulative return of daily excess fund return. Also we include monthly time dummy (TimeD) to control for fund return seasonality.

We use two alternative skewness measures which are negative coefficient of skewness denoted as NCSKEW and down-to-up volatility denoted as SK_{dnup} employed by Chen, Hong and Stein (2001).

NCSKEW is our baseline measure of skewness and calculated by taking the negative of the third moment of monthly average of daily fund returns, and dividing it by the standard deviation of monthly average of daily fund returns raised to the third power. SK_{dnup} is a second measure of return asymmetries that does not involve third moments and it is less likely to be overly influenced by a handful of extreme days as mentioned in Chen, Hong and Stein (2001).

Both measurements are followed by Chen, Hong and Stein (2001). We compute NCSKEW as follows:

$$\mathbf{NCSKEW_{f,t}} = -\frac{\left(n(n-1)^{3/2}\sum \mathrm{Ret}_{f,t}^{3}\right)}{\left((n-1)(n-2)\left(\sum \mathrm{Ret}_{f,t}^{2}\right)^{3/2}\right)} \tag{10}$$

where $Ret_{f,t}$ represents daily return to fund f at time t, and n is the number of observations on daily fund return during sample period.

$SK_{dnup,f,t}$ for fund f over the sample period is computed as follows:

$$\mathbf{SK_{dnup,f,t}} = \log\left\{\frac{\left((n_u-1)\sum_{DOWN} \mathrm{Ret}_{f,t}^{2}\right)}{\left((n_d-1)\sum_{UP} \mathrm{Ret}_{f,t}^{2}\right)}\right\} \tag{11}$$

where n_u and n_d are the number of up and down days, respectively. An up or down day is a day on which the fund return is above or below the sample mean during the sample period.

Two proxy measures for skewness in test are carried to confirm the earlier results in this paper using GMM technique in equation (9). According to Chen, Hong and Stein(2001)'s result, in consistent with their model prediction, it has been found that negative skewness is most pronounced in stocks that have faced an increase in trading volume, implying that it is more difference of opinion. In our paper, we expect that fund return is more negatively skewed if differences of opinions from turnover based on trading volume of fund manager increase when short sales are constrained. Thus we offer a direct examination of the effects of different of opinion depending on short-sales constraints.

Table 11 provides the result of regression of the equation (9) on cross section-time series for each sample periods using NCSKEW as proxy for asymmetry of fund return. We use GMM estimation method for the equation (9) to eliminate the endogenous problem among variables. We regress NCSKEW on turnover as proxy for difference of opinion controlling for volatility, leverage, cumulative return, Ln(# of holdings), and Ln(NAV). We also include monthly time dummy variables. As shown in Table 11, we confirm that negative skewness is most pronounced in funds that have experienced an increase in turnover, implying that as the differences of fund manager's opinion increase, more the asymmetry of fund return occurs. Specifically, in Table 11, for turnover variable as the proxy for differences of fund manager opinion, this coefficient is positive and significant at the 1% level regardless of any sample periods.

Also we use another alternative measure, SK_{dnup} as the proxy for asymmetry of fund return, and Table 12 provides the result of regression using GMM. As the same result shown in Table 11, we find that turnover coefficients are positive and significant at the 1% level regardless of any sample period, suggesting that as the difference of opinion increases, the asymmetry of fund return also increases.

In addition, we document that our findings support the stochastic bubble hypothesis (Blanchard and Watson, 1982; Wu, 1997), suggesting the asymmetries in fund returns are due to the popping of the bubble, although the probability that produces large negative returns is very low. That is, negative skewness could be pronounced in funds that have experienced an increase in positive cumulative return over the prior one month trading days in our paper. Specifically, as shown in Table 11 and 12, the coefficients of cumulative return are positive and significant at the 1% level, respectively regardless of any periods. Our result is in line with Blanchard and Watson (1982), and Wu(1997), and Chen, Hong, and Stein(2001) with short-sale constraints.

In conclusion based on these results, our results are consistent with Chen, Hong and Stein (2001) model prediction as the Miller's (1977) intuition and stochastic bubble view suggested by Blanchard and Watson (1982), and Wu (1997). As a result, we ensure that under short-sale constraints, the differences of opinion among fund managers as investors play a vital role in negative skewness of fund return positively in Korean fund market.

5. Conclusions

In this paper, we use unique fund return data from the ZeroIn Fund Evaluation Company to identify the asymmetric volatility and explain this fact by using turnover based on fund manager's trading volume as the proxy of differences of opinion among fund managers.

This study provides some insights into asymmetric volatility in Korean Fund Market. The results reveal an asymmetric volatility in fund return as well. Thus this result is consistent with the fact of stock return. Finally we find evidence that asymmetric volatility is general fact apparently.

In addition, we construct the portfolio based on turnover ranked to find the differences of opinion suggested by Chen, Hong, and Stein (2001). We find the evidence that there is difference of opinion, which implies investor heterogeneity only during whole period and boom, not recession period. This result suggests that fund with more differences of opinion among fund managers has more negative skewness. Furthermore, we have found that it helpful to explain the skewness of fund return in terms of idea of stochastic bubbles developed by Blanchard and Watson (1982).

Our results are robust after controlling for variables related to fund characteristics. After all, among fund managers in Korean fund market, the differences of opinion under short-sale constraints could explain the skewness of fund return and overvaluation hypothesis suggested by Miller (1977) and Chen, Hong, and Stein(2001) is supported.

References

Cheong, B. D. and Jeong, J. H., 2002, An Investigation of Asymmetric Volatility of Stock Returns in KOREA, *Risk Management* 13, 2, 97-126.

