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

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Abstract

We analyze the asymmetric behavior of fund managers with short-selling constraints under different market conditions to confirm the hypothesis of difference of opinion of fund managers and also investigate determinants in difference of opinions in fund market. This paper examines two issues: whether there exists the difference of opinions of fund managers and whether there is asymmetric volatility under short-sale constraints. Under short-sale constraints, we implement testing the hypothesis of difference of opinion found 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 under short-sale constraints using asset-allocating strategies. The test results provide evidence that there is asymmetric volatility and increased differences of opinion among fund managers. 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 opinions 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: *Asymmetric behavior, short-sale constraints, asset-allocating strategies, overvaluation effect.*

JEL Classification: *G12, G14.*

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Resumen

Este trabajo investiga dos cuestiones: si acaso existe heterogeneidad para los administradores de fondos como inversionistas y si la volatilidad que enfrentan es asimétrica bajo restricciones de ventas cortas. Bajo restricciones de ventas cortos, se testea la hipótesis de diferencia de opiniones de Chen, Hong y Stein (2001) y Hong y Stein (2003). Los resultados son consistentes con el modelo de Hong y Stein (2003), que predice que la existencia de asimetrías negativas tiene mayor probabilidad de ocurrencia mientras mayores sean las diferencias de opinión entre los administradores de fondos. Así entonces, nuestros resultados implican que el efecto de sobrevaloración es más destacado en fondos en que existe una mayor dispersión de las opiniones de los administradores de fondos. Estos resultados son consistentes con la intuición de Miller (1977) y el modelo de Hong y Stein (2003). Además, nuestros resultados también apoyan la hipótesis de burbuja estocástica y son consistentes con Blanchard y Watson (1982) y Wu (1997), incluso después de controlar por las características de los fondos.

Palabras clave: *Comportamiento asimétrico, restricciones de venta corta, estrategias de asignación de activos, efecto de sobrevaloración.*

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. In this paper, we provide new evidences using unique fund data from Korean fund market from different stock market conditions, which is one of most remarkable capital market among emerging market. Under different market conditions, fund managers who are under short-sale constraints have different trading strategies because there is asymmetric effect in different stock market condition.

In recent years, Korean fund market among emerging 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 cannot 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.

Usually prior papers use stock return with short-sale constraint in stock market to identify return asymmetry phenomena. However, our paper uses fund market data and finds asymmetric fund manager behavior because of short-sale constraints. For Korean fund market, it is a unique opportunity for us to test directly the differences in the opinions of fund managers regarding to following facts: 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.

Fund managers of Korean fund market are restricted legally in short-selling strategy in operating fund investor money. We think that it is good opportunity to test difference of opinion suggested by Chen, Hong, and Stein (2001). This short-sale constraint affects the behavior of fund manager's trading strategy in fund market and allows us to test differences of opinion of fund managers from different market conditions.

Our paper extends facts found in Kim and Sohn (2013) and deeply reexamines asymmetry phenomena for constraints of short-selling in fund manager behavior of Korean fund market. In this paper, here are some differences as follows, even though we use same data used in paper of Kim and Sohn (2013). This paper investigates the asymmetry behavior of fund manager with sort-sale constraints from different market conditions, which are boom and recession. Also this paper finds the determinants in difference of opinion through manager of Korean fund market.

In order to test the difference of opinion of fund managers, we utilize GJR-GARCH model as conditional volatility model, which is excellent model to identify the asymmetric volatility as difference of opinion in fund managers over 2002 to 2008 year. GJR-GARCH model used in this paper is incorporated to the asymmetric volatility parameters. We focus on the effect of short-sale constraints and the differences in opinion among Korean fund managers, which is found in Hong and Stein (2003).

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.

As previous studies, we empirically find asymmetric volatility phenomena and the determinants of the volatility asymmetry of fund portfolio returns under fund manager's opinion and short-sale constraint in the Korean fund market. As provided in Varian (1989), Harris and Raviv (1993), Kandel and Pearson (1995), Odean (1998), and Chen, Hong, and Stein (2001), and Hong and Stein (2003), this paper uses the fund turnover based on monthly data as proxy for the difference of opinion in fund manager and also adopt popular GJR-GRACH model to find the fund manager's asymmetric behavior. In testing this model, we separate full sample into sub-sample 1 as the boom market condition and sub-sample 2 as the recession market condition to find the extent of asymmetric volatility and difference of fund manager's opinion based on business cycle.

We understand that this paper is extended to the role of differences of opinions of fund manager under different market condition, which is main difference in comparison with Kim and Sohn (2013).

Our results show that in the whole and boom periods, differences in opinions are supported. These results are consistent with Hong and Stein (2003) 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 four 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; and 4) under different economic conditions, reexamines and deeply analyzes the asymmetry behavior fact found from Kim and Sohn (2013). Therefore, we think that this paper contributes new evidence of different asymmetric behavior and difference of opinion to existing study in Kim and Sohn (2013).

The rest of the paper is structured as follows. Section 2 provides the previous result of empirical analysis in past papers. Section 3 develops the empirical model to find the asymmetry behavior of fund manager. Section 4 explains the sample data and basic statistic results. Section 5 describes and discusses the empirical results, and in section 6, the conclusion is suggested.

2. Theoretical Background

2.1. Difference of Opinion and Short-Sale Constraints

Miller (1977) has 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 heterogonous beliefs or information about the stock value (Chang, Cheng, & Yu, 2007).

Thus, Miller (1977) also has 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) have built a rigorous model incorporating Miller's (1977) idea into a static CAPM framework using general equilibrium analysis. Jarrow (1980) has 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) have 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 500[1].

