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Investor heterogeneity and asymmetric volatility under short-sale constraints: Evidence from Korean fund market*

Heterogeneidad de inversionistas y volatilidad asimétrica bajo restricciones de ventas cortas: Evidencia de los mercados de fondos de Corea

PANDO SOHN**

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Abstract

This paper investigates two issues: whether there is heterogeneity for fund managers as investors and whether there is asymmetric volatility under short-sale constraints. If so, what are the driving factors in the Korean fund market? Fund return data from 2002 to 2008 are used to determine these factors. Specifically, for short-sale constraints, we test the hypothesis of difference of opinion developed by Chen, Hong, and Stein (2001) and Hong and Stein (2003). This hypothesis provides a unique opportunity to test directly the differences of opinion among fund managers that operate fund monies under short-sale constraints using asset-allocating strategies. The results of the GJR-GARCH model show an asymmetric volatility in returns and an increase in differences of opinion among fund managers, which extended to an increase in asymmetric volatility. Furthermore, the results of this study are 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 results imply that the overvaluation effect is more remarkable in funds for which a wider dispersion of the opinions of fund managers exists. These findings are consistent with Miller's (1977) intuition and Hong and Stein's (2003) model. In addition, our results also support the stochastic bubble hypothesis and are consistent with Blanchard and Watson (1982) and Wu (1997), even after controlling for fund characteristic variables.

Key words: *Heterogeneity, asymmetric volatility, return skewness, short sale, turnover.*

JEL Classification: *G12, G14.*

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Resumen

El trabajo estudia si existen heterogeneidades en la inversión y si existe volatilidad asimétrica bajo ventas cortas en el mercado de fondos coreano. Para ello se usan datos de retornos para el período 2002-2008. Para las restricciones de ventas cortas se prueba la hipótesis de diferencias de opiniones de Chen, Hong, y Stein (2001) y Hong y Stein (2003). Los resultados del modelo GJR-GARCH muestra volatilidad asimétrica en retornos y un aumento en las diferencias de opiniones de los administradores de fondos. A su vez, los resultados son consistentes con el modelo de Hong y Stein (2003) y la intuición provista por Miller (1977), que predice que asimetrías negativas son más probables cuando existen diferencias de opiniones, habiendo también mayor sobrevaloración. Nuestros resultados también ofrecen soporte a la hipótesis de burbujas estocásticas de Blanchard y Watson (1982) y Wu (1997), aun después de controlar por las características de los fondos.

Palabras clave: *Heterogeneidad, volatilidad asimétrica, ventas cortas.*

Clasificación JEL: *G12, G14.*

1. INTRODUCTION

How do short-sale constraints influence stock returns? This question has been debated in financial economics over the past two decades. Many scholars have been concerned about the apparent asymmetry in the relationship between stock returns and their volatility.

Prior literature has demonstrated that asymmetric volatility is inherently related to the negative skewness of market returns. Understanding the sources and magnitude of asymmetric volatility may help to explain the sources of negative skewness and the equity premium it commands.

Identifying the sources of asymmetric volatility has important implications for asset pricing and portfolio risk management as well as managing fund assets aimed at increasing 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 test directly the differences in the opinions of fund managers regarding the following: the fund manager operates the fund money under short-sale constraints using asset-allocating strategies. Chen, Hong, and Stein (2001) observe that constrained investors in short selling could be thought of as mutual funds, the charters of which typically prohibit them from taking short positions, whereas unconstrained investors can be thought of as hedge funds or other arbitrageurs.

Both practically and legally, many fund managers in Korean fund market field have experienced some obstruction in that short selling is restricted in

operating fund portfolios with fund investors' money¹. This restriction allows us to test differences of opinion under the concept of short sale constraints developed by Chen, Hong, and Stein (2001). Thus, here we test differences in opinions regarding short sale constraints in the fund market.

In recent years, Korean fund market is remarkably growth and attended as a core fund market of emerging market. Therefore, why Korean fund market is important to worldwide investors is as follows. First, Korean fund market is one of important countries in the emerging market to worldwide investors because it has a large proportion in the emerging market, particularly in Asia-Pacific rim. Second, Korean fund market has a unique characteristic in operating fund money rather than other countries to find effect of short-sale constraints on a volatility pattern of stock market because Korean fund manager can not have short sale strategy in operating fund money other than other countries do. This fact is really good opportunity to find the effect of sale selling constraint in stock market. This is why we chose the sample of Korean stock market.

In this paper, we examine how short-sale constraints in the Korean fund market influence asymmetric volatility as a proxy of fund return risk. We analyze the existence of asymmetric volatility using a conditional mean and volatility model, GJR-GARCH, which incorporates the asymmetric volatility parameters between 2002 and 2008. This study also investigates the role of opinion dispersions among fund managers regarding short sale constraints in relation to cross sections of fund returns. In testing the effect of short-sale constraints on fund returns, this study is focused on the differences in opinion among fund managers as suggested by Hong and Stein (2003). Asymmetric volatility or, equivalently, negative skewness means a tendency for volatility to increase with negative fund returns. The different opinion implies that investors invest money in trading stock at the first time, and however, after then, they recognize that it was a wrong decision in trading stock when they trade the stocks invested at the first time. Then they remake new portfolio balancing. This means that turnover occurs because investors have different thinking or different opinions.

Specifically, this study empirically identifies a specific case of asymmetric volatility and looks at the determinants of the volatility asymmetry of stock returns in the Korean fund market. Both differences in fund manager's opinions and short sale constraints are considered. As in Varian (1989), Harris and Raviv (1993), Kandel and Pearson (1995), Odean (1998), and Chen, Hong, and Stein (2001), we use the fund monthly turnover ratio as a proxy for the differences in fund managers' opinions by applying the GJR-GARCH model to show the extent of investor heterogeneity. Furthermore, we also separate the whole sample into sub sample 1 as the boom period and sub sample 2 as the recession period to identify the extent of asymmetric volatility and differences in opinions among fund managers according to the business cycle.

We believe that this study is the first to explore the role of differences in the opinions of fund managers in the asymmetric volatility of both domestic and international funds.

Our results show that in the whole and boom periods, differences in opinions are supported. These results are consistent with Hong and Stein (2003)

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

and Chen, Hong, and Stein (2001). However, interestingly, we do not find evidence of different opinions among fund managers in the recession period. These results are robust even after controlling for additional variables in the regression analysis.