Gu, Bon Il, 2000, An Investigation of Asymmetric Volatility of Stock in Korea Stock market, Financial Research 13, 129-159.

Park, Jong Won, 2006, KOSPI 200 Derivatives and Volatility Asymmetry of Stock Markets, *Korean Journal of Financial Management* 23, 1, 101-133.

Bae, K. H., Lim, C. H., and Wei, K.C. John, 2006, Corporate Governance and Conditional Skewness in the World's Stock Markets, *The Journal of Business,* 79, 2999-3028.

Bakshi, G., Cao, C., Chen, Z., 1997, Empirical performance of alternative option pricing models, *Journal of Finance*, 52, 2003-2049.

Bekaert, G., Wu, G., 2000, Asymmetric Volatility and Returns in Equity Markets, *Review of Financial Studies*, 13, 1-42.

Black, F., 1976, Studies of stock price volatility changes, *proceedings of the 1976 meetings of the American Statistical Association, business and economics statistics section,* 177-181.

Blanchard, O. J., Watson, M. W., 1982, Bubbles, rational expectations, and financial markets, in P. Wachtel, ed.: *Crises in economics and financial structure* (Lexington Books, Lexington, MA).

Boehme R., Danielsen, B. and Sorescu, S., 2006, Short sale constraints, differences of Opinion, and overvaluation, *Journal of Financial and Quantitative Analysis*, 41, 455-487.

Breen, W., Glosten, L., Jagannathan, R., 1989, Economics significance of predictable variation in stock index returns, *Journal of Finance*, 44 1177-1189.

Campbell, J. Y., Hentschel, L., 1992, No news is good news: an asymmetric model of chasing volatility in stock returns, *Journal of Financial Economics*, 31, 281-318.

Chang, E. C., Cheng, J. C., Yu, Y., 2007, Short-Sales Constraints and Price Discovery: Evidence from the Hong Kong Market, *Journal of Finance,* 62, 2097-2122.

Chen, J., Hong, H., Stein, J. C. 2001, Forecasting crashes: Trading volume, past returns, and conditional skewness in stock prices, *Journal of Financial Economics*, 2001, 61, 345-381.

Christie, A. A., 1982, The stochastic behavior of common stock variance-value, leverage and interest rate effects, *Journal of Financial Economics*, 10, 407-432.

Diether, K. B., Malloy, C. J., Scherbina, A., 2002, Differences of opinion and the cross section of stock returns, *Journal of Finance*, 57, 2113-2141.

Dumas, B., Fleming, J. and Whaley, R. E., 1998, Implied volatility functions: Empirical tests, *Journal of Finance*, 53, 2059-2106.

Engle, R. F. and Ng, V., 1993, Measuring and testing the impact of news on volatility, *Journal of Finance*, 48, 1749-1778.

Fama, E. F. and Schwert, G. W., 1977, Asset returns and inflation, *Journal of Financial Economics*, 5, 115-146.

Figlewski, Stephen, 1981, The informational effects of restrictions on short sales: Some empirical evidence, *Journal of Financial and Quantitative Analysis* 16, 463–476.

Figlewski, S. and Wang, X., 2001, Is the leverage effect a leverage effect, working paper.

French, K. R., Schwert, G. W., Stambaugh, R. F., 1987, Expected stock returns and volatility, *Journal of Financial Economics*, 19, 3-29.

Glosten, Lawrence R., Jagannathan, R., and Runkle, David E, 1993, On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks," *Journal of Finance*, *American Finance Association*, 48, 1779-1801.

Harvey, C. R., Siddique, A., 2000, Conditional skewness in asset pricing tests, *Journal of Finance*, 2000, 55, 1263-1295.

Harris, M. and A. Raviv, 1993. Differences of Opinion Make a Horse Race, Review of Financial Studies, 6, 473-506.

Hong, H. and Stein, J. C., 2003, Differences of opinion, short-sales constraints, and market crashes, *Review of Financial Studies*, 16, 487-525.

Jarrow, R. 1980, Heterogeneous expectations, restrictions on short sales, and equilibrium asset prices, *Journal of Finance*, 35, 1105-1113.

Kandel, E., Pearson, N. D., 1995, Differential interpretation of public signals and trade in speculative markets, Journal of Political Economy **4**, 831–872.

Ling, S. and M. McAleer, 2002, Stationarity and the existence of moments of a family of GARCH processes, Journal of Econometrics 106, 109-117.

Miller, E. M., 1977, Risk, uncertainty and divergence of opinion, *Journal of Finance*, 32, 1151-1168.

Nelson, D.B., 1991, conditional heteroskedasticity in asset returns: A new approach, *Econometrica*, 59, 347-370.

Odean, Terrance, 1998, Volume, Volatility, Price, and Profit When All Traders Are above Average, *Journal of Finance,* LIII, 1887–1934.

Pindyck, R. S., 1984, Uncertainty in the theory of renewable resource markets, *Review of Economic Studies*, 51, 289-303.

Poterba, M., Summers, L., 1986, The Persistence of Volatility and Stock Market Fluctuations, *American Economic Review*, 76, 1142-1151.