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

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

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

Furthermore, they have 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) have 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) have supported their empirical results. Hong and Stein (2003) have suggested that the theory on the difference of opinion hypothesis demonstrates why stock markets are more likely to reveal negative skewness and this fact is more pronounced in market crashes or recession market. In this model, investors do not engage in the bearish market and information at this time is not apparent in stock prices because there are short-sale constraints and difference of opinion across investors. Based on difference of opinion and short-sale constraints in market, it is more likely to find negative skewness under existing of short-sale constraints and higher difference of opinion among investors. As a result, we predict that stock returns will be more negatively skewed conditional volatility in high trading volume in market crash time.

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 sort 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. 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 phenomenon[2]: 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 to previous fact, 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 declines[3], 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 volatility. The volatility-feedback hypothesis argues that when either bad news

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2 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 contract 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.

3 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 (1922) supported the positive relation.

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. In this paper, as suggested in Hong and Stein (2003), we examine difference opinion of fund manager as investor using trading volume as turnover for proxy of fund manager difference of opinion under short-sale constraints.

3. Empirical Model

First of all, we explain an empirical model to show fact of asymmetric volatility. That is, the degree of the trading volume as turnover is identified from the highest difference as Quintile 1 to the lowest difference as Quintile 5, which is proxy for difference of opinion across fund managers as investors. To find these facts in the empirical test, we use GJR-GARCH (1,1) based on two different market conditions. As mentioned in previous section, we split the full sample to two sub samples, which are sub-sample 1 as market recession condition and sub-sample 2 as market boom condition to identify some different asymmetric behavior of fund manager as investor.

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. GJR-GARCH Model

In order to find asymmetric volatility of fund returns, this paper adopts the GJR-GARCH model suggested in Glosten, Jagannathan, and Runkle (1993)[4]. This model is incorporated to find asymmetric volatility. It is well known that GJR-GARCH model is the best-fitted model and also has the superior predictive power to capture the asymmetric effect of volatility of returns in Gu (2000), and Engle and Ng (1993).

To find conditional volatility of fund return, general GJR-GARCH (p, q) model is as follows.

(1) $$Ret_t = \beta_0 + \beta_1 \mathrm{Re}\, t_{t-1} + \varepsilon_t$$

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

(2) $$\sigma_t^2 = a_0 + \sum_{i=1}^{p} a_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \gamma_i S_{t-i} \varepsilon_{t-i}^2 + \sum_{j=1}^{q} b_j \sigma_{t-i}^2$$

where

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

4 GJR-GARCH model is originated from TGARCH model proposed by Zakoian (1991), which is using σ_t instead of σ_t^2.

In model (2), depending on whether ε_{t-i} is above or below the threshold value of zero, ε_{t-i}^2 has different effect on the conditional variance σ_t^2 : when ε_{t-i} is positive, the total conditional variance effects are given by $a_i\varepsilon_{t-i}^2$; when ε_{t-i} is negative, the total conditional variance effects are given by $(a_i+\gamma_i)\varepsilon_{t-i}^2$. So, we expect that γ_i is positive for bad market condition or bad news to have large impacts. This model is involved in more conditional volatility shock for bad market condition or bad news or negative news. This is called leverage effect or asymmetric phenomena in financial economics.

In this paper, we use GJR-GARCH with p=1 and q=1, which is GJR-GARCH (1, 1) because most paper suggests GJR-GARCH (1,1) in stock return time serial data. We follow previous result of financial time serial data in prior studies. GJR-GARCH model captures the asymmetric effect as long as $\gamma \neq 0$ and also for this model, regularity condition is completed if $(\alpha+b)+\frac{\gamma}{2}$ is less than 1

We also adopt extended GJR-GARCH (1,1) model to control for fund return and the mean equation from estimation model in extended GJR-GARCH (1,1) is as follows:

$$\text{(3)} \qquad \mathrm{Re}t_t = \theta_0 + \theta_1 Ret_{t-1} + \eta_1 CReturn_t + \eta_2 Ln(NAV)_t + \eta_3 G_t + D_t(YearD) + \varepsilon_t$$

Also conditional variance equation from estimation model in extended GJR-GARCH (1,1) is as follows:

$$\text{(4)} \qquad \sigma_t^2 = a_0 + a\varepsilon_{t-1}^2 + \gamma S_{t-1}\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \phi_1 D_{Monday} + \phi_2 Turnover_t$$
$$+\phi_3 Leverage_t + \phi_4 Ln(Number)_t + \phi_5 Ln(NAV)_t$$

where Ret is excess return of fund based on fund daily return minus risk free rate. T-Notes with maturity of 3 years is used as proxy for risk free rate, CReturn is the cumulative fund excess return based on daily past 6 months that use a rolling window. Ln (NAV) is the logarithm of fund net asset value, and G is new money growth in the fund portfolio based on daily time. Additionally, we insert year dummy (YearD) into mean equation (3). For conditional variance equation (4), we also add Monday dummy (D_{monday}) to control for the Monday effect and leverage of fund portfolio for each fund is measured as $\sum_{i=1}^{N} w_{i,t}(Leverage_{i,t})$. $w_{i,t}$ is the value weight of stock i at each day, and Leverage is individual leverage as total debt over total asset for each firm included in each fund. Ln (Number) is the number of portfolio holdings.

