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Stock-return Volatility and Daily Equity Trading by Investor Groups in Korea

Abstract

We examine the short-run relationship between stock-return volatility and daily equity trading by several investor groups in the Korean Stock Exchange. We also investigate whether trade characteristics and trading styles can explain the potential distinct volatility effects of these investor groups. For large stocks, we find that whether a trade is a purchase or a sale and whether it is a contrarian or a momentum trade does not play a role in the relation between volatility and trading. It is the trading of informed institutional investors against non-informed individual investors that drives volatility and produces a negative volatility effect. We further show that net foreign trading has a non-decreasing impact on volatility. Our results are robust to alternative measures of volatility and obtained after controlling for a Monday effect, volatility persistency, total volume and lagged stock returns.

Keywords: stock-return volatility, trading, investor groups

JEL classification: G12, G15

1. Introduction

It's well documented in the literature that for stocks there is a positive correlation between volatility and trading volume. (See Karpoff, 1987 for a survey). However, the potential role of trader type in the volatility-volume relation has attracted the attention of researchers only recently (Daigley and Wiley, 1999; Li and Wang, 2010). Because total trading volume is a sum across various investor groups, volatility-trading volume relations should be driven by flows from within these groups. As investor groups may have heterogeneous information sets, beliefs and trading styles, trading by various investor groups may affect volatility differently.

Studies examining the trading behavior of investor groups in developed markets, mainly aggregat investors into individual and institutional categories. So, the domestic institutional and foreign institutional investors are grouped in a broad investor group of institutional investors. Thus, such studies implicitly assume homogenous trading behavior for institutional investors from both domestic and foreign investors. On the other hand, the main focus in emerging markets is on foreign investors and here classification is by foreign and domestic investors. In such a case, domestic individual and domestic institutional investors are grouped in a broad group of domestic investors and it has been implicitly assumed that domestic individual and domestic institutional investors trade homogenously. These assumptions may be quite strong and restrictive. For instance, homogenous trading assumption for subgroups of a broad group can hide the true impact of a subgroup's trade on volatility. Finer classification of investor groups in the presence of trading data for these subgroups can help relax the assumption of homogenous trading within a broad group.

Trading data by investor type are not recorded for many markets. Many earlier studies rely on changes in *holding or ownership data* to track the trading activity. This brings two problems: First, failure to measure trading accurately may lead erroneous results. Second, ownership data is usually available only at low frequencies. Thus the frequency of the extracted trading from ownership data is low as well, missing any short term trading activity.[1] The role of investor types in the short run volatility- trading relation hasn't been studied in detail at the stock level because of the unavailability of daily stock-level trading data by investor groups.[2] The current literature mostly provides empirical evidence for the long-run relationship; however volatility behavior may be different at the daily frequency.[3]

In this study, we focus on the short-run relationship between stock-return volatility and daily equity trading by domestic individual, domestic institutional and foreign investors in the Korean Stock Exchange. We analyze Korean stocks because the Korean Stock Exchange provides trading data classified for the abovementioned three investor groups at a daily frequency.[4] More specifically, we address the questions of i) whether trading by different investor groups affects volatility equally and, ii) whether there are any trade characteristics and trading styles that drive volatility. Utilizing an extensive Korean daily trading database, we provide new evidence on the daily short term volatility-trading relationship.

We first investigate the effects of net purchases and sales by various investor groups on volatility. We then classify each purchase and sale as a momentum or a contrarian trade depending on the sign of the lagged stock return rather than classifying specific investor groups as momentum or contrarian investors as a whole (Ng and Wu, 2007). Thus, trades of investor groups are allowed to exhibit both momentum and contrarian patterns more realistically through time which reflects trading practices.

[1] For instance, only quarterly institutional ownership data is available in US (See Sias, 2004; Gompers and Metrick; 2001) and annual data are available in other developed markets such as Japan (Chang and Dong, 2006).
[2] Some studies also examine the relation between volatility and trading by investor type in futures markets where daily data for trading by several investor groups is available (Bessembinder and Seguin, 1993; Daigler and Wiley, 1999; Wang, 2002). Our focus in this study is on stock markets.
[3] Stock returns display mean reversion in the long-run, with excess volatility in the short-run (Siegel, 2008).
[4] Foreign investors are not split into institutional and individual foreign investors but it is expected that the majority of foreign investors are institutional investors.

Some potential explanations are proposed for the distinct volatility effects of trading by investor types. A stream of literature discusses that informed or uninformed trading has implications on volatility.[5] The common message of the studies in this branch of literature is that non-informational trading moves prices away from the fundamentals whereas informational trading moves prices closer to intrinsic values. The information of rational investors is incorporated into stock prices whilst noise investors provide liquidity to rational investors, and thus rational investor's trading reduces volatility.

When investor types are considered, individual investors are generally viewed as uninformed traders whereas institutional investors are viewed as better-informed sophisticated investors (Chakravarty, 2001; Sias et al., 2006).[6] On the contrary, individual investors generally trade on behalf of themselves for relatively short investment horizons with liquidity pressure.[7] The information of institutional investors is reflected in stock prices if uninformed individual investors trade against institutional investors and provide liquidity to them. Consequently, we conjecture that trading between informed institutional and uninformed individual investors has a stabilizing impact on volatility.

There is no consensus on whether foreign investors are informed or not. On the one hand, foreign investors are professional investors with extensive expertise in trading and exhibit the properties of sophisticated institutional investors and thus they may have an information advantage (Grinblatt and Keloharju, 2001). On the other hand, because of the information barriers to foreign investors related to home-bias hypothesis (Kang and Stulz, 1997; Kim and Yoo, 2009), domestic investors can have an informational edge over foreign investors. So, we do not have a prior expectation about the effects of foreign investors’ net trading.

[5] Hellwig (1980) and Wang (1993) developed models predicting that volatility increases with non-informational or liquidity-driven trading. De Long et al. (1990) contend that uninformed traders often trade irrationally, create noise and overreact to information, causing larger price variability. In contrast, rational informed traders buck against noise-driven price movements and decrease volatility.

[6] Generally, institutional investors are professionals with quantitative skills and wide experience of investment analysis. They possess extensive capital and time resources to access information.

[7] As they do not trade professionally, their trades may be exposed to fads and sentiments.

Another branch of literature proposes trading style as a potential explanation for the differential volatility effects of various investor groups. Cutler et al. (1990) and Avramov et al. (2006) argue that momentum investors buy after price increases and sell after price declines, moving the prices away from fundamentals and causing excess volatility. Conversely, contrarian investors buy after price declines and sell after price increases, moving the prices back to the fundamentals and stabilizing the markets. However, opponents of this view point out that not every contrarian trade necessarily stabilizes the prices and not every momentum trade necessarily destabilizes them.[8] Moreover, there is no theoretical justification of the views that contrarian trades necessarily represent information-based trading and that momentum trades necessarily reflect noise trading. Both contrarian and momentum trading can be informationally or alternatively liquidity driven, making it possible that these trades can be both stabilizing or destabilizing depending on whether or not information is conveyed in these trades. Therefore, we conjecture that trading style doesn't affect volatility systematically.

Finally, firm size can be important for the volatility-trading relation. It's known that institutional investors exhibit a strong preference for large stocks (Dahlquist and Robertsson, 2001; Ko et al., 2007), making it likely that institutional investors focus on extracting information for these stocks. Thus much information can be conveyed through the trading of large stocks by institutional investors. If information based trading drives volatility, then the volatility effect can be more pronounced for large stocks which are commonly traded by informed institutional investors.

For large stocks, we find that whether a net trade is initiated by purchaser or seller and whether it is a contrarian or a momentum trade does not play a role in the volatility-trading

[8] For instance, Bloomfield et al. (2009) show that individual contrarian trades also destabilize prices, by slowing down price discovery. Choe et al. (1999) argue that momentum trading is not necessarily destabilizing for at least two reasons: i) informed traders may be powerful enough to keep prices at fundamental values ii) momentum traders may act on information about fundamentals.

relation. Indeed, it is the trading of informed institutional investors against non-informed individual investors that produces a negative volatility effect. This finding is consistent with an information-based explanation for volatility behavior which suggests that informed trading causes a decrease in volatility. We further demonstrate that there's a flat relation between volatility and net purchase of foreign investors. We find some evidence that foreign investors' net sales increase volatility. However, the robustness tests employing different measures of volatility indicate a positive but insignificant relation, leading us to conclude that net foreign trading has a non-decreasing impact on volatility.

2. Literature Survey

Bessembinder and Seguin (1993) contend that heterogeneous trading patterns of investor types may affect the volatility-volume relation because various investor groups can have different motivations for trading such as hedging, speculation or exploiting their private information. Daigler and Wiley (1999) examine the volatility-volume relation in futures markets using volume data categorized by type of trader and find that trading by general public investors, who are less informed, increases volatility whereas trading by clearing members and floor traders, who are better informed, decrease volatility. They attribute the distinct effects of trading by investor type on volatility to the differentially informed nature of investor types.