This paper makes three contributions to the finance literature: 1) identifies empirically the phenomena of asymmetric volatility of returns in fund markets; 2) finds evidence for the Hong and Stein (2003) theory under short-sale constraints; and 3) shows the extent to which the opinions of fund managers differ during normal, boom, and recession periods.

The remainder of this paper is organized as follows. In section 2, we review prior empirical results about investor heterogeneity, short-sale constraints, and asymmetric volatility. In section 3, we explain the empirical design, and in section 4, we describe the sample data and characteristics of the variables. In section 5, we discuss the empirical results, and in section 6, we provide the conclusion.

2. RELATED LITERATURE

2.1. Investor heterogeneity and short-sale constraints

Miller (1977) theorized that in the presence of short-sale constraints, stock prices tend to reflect a valuation that is more optimistic than the opinion of investors on average and thus tends to be upwardly biased (Chang, Cheng, & Yu, 2007). That is, because short-sale constraints keep pessimistic investors out of the market, stock prices tend to reflect a more optimistic valuation than they otherwise would (Jarrow, 1980), which is called the 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 heterogeneous beliefs or information about the stock value (Chang, Cheng, & Yu, 2007).

Thus, Miller (1977) insisted that the combination of binding short-sale constraints and significant differences of opinion among potential investors results in share price overvaluation. This is because stock prices are determined by the consensus opinion of participating investors. If bearish investors bail out of the 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) built a rigorous model incorporating Miller's (1977) idea into a static CAPM framework using general equilibrium analysis. Jarrow (1980) showed that the total effect on restricting short sales may be quite complex. In developing a theory of market crashes based on differences in opinions among investors, Hong and Stein (2003) showed that big price changes are more likely to decrease rather than increase. They determined this by looking directly at past stock returns, of which nine were declines among the ten biggest one-day movements in the S&P 500².

Blau and Wade (2012) also investigated the symmetric pattern from short selling analyst recommendations, which are upcoming downgrades or upgrades.

² For Korean fund returns, we identified that seven are declines from the ten biggest movements in one day.

They found that short selling is abnormally high prior to both downgrades and upgrades. Brockman and Hao (2011) examined the relation between short selling and price discovery using ADR (American Depositary Receipt) shares and confirmed that short sellers are a key significant contribution to price discovery.

Furthermore, they found 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 phenomenon, called the “smirk,” in index-option implied volatilities has been the norm since the stock market crash of 1987. Chen, Hong, and Stein (2001) explained the asymmetrical distribution of aggregate stock market returns and measured this asymmetry in several ways, such as stock market crash and the smirk of implied volatility distribution.

In contrast to Miller (1977), some studies have looked at the relationship between differences in potential investors’ opinions and cross sectional stock returns. For example, Diether, Malloy, and Scherbina (2002) demonstrated that by using the dispersion of the earnings forecasts of analysts to measure the degree of divergence in investor opinion, they showed that stocks with higher dispersion rates earned lower future returns than similar stocks (Chang, Cheng, & Yu, 2007). They insisted 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) presented that short-sale constraints and high dispersion of investor opinion are both required to encourage overvaluation. These results supported the intuition of Miller (1977).

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

Although the model in Hong and Stein (2003) is conditional on two necessary and sufficient key assumptions, Chang, Chen, and Yu’s (2007) model controls only the short-sale constraints of stocks and ignores the second condition of the need for different opinions among investors. Using the Hong Kong stock market, Chang, Chen, and Yu (2007) investigated whether stock returns are more negatively skewed when short sales are constrained. However, in contrast to the results of many prior studies, they found inconsistent evidence that the returns of individual stocks exhibit greater negative skewness when short selling is allowed in market trading.

2.2. The Determinants of Asymmetric Volatility

After the determination of asymmetric volatility in stock markets, many researchers in financial economics have been challenged to identify the sources of negative asymmetries. As a result, prior studies found the determinants of an asymmetric volatility and thus provided the following sources of this phenomenon³: 1) leverage effect, 2) volatility feedback, 3) stochastic bubble, 4) difference of opinion. In a broad sense, leverage, volatility feedback, and the stochastic bubble hypothesis are based on the representative investor model, whereas the difference of investor opinion hypothesis is incorporated into investor heterogeneity. In identifying the source of 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, & Stein, 2001).

It is well known that the leverage effect hypothesis is the most acceptable theory for explaining asymmetric volatility (Black, 1976; Christie, 1982). Black (1976) and Christie (1982) showed that the relationship between 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 crashes deeply, the financial leverage of the firm rises, which subsequently increases its volatility. In contrast, when a stock price increases, the financial leverage of the firm declines, which subsequently decreases its volatility.

With a negative return, the firm's value declines⁴, making the equity riskier and increasing its volatility. Schwert (1989) argued that leverage makes the negative relation between returns and volatility more pronounced during recessions. Thus, leverage causes firms to appear riskier and have higher volatility when stock prices decline.

However, the leverage effect hypothesis has been questioned. The magnitude of the leverage effect on drops in current prices of future volatilities seems too large to be explained solely by changes in leverage (Figlewski & Wang, 2001). Schwert (1989) and Bekaert and Wu (2000) pointed out that the leverage effect cannot fully account for the volatility response to stock price changes.

Second, in response to the above debate, Pindyck (1984) French, Schwert, and Stambaugh (1987), Campbell and Hentschel (1992), and Beakert and Wu (2000) suggested the volatility feedback hypothesis to explain asymmetric

³ Besides Pindyck (1984), French, Schwert, and Stambaugh (1987), and Campbell and Hentschel (1992) argued that an anticipated increase in volatility raises the required return on equities, thereby causing an immediate stock price decline. In contrast to the leverage effect hypothesis, they suggest that volatility changes cause stock price changes. Furthermore, the recent discretionary disclosure hypothesis is suggested to explain difference of opinion. This hypothesis argues that managers' behavior affects 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 managers increases the skewness of stock returns.

⁴ Fama and Schwert (1977), and Breen, Glosten, and Jagannathan (1989) found evidence to the contrary, whereas French, Schwert, and Stambaugh (1987) and Campbell and Hentschel (1992) supported the positive relation.

volatility. The volatility-feedback hypothesis argues that when either bad news or good news arrives, it signals that market volatility will increase, which also pushes up risk premiums. Moreover, the increased risk premium offsets partially the directly positive effect of the good news. In contrast, the negative effect of the bad news is magnified.