For models (3) and (4), we design that determinants of asymmetric volatility are controlled for determining the differences of opinion across fund managers as investors. We measure proxy for differences of opinion. In empirical test from this paper, we calculate this variable as follows as mentioned in prior section. $Turnover_{i,t}$ is proxy for difference of opinion based on the daily turnover for each fund i in sample period t and also it is computed as follows. Turnover is measured as *Min(Sell$_t$,Buy$_t$)* divided by *NAV$_t$*where sell and buy mean the selling and buying amounts, respectively. As a result, we adopt this calculation process to measure a proxy for differences of opinion in this paper.

In relating to the difference of opinion across investors, Hong and Stein (2003) provide the some evidence that investors in bearish or market recession condition would be cornered and also investors' information would be incompletely reflected 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. Identifying Asymmetry Pattern

In order to identify the existence of asymmetric pattern on the conditional volatility of fund portfolio returns, we adopt the GJR-GARCH model and this model is estimated in this paper. As suggested in Engle and Ng (1993), this paper follows the methodology in Engle and Ng (1993). Namely, we implement testing on the residuals of GJR-GARCH (1,1) model with AR(1). In this testing, the extracted residuals under assumption of conditional heteroscedasticity in this model should show any sign bias, negative sign or positive sign bias if the GJR-GARCH (1,1) model is a sufficient to the fund portfolio returns. If so, this model is appropriate model to use the asymmetric conditional volatility model. The estimation models of sign bias are as follows:

(5) $$e_t^2 = b_0 + b_1 I_{t-1}^- + \mu_t$$

(6) $$e_t^2 = b_0 + b_1 I_{t-1}^- e_{t-1} + \mu_t$$

(7) $$e_t^2 = b_0 + b_1 I_{t-1}^+ e_{t-1} + \mu_t$$

Equation (5) is estimation model for sign bias, and equation (6) is estimation model for negative sign bias, and equation (7) is estimation model for positive sign bias.

In addition, as suggested in Engle and Ng (1993), the joint test for the asymmetry pattern is as follows:

(8) $$e_t^2 = b_0 + +b_1 I_{t-1}^- + b_2 I_{t-1}^- e_{t-1} + b_3 I_{t-1}^+ e_{t-1} + \mu_t$$

From above equation (5), (6), (7), and (8), I_{t-1}^- is an indicator dummy variable that takes the value of one if $e_{t-1} < 0$ and zero; otherwise $I_{t-1}^+ = 1 - I_{t-1}^-$. In the sign bias test of equation (5), the squared standardized residuals are shown on a constant and a dummy variable, I_{t-1}^-. The sign bias test equation (5), test statistic is the t-statistic for the coefficient on I_{t-1}^-. This test finds whether positive and negative processes affect future volatility differently from the predicted model.

In the negative size bias test equation (6), the squared standardized residuals are regressed on a constant and $I_{t-1}^- e_{t-1}$. This test equation (6) shows whether larger negative processes are correlated with larger biases in predicted conditional volatility. In the positive size bias test equation (7), the squared standardized residuals are regressed on a constant and $I_{t-1}^{+}e_{t-1}$. In the positive size bias test equation, test statistic indicates the t-statistic for the coefficient on $I_{t-1}^{+}e_{t-1}$. This test equation (8) is designed for whether larger positive processes are correlated with larger biases in predicted conditional volatility.

3.3. Construction of Controlling Variables

To eliminate the effects of turnover as a proxy for 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 (CRreturn) 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 (NAV) is the logarithm of net asset value (NAV) based on daily fund asset to control for fund size. Third, new money growth (G) 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 (Number) is calculated as the logarithm of portfolio holdings held in each fund. 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 is calculated as follows:

$$\sum_{j=1}^{N} W_{j,t}\left[D_{j,t-1}/E_{j,t-1}\right]$$

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

We collect fund sample data to implement the empirical test from ZeroIn Fund Evaluation Company database as same as Kim and Sohn (2013). Thus this sample includes the portfolio information like number of holdings, firm specific name, related fund money flow, fund cost (upfront fee, operating fee, etc.), fund age, and so on. To get firm characteristic variables, we match this database file to firm code including firm characteristic information from KisValue database and FnGuide database on the firm level.

We follow the sample selection process of Kim and Sohn (2013) as follows: To test suggested empirical model, we use only well managed equity funds. These sample funds are used more than 70% of share held in each fund. In addition, we eliminate funds with outlier return at 1^{th} quintile and 99^{th} quintile to control unusual fund effect and also discard funds with below 15 trading days because fund return series are too short. We exclude the small size of total net asset under 10 billion Korean Won because fund managers cannot build up fund operating strategy in managing fund money in market. After these elimination processes of sample selection, finally we use 1,588 funds in empirical test. To find the asymmetric effect and difference of opinion in fund managers with short-sale constraints and different market condition, we split 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 suggests 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 on daily basis 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 full 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

	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

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.

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 statistics of fund characteristic variables. Mean and median of fund excess return are 0.0003 and 0.0012, and also standard deviation and skewness of excess return 0.0151 and -0.3544. Cumulative excess returns of fund are 0.0758 and 0.0745, and also standard deviation and skewness of fund cumulative excess return are 0.2016 and 0.3501. Average and median of logarithm of total net asset value is 67.545 and 65.660 (unit: 1 million Korean Won). The average and median leverage of firms held in the fund are 2.1181 and 2.1607 respectively and also standard deviation and skewness is 0.4669 and –0.1867. For the average and median for the number of shares held in each fund is 47 and 49, which means 3.86 and 3.89 of logarithm of number shares held in each fund.

Table 3 reports the Pearson correlations among fund characteristic variables. We find 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 (G), but significantly positively correlated to turnover (Turnover), leverage and the number of stock shares held in the fund, Ln (Number).