The impact of trader type on the volatility-volume relation in stock exchanges at market level rather than stock level is also examined by several researchers.[9] The common feature of all these studies is that they use market index volatility and aggregated market volume by

[9] Bae et al. (2008) show that equity market volatility is influenced by the trade interactions of different investor types in Tokyo Stock Exchange. Kim et al. (2005) document that Korean stock market volatility is related to domestic volume only before the Asian crisis whereas a bidirectional relation between volatility and foreign volume exists after the crisis. However, Hamao and Mei (2001) find that trading by foreign investors doesn't increase the market volatility more than trading by domestic investors in the Japanese equity market. Wang (2007) reports a link between market volatility and foreign equity trading in Indonesia and Thailand.

investor type to examine the volatility-volume relation. This study differs from those by employing stock-level volume data classified by investor type rather than aggregated market volume and by analyzing stock return volatility rather than market index volatility.

Very few studies exist in the literature on volatility-volume relation with an investor type perspective at the stock level. While Choe et al. (1999) study the effect of foreign investors' trading on Korean stock prices and volatility in an event window framework, Li and Wang (2010) examine the volatility effects of only institutional trades in the retail investor dominated Chinese stock market. Umutlu et al. (2013) focus on the impact of foreign equity trading on the average stock-return volatility in Turkey.

This study complements these three in the following ways: First rather than focusing on one investor group, we study the volatility effects of trading by three investor groups including individual, institutional and foreign investors. Thus, we relax the assumptions of homogeneous trading for foreign and domestic institutional investors and for individual and institutional domestic investors, which may be restrictive. Second every day, we classify each purchase and sale of investor groups also as a contrarian or a momentum trade rather than as previous studies did classifying each investor group as contrarian and momentum investor group as a whole for the full sample period. A much richer data set of Korean stocks allows us to remove the restrictive assumptions that the trades of an investor group can be classified as either a contrarian trade or a momentum trade as a whole and that they cannot shift from contrarian to momentum through time and vice versa.

This paper is also related with the studies that investigate the relation between stock-return volatility and the level of or changes in institutional-foreign ownership (Aimpichaimongkol and Padungsaksawasdi, 2013; Bushee and Noe, 2000; Chang and Dong, 2006; Che, 2011; Chen et al., 2013; Li et al 2011). In these studies, the change in ownership is used as a proxy for institutional trading and/or foreign trading at low frequencies. Our paper is distinguished from this line of research in direct and accurate measurement of institutional trading and foreign trading at daily frequency and thus, in its ability to shed light on the short run relation between stock-return volatility and daily trading by investor groups.

3. Data and Variables

The main data set in this study is the daily equity purchases and sales in terms of number of shares traded for three investor groups, namely individual, institutional and foreign investors. The data set is obtained from the Korean Stock Exchange. This data set of Korean stocks has some appealing properties in the following senses: First, directly observable stock-level trading data rather than ownership data enable us to identify trading activity precisely. Second, the used firm-level trading data set used in this study is at daily frequency. Similar types of data sets elsewhere are of quarterly frequency for US and some other developed markets. However, daily trading data sets available for Korean stocks enable us to take a short-run perspective on the volatility-volume relation. Third, we have trading data for individual, institutional and foreign investors. This type of classification is finer than other groupings which mostly classify investors broadly as i) foreign and domestic investors or ii) institutional and individual investors.

The research period extends from 2004.01.01 to 2010.12.30. For each stock included in the KOSPI200 Index and for each day in the sample period, the number of shares purchased and sold for investor types are obtained. Wu and Xu (2000) contend that if informed traders are confident in the information they have, their trades will bunch on one side of trading and create a trading imbalance. Such a trading imbalance will affect prices and thus volatility. Therefore we employ net trade, to test the implications of the information-based explanations of volatility. We define net sales, NS_K, and net buys, NB_K, as trading imbalance variables for each investor group K. NS_K (NB_K) is the maximum of zero or the difference between the number of shares sold (purchased) and the number of shares purchased (sold) normalized by million shares. *NS* and *NB* are defined for individual, institutional and foreign investor groups. More specifically, we compute net trading for each investor group *K* in the following way:

$$NB_{Kt} = \text{Max}[B_{Kt} - S_{Kt}, 0] \quad (1)$$

$$NS_{Kt} = \text{Max}[S_{Kt} - B_{Kt}, 0] \quad (2)$$

where B_K represents the number of shares purchased by investor group K on day t, and S_K represents the number of shares sold by investor group K on day t. By definition of net trades given in equations (1) and (2), net trading of one investor group is equal to the summation of the net trading of the other two investor groups in the opposite side of the transaction. In other words, for instance, if the purchases (sales) exceed the sales (purchases) of institutional investors, then institutional investors are the net buyers of stocks from individual and foreign investor groups. Mathematically, this can be shown as the following:

$$B_{INST,t} = S_{INST\text{-}INST,t} + S_{IND\text{-}INST,t} + S_{FORG\text{-}INST,t} \quad (3)$$

$$S_{INST,t} = B_{INST\text{-}INST,t} + B_{IND\text{-}INST,t} + B_{FORG\text{-}INST,t} \quad (4)$$

where B_{INST} (S_{INST}) is the buy (sale) of institutional investors; $S_{INST\text{-}INST}$ ($B_{INST\text{-}INST}$) represents the sale (buy) of institutional investors to (from) institutional investors; $S_{IND\text{-}INST}$ ($B_{IND\text{-}INST}$) represents the sale (buy) of individual investors to (from) institutional investors; and $S_{FORG\text{-}INST}$ ($B_{FORG\text{-}INST}$) represents the sale (buy) of foreign investors to (from) institutional investors. After multiplying Eq. (4) with minus one and summing it with Eq. (3), we have the following:

$$B_{INST,t} - S_{INST,t} = (S_{INST\text{-}INST,t} - B_{INST\text{-}INST,t}) + (S_{IND\text{-}INST,t} - B_{IND\text{-}INST,t}) + (S_{FORG\text{-}INST,t} - B_{FORG\text{-}INST,t}) \quad (5)$$

Sales of institutional investors to institutional investors, $S_{INST\text{-}INST}$, is equal to buys of institutional investors from institutional investors, $B_{INST\text{-}INST}$, in number as they represent the opposite sides of a transaction. Therefore, the first term on the right hand side of Eq. (5) is equal to zero. By following a similar argument, it is straightforward to show that the difference between the sales and buys, not the difference between the buys and sales as in the case of institutional investors, of individual and foreign investors are represented as the following:

$$S_{IND,t} - B_{IND,t} = (B_{IND\text{-}IND,t} - S_{IND\text{-}IND,t}) + (B_{INST\text{-}IND,t} - S_{INST\text{-}IND,t}) + (B_{FORG\text{-}IND,t} - S_{FORG\text{-}IND,t}) \quad (6)$$

$$S_{FORG,t} - B_{FORG,t} = (B_{FORG\text{-}FORG,t} - S_{FORG\text{-}FORG,t}) + (B_{INST\text{-}FORG,t} - S_{INST\text{-}FORG,t}) + (B_{IND\text{-}FORG,t} - S_{IND\text{-}FORG,t}) \quad (7)$$

Again the first terms of Eq.(6) and Eq.(7) are zero due to similar arguments discussed above. After summing equations (6) and (7) and making some rearrangements, we have the following:

$$(S_{IND,t} - B_{IND,t}) + (S_{FORG,t} - B_{FORG,t}) = (B_{INST\text{-}IND,t} - S_{INST\text{-}IND,t}) + (B_{INST\text{-}FORG,t} - S_{INST\text{-}FORG,t}) + (B_{FORG\text{-}IND,t} - S_{IND\text{-}FORG,t}) + (B_{IND\text{-}FORG,t} - S_{FORG\text{-}IND,t}) \quad (8)$$

The last two terms of Eq.(8) are zero because sales are subtracted from the buys of the same transaction on the opposite side. Subtracting Eq.(8) from Eq. (5) and some algebra yields the following:

$$(B_{INST,t} - S_{INST,t}) - (S_{IND,t} - B_{IND,t}) - (S_{FORG,t} - B_{FORG,t}) = (S_{IND\text{-}INST,t} - B_{INST\text{-}IND,t}) + (S_{INST\text{-}IND,t} - B_{IND\text{-}INST,t}) + (S_{FORG\text{-}INST,t} - B_{INST\text{-}FORG,t}) + (S_{INST\text{-}FORG,t} - B_{FORG\text{-}INST,t}) \quad (9)$$

The right hand side of Eq.(9) is equal to zero because all the sales and purchases expressed in the same parentheses correspond to the opposite sides of the same transaction. Finally,

$$(B_{INST,t} - S_{INST,t}) = (S_{IND,t} - B_{IND,t}) + (S_{FORG,t} - B_{FORG,t}) \tag{10}$$

Given Eq.(1) and (2), when $B_{K,t} > S_{K,t}$, $NB_{K,t} = B_{K,t} - S_{K,t}$, $NS_{K,t} = 0$ and thus $NB_{K,t} - NS_{K,t} = B_{K,t} - S_{K,t}$ and when $B_{K,t} < S_{K,t}$, $NB_{K,t} = 0$, $NS_{K,t} = S_{K,t} - B_{K,t}$, $NB_{K,t} - NS_{K,t} = 0 - (S_{K,t} - B_{K,t}) = B_{K,t} - S_{K,t}$. So, it is concluded that

$$NB_{K,t} - NS_{K,t} = B_{K,t} - S_{K,t} \tag{11}$$

By using the similar arguments, it is straight forward to show that

$$NS_{K,t} - NB_{K,t} = S_{K,t} - B_{K,t} \tag{12}$$

Substituting Eq. (11) and (12) into (10) yields

$$NB_{INST,t} = NS_{IND,t} + NS_{FORG,t} \tag{13}$$

Then, it can be easily shown that the following series of equations for the remaining trade interactions among investor groups apply by following the steps outlined above:

$$NS_{INST,t} = NB_{IND,t} + NB_{FORG,t} \tag{14}$$

$$NB_{IND,t} = NS_{INST,t} + NS_{FORG,t} \tag{15}$$

$$NS_{IND,t} = NB_{INST,t} + NB_{FORG,t} \tag{16}$$

$$NB_{FORG,t} = NS_{IND,t} + NS_{INST,t} \tag{17}$$

$$NS_{FORG,t} = NB_{IND,t} + NB_{INST,t} \tag{18}$$

It is important to note that Equations through (13) and (18) cannot hold simultaneously on the same day. On every single day during the sample period, one of the equations through (13) and (18) will govern the trade interactions among investor groups and the other equations will be redundant. Therefore, the equations summing the trade interactions change from day to day.