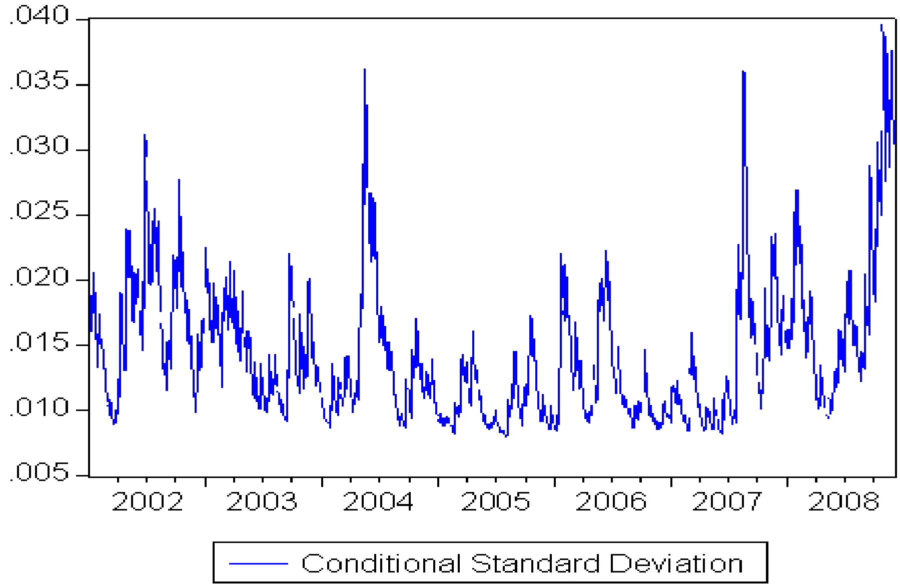
Schwert, G. W., 1989, Why does stock market volatility change over time? *Journal of Finance*, 44, 1115-1153.

Varian, H., 1989, Difference of Opinion in Financial Markets. In Financial Risk: Theory, Evidence, and Implications. Stone C.C. (Ed.), Kluwer, Dordrecht, The Netherlands.

Wu, Y., 1997, Rational Bubbles in the Stock Market: Accounting for the U.S. Stock-Price Volatility, Economic Inquiry 35, 309 -319

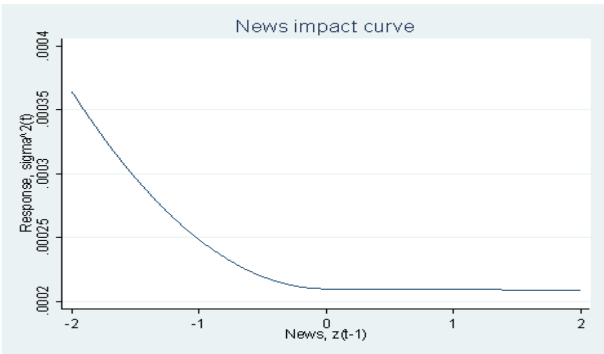
<Figure 1> Conditional Volatility

This figure show the conditional volatility from GJR-GARCH(1,1) of daily fund return. We use fund sample data from 2002 to 2008 in Korean fund market.

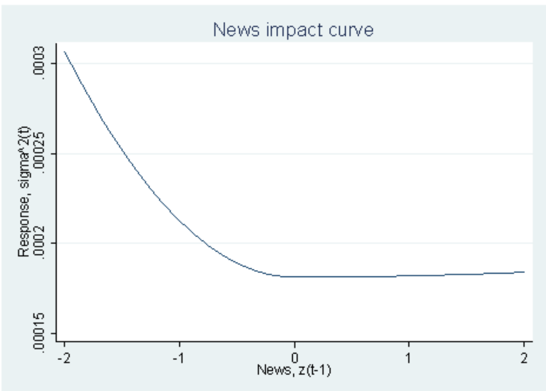


<Figure 2> News Impact Curve from GJR-GARCH(1,1)

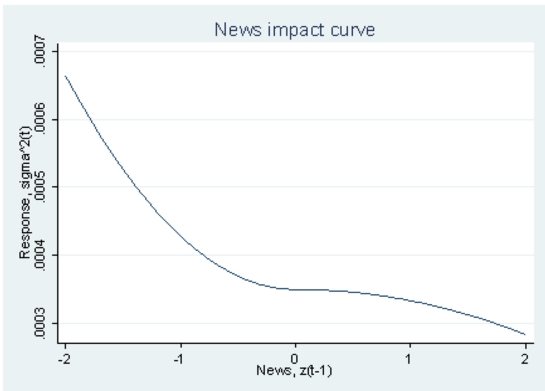
Panel A: Whole period (1.31.2002-11.28.2008)



Panel B: Sub period 1(1.31.2002-9.28.2007)



Panel C: Sub period 2(10.1.2007-11.28.2008)



<Table 1> Summary statistics

This table reports summary statistics of fund daily raw return using fund data in Korean fund market from January 2002 to November 2008. Sample period is separated into whole period, sub period 1 and sub period 2.

	Whole period (1/31/2002-11/28/2008)	Sub period 1: Boom (1/31/2002-9/30/2007)	Sub period 2: Recession (10/1/2007-11/28/2008)
Mean	0.0003	0.0007	-0.0017
Median	0.0012	0.0014	0.0195
Standard Deviation	0.0151	0.0140	0.0195
Skewness	-0.3544	-0.3493	-0.1876
Kurtosis	2.1739	2.0332	1.3745

<Table 2> Summary statistics for variables

This table reports the summary statistics of variable used in sample using fund data and stock shares held in fund. ExRet is measured as fund return minus risk free rate (Korean T-note with 3 years). CumExRet is cumulative fund excess return of daily based on prior 6 months using rolling window. Ln(NAV) denotes the logarithm of net asset value of fund and NG is new money growth in fund as $\left[NAV_t - NAV_{t-1} \times (1+r_t)\right] / NAV_{t-1}$. Turnover is daily turnover for each fund i in sample period t and is measured as following way: $Min(Sell_t, Buy_t)/NAV_t$, where sell and buy are selling and buying amount, respectively. Leverage is computed as $\sum_{i=1}^{N} w_{i,t}(Leverage_{i,t})$ where $w_{i,t}$ is the value weight of stock i in fund portfolio f at each day and Ln(freq) is the number of portfolio holdings held in each fund.