TABLE 2

SUMMARY STATISTICS OF VARIABLES

	Mean	Median	Std.	Skewness	Kurtosis	Max	Min
Excess Return	0.0003	0.0012	0.0151	–0.3544	2.1739	0.0663	–0.0722
Cumulative Excess Return	0.0758	0.0745	0.2016	0.3501	0.3898	0.7962	–0.4780
Ln(NAV): 1 million Won	67.545	65.660	6.703	0.3090	–1.0538	80.389	56.925
Growth(G)	–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(Number)	3.8635	3.8941	0.1762	–0.1398	–1.3729	4.1380	3.5518

This table reports the summary statistics of variables used in the sample using fund data and stock shares held in funds. Excess Return is measured as fund return minus risk free rate (T-note with 3 years). Cumulative Excess Return 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 G is new money growth in the 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 follows: $Min(Sell_t, Buy_t) / NAV_t$, where sell and buy mean 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.

TABLE 3
CORRELATION

	ExRet	CumExRet	Ln(NAV)	NG	Turnover	Leverage
CumExRet	0.097					
	(0.0001)					
Ln(NAV)	–0.013	–0.071				
	(0.587)	(0.003)				
NG	0.006	–0.223	0.538			
	(0.817)	(0.0001)	(0.0001)			
Turnover	0.031	0.461	0.234	–0.049		
	(0.208)	(0.0001)	(0.0001)	(0.042)		
Leverage	0.015	0.291	–0.657	–0.470	–0.185	
	(0.524)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	
Ln(freq)	–0.006	0.164	0.695	0.404	0.614	–0.659
	(0.801)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)

Note: ( ) is p-value.

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 $\left[NAV_t - NAV_{t-1} \times (1+r_t)\right] / NAV_{t-1}$. 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 mean 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.

5. Empirical Results

5.1. The Asymmetric Effect of Return on volatility

We identify the existence of an asymmetric effect of fund returns on conditional volatility. We focus on the different market conditions as bearish (recession) and bull (boom) market. Both GJR-GARCH (1,1) and extended GJR-GARCH (1,1) are based on separated sample data as sub period 1, and sub period 2, respectively. As mentioned above, to identify an asymmetric effect on volatility, we use equations (1) to (4).

In Table 4, it presents the results of the GJR-GARCH (1,1) model used to identify the existence of an asymmetric effect on conditional volatility. In Panel A, for sub-period 1 and sub-period 2, asymmetric coefficient γ is significant at the 1% and positive value in Model 1, Model 2, Model 3, and Model 4. This result confirms that there exists an asymmetric effect on volatility. In addition, the positive process would imply a higher next period conditional variance than negative process of the same sign, indicating that the existence of the leverage effect exists in returns of the Korean fund market. This result concludes that it is not consistent with the result of Bekaert and Wu (2000).

Specifically 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 0.2484 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 0.9581 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. We find that the results for the joint test for asymmetry suggest evidence for the existence of asymmetry in Korean fund returns during 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

Panel A: GJR–GARCH (1,1)				
	Sub period 1(boom)		Sub period 2(recession)	
	Model 1	Model 2	Model 1	Model 2
Ret_{t-1}	0.0791**	0.0611***	–0.0430	–0.0537
	(2.62)	(2.06)	(–0.62)	(–0.77)
CReturn		0.0083*		0.0074
		(4.99)		(0.92)
$Ln(NAV)_t$		0.0002		0.0052
		(0.37)		(0.56)
G_t (New Growth)		0.0137		0.0388
		(1.77)		(0.88)
ε^2_{t-1}	0.0021	–0.0350**	–0.0386	–0.0801***
	(0.15)	(–2.65)	(–1.51)	(–1.92)
$S_{t-1}\varepsilon^2_{t-1}$	0.1536*	0.2127*	0.2484*	0.2390*
	(6.57)	(7.45)	(3.00)	(3.07)
σ^2_{t-1}	0.8798*	0.8571*	0.8873*	0.9044*
	(54.47)	(43.22)	(16.52)	(17.09)
D_{Monday}		–0.000003		–0.00001
		(–0.28)		(–0.37)
$Turnover_t$		0.0001***		–0.0004
		(1.87)		(–0.96)
$Leverage_t$		0.000004		0.00003
		(1.70)		(0.85)
$Ln(Number)_t$		–0.00003*		–0.000001
		(–4.12)		(–0.01)
$Ln(NAV)_t$		0.000003**		–0.0001**
		(2.28)		(–2.03)

Panel A: GJR–GARCH (1,1)				
	Sub period 1(boom)		Sub period 2(recession)	
	Model 1	Model 2	Model 1	Model 2
Year Dummy	Yes	Yes	Yes	Yes
Skewness	–0.224	–0.249	–0.355	–0.242
Kurtosis	3.607	3.450	3.303	2.926
Likelihood Ratio	4167.57	4190.74	755.93	762.91
Panel B: Test of Asymmetry using methodology from Engle and Ng(1993)				
Sign Bias(×100)	0.008**	0.011*	0.013	0.015
	(2.40)	(3.21)	(0.97)	(1.25)
Positive Bias(×100)	–0.311	–0.393	0.041	–0.027
	(–1.59)	(–1.94)	(0.11)	(–0.05)
Negative Bias (×100)	–0.855*	–0.876*	–1.441***	–1.310***
	(–4.38)	(–4.57)	(–2.09)	(–2.02)
Joint Bias F-statistics	6.22*	6.88*	1.79	1.55