Institutional investor group consists of several subgroups such as insurance companies, investment trust companies, banks, pension funds and etc. The daily trading data for these subgroups are available as well. However for many stocks and days, we observe no trading activity for some of the institutional subgroups. Therefore, we aggregate the trading of all institutional investor subgroups within a day to ensure variation in trading activity across days. We also include total trading volume in the regression models as a control variable because it is well known that volatility and volume are correlated (Karpoff, 1987). As trading volume is expressed in total number of shares traded, it also controls for potential changes in number of shares traded induced by transactions such as stock repurchases and issues. Some studies document a correlation between lagged return and volatility (Avramov et al., 2006). To control for this effect, we include the lagged return, R_{t-1}, as an explanatory variable in the model.

Panel A of Table 1 presents the cross sectional averages of some basic statistics of individual stocks which are calculated by using time series data. According to average net trading data in Panel A, individual investors are the most active traders with the highest net sale (NS_{IND} = 0.039 million shares/day) and net buy (NB_{IND} = 0.0376 million shares/day). Institutional investors follow individual investors as the second most active traders with NS_{INST} of 0.0335 and NB_{INST} of 0.0342. Foreign investors are the least active trader group with NS_{FORG} of 0.0293 and NB_{FORG} of 0.0289, suggesting that their average holding period is longer than those of the other two investor groups.

In Panel B, the average correlations of net trading between investor groups are reported. It is noteworthy that a high correlation exists between NB_{INST} and NS_{IND} with a correlation coefficient of 0.6466 and between NB_{IND} and NS_{INST} with a correlation coefficient of 0.6481. Since net trading of one investor group is the algebraic sum of the net trading of the other two investor groups in the opposite side of the transaction, these high correlations for the opposite trades between institutional and individual investors indicate that there is a strong trading between these two investor groups.

< Insert Table 1 here >

4. Stock-return Volatility and Net Trading by Investor Type

We first examine the link between stock-return volatility and net sales-buys of investor groups via the following daily regression model which is estimated for each stock during the in sample period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{NB} NB_{Kt} + \varepsilon_t \qquad (19)$$

Where σ_t is the conditional stock-return volatility on day t and is the square root of the conditional variance estimated from a GARCH (1, 1) model:

$$R_t = c + \varepsilon_t \qquad (20)$$

$$\sigma_t^2 = w + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \qquad (21)$$

Here, R_t is daily stock return. M_t is a dummy variable that takes the value of one for Mondays and zero otherwise and it accounts for potential higher weekend volatility due to more information. $Volume_t$ is the trading volume in number of shares traded expressed in millions. NS_{Kt} (NB_{Kt}) stands for net sale (net buy) for investor group K. Lagged values of volatility are included in the models to account for persistency in volatility which is a pervasive feature of volatility behavior. The models are estimated for each stock separately during the research period by using the ordinary least square (OLS) estimation technique. We include twelve lags of daily volatility in the regression model to wipe out any autocorrelation in the residuals so that the OLS estimators in the presence of the lagged dependent variables are consistent.[10] We report the cross-sectional mean of the coefficient estimates for individual stocks in Table 2. The standard errors of the cross-sectional means which correct for cross-correlations in residuals of Equation (19) are estimated in the spirit of the method of Jones et al. (1994). Although this approach provides consistent estimators, it may not be efficient as it depends on OLS estimations. However, the gains from efficiency are unlikely to be large as the cross-sectional correlations are small.

< Insert Table 2 here >

Panel A of Table 2 presents the results of Equation (19) which includes the net sales and buys of individual investors. The results suggest that size effect has a role in explaining the volatility. For the full portfolio consisting of all stocks (the portfolio *All*), and for the portfolio of small-sized stocks (the portfolio *P1*), we document no significant effect for NS_{IND} and NB_{IND} on the volatility. On the other hand, for the large-sized portfolio (the portfolio *P2*), the coefficient estimate for net sales, β_{IND}^{NS}, is -0.0005 (with a t-statistic of -2.20) and for net buys, β_{IND}^{NB}, is -0.0005 (with a t-statistic of -2.23). These results show that both *NS* and *NB* for individual investors have a significant negative effect on the volatility for *P2*.

The results for institutional investors which are presented in Panel B of Table 2 sketch a similar picture. Only for the large-sized portfolio, we document a highly significant negative

[10] The OLS estimation method provides consistent estimates when lagged dependent variable is included in the regression model if the residual autocorrelation is eliminated (Davidson and MacKinnon, 1993).

effect for *NS* and *NB*. NS_{INST} has a coefficient estimate of -0.0007 (with a t-statistic of -3.56) and NB_{INST} has a coefficient estimate of -0.0008 (with a t-statistic of -3.72). Panel C of Table 2 shows that coefficient estimate for the net sale of foreign investors is significantly positive (β^{NS}_{FORG} = 0.0006, t-stat = 2.78) and that for the net purchase is insignificant (β^{NB}_{FORG} = 0.0003, t-stat = 1.31).

NS_{IND} and NB_{INST} have significant coefficient estimates with the same signs for the large-sized portfolio, suggesting that individual investors act as net sellers of large stocks whose net buyers are institutional investors. Similarly, both NB_{IND} and NS_{INST} have negative significant coefficient estimates for the large-sized portfolio, implying that net purchases of individual investors and net sales of institutional investors correspond to each other. So, individual investors also act as net buyers of large stocks whose net sellers are institutional investors.

Overall, the results indicate that regardless of whether a trade is a sale or a purchase, an increase in net trade between individual and institutional investors decreases the volatility. It can be inferred from the preliminary evidence that trades between individual and institutional investors but not those between individual and foreign investors and not the ones between institutional and foreign investors help reduce volatility for the large stocks. These implications can be tested formally by decomposing the net trades into their constituents. In the next section we focus on this issue.

4.1. Stock-return Volatility and the Decomposition of Net Trades by Investor Type

By the definition of a net trade, any net sale (purchase) of an investor group will meet with the net purchases (sales) of the other two investor groups. For instance, on some days net sales by individual investors will be equal to the algebraic sum of the net purchases of institutional and foreign investors. In a similar vein, for some other days the opposite side of the net purchase of institutional investors will be net sales of individual and foreign investors and etc. So, any net trade of an investor group can be decomposed into reverse trades of the other two investor groups. The ability to decompose a net trade allows us examine by which components of a given trade the volatility is affected. Thus, we can formally test the implication of the previous section that the net trading of large stocks between institutional and individual investors causes a decrease in volatility. Furthermore, we can also check the robustness of our previously obtained results in this section.

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \sum_{K=1}^{2} \beta_K^{NB} NB_{Kt} + \sum_{K=1}^{2} \beta_K^{NS} NS_{Kt} + \varepsilon_t \tag{22}$$

Here, the subscript K changes from one to two and represents the trading counterparts of a given investor group. For instance given the net trades of individual investors, NB_{K1}, NB_{K2} and NS_{K1}, NS_{K2} represent the net buy and net sale of institutional (K_1) and foreign (K_2) investor groups trading against individual investors. NB_{IND} and NB_{FORG} are the components of NS_{IND}. NS_{INST} and NS_{FORG} are the components of NB_{IND}.

The regression specification represented by Eq. (22) is different from that represented by Eq. (19) in the sense that Eq. (22) focuses on the trades of the two trading counterparts, given the trading of one investor group in an attempt to examine the channels through which the given trade affect volatility. On the other hand, Eq. (19) includes only the trading of the given investor group without its components and is used to examine the effect of the given investor group on volatility. The results of this time-series regression represented by Eq. (22) are presented in Table 3.

< Insert Table 3 here >

Panel A of Table 3 documents the results of the specification which includes the components of the net trades of individual investors as regressors. For the large sized portfolio, the NB_{INST} component of NS_{IND} has a negative significant slope estimate (β_{INST}^{NB} = -0.0009) whereas NB_{FORG} component has a positive significant slope (β_{FORG}^{NB} = -0.0005). So, the negative relation between NS_{IND} and the volatility reported in Panel A of Table 2 in the previous section is due to the net purchase of institutional investors from individual investors but not due to the net purchase of foreign investors from the individual investors.