As a result, stock prices crash more deeply in response to bad news than to good news even if the process driving the news is symmetric. This relationship then leads to negatively skewed stock returns. Bekaert and Wu (2000) insisted that the volatility feedback effect empirically dominates the leverage effect. Campbell and Hentschel (1992) showed by using the conditional volatility model with a Quadratic GARCH that volatility feedback has an important effect on return only during a high volatility period.

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

Third, the stochastic bubble hypothesis was suggested by Blanchard and Watson (1982) and Wu (1997), as an alternative explanation of volatility asymmetry. In this hypothesis, asymmetry is due to the popping of the bubble, which generates very large negative returns with a low probability event. Blanchard and Watson (1982) showed that the bursting of internet bubbles causes negative skewness. By applying the Kalman filter to examine relationships in U.S. stock-price volatility, Wu (1997) provided some evidence that rational stochastic asset bubbles can help explain the excess volatility of stock prices.

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

With regard to the volatility of Korean stock returns, even though prior studies suggested the presence of asymmetric volatility, they also demonstrated many mixed results for the causes of this phenomenon (Gu, 2000; Cheong & Jeong, 2002; Park, 2006). In general, the leverage effect dominates the feedback effect. However, these studies investigated only stock market volatility, not fund markets with short-sale constraints.

Although several factors determine asymmetric volatility, in this paper, we focus on the differences of opinion among fund managers under the constraints of short selling. We believe that no previous study has examined the differences in investor opinions predicted by Hong and Stein (2003) using trading volume

(turnover) as a proxy of fund manager heterogeneity when short sales are under constraint.

3. THE EMPIRICAL DESIGN

In this section, we describe an empirical design to show 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 the existence of asymmetric volatility fund returns and clarify differences in the opinions of fund managers. To acknowledge this asymmetric effect and differences of opinion among fund managers, we separate the whole sample into two samples: sub-period 1, which is defined as the recession and sub-period 2, which is defined as the boom.

3.1. The asymmetric volatility model

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

$$(1) \quad r_t = \Phi_0 + \Phi_1 r_{t-1} + \varepsilon_t$$

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

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

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

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

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

news, has a higher impact than the 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 $(\alpha + \gamma)\varepsilon_{t-1}^2$ when ε_{t-1} is negative. This implies that the negative impact adds more volatility shock to the model. Thus, we expect γ to be positive, so that the bad news has a larger impact⁵. The GJR-GARCH (1,1) model is asymmetric as long as $\gamma \neq 0$. As suggested by Ling and McAleer (2002), the regularity that is 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 variables related to equity funds. This estimation model is given by

Mean Equation:

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

Variance Equation:

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

where r is fund excess return as fund daily return minus risk free rate (treasury note with maturity of 3 years), Cumreturn is the cumulative fund excess daily return based on the past 6 months using a rolling window, $\text{Ln}(\text{NAV})$ is the logarithm of net asset value of the fund, and 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

the Monday effect and leverage is computed as $\sum_{i=1}^N w_{i,t} (\text{Leverage}_{i,t})$ where $w_{i,t}$

is the value weight of stock i in fund portfolio f at each day and $\text{Ln}(\text{freq})$ is the number of portfolio holdings held in each fund.

In models (3) and (4), the determinants of asymmetric volatility are controlled to determine 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 follows: $\text{Turnover}_{i,t}$ is the daily turnover for each fund i in sample

period t and is measured as follows: $\text{Turnover}_t = \frac{\text{Min}(\text{Sell}_t, \text{Buy}_t)}{\text{NAV}_t}$ where sell and

buy are the selling and buying amounts, respectively. Thus, we use this model as a proxy for differences of opinion in this study.

⁵ In general, it is called a leverage effect.

Focusing on differences of opinion, the Chen, Hong, and Stein (2001) and Hong and Stein (2003) model has 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—as in many models with differences of opinion—trading volume is a proxy for the intensity of disagreement (Varian, 1989; Harris & Raviv, 1993; Kandel & Pearson, 1995; and Odean, 1998).

Regarding 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 be cornered and their information will be incompletely revealed in prices. This concealment of information sets the stage for negative skewness in subsequent rounds of trade when the arrival of bad news to other, previously more-bullish investors forces the hidden information to be revealed.

3.2. Test of asymmetry

To investigate further the existence of the asymmetric effect on the volatility of return, the asymmetric GARCH, called the GJR-GARCH model, is estimated here. According to Engle and NG (1993), we conduct testing on the residuals from an 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 this model under assumption of conditional heteroscedasticity will display any sign bias, negative size bias, or positive size bias. It would then be justifiable to use an asymmetric conditional volatility model. The joint test for asymmetry as proposed in Engle and Ng (1993) is as follows:

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

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

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

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

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

In the sign bias test, the squared standardized residuals are regressed on a constant and a dummy variable, denoted as 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 include several control variables as in Harvey and Siddique (2000), Chen, Hong, and Stein (2001), and Bae, Lim, and Wei (2006). We control for the variables related to fund characteristics.

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

Second, $\ln(\text{NAV})$ 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 $\left[\text{NAV}_t - \text{NAV}_{t-1} \times (1 + r_t) \right] / \text{NAV}_{t-1}$, where r_t is monthly fund return at time t and NAV is total net asset value. Fourth, $\ln(\text{Freq})$ is measured as the logarithm of portfolio holdings. It is predicted that these two variables increase conditional volatility as the number of portfolios and the size of funds increase. Thus, it is expected that two variables have a 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 , $D_{j,t-1}$ is the total debt of firm j held by each fund i at the end of year $(t-1)$, and $E_{j,t-1}$ is the total equity of firm j held by each fund i at the end of year $(t-1)$. As the leverage rises, the conditional volatility increases.

4. DATA AND CHARACTERISTICS OF VARIABLES

Sample data used in the empirical test was collected from the ZeroIn Fund Evaluation Company database. This database contains the portfolio information at monthly levels related to funds, such as portfolio holding, fund cost, fund age, and so on. However, because there was no information on individual firms held in the funds, we employed the KisValue database and the FnGuide database to collect information on the firm level. For the sample of the empirical test, we used only well managed equity funds, which included above 70% of stock

share. In addition, we excluded funds with outlier return, and we discarded funds that were below 15 trading days. However, we did not control for total net asset of the fund in the empirical test because many funds are small size. If small size of total net asset is excluded in our sample, then there will be small sample size bias. Finally, 1,588 funds were used in the sample. Furthermore, we separate the whole sample into two subsamples as the boom period sample (sub-period 1: 1/31/2002-9/28/2007) and the recession period sample (sub-period 2: 10/1/2007-11/28/2007), in order to determine the extent of differences of opinion among fund managers.