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

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:

$$\mathrm{Re}t_t = \theta_0 + \theta_1 Ret_{t-1} + \eta_1 CReturn_t + \eta_2 Ln(NAV)_t + \eta_3 G_t + D_t(YearD) + \varepsilon_t$$

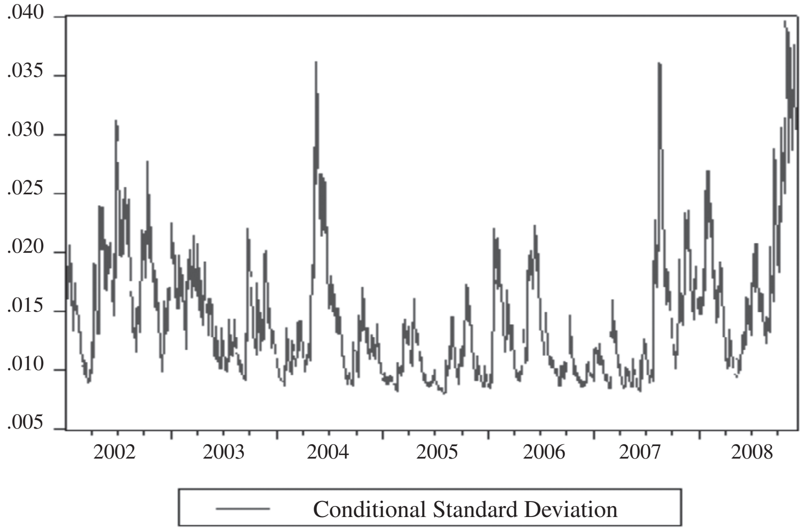
$$\sigma_t^2 = a_0 + a\varepsilon_{t-1}^2 + \gamma S_{t-1}\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \phi_1 D_{Monday} + \phi_2 Turnover_t + \phi_3 Leverage_t + \phi_4 Ln(Number)_t + \phi_5 Ln(NAV)_t$$

Model 1 in sub-period 1(boom), and sub-period 2(recession) does not control Cumulative return (CReturn), Size of fund(Ln(NVA)), and fund growth (G(Newgrowth)) as independent terms in mean equation and also Monday dummy (D_{MONDAY}), Turnover, Leverage, Ln(Number), and Ln(NAV) as independent terms in variance equation to identify the uncontrolled and controlled effect differently. Model 2 in 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.

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. 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 one. It indicates that bad news more greatly effect on volatility than good news does. Figure 2 depicts the asymmetric effect from GJR-GARCH (1,1). Obviously, the news- impact curves in Panel A and B show that news at time (t-1) has an asymmetric impact on volatility at event time t. This result confirms the results of the GJR-GARCH (1,1) model.

FIGURE 1
CONDITIONAL VOLATILITY



This figure shows 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.

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. The results are shown in Table 5, 6, and 7.

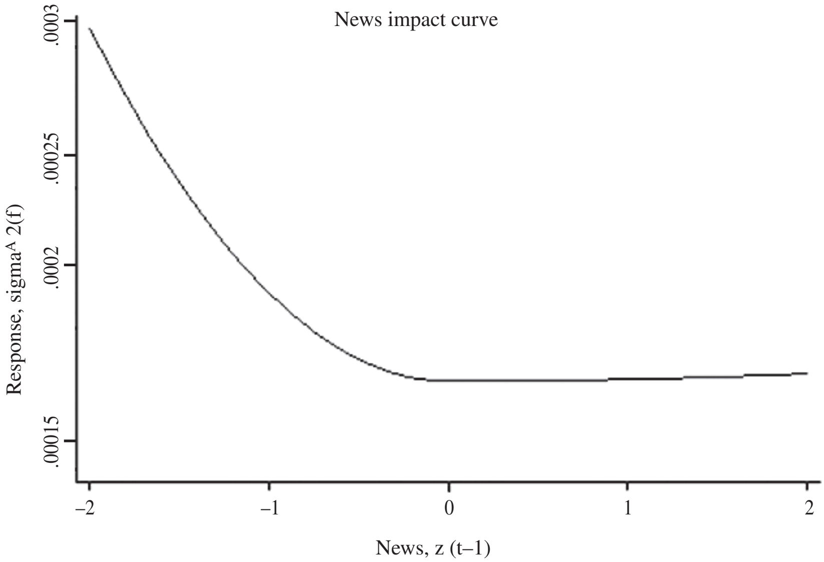
Table 5 shows the results of differences of opinion in the full period. All asymmetric coefficients γ are significant at 1%. Interestingly, as we expected, the results show that as difference of opinion increases to highest from lowest, the degree of asymmetric volatility also increases gradually. Specifically, the γ value changes from the lowest level at 0.1589 to the highest level at 0.1798, increasingly. This evidence indicates that difference of opinion hypothesis is supported. Thus this result is consistent with Hong and Stein (2003) and Stein, Hong, and Stein (2001). This evidence implies that fund with larger increases in turnover is more pronounced in having more negative skewness. In addition, we also find that the effect of turnover is very strong and also statistically and economically significant.