In the analysis of the net purchases of individual investors, we examine NS_{INST} and NS_{FORG} as the components of NB_{IND}. NS_{INST} has a significant negative slope estimate of -0.0009 (with a t-statistic of -3.42) for the large sized portfolio, while we observe a positive significant slope of 0.0008 (with a t-statistic of 3.25) for NS_{FORG}. This suggests that the net sale of institutional investors to individual investors, NS_{INST}, is leading to the negative relation between the volatility and NB_{IND} but net sale of foreigners to individual investors does not contribute to the negative volatility effect of NB_{IND}.

We reach similar conclusions from the results in Panel B of Table 3. Again only for the large sized portfolio, the decomposition of NS_{INST} indicates that NB_{IND} has a negative significant slope of -0.0009 (t-stat= -3.57) and the decomposition of NB_{INST} shows that NS_{IND} has a negative significant slope of -0.0010 (t-stat= -3.61). Thus, NB_{IND} is playing a role in explaining the negative impact of NS_{INST} and NS_{IND} drives the negative effect of NB_{INST}, which were also the results previously obtained in Panel B of Table 2.

In Panel C, we observe negative slope estimates for NB_{IND}, NB_{INST}, NS_{IND} and NS_{INST}. Although we do not detect a negative significant impact of net trades of foreign investors in Panel C of Table 2, some negative significant coefficients reported in Panel C of Table 3 seem interesting. These results can be partly explained by the fact that NB_{IND} and NB_{INST} are also the components of NS_{INST} and NS_{IND} which were previously shown to have a strong negative relation with the volatility in Table 2. Because the pair-wise correlation between NB_{IND} and NS_{INST}; and that between NB_{INST} and NS_{IND} are high (as documented in Panel B of Table 1 with correlation coefficients of 0.6481 and 0.6466 respectively), they are the major components of NS_{INST} and NS_{IND}. Therefore NB_{IND} and NB_{INST} are more likely to be the channels through which NS_{INST} and NS_{IND} transmit their impact on the volatility. Similar arguments apply for NS_{INST} and NS_{IND} as the major components of NB_{IND} and NB_{INST}, respectively.

The results in three panels of Table 3 can also be interpreted as estimates of different regression specifications in which the net trades of several investors groups enter the regression equation in different combinations. The results for the large portfolio in different panels indicate that NB_{INST}, NB_{IND}, NS_{INST}, and NS_{IND} are the variables that have a negative impact on the volatility while NS_{FORG} and NB_{FORG} have positive slopes. Because the net trades of individual and institutional investors in the reverse sides of a net trade meet partly with each other and because their effect on the volatility is in the same direction, the interpretation of the results as the outcomes of the regression specifications in different combinations also supports the conclusions of the decomposition analysis above.

In summary, the analysis with the decomposed net trades shows that net trading between institutional investors and individual investors governs the negative volatility-trading relation only for the portfolio of large stocks. This result conforms with the one obtained in the previous section where net purchase and net sale enter into the regression specifications without being decomposed into their constituent trades. Thus, the decomposition analysis also serves as a robustness check for the previous findings.

Overall, the results provide support to our conjecture that the trading of institutional investors conveys much information for large stocks as institutional investors prefer to focus their efforts to acquire information for these types of stocks and to trade on the obtained information. Our result that trading of rational institutional investors against irrational individual investors decreases the volatility, is also consistent with the information-based explanation of volatility behavior which suggests that informed trading reduces volatility.

4.2 Volatility and Trading Style of Investor Groups

Some studies suggest that trading style can have an impact on volatility. Without referencing to investor grouping, Avramov et al. (2006) shows that momentum trading increases volatility whereas contrarian trading reduces it. However, there is not a consensus about the volatility effects of momentum and contrarian trading. Bloomfield et al. (2009) argues that contrarian trading can be destabilizing and Choe et al. (1999) support the idea that momentum trading is not necessarily destabilizing. In this section, we empirically examine whether or not trading styles matter in explaining the distinct volatility effects of net trading by investor groups.

Although there are some studies trying to define the general trading behavior of investor groups, these studies do not classify the individual trades of investor groups. Rather than classifying specific investor groups as momentum or contrarian investors as a whole, we classify each trade of investor groups as a momentum or contrarian trade conditioned on the lagged stock returns calculated over the period from day t-5 to day t-1. Thus, trades of investor groups are allowed to exhibit both momentum and contrarian patterns through time depending on the lagged return. Hence, we can track the changes in the trading patterns of investors through time, enabling us to examine whether momentum and contrarian trading patterns have distinct effects on the volatility. We further disentangle the effects of momentum and contrarian trades under the net purchase and net sale trades in the following specification:

$$\sigma_t = c + \beta_D D_t + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NB} NB_{Kt} + \beta_K^{D*NB} D_t * NB_{Kt} + \beta_K^{NS} NS_{Kt} + \beta_K^{D*NS} D_t * NS_{Kt} + \varepsilon_t \quad (23)$$

where *D* is a dummy variable which takes the value of one when stock return from day *t*-5 to day *t*-1, $R_{t-5,t-1}$, is positive on day *t* and zero otherwise. All other variables are as defined previously.

We define a sale as a contrarian (a momentum) sale, *CS* (*MS*), when the lagged returns are positive (negative) before the sale trade. Likewise, we define a buy as a contrarian (momentum) buy, *CB* (*MB*), when the return over the five day before the purchase trade is negative (positive). Thus, when *D* is equal to zero and thus the lagged returns are negative on a day, then the net sale on that day is a momentum sale and the net buy is a contrarian buy. On the other hand, when *D* is equal to one and thus the lagged returns are positive on a day, the net sale on that day is a contrarian sale and the net buy is a momentum buy.

To infer the effects of contrarian and momentum trades on volatility in Eqn. (23), we examine how a change in net sale (*NS*) or net buy (*NB*) will cause a change in σ_t. More technically,

When *D* = 0;

$$\frac{\partial \sigma}{\partial NS} = \beta_K^{NS} \text{ and } \frac{\partial \sigma}{\partial NB} = \beta_K^{NB} \text{ ;}$$

When *D* = 1;

$$\frac{\partial \sigma}{\partial NS} = \beta_K^{NS} + \beta_K^{D*NS} \text{ and } \frac{\partial \sigma}{\partial NB} = \beta_K^{NB} + \beta_K^{D*NB}$$

When *D* is equal to zero, *NS* is a momentum sale, *MS*, (i.e., lagged return is negative before a sale) and hence the marginal impact of *NS* on σ_t represented by β_K^{NS} as shown above is the effect of *MS* on the volatility. On the purchase side, *NB* is a contrarian buy, *CB*, (i.e., lagged return is negative before a purchase) as *D* is equal to zero and β_K^{NB} represents the marginal impact of *CB* on volatility.

On the other hand, when *D* equals to 1, *NS* is a contrarian sale, *CS*, and therefore the impact of *NS* on volatility, which is represented by $\beta_K^{NS} + \beta_K^{D*NS}$, will show the effect of *CS*.[11] Similarly when *D* equals to 1, *NB* is a momentum buy, *MB*, and the effect of *NB* which is $\beta_K^{NB} + \beta_K^{D*NB}$ will determine the differential impact of *MB* on σ_t. It is also noteworthy that dummy variable, *D*, is also included in the regression equation as an additional explanatory variable. Thus, not only can the slope terms change depending on the value of the dummy variable, but also the intercept term can vary as well. Including *D* individually in Eqn. (23) avoids the potential omitted variable bias and provides a clearer picture of the effect of trading style on volatility.[12]

< Insert Table 4 about here >

The results for Eq. (23) are presented in Table 4. Our focus is on the large portfolio as we only observed significant results for this portfolio in the previous sections. We now examine whether this effect for the large portfolio is driven by one period momentum or contrarian trading. The results for the small and the full sample portfolios are also presented but even if we encounter a few significant coefficient estimates for contrarian and momentum trades for these portfolios, we know from the previous section that their combined effect cancels out at the aggregate level when considering only net trades without being decomposed. Therefore only the results for the large portfolio will be discussed in detail.

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[11] The sum of coefficients will have the standard error of $\left(\mathrm{var}(\beta_K^{NS}) + 2\,\mathrm{cov}(\beta_K^{NS}, \beta_K^{D*NS}) + \mathrm{var}(\beta_K^{D*NS})\right)^{1/2}$

[12] We thank referee for bringing this issue to our attention.

In Panel A of Table 4, we find that the impact of CS_{IND} measured by $\beta_{IND}^{NS} + \beta_{IND}^{D*NS}$ is insignificant and that the coefficient estimate for MS_{IND}, β_{IND}^{NS}, is -0.0016 (with a t-statistic of -4.19). This result suggests that the negative significant effect of NS_{IND} reported in Panel A of Table 2 for the large portfolio is mainly because of the momentum sales of individual investors. On the purchase side, we detect significant results for both of the trading styles. We find that β_{IND}^{NB} representing the impact of CB_{IND} is -0.0006 and $\beta_{IND}^{NB} + \beta_{IND}^{D*NB}$ representing the impact of MB_{IND} is -0.0006 with t-statistics of -2.32 and -1.70, respectively. Thus, both contrarian and momentum purchases of individual investors contribute to the negative significant impact of NB_{IND}.