	Mean	Median	Std.	Skewness	Kurtosis	Max	Min
ExRet	0.0003	0.0012	0.0151	-0.3544	2.1739	0.0663	-0.0722
CumExRet	0.0758	0.0745	0.2016	0.3501	0.3898	0.7962	-0.4780
Ln(NAV)	6.7545	6.5660	0.6703	0.3090	-1.0538	8.0389	5.6925
NG	-0.0157	-0.0064	0.0454	-0.8938	3.0472	0.0928	-0.2146
Turnover	0.0635	0.0628	0.0174	0.4972	1.5857	0.1337	0.0276
Leverage	2.1181	2.1607	0.4669	-0.1867	-0.4423	3.0400	0.9265
Ln(freq)	3.8635	3.8941	0.1762	-0.1398	-1.3729	4.1380	3.5518

<Table 3> Correlation

This table shows the Pearson correlation among variables used in model. ExRet is measured as fund return minus risk free rate (T-note with 3 years). CumExRet is cumulative fund excess return of daily fund return based on prior 6 months using rolling window. Ln(NAV) denotes the logarithm of net asset value of fund and NG is new money growth in fund as $\left[NAV_t - NAV_{t-1} \times (1+r_t)\right] / NAV_{t-1}$. Turnover is daily turnover for each fund i in sample period t and is measured as following way: $Min(Sell_t, Buy_t) / NAV_t$, where sell and buy are selling and buying amount, respectively. Leverage is computed as $\sum_{i=1}^{N} w_{i,t}(Leverage_{i,t})$ where $w_{i,t}$ is the value weight of stock i in fund portfolio f at each day and Ln(freq) is the number of portfolio holdings held in each fund.

	ExRet	CumExRet	Ln(NAV)	NG	Turnover	Leverage	Ln(freq)
ExRet							
CumExRet	0.097						
	(<.0001)						
Ln(NAV)	-0.013	-0.071					
	(0.587)	(0.003)					
NG	0.006	-0.223	0.538				
	(0.817)	(<.0001)	(<.0001)				
Turnover	0.031	0.461	0.234	-0.049			
	(0.208)	(<.0001)	(<.0001)	(0.042)			
Leverage	0.015	0.291	-0.657	-0.470	-0.185		
	(0.524)	(<.0001)	(<.0001)	(<.0001)	(<.0001)		
Ln(freq)	-0.006	0.164	0.695	0.404	0.614	-0.659	
	(0.801)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	(<.0001)	

Notice: ( ) is p-value

<Table 4> The Result of GJR-GARCH model

This table presents the result of extended GJR-GARCH(1,1) from separated sample period. Extended GJR-GARCH(1,1) is given by mean and variance equation as follows:

$$r_t = \Phi_0 + \Phi_1 r_{t-1} + b_1 Cumreturn_t + b_2 Ln(NAV)_t + b_3 Newgrowth_t + \varepsilon_t$$

$$\sigma_t^2 = \omega_0 + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2 + \omega_1 M_{d_t} + \omega_2 Turnover_t + \omega_3 Leverage_t$$

$$+\omega_4 Ln(freq)_t + \omega_5 Ln(NAV)_t$$

( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH (1,1)						
	Whole period		Sub period 1(boom)		Sub period 2(recession)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Φ_1	0.0646**	0.0484***	0.0791**	0.0611***	-0.0430	-0.0537
	(2.33)	(1.74)	(2.62)	(2.06)	(-0.62)	(-0.77)
b_1		0.0079*		0.0083*		0.0074
		(5.38)		(4.99)		(0.92)
b_2		-0.0002		0.0002		0.0052
		(-0.35)		(0.37)		(0.56)
b_3		0.0123		0.0137		0.0388
		(1.59)		(1.77)		(0.88)
α	-0.0023	-0.0234**	0.0021	-0.0350**	-0.0386	-0.0801***
	(-0.18)	(-2.31)	(0.15)	(-2.65)	(-1.51)	(-1.92)
β	0.8794*	0.8731*	0.8798*	0.8571*	0.8873*	0.9044*
	(58.19)	(52.55)	(54.47)	(43.22)	(16.52)	(17.09)
γ	0.1694*	0.2093*	0.1536*	0.2127*	0.2484*	0.2390*
	(7.39)	(7.94)	(6.57)	(7.45)	(3.00)	(3.07)
ω_1		-0.000003		-0.000003		-0.00001
		(-0.31)		(-0.28)		(-0.37)
ω_2		0.0001		0.0001***		-0.0004
		(1.11)		(1.87)		(-0.96)
ω_3		0.0000001		0.000004		0.00003
		(0.04)		(1.70)		(0.85)
ω_4		-0.00002*		-0.00003*		-0.000001
		(-3.43)		(-4.12)		(-0.01)
ω_5		0.000003**		0.000003**		-0.0001**
		(2.41)		(2.28)		(-2.03)
Skewness	-0.232	-0.258	-0.224	-0.249	-0.355	-0.242
Kurtosis	3.512	3.476	3.607	3.450	3.303	2.926
Like.Ratio	4916.53	4937.29	4167.57	4190.74	755.93	762.91
Panel B: Test of Asymmetry based on Engle and NG(1993)						
Sign Bias(×100)	0.008**	0.011*	0.008**	0.011*	0.013	0.015
t-statistics	(2.27)	(2.97)	(2.40)	(3.21)	(0.97)	(1.25)
Positive Bias(×100)	-0.062	-0.116	-0.311	-0.393	0.041	-0.027
t-statistics	(-0.31)	(-0.59)	(-1.59)	(-1.94)	(0.11)	(-0.05)
Negative Bias (×100)	-0.985**	-0.935*	-0.855*	-0.876*	-1.441***	-1.310***
t-statistics	(-2.64)	(-4.72)	(-4.38)	(-4.57)	(-2.09)	(-2.02)
Joint Bias F-statistics	8.37*	7.72*	6.22*	6.88*	1.79	1.55