For boom market, Table 6 shows that as difference of opinion increases to highest from lowest, the degree of asymmetric volatility decreases gradually. This

FIGURE 2

NEWS IMPACT CURVE FROM GJR-GARCH(1,1)

Panel A: Sub period 1(1.31.2002-9.28.2007)



Panel B: Sub period 2(10.1.2007-11.28.2008)

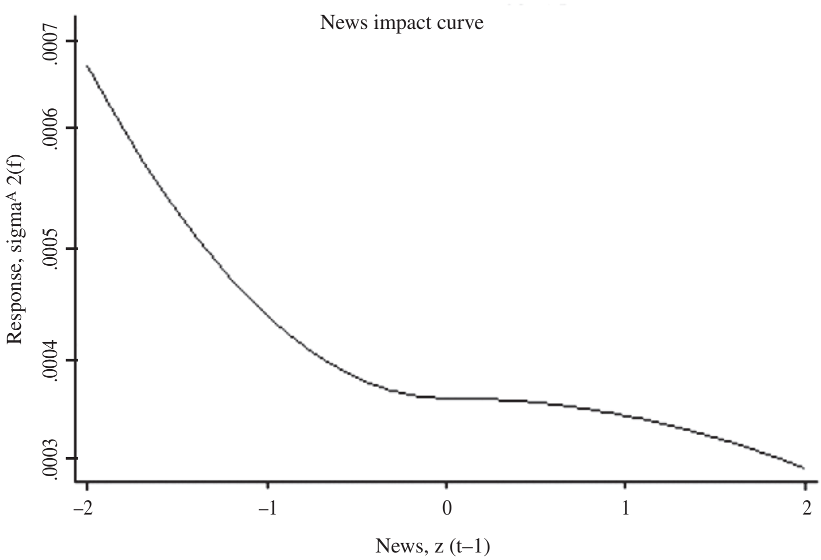


TABLE 5
RESULTS OF THE GJR-GARCH MODEL BASED ON TURNOVER PORTFOLIO RANKED: FULL PERIOD

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

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

This table reports the results of GJR-GARCH(1,1) using following the model in mean $\mathrm{Re}t_t = \beta_0 + \beta_1 \mathrm{Re}t_{t-1} + \varepsilon_t$ and conditional variance $\sigma_t^2 = a_0 + a\varepsilon_{t-1}^2 + \gamma S_{t-1}\varepsilon_{t-1}^2 + b\sigma_{t-1}^2$ where $S_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $S_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

result means that for hot market, reversely the degree of asymmetric volatility is more pronounced in lowest difference of opinion. For recession market, Table 7 shows that as difference of opinion increases to highest from lowest, the degree of asymmetric volatility increases gradually. This result is different pattern to result of boom market. Therefore, our result concludes that there is difference asymmetric degree from market condition.

To confirm this result, we add 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 examine 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

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

Panel A: GJR-GARCH(1,1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Ret_{t-1}	0.0743**	0.0779*	0.0771*	0.0780*	0.0872*
	(2.45)	(2.58)	(2.55)	(2.58)	(2.91)
ε^2_{t-1}	0.0061	0.0042	0.0107	0.0035	–0.0071
	(0.43)	(0.28)	(0.72)	(0.24)	(–0.52)
$S_{t-1}\varepsilon^2_{t-1}$	0.8860*	0.8845*	0.8799*	0.8757*	0.8702*
	(57.12)	(55.84)	(54.57)	(51.21)	(48.54)
σ^2_{t-1}	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
Likelihood Ratio	4197.8	4177.1	4162.8	4157.9	4145.1
Panel B: Test of Asymmetry metodology from Engle and NG(1993)					
Sign Bias(×100)	0.0076**	0.0083*	0.0086*	0.0088*	0.0085**
	(2.42)	(2.61)	(2.59)	(2.61)	(2.50)
Positive Bias(×100)	–0.2879	–0.3136	–0.3041	–0.3222	–0.3029
	(–1.54)	(–1.69)	(–1.59)	(–1.64)	(–1.49)
Negative Bias(×100)	–0.8162*	–0.8458*	–0.9234*	–0.8883*	–0.8626*
	(–4.27)	(–4.45)	(–4.71)	(–4.49)	(–4.32)
Joint Bias F-statistics	6.09*	6.62*	7.42*	6.73*	6.22*

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

This table reports the results of GJR-GARCH(1,1) using following the model in mean $\mathrm{Re}t_t = \beta_0 + \beta_1 \mathrm{Re}t_{t-1} + \varepsilon_t$ and conditional variance $\sigma_t^2 = a_0 + a\varepsilon_{t-1}^2 + \gamma S_{t-1}\varepsilon_{t-1}^2 + b\sigma_{t-1}^2$ where $S_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $S_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

managers exist. This evidence is strong and robust after controlling for variables 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 investigate 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 clarify that differ-

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

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

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

This table reports the results of GJR-GARCH(1,1) using following the model in mean $\mathrm{Re}t_t = \beta_0 + \beta_1 \mathrm{Re}t_{t-1} + \varepsilon_t$ and conditional variance $\sigma_t^2 = a_0 + a\varepsilon_{t-1}^2 + \gamma S_{t-1}\varepsilon_{t-1}^2 + b\sigma_{t-1}^2$ where $S_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $S_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

ence 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 find differences of opinion among fund managers during the full and boom periods.

5.3. Robustness checks

An earlier analysis in this paper provides results without controlling for variables related to fund characteristics using portfolio approach. Thus, these results could be not robust. Thus, two measures are introduced directly as proxies for measuring fund return asymmetry.