In panel B of Table 4, we observe negative significant slopes for both CS_{INST}, $\beta_{INST}^{NS} + \beta_{INST}^{D*NS}$ = -0.0007, and MS_{INST}, β_{INST}^{NS} = -0.0006 (with t-statistics of -2.17 and -2.41). Therefore both contrarian and momentum sales contribute to the negative impact of net sales of institutional investors which was documented in Panel B of Table 2. On the purchase side, we both detect a negative significant impact for CB_{INST} with a β_{INST}^{NB} of -0.0010 (t-stat = -2.88) and for MB_{INST} with a $\beta_{INST}^{NS} + \beta_{INST}^{D*NS}$ of -0.0005 (t-stat = -1.72), suggesting that both contrarian and momentum purchases of institutional investors lead to the negative significant impact of NB_{INST} which was documented in Panel B of Table 2 for the large portfolio.

Finally, in Panel C of Table 4 we present the results for foreign investors. For the large sized portfolio, only the coefficient estimates for CS_{FORG} and MB_{FORG} are significant. The positive significant slope of $\beta_{FORG}^{NS} + \beta_{FORG}^{D*NS}$ indicates that the source of positive significant effect of NS_{FORG} documented in Panel C of Table 2 is the CS_{FORG}. The marginal positive significant impact of MB_{FORG} ($\beta_{FORG}^{NB} + \beta_{FORG}^{D*NB}$ = 0.0006, t-stat= 1.88) is diluted when combined with the impact CB_{FORG} and the resulting net effect of NB_{FORG} on volatility turns out to be insignificant as shown in Panel C of Table 2.

The results obtained so far about the volatility effects of trading style are mixed and do not indicate a consistent impact among investor groups. Contrarian and momentum trades decrease volatility for individual and institutional investors except for contrarian sale of individual investors whereas they increase volatility for foreign investors. Thus, we conclude that trading style does not consistently and systematically drive volatility.

A closer look at the results in Table 4 provides further insights about the interaction of investor groups. It's important to note that contrarian sale (purchase) of an investor group corresponds to the momentum purchase (sale) of another investor group taking part on the other side of the transaction. This is due to the fact that the sign of the lagged return is the same for both sides of the trade and also due to the fact that the sign determines whether a trade is a contrarian or momentum trade depending on the trade being a sale or a purchase. And as one side of the transaction is always sale and the opposite side is always purchase, a trade is classified as a momentum trade on one side of the transaction whereas the same trade is classified as a contrarian trade on the other side. In other words, while the trade of an investor group acting as net sellers will be classified as momentum (contrarian) sale if the sign of the lagged return is negative (positive), the trade of the other investor group acting as net buyers of the same stocks will be classified as contrarian (momentum) buy. As we work with net trades, then net contrarian sale (purchase) of an investor group is the algebraic sum of net momentum purchase (sale) of the remaining two investor groups. Briefly, any momentum-contrarian net purchase-sale trade of an investor group can be decomposed into the corresponding trades of the other two investor groups.

Motivated by this discussion, we examine the sign and significance of a net trade of one investor group, say the trade of investor group K_1, and of the corresponding trades of the other two investor groups K_2 and K_3 as the components of the given trade K_1. Thus, we check the transmission channels of the volatility effect for the given trade. For instance, let the contrarian sale of individual investors be the given trade. This trade corresponds to momentum purchases of institutional and foreign investors. For the large portfolio, we find a statistically insignificant coefficient estimate for CS_{IND} as can be seen in Panel A of Table 4. We do not examine the components of this trade as there's no point in trying to decompose an insignificant effect. On the other hand, the coefficient estimate of MS_{IND} is significantly negative with a β_{IND}^{NS} of -0.0016 (and a t-statistic of -4.19). So, it makes sense to analyze the underlying components that lead to this significant volatility effect. The coefficient estimates for the components of MS_{IND} are β_{INST}^{NB} of -0.0010 for CB_{INST} (Panel B of Table 4) and β_{FORG}^{NB} of 0.0001 for CB_{FORG} (Panel C of Table 4) (with the t-statistics of -2.88 and 0.36), respectively. As the sign and significance levels of MS_{IND} and CB_{INST} are similar, these findings imply that individual investors act as momentum sellers of large stocks whose contrarian purchasers are institutional investors. A negative volatility effect is produced as a result of this trade.

We proceed with the purchases of individual investors and first examine their contrarian purchases. For large stocks, we find a negative significant coefficient estimate of β_{IND}^{CB} of -0.0006 for CB_{IND} (with a t-statistic of -2.32). The coefficient estimates for the components of contrarian purchases of individual investors are -0.0006 (β_{INST}^{NS}) for MS_{INST} and 0.0002 (β_{FORG}^{NS}) for MS_{FORG} with t-statistics of -2.41 and 0.83. It's noteworthy that sign and significance levels are similar for CB_{IND} and MS_{INST} this time. These findings suggest that contrarian purchases of individual investors and momentum sales of institutional investors meeting with each other creates a negative volatility effect. As the last trade of individual investors, we study their momentum purchases. As indicated in Panel A of Table 4, the coefficient estimate for momentum buy of individual investors, $\beta_{IND}^{NB} + \beta_{IND}^{D*NB}$, for the large stocks is -0.0006 and significant at 10% significance level. Examining the coefficients estimates of MB_{IND}'s components reveal that $\beta_{INST}^{NS} + \beta_{INST}^{D*NS}$ for CS_{INST} is -0.0007 and $\beta_{FORG}^{NS} + \beta_{FORG}^{D*NS}$ for CS_{FORG} is 0.0011 both of which are significant at conventional significance levels. The similarity of the sign and significance levels of MB_{IND} and CS_{INST} suggest that institutional contrarian sale of large stocks to individual momentum purchasers decreases the volatility.

Next, we continue with examining the components of institutional investors. Panel B of Table 4 indicates that CS_{INST}, MS_{INST}, CB_{INST} and MB_{INST} have all significant association with the volatility for the large sized portfolio. Therefore, we focus on all these trades in examination of which components can be the driving forces for the observed significant volatility effect. Given the trade of contrarian sale of institutional investors, we observe the coefficient estimates for MB_{IND} and MB_{FORG} as the component trades. For the large portfolio, only MB_{IND} has a significant negative slope ($\beta_{IND}^{NB} + \beta_{IND}^{D*NB}$ = -0.0006 and t= -1.70). So, there is preliminary evidence that contrarian sales of institutional investors matching with momentum purchases of individual investors decrease volatility.

We progress with the examination of momentum sales of institutional investors, MS_{INST}. The components of MS_{INST} are CB_{IND} and CB_{FORG}. Only CB_{IND} has a negative coefficient estimate which is also significant. Conversely, the other component, CB_{FORG}, has a positive insignificant coefficient estimate. This is initial evidence supporting the view that momentum sales of institutional investors and contrarian purchases of individual investors are corresponding to each other in generating a negative volatility effect.

Next, we move on the contrarian purchase of institutional investors with a significant β_{INST}^{NB} of -0.0010 whose components are MS_{IND} with a significant β_{IND}^{NS} of -0.0016 and MS_{FORG}

with an insignificant β_{FORG}^{NS} of 0.0002. Again this implies that contrarian purchases of institutional investors and momentum sales of individual investors are the opposite sides of a transaction and act in the same way to reduce volatility.

Lastly, we investigate the momentum purchase of institutional investors, MB_{INST}, as the final institutional trade affecting the volatility significantly. The coefficient estimates of $\beta_{IND}^{NS} + \beta_{IND}^{D*NS}$ and $\beta_{FORG}^{NS} + \beta_{FORG}^{D*NS}$ for CS_{IND} and CS_{FORG} components of MB_{INST} are both positive. This result is interesting given that the sign of MB_{INST} is negative. The positive sign for the slope of CS_{FORG} is not surprising as we documented positive coefficient estimate for NS_{FORG} in Panel C of Table 2. The contrarian sale which is a constituent of foreign investors' net sale can therefore reasonably have a positive slope. Providing an explanation for the positive sign for the slope of CS_{IND} requires much attention. CS_{IND} is also the component of MB_{FORG} and a thorough examination of Panel C of Table 4 reveals that MB_{FORG} has a positive slope. This indicates that CS_{IND} is the main component of MB_{FORG} and the effect of MB_{FORG} on volatility is likely to be transmitted by CS_{IND}.

Finally, we focus on the net trades of foreign investors for the large sized portfolio to investigate their components. We will examine only CS_{FORG} and MB_{FORG} which are documented to affect volatility significantly in Panel C of Table 4. We have mentioned the underlying reasons for the link between CS_{IND} and MB_{FORG} above, so we proceed with the examination of the components of CS_{FORG} which are MB_{IND} and MB_{INST}. Both of these components have negative coefficient estimates while CS_{FORG} has a positive one. Note that MB_{IND} and MB_{INST} are also the reverse trades of contrarian sale of institutional and individual investors, respectively. The negative slopes for these components suggest that the volatility effects of MB_{IND} and MB_{INST} as components of CS_{FORG} are dominated by the effects arising from the contrarian sales between individual and institutional investors.