Notice) *, **, and *** are significant at the 1%, 5% 10%, respectively

<Table 5> The result of GJR-GARCH model based on turnover portfolio ranked : Whole period (1.31.2002-11.28.2008)

This table reports the result of GJR-GARCH(1,1) using following model in mean $r_t = \Phi_0 + \Phi_1 r_{t-1} + \varepsilon_t$ and conditional variance $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2$ where $I_{t-1} = 1 \quad if \ \varepsilon_{t-1} < 0$, $I_{t-1} = 0 \quad if \ \varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH(1,1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Φ_1	0.0596**	0.0640**	0.0633**	0.0644**	0.0708*
	(2.14)	(2.31)	(2.28)	(2.33)	(2.57)
α	0.0006	-0.0009	0.0048	-0.0013	-0.0071
	(0.05)	(-0.07)	(0.37)	(-0.10)	(-0.59)
β	0.8847*	0.8835*	0.8790*	0.8754*	0.8733*
	(60.53)	(59.39)	(57.92)	(55.58)	(53.87)
γ	0.1589*	0.1647*	0.1624*	0.1732*	0.1798*
	(7.32)	(7.28)	(7.12)	(7.40)	(7.53)
Skewness	-0.239	-0.228	-0.226	-0.229	-0.229
Kurtosis	3.487	3.488	3.506	3.543	3.561
Lik.Ratio	4963.1	4928.8	4909.3	4898.7	4885.9
Panel B: Test of Asymmetry based on Engle and NG(1993)					
Sign Bias(×100)	0.007**	0.009**	0.009**	0.009**	0.009**
t-statistics	(2.12)	(2.45)	(2.42)	(2.29)	(2.24)
Positive Bias(×100)	-0.073	-0.070	-0.094	-0.003	-0.022
t-statistics	(-0.38)	(-0.35)	(-0.47)	(-0.01)	(-0.11)
Negative Bias(×100)	-0.880*	-0.922*	-1.030*	-1.018*	-0.961*
t-statistics	(-4.47)	(-4.60)	(-4.96)	(-4.81)	(-4.49)
Joint Bias F-statistics	7.28*	7.76*	8.92*	8.90*	7.67*

Notice) *, **, and *** are significant at the 1%, 5% and 10%, respectively

<Table 6> The result of GJR-GARCH model based on turnover portfolio ranked : Sub period 1 (1.31.2002-9.28.2007)

This table reports the result of GJR-GARCH(1,1) using following model in mean $r_t = \Phi_0 + \Phi_1 r_{t-1} + \varepsilon_t$ and conditional variance $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2$ where $I_{t-1} = 1 \quad if \ \varepsilon_{t-1} < 0$, $I_{t-1} = 0 \quad if \ \varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH(1,1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Φ_1	0.0743**	0.0779*	0.0771*	0.0780*	0.0872*
	(2.45)	(2.58)	(2.55)	(2.58)	(2.91)
α	0.0061	0.0042	0.0107	0.0035	-0.0071
	(0.43)	(0.28)	(0.72)	(0.24)	(-0.52)
β	0.8860*	0.8845*	0.8799*	0.8757*	0.8702*
	(57.12)	(55.84)	(54.57)	(51.21)	(48.54)
γ	0.1430*	0.1482*	0.1444*	0.1557*	0.1712*
	(6.45)	(6.40)	(6.22)	(6.53)	(6.92)
Skewness	-0.232	-0.224	-0.217	-0.221	-0.217
Kurtosis	3.566	3.593	3.613	3.561	3.650
Like.Ratio	4197.8	4177.1	4162.8	4157.9	4145.1
Panel B: Test of Asymmetry based on Engle and NG(1993)					
Sign Bias(×100)	0.0076**	0.0083*	0.0086*	0.0088*	0.0085**
t-statistics	(2.42)	(2.61)	(2.59)	(2.61)	(2.50)
Positive Bias(×100)	-0.2879	-0.3136	-0.3041	-0.3222	-0.3029
t-statistics	(-1.54)	(-1.69)	(-1.59)	(-1.64)	(-1.49)
Negative Bias(×100)	-0.8162*	-0.8458*	-0.9234*	-0.8883*	-0.8626*
t-statistics	(-4.27)	(-4.45)	(-4.71)	(-4.49)	(-4.32)
Joint Bias F-statistics	6.09*	6.62*	7.42*	6.73*	6.22*

Notice) *, **, and *** are significant at the 1%, 5% and 10%, respectively

<Table 7> The result of GJR-GARCH model based on turnover portfolio ranked : Sub period 2 (10.1.2007-11.28.2008)