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

As shown in Table 1, the skewness values of the fund return series, in fact, are negatively skewed in common sense for the whole period. However, surprisingly, the fund return series is more negatively skewed in the boom period than in the recession period, which is in contrast to normal facts related to stock returns. That is, the values of skewness for each boom and recession period are -0.3493 and -0.1876, respectively, which indicates that negatively skewed value in the boom period is almost double of that in the recession period. This phenomenon in the fund return series is very interesting and even puzzling. We believe that it might be caused by the fund manager's active involvement in fund money operations. Our interpretation is that a negatively skewed distribution is caused by relatively few fund managers with very low performance in the boom period instead of the recession period. Indeed, fund managers, who manage money actively and effectively, may outperform market returns in good investment

TABLE 1
SUMMARY STATISTICS

This table reports summary statistics of daily raw fund returns using fund data in the Korean fund market from January 2002 to November 2008. The sample period is separated into the 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

time, whereas in bad investment times, fund managers that are resistant to loss actively manage money in well-managed funds or rebalanced fund portfolios.

With regard to average returns, it is known that fund managers demand higher returns for more negatively skewed returns, which could be the most significant reason that the average fund return is much higher in the boom period than in the recession period. Apparently, fund returns during the whole period became much more negatively skewed.

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

Table 3 reports the Pearson correlations among fund characteristic variables. We found that on average, excess returns of funds were not significant to fund characteristic variables, and thus were not correlated. However, cumulative excess returns are significantly negatively correlated to total net assets (LnNAV) and new growth (NG), but significantly positively correlated to turnover (Turnover), leverage (Lev), and the number of stock shares held in the fund (Ln[freq]).

TABLE 2
SUMMARY STATISTICS OF VARIABLES

This table reports the summary statistics of variables used in the sample using fund data and stock shares held in funds. ExRet is measured as fund return minus risk free rate (T-note with 3 years). CumExRet is cumulative fund excess of daily return based on the prior 6 months using a rolling window. Ln(NAV) denotes the logarithm of the net asset value of fund and NG is new money growth in the fund as $[NAV_t - NAV_{t-1} \times (1 + r_f)] / NAV_{t-1}$. Turnover is daily turnover for each fund *i* in sample period *t* and is measured as follows: $Min(Sell_i, Buy_i) / NAV_i$, 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 reports the Pearson correlation among variables used in the 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 the prior 6 months using a rolling window. Ln(NAV) denotes the logarithm of the net asset value of the fund and NG is new money growth in the fund as $[NAV_t - NAV_{t-1} \times (1 + r_t)] / NAV_{t-1}$. Turnover is the daily turnover for each fund *i* in sample period *t* and is measured as follows: $Min(Sell_t, Buy_t) / NAV_t$, 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
CumExRet	0.097 (0.0001)					
Ln(NAV)	-0.013 (0.587)	-0.071 (0.003)				
NG	0.006 (0.817)	-0.223 (0.0001)	0.538 (0.0001)			
Turnover	0.031 (0.208)	0.461 (0.0001)	0.234 (0.0001)	-0.049 (0.042)		
Leverage	0.015 (0.524)	0.291 (0.0001)	-0.657 (0.0001)	-0.470 (0.0001)	-0.185 (0.0001)	
Ln(freq)	-0.006 (0.801)	0.164 (0.0001)	0.695 (0.0001)	0.404 (0.0001)	0.614 (0.0001)	-0.659 (0.0001)

Notice: () is p-value.

5. EMPIRICAL RESULTS

5.1. The asymmetric effect of return on volatility

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

Table 4 presents the results of the GJR-GARCH (1,1) model used to determine the existence of an asymmetric effect on volatility. In Panel A, asymmetric coefficient γ is significant at the 1% and positive value regardless of any specification. This result ensured that fund return series have an 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 the leverage effect was observed in returns of the Korean fund market. Our result is not consistent with Bekaert and Wu (2000) who rejected the leverage effect in equity markets.

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

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

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

TABLE 4
RESULTS OF THE GJR-GARCH MODEL

This table presents the results of the extended GJR-GARCH(1,1) model for the separated sample period. Extended GJR-GARCH(1,1) is given by the following mean and variance equation:

$$\begin{aligned} r_t = & \Phi_0 + \Phi_1 r_{t-1} + b_1 \text{Cumreturn}_t + b_2 \text{Ln}(\text{NAV})_t + b_3 \text{Newgrowth}_t + \varepsilon_t \\ \sigma_t^2 = & \omega_0 + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma I_{t-1} \varepsilon_{t-1}^2 + \omega_1 M_{d_t} + \omega_2 \text{Turnover}_t + \omega_3 \text{Leverage}_t \\ & + \omega_4 \text{Ln}(\text{freq})_t + \omega_5 \text{Ln}(\text{NAV})_t \end{aligned}$$

Model 1 in whole period, sub-period 1(boom), and sub-period 2(recession) does not control Cumulative return (Cumreturn), Size of fund (Ln(NVA)), and fund growth (Newgrowth) as independent terms in mean equation and also Monday dummy(M), Turnover, Leverage, Ln(freq), and Ln(NAV) as independent terms in variance equation to identify the uncontrolled and controlled effect differently. Model 2 in whole period, sub-period 1(boom), and sub-period 2(recession) includes all independent terms to control the affecting factor. () are 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** (2.33)	0.0484*** (1.74)	0.0791** (2.62)	0.0611*** (2.06)	-0.0430 (-0.62)	-0.0537 (-0.77)
b_1		0.0079* (5.38)		0.0083* (4.99)		0.0074 (0.92)