TABLE 8
RESULTS OF THE GJR-GARCH MODEL WITH CONTROL VARIABLES BASED ON TURNOVER PORTFOLIO RANKED:
Full period

Panel A: GJR-GARCH(1,1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Ret_{t-1}	0.0456	0.0506***	0.0476	0.0497	0.0543***
	(1.60)	(1.84)	(1.70)	(1.80)	(1.97)
$CReturn_t$	0.0070*	0.0070*	0.0086*	0.0081*	0.0091*
	(4.76)	(4.78)	(5.41)	(5.10)	(5.83)
$Ln(NAV)$	–0.0003	–0.0003	–0.0004	–0.0002	0.0003
	(–0.57)	(–0.72)	(–1.00)	(–0.38)	(0.84)
G_t (New Growth)	0.0023	0.0093	0.0147	0.0143	0.0184**
	(0.55)	(1.19)	(1.76)	(1.68)	(2.23)
ε^2_{t-1}	–0.0092	–0.0235**	–0.0151	–0.0164	–0.0223**
	(–0.88)	(–2.16)	(–1.39)	(–1.55)	(–2.17)
$S_{t-1}\varepsilon^2_{t-1}$	0.1780*	0.1991*	0.2005*	0.1996*	0.2063*
	(7.90)	(8.11)	(7.63)	(7.56)	(7.82)
σ^2_{t-1}	0.8894*	0.8790*	0.8669*	0.8711*	0.8725*
	(62.47)	(57.13)	(49.23)	(50.60)	(52.46)
D_{Monday}	–0.000002	–0.000015	–0.000002	0.000004	0.000007
	(–0.21)	(–1.48)	(–0.24)	(0.36)	(0.61)
$Turnover_t$	0.000027	0.000021	0.000001	–0.000012	0.000018
	(0.54)	(0.44)	(0.02)	(–0.29)	(0.54)
$Leverage_t$	–0.000003	0.000002	0.000003***	0.000003	0.000001
	(–1.23)	(0.99)	(1.85)	(1.69)	(0.30)
$Ln(Number)_t$	–0.000008	–0.000017*	–0.000008**	–0.000003	–0.000010**
	(–1.66)	(–4.77)	(–2.45)	(–0.80)	(–2.55)
$Ln(NAV)_t$	0.000002	0.000003*	0.000003*	0.000002	0.000001
	(1.15)	(2.74)	(2.97)	(1.77)	(0.93)
Year Dummy	Yes	Yes	Yes	Yes	Yes
Skewness	–0.249	–0.246	–0.244	–0.229	–0.235
Kurtosis	3.431	3.399	3.446	3.488	3.505
Likelihood Ratio	4978.029	4951.963	4931.26	4917.735	4906.434
Panel B: Test of Asymmetry using methodology from Engle and NG(1993)					
Sign Bias(×100)	0.009*	0.010*	0.010*	0.011*	0.012*
	(2.82)	(2.97)	(2.79)	(2.94)	(3.17)
Positive Bias(×100)	–0.186	–0.198	–0.176	–0.070	–0.068
	(–0.97)	(–1.04)	(–0.89)	(–0.35)	(–0.33)
Negative Bias(×100)	–0.879*	–0.869*	–0.889*	–0.999*	–0.972*
	(–4.56)	(–4.53)	(–4.59)	(–4.91)	(–4.68)
Joint Bias F-statistics	7.14*	7.10*	7.41*	8.97*	8.50*

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

This table reports the results of extended GJR-GARCH(1,1), including control variables by using the following model in mean $Ret_t = \theta_0 + \theta_1 Ret_{t-1} + \eta_1 CReturn_t + \eta_2 Ln(NAV)_t + \eta_3 G_t + D_t(YearD) + \varepsilon_t$ and conditional variance $\sigma_t^2 = a_0 + a\varepsilon^2_{t-1} + \gamma S_{t-1}\varepsilon^2_{t-1} + b\sigma^2_{t-1} + \phi_1 D_{Monday} + \phi_2 Turnover_t + \phi_3 Leverage_t + \phi_4 Ln(Number)_t + \phi_5 Ln(NAV)_t$, where $S_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $S_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

TABLE 9
RESULTS OF THE GJR-GARCH MODEL WITH CONTROL VARIABLES
BASED ON TURNOVER PORTFOLIO RANKED:
(Boom Market)

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

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

This table reports the results of extended GJR-GARCH(1,1), including control variables by using the following model in mean $\mathrm{Re}t_t = \theta_0 + \theta_1 Ret_{t-1} + \eta_1 CReturn_t + \eta_2 Ln(NAV)_t + \eta_3 G_t + D_t(YearD) + \varepsilon_t$ and conditional variance $\sigma_t^2 = a_0 + a\varepsilon_{t-1}^2 + \gamma S_{t-1}\varepsilon_{t-1}^2 + b\sigma_{t-1}^2 + \phi_1 D_{Monday} + \phi_2 Turnover_t \quad + \phi_3 Leverage_t$ $+ \phi_4 Ln(Number)_t + \phi_5 Ln(NAV)_t$, where $S_{t-1} = 1 \;\; if \;\; \varepsilon_{t-1} < 0$, $S_{t-1} = 0 \;\; if \;\; \varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