This table reports the result of GJR-GARCH(1,1) using following model in mean $r_t = \Phi_0 + \Phi_1 r_{t-1} + \varepsilon_t$ and conditional variance $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2$ where $I_{t-1} = 1 \quad if \ \varepsilon_{t-1} < 0$, $I_{t-1} = 0 \quad if \ \varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH(1,1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Φ_1	-0.0562	-0.0412	-0.0394	-0.0335	-0.0471
	(-0.79)	(-0.59)	(-0.57)	(-0.48)	(-0.68)
α	-0.0452***	-0.0377	-0.0387	-0.0405	-0.0307
	(-1.83)	(-1.45)	(-1.46)	(-1.60)	(-1.19)
β	0.8975*	0.8915*	0.8856*	0.8794*	0.8847*
	(17.32)	(16.33)	(16.14)	(16.66)	(16.54)
γ	0.2392*	0.2440*	0.2509*	0.2631*	0.2400*
	(3.04)	(2.95)	(3.01)	(3.14)	(2.88)
Skewness	-0.367	-0.336	-0.352	-0.359	-0.359
Kurtosis	3.375	3.224	3.240	3.346	3.354
Like.Ratio	772.5	758.7	753.4	747.8	748.0
Panel B: Test of Asymmetry based on Engle and NG(1993)					
Sign Bias(×100)	0.006	0.010	0.013	0.012	0.011
t-statistics	(0.46)	(0.79)	(0.98)	(0.87)	(0.79)
Positive Bias(×100)	0.103	0.053	0.020	0.094	0.108
t-statistics	(0.18)	(0.09)	(0.03)	(0.16)	(0.18)
Negative Bias(×100)	-1.469**	-1.333**	-1.669**	-1.611**	-1.530**
t-statistics	(-2.19)	(-2.00)	(-2.36)	(-2.23)	(-2.08)
Joint Bias F-statistics	2.25**	1.65	2.25***	2.11	1.88

Notice) *, **, and *** are significant at the 1%, 5% 10%, respectively

<Table 8> The result of GJR-GARCH model with control variables based on turnover portfolio ranked: Whole period (1.31.2002-11.28.2008)

This table reports the result of extended GJR-GARCH(1,1) including control variables by using following model in mean $r_t = \Phi_0 + \Phi_1 r_{t-1} + b_1 cumreturn_t + b_2 Ln(NAV) + b_3 NewGrowth_t + \varepsilon_t$ and conditional variance $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2 + w_1 M_{dt} + w_2 Turnover_t + w_3 Leverage_t + w_4 Ln(freq)_t + w_5 Ln(NAV)_t$ where $I_{t-1} = 1\ \ if\ \ \varepsilon_{t-1} < 0$, $I_{t-1} = 0\ \ if\ \ \varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH(1,1)

	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Φ_1	0.0456	0.0506***	0.0476	0.0497	0.0543***
	(1.60)	(1.84)	(1.70)	(1.80)	(1.97)
b_1	0.0070*	0.0070*	0.0086*	0.0081*	0.0091*
	(4.76)	(4.78)	(5.41)	(5.10)	(5.83)
b_2	-0.0003	-0.0003	-0.0004	-0.0002	0.0003
	(-0.57)	(-0.72)	(-1.00)	(-0.38)	(0.84)
b_3	0.0023	0.0093	0.0147	0.0143	0.0184**
	(0.55)	(1.19)	(1.76)	(1.68)	(2.23)
α	-0.0092	-0.0235**	-0.0151	-0.0164	-0.0223**
	(-0.88)	(-2.16)	(-1.39)	(-1.55)	(-2.17)
β	0.8894*	0.8790*	0.8669*	0.8711*	0.8725*
	(62.47)	(57.13)	(49.23)	(50.60)	(52.46)
γ	0.1780*	0.1991*	0.2005*	0.1996*	0.2063*
	(7.90)	(8.11)	(7.63)	(7.56)	(7.82)
ω_1	-0.000002	-0.000015	-0.000002	0.000004	0.000007
	(-0.21)	(-1.48)	(-0.24)	(0.36)	(0.61)
ω_2	0.000027	0.000021	0.000001	-0.000012	0.000018
	(0.54)	(0.44)	(0.02)	(-0.29)	(0.54)
ω_3	-0.000003	0.000002	0.000003***	0.000003	0.000001
	(-1.23)	(0.99)	(1.85)	(1.69)	(0.30)
ω_4	-0.000008	-0.000017*	-0.000008**	-0.000003	-0.000010**
	(-1.66)	(-4.77)	(-2.45)	(-0.80)	(-2.55)
ω_5	0.000002	0.000003*	0.000003*	0.000002	0.000001
	(1.15)	(2.74)	(2.97)	(1.77)	(0.93)
Skewness	-0.249	-0.246	-0.244	-0.229	-0.235
Kurtosis	3.431	3.399	3.446	3.488	3.505
Like.Ratio	4978.029	4951.963	4931.26	4917.735	4906.434

Panel B: Test of Asymmetry based on Engle and NG(1993)

	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Sign Bias(×100)	0.009*	0.010*	0.010*	0.011*	0.012*
t-statistics	(2.82)	(2.97)	(2.79)	(2.94)	(3.17)
Positive Bias(×100)	-0.186	-0.198	-0.176	-0.070	-0.068
t-statistics	(-0.97)	(-1.04)	(-0.89)	(-0.35)	(-0.33)
Negative Bias(×100)	-0.879*	-0.869*	-0.889*	-0.999*	-0.972*
t-statistics	(-4.56)	(-4.53)	(-4.59)	(-4.91)	(-4.68)
Joint Bias F-statistics	7.14*	7.10*	7.41*	8.97*	8.50*

Notice) *, **, and *** are significant at the1%, 5% 10%, respectively

<Table 9> The Result of GJR-GARCH model with control variables based on turnover portfolio ranked: Sub period 1 (1.31.2002-9.28.2007)