In summary, we have strong preliminary evidence pointing out that contrarian sale (purchase) and momentum purchase (sale) of individual and institutional investors opposing each other, decrease volatility. Thus, it is the trading between individual and institutional investors that leads to the negative volatility effect no matter whether the trade exhibits momentum or contrarian patterns. In the next section, we check these implications formally by entering all the components of a given trade for an investor group in the same regression specification simultaneously.

4.3 Volatility and Decomposed Contrarian and Momentum Trades

In the previous section, we searched the three panels of Table 4 to find out which investor groups' trades have coefficient estimates with similar signs and significance levels. By this way, we inferred the trade components that affect volatility in the same way. We now perform analyses in which all the components of the contrarian-momentum sales and purchases of an investor group enters into the same regression model simultaneously. This practice allows us to examine the trade interactions among several investor groups directly by including all possible pair-wise trade combinations of a given investor group with the remaining two investor groups in the same model. Thus, we are able to detect which component(s) of each trade of a given investor group determines the volatility effect. More specifically, we estimate the following regression model:

$$\begin{aligned}\sigma_t &= c + \beta_D D_t + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} \\ &+ \sum_{K=1}^{2} \beta_K^{NB} NB_{Kt} + \sum_{K=1}^{2} \beta_K^{D*NB} D_t * NB_{Kt} + \sum_{K=1}^{2} \beta_K^{NS} NS_{Kt} + \sum_{K=1}^{2} \beta_K^{D*NS} D_t * NS_{Kt} + \varepsilon_t\end{aligned} \tag{24}$$

Here, the subscript K changes from one to two and represents the trading counterparts of a given investor group. For instance, given that we want to decompose the momentum and contrarian trades of individual investors, then *K* will denote institutional and foreign investors and etc. All other variables are as defined previously.

Table 5 presents the estimation results of Eq. (24). Again, we focus on the results of the large sized portfolio. We first analyze the trade components of individual investors and report the results in Panel A. The trades of individual investors that are to be decomposed are CS_{IND}, MS_{IND}, CB_{IND}, and MB_{IND}. When we focus on CS_{IND} part of individual sale that is decomposed into MB_{INST} and MB_{FORG} in the presence of all possible trade components in the regression model, we observe that MB_{INST} has a negative slope ($\beta_{INST}^{NB} + \beta_{INST}^{D*NB}$ = -0.0006) while MB_{FORG} has a positive one ($\beta_{FORG}^{NB} + \beta_{FORG}^{D*NB}$=0.0009). These findings confirm the positive correlation between the volatility effects of CS_{IND} and MB_{FORG} and negative association between CS_{IND} and MB_{INST} in Table 4 of the previous section. Then, we move on decomposition of MS_{IND} into CB_{INST} and CB_{FORG}. We find that CB_{INST} has a negative significant coefficient estimate (β_{INST}^{NB} = -0.0019) and CB_{FORG} has no significant coefficient estimate, again supporting the result of the previous section that opposing trades of MS_{IND} and CB_{INST} affect volatility in the same direction.

Next, we proceed with analyzing the purchases of individual investors. We start with examining the components of CB_{IND}. The MS_{INST} component of this trade has a negative significant slope which is a result also obtained for MS_{INST} in Panel B of Table 4. We do not document a significant slope for the other component, MS_{FORG}, in Panel A of Table 5, which is also the case for this component as observed Panel C of Table 4. Finally, we examine MB_{IND} as the last part of individual purchase. While the CS_{INST} component of this trade has a negative significant impact ($\beta_{INST}^{NS} + \beta_{INST}^{D*NS}$ = -0.0010), CS_{FORG} component has a positive significant effect ($\beta_{FORG}^{NS} + \beta_{FORG}^{D*NS}$ = 0.0013). Again, these results are consistent with the coefficient estimate of CS_{INST} documented in Panel B of Table 4, and with that of CS_{FORG} in Panel C of Table 4.

< Insert Table 5 about here >

We go on with the analysis of the trade components of institutional investors in Panel B of Table 5. The results for the large sized portfolio show that MB_{IND} component of CS_{INST}, CB_{IND} component of MS_{INST}, and MS_{IND} component of CB_{INST} all have a negative significant coefficient estimate. CS_{IND} component of MB_{INST} has a negative insignificant coefficient estimate. These findings show that the negative volatility effect of institutional trading documented in Panel B of Table 4 arise when institutional investors trade against individual investors. Furthermore, it is evident in the same panel that MB_{FORG} component of CS_{INST}, CB_{FORG} component of MS_{INST}, MS_{FORG} component of CB_{INST} and CS_{FORG} component of MB_{INST} either have a positive insignificant or a positive significant impact. These results are similar to the results obtained from the analysis of the coefficient estimates reported in different panels of Table 4.

Finally, we turn our attention to the trades of foreign investors in Panel C of Table 5. We only focus on CS_{FORG} and MB_{FORG} which are documented to have significant impact on volatility. We exclude MS_{FORG} and CB_{FORG} from the analysis because they don't significantly affect volatility for the large sized portfolio as it is evident in Panel C of Table 4. We find insignificant coefficient estimates for the components of CS_{FORG}, supporting our argument in the previous section that the effects of MB_{IND} and MB_{INST} as components of CS_{FORG} are not the major effects and are dominated by their other effects arising from the trades between individual and institutional investors. When we analyze the components of MB_{FORG} having a positive coefficient estimate, we observe that only the CS_{IND} component has a positive coefficient estimate, though it is insignificant. This result is also in line with the findings reported in Panel A of Table 4.

In summary, the results in Table 5 which confirms the ones in Table 4 show that i) CS_{IND} against MB_{INST}, ii) MS_{IND} against CB_{INST}, iii) CB_{IND} against MS_{INST} and iv) MB_{IND} against CS_{INST} have a stabilizing effect on the volatility regardless of whether the trade is a momentum or a contrarian trade. Although foreign momentum and contrarian trades have non-negative coefficient estimates as depicted in Panel C of Table 4, the coefficient estimates for their components are mostly negative as can be seen in Panel C of Table 5. As the components of foreign trade are also the partial components of institutional and individual trades, these results show that components of foreign trade act as the influence channels for the transmission of the volatility effect between individual and institutional investors.

It is noteworthy that only trades that lead to a decrease in volatility are the ones between individual and institutional investors. So, we conclude that it is not the trading style that drives the negative volatility effect but it is whether the trade is taking place between individual and institutional investors. Theoretical discussion and empirical evidence suggests that informed trading reduces volatility. As institutional investors are more sophisticated investors with resources to access information and individual investors trade on impulse rather than information, we conclude that informed trading of institutional investors against uninformed trading of individual investors decreases the volatility. The more institutional investors trade large stocks, a correlation between informed trading and the trading of the portfolio of large sized stocks emerges.

4.4 Volatility and Trading by Investor Groups during the Crisis Period

Crisis periods are exceptional periods with increased uncertainty. These periods are characterized by high volatility (Umutlu et al., 2013). Investors can change their usual trading patterns during these periods. If this is the case, the association between trading and volatility during the crisis period can exhibit different patterns. The credit crisis that started in 2007 had its origins in the United States but spread to other countries quickly and became a global crisis. The global crisis had a relatively limited impact on Asia as compared the severe impact of the Asian crisis in 1997 (Park et al. 2013). Without exception, Republic of Korea performed better during the global crisis than it did during the Asian crisis. Although the Global crisis and the Asian crisis had their unique dynamics, they share some common features as well. Both crises are characterized by the sudden outflow of foreign capital. During the global crisis, western financial institutions withdrew their funds to repair their deteriorated balance sheets at their countries where the impact of the crisis is much severe. Therefore it is of interest to examine how the correlation between net sales-purchases of investor groups, and especially those of foreign investors, and the volatility evolve during the global crisis period. To examine this issue, we run the regression Eq. (19) for the crisis period of 01.07.2007-31.12.2010 separately and report the results in Table 6.

< Insert Table 6 about here >

The results for individual investors show that NS_{IND} and NB_{IND} have a negative significant impact on the volatility during the crisis period (see Panel A of Table 6) for large stocks which is also the case for the full sample period (See Panel A of Table 2). On the institutional investor's side, NS_{INST} and NB_{INST} also preserve their negative significant association with the volatility for the crisis period as well (See Panel B of Table 6). So, the negative link between the volatility and net trading of individual and institutional investors remains the same during the crisis period. The main difference between Table 6 and Table 2 is the effect of foreign investors' net sales on the volatility. As can be seen in Panel C of Table 6,

NS_{FORG} has an insignificant coefficient estimate during the crisis period. Panel C of Table 2 shows that, it has a significant destabilizing effect for the full sample period. On the contrary to the argument that foreign investors cause instability in domestic stock markets by exiting from these markets quickly when unfavorable market conditions arise, we find that foreign investors did not destabilize Korean Stock Market during the Global Crisis period. This finding is consistent with that of Choe et al. (1999) who provided no evidence that trades by foreign investors had a destabilizing effect on Korean stock market during the Asian crisis in 1997.

< Insert Table 7 about here >

Our next focal point is to determine whether a possible change in trading styles of investor groups during the crisis period can change the volatility effects. For this purpose, we run the regression Eq. (23) for the crisis period and document the results in Table 7. The results for the large stock portfolio of individual and institutional investors in Panels A and B of Table 7 are very similar to those in Panel A and B of Table 4 except for two minor differences. Different from the insignificant coefficient estimate for the full sample period, we observe a negative significant coefficient estimate for CS_{IND} during the crisis period. And the negative significant slope of CB_{INST} for the full sample period turns out to be positive and insignificant during the crisis period. Apart from these minor differences, our main result that the negative volatility effect stems from the trading between individual and institutional investors regardless of whether a trade is a contrarian or a momentum trade still holds for the crisis period.