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
b ₂		–0.0002 (–0.35)		0.0002 (0.37)		0.0052 (0.56)
b ₃		0.0123 (1.59)		0.0137 (1.77)		0.0388 (0.88)
α	–0.0023 (–0.18)	–0.0234** (–2.31)	0.0021 (0.15)	–0.0350** (–2.65)	–0.0386 (–1.51)	–0.0801*** (–1.92)
β	0.8794* (58.19)	0.8731* (52.55)	0.8798* (54.47)	0.8571* (43.22)	0.8873* (16.52)	0.9044* (17.09)
γ	0.1694* (7.39)	0.2093* (7.94)	0.1536* (6.57)	0.2127* (7.45)	0.2484* (3.00)	0.2390* (3.07)
ω ₁		–0.000003 (–0.31)		–0.000003 (–0.28)		–0.00001 (–0.37)
ω ₂		0.0001 (1.11)		0.0001*** (1.87)		–0.0004 (–0.96)
ω ₃		0.0000001 (0.04)		0.000004 (1.70)		0.00003 (0.85)
ω ₄		–0.00002* (–3.43)		–0.00003* (–4.12)		–0.000001 (–0.01)
ω ₅		0.000003** (2.41)		0.000003** (2.28)		–0.0001** (–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** (2.27)	0.011* (2.97)	0.008** (2.40)	0.011* (3.21)	0.013 (0.97)	0.015 (1.25)
t-statistics						
Positive Bias(×100)	–0.062 (–0.31)	–0.116 (–0.59)	–0.311 (–1.59)	–0.393 (–1.94)	0.041 (0.11)	–0.027 (–0.05)
t-statistics						
Negative Bias (×100)	–0.985** (–2.64)	–0.935* (–4.72)	–0.855* (–4.38)	–0.876* (–4.57)	–1.441*** (–2.09)	–1.310*** (–2.02)
t-statistics						
Joint Bias F–statistics	8.37*	7.72*	6.22*	6.88*	1.79	1.55

Notice: *, **, and *** are significant at 1%, 5% 10%, respectively.

Figure 1 illustrates conditional volatility derived from GJR-GARCH. It shows that conditional volatility is high in the years 2004, 2007, and 2008. As we see Figure 1, we identify that the volatility pattern of Korean fund market is very dynamic and not constant at all.

Regarding the asymmetry on volatility illustrated by Figure 1, the news-impact curve in Figure 2 helps explain the idea of asymmetry. The news-impact curve measures how new information is incorporated into volatility estimates. Figure 2 shows that the news-impact curve allows good news and bad news to have different impacts 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 does.

FIGURE 1
CONDITIONAL VOLATILITY

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

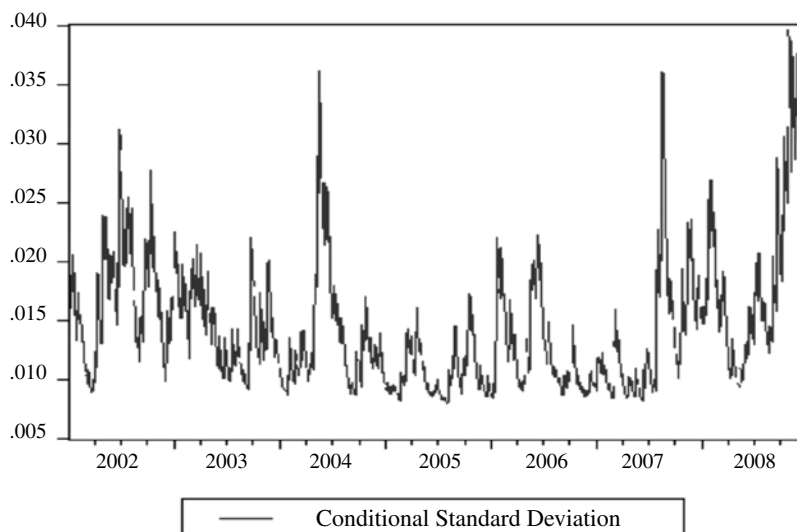


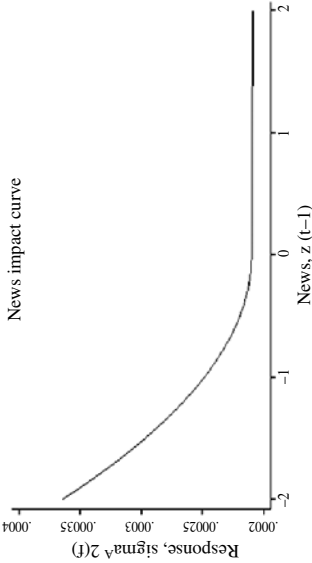
Figure 2 depicts the asymmetric effect from GJR-GARCH (1,1). Obviously, the news-impact curves in Panel A, B, and C show that news at time (t-1) has an asymmetric impact on volatility at t. This result confirms the results of the GJR-GARCH (1,1) model.

5.2. The result of differences of opinion

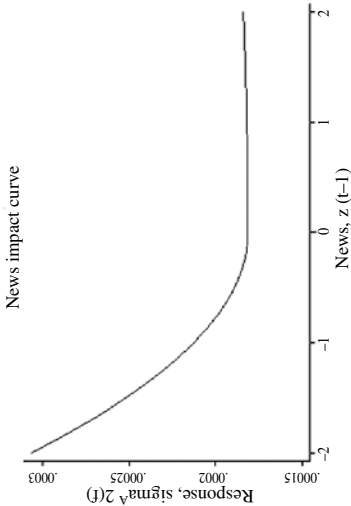
We examined the differences of opinion (hereafter DO) among fund managers by using turnover as its proxy. We constructed a portfolio based on the quintile of turnover, such as quintile 1 as lowest DO, quintile 2..., and quintile 5 as the highest DO. First, we implemented the GJR-GARCH model without control variables. Second, we confirmed the results of the first test after including the control variables in the extended GJR-GARCH model. We also reported the results of difference of opinion in separate periods.

Table 5 shows the results of differences of opinion in the whole period. All asymmetric coefficients γ are significant at 1%. Interestingly, as we expected, the results showed that as difference of opinion increases to highest from lowest, the degree of asymmetric volatility also increases gradually. Specifically, the γ value changes from the lowest level at 0.1589 to the highest level at 0.1798, increasingly. This result supports the difference of opinion hypothesis suggested by Hong and Stein (2003) and Stein, Hong, and Stein (2001). Obviously, funds that experience larger increases in turnover relative to trend are indeed predicted

FIGURE 2
NEWS IMPACT CURVE FROM GJR-GARCH(1,1)
Panel A: Whole period (1.31.2002-11.28.2008)



Panel C: Sub period 2(10.1.2007-11.28.2008)



Panel B: Sub period 1(1.31.2002-9.28.2007)