This table reports the result of extended GJR-GARCH(1,1) with AR(1) including control variables by using following model in mean $r_t = \Phi_0 + \Phi_1 r_{t-1} + b_1 cumreturn_t + b_2 Ln(NAV) + b_3 NewGrowth_t + \varepsilon_t$ and conditional variance $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2 + w_1 M_{dt} + w_2 Turnover_t + w_3 Leverage_t + w_4 Ln(freq)_t + w_5 Ln(NAV)_t$, where $I_{t-1} = 1 \;\; if \;\; \varepsilon_{t-1} < 0$, $I_{t-1} = 0 \;\; if \;\; \varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH(1,1) with AR(1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Φ_1	0.0623**	0.0658**	0.0612**	0.0650**	0.0706**
	(2.04)	(2.25)	(2.03)	(2.20)	(2.40)
b_1	0.0067*	0.0068*	0.0089*	0.0083*	0.0087*
	(3.96)	(3.98)	(4.95)	(4.62)	(4.00)
b_2	-0.0002	-0.0001	0.00001	0.0002	0.0006
	(-0.32)	(-0.12)	(0.02)	(0.49)	(1.30)
b_3	0.0055	0.0102	0.0130	0.0109	0.0158
	(1.15)	(1.28)	(1.50)	(1.25)	(1.81)
α	-0.0132	-0.0276**	-0.0202	-0.0205	-0.0318**
	(-1.01)	(-2.07)	(-1.47)	(-1.52)	(-2.51)
β	0.8826*	0.8756*	0.8589*	0.8571*	0.8593*
	(50.87)	(50.99)	(41.92)	(40.08)	(42.80)
γ	0.1772*	0.1827*	0.1920*	0.1909*	0.2047*
	(7.26)	(7.45)	(6.94)	(6.79)	(7.23)
ω_1	-0.000004	-0.000016	-0.000003	0.000003	0.000011
	(-0.41)	(-1.47)	(-0.28)	(0.26)	(0.86)
ω_2	0.00006	0.00004	0.00001	-0.00001	0.00002
	(1.07)	(0.79)	(0.23)	(-0.18)	(0.48)
ω_3	-0.000001	0.000005**	0.000006*	0.000007*	0.000004
	(-0.26)	(2.35)	(2.90)	(2.88)	(1.74)
ω_4	-0.000015*	-0.000020*	-0.000012*	-0.000007	-0.000012*
	(-2.29)	(-5.01)	(-2.80)	(-1.49)	(-2.65)
ω_5	0.000002	0.000003*	0.000002**	0.000001	0.000001
	(1.39)	(2.73)	(2.22)	(1.45)	(0.83)
Skewness	-0.239	-0.233	-0.229	-0.208	-0.213
Kurtosis	3.420	3.402	3.468	3.489	3.487
Lik.Ratio	4212.4	4199.8	4182.8	4176.8	4165.1
Panel B: Test of Asymmetry based on Engle and NG(1993)					
Sign Bias(×100)	0.011*	0.011*	0.012*	0.012*	0.013*
t-statistics	(3.29)	(3.38)	(3.49)	(3.65)	(3.75)
Positive Bias(×100)	-0.360***	-0.354***	-0.385***	-0.401**	-0.399***
t-statistics	(-1.89)	(-1.85)	(-1.97)	(-2.02)	(-1.97)
Negative Bias(×100)	-0.836*	-0.869*	-0.911*	-0.919*	-0.890*
t-statistics	(-4.43)	(-4.60)	(-4.80)	(-4.70)	(-4.51)
Joint Bias F-statistics	6.71*	7.24*	7.86*	7.69*	7.30*

Notice) *, **, and *** are significant at the 1%, 5% and 10%, respectively

<Table 10> The result of GJR-GARCH model with control variables based on turnover portfolio ranked: Sub period 2 (10.1.2007-11.28.2008)

This table reports the result of extended GJR-GARCH(1,1) with AR(1) including control variables by using following model in mean $r_t = \Phi_0 + \Phi_1 r_{t-1} + b_1 cumreturn_t + b_2 Ln(NAV) + b_3 NewGrowth_t + \varepsilon_t$ and conditional variance $\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \gamma I_{t-1}\varepsilon_{t-1}^2 + w_1 M_{dt} + w_2 Turnover_t + w_3 Leverage_t + w_4 Ln(freq)_t + w_5 Ln(NAV)_t$ where $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $I_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

Panel A: GJR-GARCH (1,1) with AR(1)

	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Φ_1	-0.0459	-0.0538	-0.0533	-0.0730	-0.0994
	(-0.67)	(-0.70)	(-0.81)	(-1.05)	(-1.56)
b_1	0.0046	0.0074	0.0125*	0.0134***	0.0184*
	(0.98)	(1.23)	(2.89)	(1.96)	(2.87)
b_2	0.0015	0.0043	-0.0020	0.0002	0.0004
	(0.53)	(1.28)	(-0.70)	(0.05)	(0.10)
b_3	-0.0062	0.0084	0.0411	0.1426*	0.1166*
	(-0.61)	(0.16)	(0.95)	(3.03)	(2.64)
α	-0.0958**	-0.0433	-0.1099*	-0.0520	-0.0723*
	(-2.55)	(-1.40)	(-3.13)	(-1.53)	(-3.72)
β	0.2916*	0.2237*	0.2655*	0.2423*	0.2608*
	(3.38)	(2.69)	(4.21)	(2.93)	(6.16)
γ	0.9391*	0.9132*	0.9590*	0.9026*	0.9042*
	(22.61)	(16.52)	(27.59)	(14.51)	(32.49)
ω_1	-0.00004	0.00001	-0.00005	-0.00001	-0.00004**
	(-1.09)	(0.46)	(-1.46)	(-0.14)	(-2.30)
ω_2	-0.0006	-0.0001	-0.0004	-0.0004	-0.0006*
	(-1.08)	(-0.22)	(-1.26)	(-1.47)	(-3.59)
ω_3	0.000004	-0.00001	-0.00001	0.00004**	-0.000002
	(0.26)	(-0.53)	(-0.39)	(2.16)	(-0.13)
ω_4	0.00003*	-0.00002	-0.00003***	-0.00010*	0.000003**
	(2.64)	(-0.88)	(-1.74)	(-3.00)	(2.20)
ω_5	0.00001	-0.00002*	-0.00002*	-0.00001	-0.00004*
	(0.47)	(-3.05)	(-2.95)	(-1.04)	(-14.27)
Skewness	-0.346	-0.203	-0.208	-0.203	-0.283
Kurtosis	3.281	3.013	3.012	3.013	3.187
Lik.Ratio	774.6	763.2	759.1	753.5	755.9