The findings for foreign investors during the crisis period are less uniform. Panel C of Table 7 shows that the coefficient estimates of CS_{FORG} and MB_{FORG} change sign. CS_{FORG} no longer has a positive significant impact on volatility while MB_{FORG} now has a decreasing impact. Although we observe some slight changes in the way the trading style of foreign investors affect volatility, the net effect of combined momentum and contrarian trades is immaterial as we observe insignificant results for the net sales and purchases of foreign investors in Panel C of Table 6. More importantly, we do not detect any systematic differences between the impacts of momentum and contrarian trades on volatility which was also the case for the full sample period.

In summary, both the net purchases-sales and the contrarian-momentum trades of individual and institutional investors during the crisis period affect the volatility almost in the same way as they do during the full sample period. A flat relation between volatility and net purchases of foreign investors documented for the full sample period also holds for the crisis period. However, unlike the result of a positive relation between the volatility and net sale of foreign investors for the full sample period, the results obtained for the crisis period indicate that there is no relation between the volatility and the net sales of foreign investors. This is consistent with the result of Choe et al. (1999) which indicates that foreign investors do not have a destabilizing effect on the Korean Stock Market during the Asian crisis. Thus, the feared boosting impact of foreign investors' trades especially during the crisis period is not a concern for the Korean Stock Exchange.

5. Robustness Tests

So far, we have dealt with many different versions and components of the independent variables. We now shift our attention to the dependent variable and check whether our results are sensitive to the alternative measures of volatility. We employ two other different definitions of volatility in our robustness tests.

5.1. Realized Volatility and Trading by Investor Groups

We use historical data to estimate volatility and measure daily realized volatility as the square root of the sum of the squared daily returns over the prior twenty four trading days.[13] We rerun Eqns. (19) and (23) with the realized volatility as the dependent variable. Estimation results for Eqn. (19) are presented in Table 8. In line with the findings from the analyses with the GARCH volatility of the previous section, we consistently provide evidence in Panels A and B of Table 8 that net sales and net purchases of both individual and institutional investors have a stabilizing impact on volatility for the large-sized portfolio. These findings support our argument that individual and institutional investors trading against each other create a negative volatility impact. Net sales and purchases of foreign investors have positive but insignificant coefficient estimates as can be seen in Panel C of Table 8. Again, these findings are consistent with the positive coefficient estimates presented in Panel C of Table 2. The only difference is that β^{NS}_{FORG} is significant in Table2.

< Insert Table 8 about here >

The estimates of Eq. (23) with the realized volatility presented in Table 9 show that both contrarian and momentum trades can reduce volatility as in the case of the trades of individual and institutional investors or conversely they can give rise to a destabilizing impact as in the case of the trades of foreign investors. Thus, with an alternative measure of volatility we provide further evidence that contrarian and momentum trading can increase or decrease volatility and therefore trading style does not affect volatility in a systematic way. Moreover, we detect that the coefficient estimates of contrarian and momentum trades of individual and institutional investors have negative sign and similar significance levels, providing additional

[13] It would be interesting to measure realized volatility by using intraday returns, if intraday data were available.

evidence for our previously obtained result that individual and institutional investors are taking part at the reverse sides of a trade which produces a negative volatility effect.

< Insert Table 9 about here >

5.2. Standard Deviation of Returns and Trading by Investor Groups

As a final robustness check, we re-perform our analysis by computing volatility as the standard deviation of daily stock returns on a rolling basis with a window length of twenty four past business days. As shown in Table 10 when standard deviation of daily returns is the dependent variable, we persistently document that net sales and purchases of both individual and institutional investors produce a negative volatility effect for the large sized portfolio. Moreover, similar to the findings from the previous analyses with the realized and conditional volatilities, we report positive coefficient estimates for net sales and purchases of foreign investors. Both of the coefficient estimates are statistically insignificant just like the results obtained for realized volatility. However, the slope of net sales was significantly positive for the analyses with conditional volatility as presented in panel C of Table 2. The robustness tests employing two different measures of volatility confirm our no impact result for the net purchases of foreign investors. On the sale side of foreigners, when the positive impact on conditional volatility of their sales is combined with the no impact result of the robustness tests, we conclude that net sales of foreign investors has a non-decreasing impact on volatility.

< Insert Table 10 about here >

Analysis of trading style when volatility is calculated as the standard deviation of stock returns produces the results in Table 11. The results are similar to those presented in Tables 4 and 9 and support our result that trading style does not have a role in explaining volatility. Moreover, a detailed examination of the contrarian and momentum components of individual and institutional investors' net trades which meet with each other, reveals that the coefficient estimates for these trades have all negative signs and similar significance levels. On the other hand, contrarian and momentum trades of foreign investors have positive and insignificant coefficient estimates. Thus, we persistently provide evidence for the result that trading between individual and institutional investors generates the negative volatility effect.

< Insert Table 11 about here >

Overall, the analyses in Section 5 which employs different measures of volatility show that our main results remain unaltered and are robust to alternative definitions of volatility.

6. Conclusion

This study examines the short-run relationship between stock-return volatility and daily equity trading by employing a precise and directly observable measure of trading activity by domestic individual, domestic institutional and foreign investors on the Korean Stock Exchange. We relax the assumption of homogenous trading within a broader investor group and explore the similarities or differences in the volatility effects of trading by these three investor groups. Taking advantage of the Korean daily trading data and information on investor types, we provide new evidence on the daily short term relationship between stock-return volatility and trading by investor groups. We further examine whether some trading characteristics and styles can help explain the potential distinct volatility effects of investor groups.

We only find significant and consistent results for the portfolio of large stocks. Our results for the portfolio of large stocks (which are robust to two alternative measures of volatility and obtained under the control of a Monday dummy, volatility persistency, total volume and lagged stock returns) can be summarized as follows. Firstly, regardless of whether a net trade is a purchase or a sale, volatility decreases if this trade is taking place between individual and institutional investors.

Secondly, it is not the trading style, i.e., whether a trade is a contrarian or a momentum trade, that affects volatility but it is whether a trade is taking place between individual and institutional investors that produces a negative volatility effect. We attribute this negative volatility effect caused by the trading between individual and institutional investors to the informed trading of institutional against uninformed individual investors.

Theoretical studies suggest that informed trading pushes prices to a level set by fundamentals. Institutional investors are professionals who have relatively easy access to information with the help of deep resources of capital, human and time resources. On the other hand, individual investors are atomistic investors who generally trade on their subjective beliefs and expectations which may be based on sentiment. They may also not be able to afford the costs of acquiring information due to their limited resources. Overall, the negative volatility effect resulting from the trading between institutional and individual investors is consistent with the information-based explanation for volatility behavior. Given that our results are only valid for the portfolio of large stocks, this is also in line with the fact that informed institutional investors mostly engage in the trading of large stocks.

Our third finding concerns the impact of foreign trading on volatility. We consistently find no significant relationship between any measure of volatility and foreign net purchases.

We find a positive relation between conditional volatility and foreign net sales, but robustness test employing two different measures of volatility show that there is a positive but not significant relation. When all these findings are considered, we end up with the result that foreign trading has either an increasing impact or no significant impact on volatility, ruling out a negative relation between volatility and foreign trading. Thus, we conclude that foreign trading has a non-decreasing impact on volatility.

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Table 1: Descriptive Statistics

This table presents the cross-sectional average of some basic statistics of the KOSPI200 stocks which are calculated by using the time-series data between 01.01.2004 and 30.12.2010. *Mcap* is the market capitalization in million Won, *Shares* is the total number of million shares, *Volume* is the trading volume in million shares, *Value Traded* is the trading volume in million Won. *NS* (*NB*) stands for net sale (net buy) and is the maximum of zero or the difference between the number of shares sold (purchased) and the number of shares purchased (sold) in millions. *NS* and *NB* are defined for individual, institutional and foreign investor groups.