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

Panel A: GJR-GARCH (1,1) with AR(1)					
	Quintile 1 (Lowest DO)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (Highest DO)
Ret_{t-1}	–0.0459	–0.0538	–0.0533	–0.0730	–0.0994
	(–0.67)	(–0.70)	(–0.81)	(–1.05)	(–1.56)
$CReturn_t$	0.0046	0.0074	0.0125*	0.0134***	0.0184*
	(0.98)	(1.23)	(2.89)	(1.96)	(2.87)
$Ln(NAV)$	0.0015	0.0043	–0.0020	0.0002	0.0004
	(0.53)	(1.28)	(–0.70)	(0.05)	(0.10)
G_t (New Growth)	–0.0062	0.0084	0.0411	0.1426*	0.1166*
	(–0.61)	(0.16)	(0.95)	(3.03)	(2.64)
ε^2_{t-1}	–0.0958**	–0.0433	–0.1099*	–0.0520	–0.0723*
	(–2.55)	(–1.40)	(–3.13)	(–1.53)	(–3.72)
$S_{t-1}\varepsilon^2_{t-1}$	0.9391*	0.9132*	0.9590*	0.9026*	0.9042*
	(22.61)	(16.52)	(27.59)	(14.51)	(32.49)
σ^2_{t-1}	0.2916*	0.2237*	0.2655*	0.2423*	0.2608*
	(3.38)	(2.69)	(4.21)	(2.93)	(6.16)
D_{Monday}	–0.00004	0.00001	–0.00005	–0.00001	–0.00004**
	(–1.09)	(0.46)	(–1.46)	(–0.14)	(–2.30)
$Turnover_t$	–0.0006	–0.0001	–0.0004	–0.0004	–0.0006*
	(–1.08)	(–0.22)	(–1.26)	(–1.47)	(–3.59)
$Leverage_t$	0.000004	–0.00001	–0.00001	0.00004**	–0.000002
	(0.26)	(–0.53)	(–0.39)	(2.16)	(–0.13)
$Ln(Number)_t$	0.00003*	–0.00002	–0.00003***	–0.00010*	0.000003**
	(2.64)	(–0.88)	(–1.74)	(–3.00)	(2.20)
$Ln(NAV)_t$	0.00001	–0.00002*	–0.00002*	–0.00001	–0.00004*
	(0.47)	(–3.05)	(–2.95)	(–1.04)	(–14.27)
Year Dummy	Yes	Yes	Yes	Yes	Yes
Skewness	–0.346	–0.203	–0.208	–0.203	–0.283
Kurtosis	3.281	3.013	3.012	3.013	3.187
Likelihood Ratio	774.6	763.2	759.1	753.5	755.9
Panel B: Test of Asymmetry using methodology from Engle and NG(1993)					
Sign Bias(×100)	0.008	0.015	0.014	0.019	0.010
	(0.67)	(1.39)	(1.20)	(1.56)	(0.84)
Positive Bias(×100)	0.047	–0.090	–0.050	–0.021	–0.027
	(0.09)	(–0.21)	(–0.09)	(–0.05)	(–0.06)
Negative Bias(×100)	–1.468**	–1.263**	–1.266***	–1.443**	–1.023
	(–2.26)	(–2.09)	(–1.99)	(–2.18)	(–1.60)
Joint Bias F-statistics	2.230	1.610	1.490	1.830	0.960

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

This table reports the results of extended GJR-GARCH(1,1), including control variables by using the following model in mean $Ret_t = \theta_0 + \theta_1 Ret_{t-1} + \eta_1 CReturn_t + \eta_2 Ln(NAV)_t + \eta_3 G_t + D_t(YearD) + \varepsilon_t$ and conditional variance $\sigma^2_t = a_0 + a\varepsilon^2_{t-1} + \gamma S_{t-1}\varepsilon^2_{t-1} + b\sigma^2_{t-1} + \phi_1 D_{Monday} + \phi_2 Turnover_t + \phi_3 Leverage_t + \phi_4 Ln(Number)_t + \phi_5 Ln(NAV)_t$, where $S_{t-1} = 1$ if $\varepsilon_{t-1} < 0$, $S_{t-1} = 0$ if $\varepsilon_{t-1} > 0$. ( ) is the Bollerslev and Wooldridge (1992) robust t-statistics.

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 regression[5]. Thus, our estimation equation is as follows:

(9)
$$\begin{aligned} Skewness_{f,t} &= \alpha + \beta_1 Volatility_{f,t} + \beta_2 Turnover_{f,t} + \beta_3 Leverage_{f,t} \\ &+ \beta_4 CReturn_{f,t} + \beta_5 Ln(\#of\ holdings)_{f,t} + \beta_6 Ln(NAV)_{f,t} \\ &+ \beta_7 TimeD + \varepsilon_{f,t} \end{aligned}$$

where two measures of NCSKEW and SK_{dnup} are used as skewness proxies. $Leverage_{f,t} = \sum_{i=1}^{N} w_{i,t}(Leverage_{i,t})$, $volatility_{f,t} = \sigma_{f,t} \cdot \sqrt{TradingDay}$ 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, $Leverage_{i,t} = \frac{Debt_{i,t}}{Equity_{i,t}}$, $\sigma_{f,t}$ is the standard deviation of daily return in fund f, $\sqrt{Trading}$ is number of trading days at that month, $CReturn_{f,t}$ 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)
$$NCSKEW_{f,t} = -\frac{\left((n(n-1)^{3/2}\sum Ret_{f,t}^{3}\right)}{\left((n-1)(n-2)\left(\sum Ret_{f,t}^{2}\right)^{3/2}\right)}$$

5 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:

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

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 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 confirm 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 use 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 find 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.

In addition, 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

	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*	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(Number)	–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(Month)	Yes	Yes	Yes
J-statistics	40.16*	20.85*	16.57*

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

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(Number) 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.

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

	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*	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(Number)	–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(Month)	Yes	Yes	Yes
J-statistics	31.37*	11.47***	33.03*

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

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(Number) represents the number of holdings held in each fund. Ln(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.

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.

This study provides insights into asymmetric volatility in the Korean Fund Market. The results also reveal asymmetric volatility in fund returns. Thus, these results are consistent with the facts of stock returns. Finally, we find 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 indicates that funds having more differences of opinion among fund managers are more negatively skewed. 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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