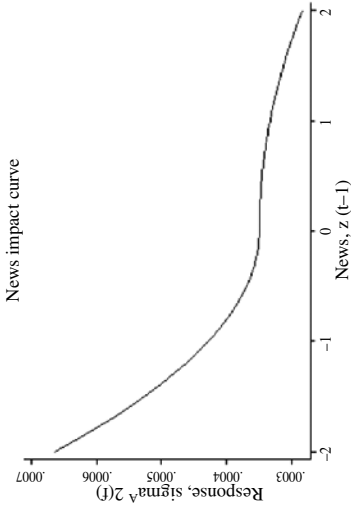


TABLE 5
RESULTS OF THE GJR-GARCH MODEL BASED ON TURNOVER
PORTFOLIO RANKED:
Whole period (1.31.2002-11.28.2008)

This table reports the results of GJR-GARCH(1,1) using following the 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 $I_{t-1} = 1$ 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	0.0596** (2.14)	0.0640** (2.31)	0.0633** (2.28)	0.0644** (2.33)	0.0708* (2.57)
α	0.0006 (0.05)	-0.0009 (-0.07)	0.0048 (0.37)	-0.0013 (-0.10)	-0.0071 (-0.59)
β	0.8847* (60.53)	0.8835* (59.39)	0.8790* (57.92)	0.8754* (55.58)	0.8733* (53.87)
γ	0.1589* (7.32)	0.1647* (7.28)	0.1624* (7.12)	0.1732* (7.40)	0.1798* (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** (2.12)	0.009** (2.45)	0.009** (2.42)	0.009** (2.29)	0.009** (2.24)
Positive Bias(×100)	-0.073 (-0.38)	-0.070 (-0.35)	-0.094 (-0.47)	-0.003 (-0.01)	-0.022 (-0.11)
Negative Bias(×100)	-0.880* (-4.47)	-0.922* (-4.60)	-1.030* (-4.96)	-1.018* (-4.81)	-0.961* (-4.49)
Joint Bias F-statistics	7.28*	7.76*	8.92*	8.90*	7.67*

Notice: *, **, and *** are significant at 1%, 5% and 10%, respectively.

to have more negative skewness. Moreover, the effect of turnover is strongly statistically and economically significant. To confirm this result, we added several control variables into the GJR-GARCH model. Table 8 reports the strong results for differences of opinion. The results shown are consistent with the results shown in Table 5, implying that our results are robust after controlling for fund characteristic variables.

Additionally, we examined whether there are differences of opinion during the boom and recession periods. The results of the boom period are shown in Table 6 and Table 9. These results are similar to those shown in Table 5 and Table 8, which indicates that even in boom periods, differences of opinion among fund managers exist. This evidence is strong and robust after controlling for variables

TABLE 6
THE RESULTS OF THE GJR-GARCH MODEL BASED ON
TURNOVER PORTFOLIO RANKED:
Sub period 1 (1.31.2002-9.28.2007)

This table reports the results 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 $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $I_{t-1} = 0$ if $\varepsilon_{t-1} > 0$, () are 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** (2.45)	0.0779* (2.58)	0.0771* (2.55)	0.0780* (2.58)	0.0872* (2.91)
α	0.0061 (0.43)	0.0042 (0.28)	0.0107 (0.72)	0.0035 (0.24)	-0.0071 (-0.52)
β	0.8860* (57.12)	0.8845* (55.84)	0.8799* (54.57)	0.8757* (51.21)	0.8702* (48.54)
γ	0.1430* (6.45)	0.1482* (6.40)	0.1444* (6.22)	0.1557* (6.53)	0.1712* (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** (2.42)	0.0083* (2.61)	0.0086* (2.59)	0.0088* (2.61)	0.0085** (2.50)
Positive Bias(×100)	-0.2879 (-1.54)	-0.3136 (-1.69)	-0.3041 (-1.59)	-0.3222 (-1.64)	-0.3029 (-1.49)
Negative Bias(×100)	-0.8162* (-4.27)	-0.8458* (-4.45)	-0.9234* (-4.71)	-0.8883* (-4.49)	-0.8626* (-4.32)
Joint Bias F-statistics	6.09*	6.62*	7.42*	6.73*	6.22*

Notice: *, **, and *** are significant at 1%, 5% and 10%, respectively.

related to funds, as shown in Table 9. Thus, we conclude that even during boom periods, the difference of opinion hypothesis is supported, suggesting that funds with greater difference of opinion have more negative skewness.

We investigated whether this evidence would be apparent during the recession period. The results of difference of opinion are provided in Table 7 and Table 10. Interestingly, Table 7, without the control variable, presents the same weak indication of investor heterogeneity. 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 large divergences in the opinions of fund managers. When we include the control for variables in Table 10, this phenomenon is also inconsistent over differences of opinion. Thus, the results

TABLE 7
RESULTS OF THE GJR-GARCH MODEL BASED ON TURNOVER
PORTFOLIO RANKED:
Sub period 2 (10.1.2007-11.28.2008)

This table reports the results of GJR-GARCH(1,1) using the 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 $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $I_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. () are 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 (-0.79)	-0.0412 (-0.59)	-0.0394 (-0.57)	-0.0335 (-0.48)	-0.0471 (-0.68)
α	-0.0452*** (-1.83)	-0.0377 (-1.45)	-0.0387 (-1.46)	-0.0405 (-1.60)	-0.0307 (-1.19)
β	0.8975* (17.32)	0.8915* (16.33)	0.8856* (16.14)	0.8794* (16.66)	0.8847* (16.54)
γ	0.2392* (3.04)	0.2440* (2.95)	0.2509* (3.01)	0.2631* (3.14)	0.2400* (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 1%, 5% 10%, respectively.

clarified that difference of opinion hypothesis is not supported during the recession period, which means that there is no investor heterogeneity in the recession period. This result is very interesting and requires more detailed scrutiny in our future research.