Panel B: Test of Asymmetry based on Engle and NG(1993)

Sign Bias(×100)	0.008	0.015	0.014	0.019	0.010
t-statistics	(0.67)	(1.39)	(1.20)	(1.56)	(0.84)
Positive Bias(×100)	0.047	-0.090	-0.050	-0.021	-0.027
t-statistics	(0.09)	(-0.21)	(-0.09)	(-0.05)	(-0.06)
Negative Bias(×100)	-1.468**	-1.263**	-1.266***	-1.443**	-1.023
t-statistics	(-2.26)	(-2.09)	(-1.99)	(-2.18)	(-1.60)
Joint Bias F-statistics	2.230	1.610	1.490	1.830	0.960

Notice) *, **, and *** are significant at the 1%, 5% and 10%, respectively

<Table 11> The regression result for NCSKEW

This table reports the regression result of equation (9) using GMM for each sample periods. Sample period used in this paper is separated into whole period, sub-period 1 and sub-period 2 in order to find the effect of turnover on asymmetric volatility. NCSKEW is used as a proxy for the asymmetry of fund return and a dependent variable. As explanatory variables, volatility is monthly standard deviation based on daily fund return and turnover which is a proxy for the differences of opinion of fund manager as investor is based on fund trading volume. Leverage denotes debt-to-total asset of firms held by each fund portfolio. Cumulative return is computed as a geometrically accumulated return from daily fund return. Ln(freq) represents a number of holdings held in each fund. Ln(NAV) represents the net asset value of fund. Time dummy as month is included in estimation equation. J-statistics is statistically value under null hypothesis that instrument variables used in this paper are overidentified.

	Whole period (1/31/2002-11/28/2008)	Sub period 1 (1/31/2002-9/28/2007)	Sub period 2 (10/1/2007-11/28/2007)
Intercept	1.0367*	1.5923*	-0.2157
	(5.82)	(7.92)	(-0.77)
Volatility	-6.1641*	-14.1330*	1.1506*
	(-11.71)	(-21.89)	(2.92)
Turnover	2.3800*	2.0967*	1.7794*
	(5.95)	(4.16)	(3.37)
Leverage	-0.0947*	-0.0527***	-0.2241*
	(-4.29)	(-1.99)	(-3.15)
Cumulative Return	0.5853*	0.4193*	1.2497*
	(6.97)	(4.29)	(12.23)
Ln(freq)	-0.1561*	-0.2308*	0.0361
	(-3.89)	(-4.62)	(0.59)
Ln(NAV)	0.0042	0.0472*	0.0107
	(0.42)	(3.24)	(0.96)
Time Dummy	Yes	Yes	Yes
J-statistics	40.16*	20.85*	16.57*

Notice) *, **, and *** are significant at the 1%, 5% and 10%, respectively

<Table 12> The regression result for SK_{dnup}

This table reports the regression result of equation (9) using GMM for each sample periods. Sample period used in this paper is separated into whole period, sub-period 1 and sub-period 2 in order to find the effect of turnover on asymmetric volatility. SK_{dnup} is used as a proxy for the asymmetry of fund return and a dependent variable. As explanatory variables, volatility is monthly standard deviation based on daily fund return and turnover for a proxy for the differences of opinion of fund manager as investor is based on fund trading volume. Leverage denotes debt-to-total asset of firms held by each fund portfolio. Cumulative return is computed as a geometrically accumulated return from daily fund return. Ln(freq) represents a number of holdings held in each fund. Ln(NAV) represents the net asset value of fund. Time dummy as month is included in estimation equation. J-statistics is statistically value under null hypothesis that instrument variables used in this paper are overidentified.

	Whole period (1/31/2002-11/28/2008)	Sub period 1 (1/31/2002-9/28/2007)	Sub period 2 (10/1/2007-11/28/2007)
Intercept	1.0329*	1.4692*	-0.2669
	(6.43)	(8.23)	(-0.88)
Volatility	-4.7726*	-11.5916*	1.2452**
	(-10.84)	(-20.92)	(2.47)
Turnover	2.3268*	1.9795*	3.3838*
	(6.09)	(4.36)	(5.09)
Leverage	-0.0772*	-0.0712*	-0.4480*
	(-3.74)	(-3.05)	(-5.40)
Cumulative Return	1.3153*	1.1684*	1.6507*
	(16.91)	(13.70)	(11.15)
Ln(freq)	-0.1564*	-0.1961*	0.0890
	(-4.37)	(-4.61)	(1.34)
Ln(NAV)	-0.0067	0.0406*	0.0121
	(-0.72)	(3.33)	(0.90)
Time Dummy	Yes	Yes	Yes
J-statistics	31.37*	11.47***	33.03*

Notice) *, **, and *** are significant at the 1%, 5% and 10%, respectively