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

5.3. Robustness checks

An earlier analysis in this paper provided results without controlling for variables related to fund characteristics using portfolio approach. Thus, these

TABLE 8
RESULTS OF THE GJR-GARCH MODEL WITH CONTROL VARIABLES BASED
ON TURNOVER PORTFOLIO RANKED:
Whole period (1.31.2002-11.28.2008)

This table reports the results of extended GJR-GARCH(1,1), including control variables by using the 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 $\varepsilon_{t-1} > 0$. () are 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 (1.60)	0.0506*** (1.84)	0.0476 (1.70)	0.0497 (1.80)	0.0543*** (1.97)
b_1	0.0070* (4.76)	0.0070* (4.78)	0.0086* (5.41)	0.0081* (5.10)	0.0091* (5.83)
b_2	-0.0003 (-0.57)	-0.0003 (-0.72)	-0.0004 (-1.00)	-0.0002 (-0.38)	0.0003 (0.84)
b_3	0.0023 (0.55)	0.0093 (1.19)	0.0147 (1.76)	0.0143 (1.68)	0.0184** (2.23)
α	-0.0092 (-0.88)	-0.0235** (-2.16)	-0.0151 (-1.39)	-0.0164 (-1.55)	-0.0223** (-2.17)
β	0.8894* (62.47)	0.8790* (57.13)	0.8669* (49.23)	0.8711* (50.60)	0.8725* (52.46)
γ	0.1780* (7.90)	0.1991* (8.11)	0.2005* (7.63)	0.1996* (7.56)	0.2063* (7.82)
ω_1	-0.000002 (-0.21)	-0.000015 (-1.48)	-0.000002 (-0.24)	0.000004 (0.36)	0.000007 (0.61)
ω_2	0.000027 (0.54)	0.000021 (0.44)	0.000001 (0.02)	-0.000012 (-0.29)	0.000018 (0.54)
ω_3	-0.000003 (-1.23)	0.000002 (0.99)	0.000003*** (1.85)	0.000003 (1.69)	0.000001 (0.30)
ω_4	-0.000008 (-1.66)	-0.000017* (-4.77)	-0.000008** (-2.45)	-0.000003 (-0.80)	-0.000010** (-2.55)
ω_5	0.000002 (1.15)	0.000003* (2.74)	0.000003* (2.97)	0.000002 (1.77)	0.000001 (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)					
Sign Bias(×100)	0.009* (2.82)	0.010* (2.97)	0.010* (2.79)	0.011* (2.94)	0.012* (3.17)
Positive Bias(×100)	-0.186 (-0.97)	-0.198 (-1.04)	-0.176 (-0.89)	-0.070 (-0.35)	-0.068 (-0.33)
Negative Bias(×100)	-0.879* (-4.56)	-0.869* (-4.53)	-0.889* (-4.59)	-0.999* (-4.91)	-0.972* (-4.68)
Joint Bias F-statistics	7.14*	7.10*	7.41*	8.97*	8.50*

Notice: *, **, and *** are significant at 1%, 5% 10%, respectively.

TABLE 9
RESULTS OF THE GJR-GARCH MODEL WITH CONTROL VARIABLES
BASED ON TURNOVER PORTFOLIO RANKED:
Sub period 1 (1.31.2002-9.28.2007)

This table reports the results 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 $\varepsilon_{t-1} > 0$. () are 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** (2.04)	0.0658** (2.25)	0.0612** (2.03)	0.0650** (2.20)	0.0706** (2.40)
b_1	0.0067* (3.96)	0.0068* (3.98)	0.0089* (4.95)	0.0083* (4.62)	0.0087* (4.00)
b_2	-0.0002 (-0.32)	-0.0001 (-0.12)	0.00001 (0.02)	0.0002 (0.49)	0.0006 (1.30)
b_3	0.0055 (1.15)	0.0102 (1.28)	0.0130 (1.50)	0.0109 (1.25)	0.0158 (1.81)
α	-0.0132 (-1.01)	-0.0276** (-2.07)	-0.0202 (-1.47)	-0.0205 (-1.52)	-0.0318** (-2.51)
β	0.8826* (50.87)	0.8756* (50.99)	0.8589* (41.92)	0.8571* (40.08)	0.8593* (42.80)
γ	0.1772* (7.26)	0.1827* (7.45)	0.1920* (6.94)	0.1909* (6.79)	0.2047* (7.23)
ω_1	-0.000004 (-0.41)	-0.000016 (-1.47)	-0.000003 (-0.28)	0.000003 (0.26)	0.000011 (0.86)
ω_2	0.00006 (1.07)	0.00004 (0.79)	0.00001 (0.23)	-0.00001 (-0.18)	0.00002 (0.48)
ω_3	-0.000001 (-0.26)	0.000005** (2.35)	0.000006* (2.90)	0.000007* (2.88)	0.000004 (1.74)
ω_4	-0.000015* (-2.29)	-0.000020* (-5.01)	-0.000012* (-2.80)	-0.000007 (-1.49)	-0.000012* (-2.65)
ω_5	0.000002 (1.39)	0.000003* (2.73)	0.000002** (2.22)	0.000001 (1.45)	0.000001 (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($\times 100$)	0.011* (3.29)	0.011* (3.38)	0.012* (3.49)	0.012* (3.65)	0.013* (3.75)
Positive Bias($\times 100$)	-0.360*** (-1.89)	-0.354*** (-1.85)	-0.385*** (-1.97)	-0.401** (-2.02)	-0.399*** (-1.97)
Negative Bias($\times 100$)	-0.836* (-4.43)	-0.869* (-4.60)	-0.911* (-4.80)	-0.919* (-4.70)	-0.890* (-4.51)
Joint Bias F-statistics	6.71*	7.24*	7.86*	7.69*	7.30*

Notice: *, **, and *** are significant at 1%, 5% and 10%, respectively.

TABLE 10
RESULTS OF THE GJR-GARCH MODEL WITH CONTROL VARIABLES
BASED ON TURNOVER PORTFOLIO RANKED:
Sub period 2 (10.1.2007-11.28.2008)

This table reports the results 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 (-0.67)	-0.0538 (-0.70)	-0.0533 (-0.81)	-0.0730 (-1.05)	-0.0994 (-1.56)
b_1	0.0046 (0.98)	0.0074 (1.23)	0.0125* (2.89)	0.0134*** (1.96)	0.0184* (2.87)
b_2	0.0015 (0.53)	0.0043 (1.28)	-0.0020 (-0.70)	0.0002 (0.05)	0.0004 (0.10)
b_3	-0.0062 (-0.61)	0.0084 (0.16)	0.0411 (0.95)	0.1426* (3.03)	0.1166* (2.64)
α	-0.0958** (-2.55)	-0.0433 (-1.40)	-0.1099* (-3.13)	-0.0520 (-1.53)	-0.0723* (-3.72)
β	0.2916* (3.38)	0.2237* (2.69)	0.2655* (4.21)	0.2423* (2.93)	0.2608* (6.16)
γ	0.9391* (22.61)	0.9132* (16.52)	0.9590* (27.59)	0.9026* (14.51)	0.9042* (32.49)
ω_1	-0.00004 (-1.09)	0.00001 (0.46)	-0.00005 (-1.46)	-0.00001 (-0.14)	-0.00004** (-2.30)
ω_2	-0.0006 (-1.08)	-0.0001 (-0.22)	-0.0004 (-1.26)	-0.0004 (-1.47)	-0.0006* (-3.59)
ω_3	0.000004 (0.26)	-0.00001 (-0.53)	-0.00001 (-0.39)	0.00004** (2.16)	-0.000002 (-0.13)
ω_4	0.00003* (2.64)	-0.00002 (-0.88)	-0.00003*** (-1.74)	-0.00010* (-3.00)	0.000003** (2.20)
ω_5	0.00001 (0.47)	-0.00002* (-3.05)	-0.00002* (-2.95)	-0.00001 (-1.04)	-0.00004* (-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.

results could be not robust. Thus, two measures are introduced directly as proxies for measuring fund return asymmetry.

Additionally, to isolate the effect of differences of opinion on the skewness of fund returns, our model includes a number of control variables. The GMM method is employed to estimating cross-section regression⁶. Thus, our estimation equation is as follows:

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

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

$\text{Leverage}_{f,t} = \sum_{i=1}^N w_{i,t} (\text{Leverage}_{i,t})$, $\text{volatility}_{f,t} = \sigma_{f,t} \cdot \sqrt{\text{TradingDay}}$ where $w_{i,t}$ is the value weight of stock i in fund portfolio f at the end of each month and $\sigma_{f,t}$ is, $\text{Leverage}_{i,t} = \frac{\text{Debt}_{i,t}}{\text{Equity}_{i,t}}$, $\sigma_{f,t}$ is the standard deviation of daily return in fund f , $\sqrt{\text{Trading}}$ is number of trading days at that month, $\text{CReturn}_{f,t}$ is the cumulative return of daily excess fund return. We also include monthly time dummy (TimeD) to control for fund return seasonality.

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

NCSKEW is our baseline measure of skewness and is 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 follow Chen, Hong and Stein (2001). We compute NCSKEW as follows:

$$(10) \quad \text{NCSKEW}_{f,t} = - \frac{\left(n(n-1)^{3/2} \sum \text{Ret}_{f,t}^3 \right)}{\left((n-1)(n-2) \left(\sum \text{Ret}_{f,t}^2 \right)^{3/2} \right)}$$

⁶ In estimating our model's specifications, the cross section-time series GMM technique is employed because our estimation at a contemporaneous time may have an endogeneity problem. The instrumental variables employed in the estimating model are lagged independent variables, and we provide J-statistics for the over-identification of instrumental variables, which is under the null hypothesis that instrumental variables used are over-identified.

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 the sample period.

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

$$(11) \quad SK_{dnup,f,t} = \log \left\{ \frac{\left((n_u - 1) \sum_{DOWN} Ret_{f,t}^2 \right)}{\left((n_d - 1) \sum_{UP} Ret_{f,t}^2 \right)} \right\}$$

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

Table 11 provides the results of regression in equation (9) on a cross section-time series for each sample period using NCSKEW as the proxy for the asymmetry of fund return. We use the GMM estimation method for equation (9) to eliminate the endogenous problem among variables. We regress NCSKEW on turnover as the proxy for differences 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 confirmed that negative skewness is most pronounced in funds that have experienced an increase in turnover, which implies that as the differences in fund managers' opinions increase, more asymmetry in fund returns occurs. Specifically, as shown in Table 11, the coefficient of the turnover variable as the proxy for differences in fund managers' opinions is positive and significant at the 1% level regardless of sample period.

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

Furthermore, our findings support the stochastic bubble hypothesis (Blanchard & Watson, 1982; Wu, 1997), suggesting that the asymmetries in fund returns are due to the popping of the bubble, although the probability that the latter produces large negative returns is very low. That is, negative skewness could be

TABLE 11
REGRESSION RESULTS FOR NCSKEW ON DIFFERENCES OF OPINION

This table reports the regression results of equation (9) using GMM for each sample period. The 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 the monthly standard deviation based on daily fund return and turnover, which is a proxy for the differences of opinion of fund managers as investors based on fund trading volume. Leverage denotes the debt-to-total assets of firms held by each fund portfolio. Cumulative return is computed as a geometrically accumulated return from daily fund return. Ln(freq) represents the number of holdings held in each fund. Ln(NAV) represents the net asset value of the fund. Time dummy as month is included in the estimation equation. J-statistics are statistically valued under the null hypothesis that instrument variables used in this paper are over-identified.

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

Notice: *, **, and *** are significant at 1%, 5% and 10%, respectively.

pronounced in funds that have experienced an increase in positive cumulative returns over the month prior to the trading days used 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 period. Our results are in line with Blanchard and Watson (1982), Wu (1997), and Chen, Hong, and Stein (2001) regarding short-sale constraints.

Based on these results, our results are consistent with Chen, Hong and Stein’s (2001) model as predicted in Miller’s (1977) intuition and stochastic bubble and suggested by Blanchard and Watson (1982) and Wu (1997). There, we assert that under short-sale constraints, the differences of opinion among fund managers as investors play a positive, vital role in the negative skewness of fund returns in the Korean fund market.

TABLE 12
REGRESSION RESULTS FOR SK_{dnup} ON DIFFERENCES OF OPINION

This table reports the regression results of equation (9) using GMM for each sample period. The 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. A proxy for the differences of opinion of fund managers as investors is based on fund trading volume. Leverage denotes the debt-to-total assets of firms held by each fund portfolio. Cumulative return is computed as a geometrically accumulated return from the daily fund return. $\ln(\text{freq})$ represents the number of holdings held in each fund. $\ln(\text{NAV})$ represents the net asset value of fund. Time dummy as month is included in the estimation equation. J-statistics are statistically valued under the null hypothesis that the instrument variables used in this paper are over-identified.

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

Notice: *, **, and *** are significant at 1%, 5% and 10%, respectively.

6. CONCLUSION

We use unique fund return data from the ZeroIn Fund Evaluation Company to identify asymmetric volatility and explained this phenomenon by using turnover based on the trading volume of fund managers as the proxy for differences of opinion among fund managers.

This study provides insights into asymmetric volatility in the Korean Fund Market. The results also revealed asymmetric volatility in fund returns. Thus, these results are consistent with the facts of stock returns. Finally, we found evidence that asymmetric volatility is apparently a general phenomenon.

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

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

As the limitation of this paper, we need to use more recent data which are disclosure strictly by Korean law if we can obtain the raw data through resolving the consent of data provider. Accordingly, we will do study on further research by using recent data after the year of 2008.

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