Panel A: Basic Daily Statistics

	Mean	Std. Dev.	Median	Min.	Max.
Mcap (in million Won)	305417	12959	302350	288020	325430
Shares (in millions)	73.84	3.79	73.10	68.65	79.80
Volume (in millions)	0.7173	0.8273	0.4792	0.0782	11.21
Value Traded (in million Won)	17946	15734	13945	1886	214590
NS_{IND}	0.0379	0.0771	0.0031	0	0.9841
NS_{INST}	0.0335	0.0927	0.0006	0	1.8861
NS_{FORG}	0.0293	0.0722	0.0003	0	1.3566
NB_{IND}	0.0376	0.0882	0.0004	0	1.4034
NB_{INST}	0.0342	0.0781	0.0015	0	1.3167
NB_{FORG}	0.0289	0.0740	0.0017	0	1.4331

Panel B: Correlation Matrix

	NS_{IND}	NS_{INST}	NS_{FORG}	NB_{IND}	NB_{INST}	NB_{FORG}
NS_{IND}	1					
NS_{INST}	-0.1142	1				
NS_{FORG}	-0.0834	-0.0220	1			
NB_{IND}	-0.1939	0.6481	0.4674	1		
NB_{INST}	0.6466	-0.1673	0.3516	-0.1051	1	
NB_{FORG}	0.4247	0.3634	-0.1499	-0.0635	-0.0413	1

Table 2: Volatility and Net Sales-Buys by Investor Groups

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{NB} NB_{Kt} + \varepsilon_t$$

Where σ_t is the conditional stock-return volatility on day t and is the square root of the conditional variance estimated from GARCH (1, 1) model. M is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and R is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group K and is the maximum of zero or the difference between the number of shares sold (purchased) and the number of shares purchased (sold) in millions. NS_K and NB_K are defined for individual, institutional and foreign investor groups. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{IND}^{NS}	β_{IND}^{NB}	$\bar{R}^2$
All	0.0012[a]	0.0000	0.0040[a]	0.0118[a]	0.0010	-0.0003	0.928
	(23.24)	(0.62)	(14.44)	(35.37)	(0.97)	(-0.32)	
P1-Small	0.0015[a]	0.0000	0.0068[a]	0.0155[a]	0.0026	-0.0002	0.911
	(27.48)	(0.23)	(12.26)	(43.20)	(1.23)	(-0.08)	
P2-Large	0.0009[a]	0.0000	0.0013[a]	0.0080[a]	-0.0005[b]	-0.0005[b]	0.945
	(15.27)	(0.97)	(25.01)	(20.14)	(-2.20)	(-2.23)	

Panel B: Institutional Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{INST}^{NS}	β_{INST}^{NB}	$\bar{R}^2$
All	0.0012[a]	0.0000	0.0042[a]	0.0116[a]	-0.0013	-0.0008	0.928
	(23.38)	(0.64)	(14.76)	(35.13)	(-1.34)	(-0.90)	
P1-Small	0.0015[a]	0.0000	0.0072[a]	0.0154[a]	-0.0018	-0.0007	0.910
	(27.54)	(0.23)	(12.67)	(43.00)	(-0.97)	(-0.43)	
P2- Large	0.0009[a]	0.0000	0.0013[a]	0.0079[a]	-0.0007[a]	-0.0008[a]	0.945
	(15.47)	(1.01)	(24.58)	(19.87)	(-3.56)	(-3.72)	

Panel C: Foreign Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{FORG}^{NS}	β_{FORG}^{NB}	$\bar{R}^2$
All	0.0012[a]	0.0000	0.0042[a]	0.0117[a]	0.0005	0.0008	0.928
	(23.36)	(0.65)	(15.80)	(35.69)	(0.52)	(0.65)	
P1-Small	0.0015[a]	0.0000	0.0071[a]	0.0155[a]	0.0004	0.0013	0.911
	(27.68)	(0.22)	(13.71)	(43.42)	(0.22)	(0.53)	
P2- Large	0.0009[a]	0.0000	0.0012[a]	0.0079[a]	0.0006[a]	0.0003	0.945
	(15.28)	(1.03)	(21.97)	(20.25)	(2.78)	(1.31)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 3: Volatility and Decomposed Net Sales-Purchases by Investor Groups

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \sum_{K=1}^{2} \beta_K^{NB} NB_{Kt} + \sum_{K=1}^{2} \beta_K^{NS} NS_{Kt} + \varepsilon_t$$

Where σ_t is the conditional stock-return volatility on day t and is the square root of the conditional variance estimated from GARCH (1, 1) model. M is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and R is the daily stock return. The subscript K changes from one to two and represents the other two investor groups trading against the given investor group. For instance, for individual investors NS_K and NB_K represents the net sale and net buy of the institutional and foreign investor groups, respectively. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors					Decomposition of NS_{IND}		Decomposition of NB_{IND}		
Portfolio	c	β_M	β_{VOL}	β_R	β_{INST}^{NB}	β_{FORG}^{NB}	β_{INST}^{NS}	β_{FORG}^{NS}	$\bar{R}^2$
All	0.0012[a]	0.0000	0.0044[a]	0.0118[a]	-0.0007	0.0019	-0.0018	0.0009	0.928
	(23.54)	(0.66)	(14.84)	(35.34)	(-0.68)	(1.39)	(-1.60)	(0.79)	
P1-Small	0.0015[a]	0.0000	0.0076[a]	0.0156[a]	-0.0006	0.0033	-0.0028	0.0010	0.911
	(27.65)	(0.23)	(12.84)	(43.24)	(-0.28)	(1.20)	(-1.23)	(0.43)	
P2-Large	0.0009[a]	0.0000	0.0013[a]	0.0080[a]	-0.0009[a]	0.0005[b]	-0.0009[a]	0.0008[a]	0.945
	(15.61)	(1.03)	(22.57)	(20.03)	(-3.18)	(2.05)	(-3.42)	(3.25)	
Panel B: Institutional Investors					Decomposition of NS_{INST}		Decomposition of NB_{INST}		
Portfolio	c	β_M	β_{VOL}	β_R	β_{IND}^{NB}	β_{FORG}^{NB}	β_{IND}^{NS}	β_{FORG}^{NS}	$\bar{R}^2$
All	0.0012[a]	0.0000	0.0043[a]	0.0118[a]	-0.0005	0.0009	0.0003	0.0011	0.928
	(23.50)	(0.64)	(14.10)	(35.38)	(-0.41)	(0.72)	(0.28)	(1.03)	
P1-Small	0.0015[a]	0.0000	0.0073[a]	0.0155[a]	0.0000	0.0011	0.0017	0.0015	0.911
	(27.62)	(0.24)	(12.03)	(43.20)	(-0.01)	(0.45)	(0.75)	(0.69)	
P2-Large	0.0009[a]	0.0000	0.0013[a]	0.0080[a]	-0.0009[a]	0.0007[b]	-0.0010[a]	0.0008[a]	0.945
	(15.57)	(1.00)	(22.79)	(20.11)	(-3.57)	(2.48)	(-3.61)	(3.08)	
Panel C: Foreign Investors					Decomposition of NS_{FORG}		Decomposition of NB_{FORG}		
Portfolio	c	β_M	β_{VOL}	β_R	β_{IND}^{NB}	β_{INST}^{NB}	β_{IND}^{NS}	β_{INST}^{NS}	$\bar{R}^2$
All	0.0012[a]	0.0000	0.0045[a]	0.0118[a]	0.0011	-0.0015	0.0011	-0.0028[b]	0.928
	(23.65)	(0.65)	(14.51)	(35.32)	(0.88)	(-1.17)	(0.73)	(-2.32)	
P1-Small	0.0015[a]	0.0000	0.0076[a]	0.0155[a]	0.0025	-0.0024	0.0025	-0.0048[b]	0.911
	(27.71)	(0.23)	(12.39)	(43.10)	(0.96)	(-0.93)	(0.87)	(-1.98)	
P2-Large	0.0009[a]	0.0000	0.0014[a]	0.0080[a]	-0.0002	-0.0006[b]	-0.0004	-0.0009[a]	0.945
	(15.74)	(1.01)	(23.57)	(20.10)	(-0.64)	(-2.46)	(-1.51)	(-3.27)	

a indicates significance at 1% level. b indicates significance at 5% level . c indicates significance at 10% level.

Table 4: Volatility and Trading Style

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_D D_t + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{D*NS} D_t * NS_{Kt}$$
$$+ \beta_K^{NB} NB_{Kt} + \beta_K^{D*NB} D_t * NB_{Kt} + \varepsilon_t$$

Where σ_t is the conditional stock-return volatility on day t and is the square root of the conditional variance estimated from GARCH (1, 1) model. D is a dummy variable that takes the value of one when stock return from day t-5 to day t-1 is positive before a transaction and zero otherwise. M is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and R is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group K. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

						CS_{IND}	MS_{IND}	CB_{IND}	MB_{IND}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	β_{IND}^{NS}	β_{IND}^{NB}	$\beta_{IND}^{NB}+\beta_{IND}^{D*NB}$	$\bar{R}^2$
All	0.0012[a]	-0.0001[a]	0.0000	0.004[a]	0.0125[a]	0.0010	0.0015	-0.0001	-0.0017	0.928
	(24.63)	(-8.74)	(0.62)	(14.27)	(36.35)	(0.77)	(0.80)	(-0.06)	(-1.19)	
P1-Small	0.0015[a]	-0.0001[a]	0.0000	0.0069[a]	0.0162[a]	0.0019	0.0045	0.0005	-0.0029	0.911
	(28.67)	(-7.09)	(0.21)	(12.13)	(43.46)	(0.72)	(1.25)	(0.18)	(-0.99)	
P2-Large	0.0009[a]	-0.0001[a]	0.0000	0.0013[a]	0.0087[a]	0.0001	-0.0016[a]	-0.0006[b]	-0.0006[c]	0.945
	(16.42)	(-7.23)	(0.99)	(24.88)	(21.28)	(0.43)	(-4.19)	(-2.32)	(-1.70)	

Panel B: Institutional Investors

						CS_{INST}	MS_{INST}	CB_{INST}	MB_{INST}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	β_{INST}^{NS}	β_{INST}^{NB}	$\beta_{INST}^{NB}+\beta_{INST}^{D*NB}$	$\bar{R}^2$
All	0.0012[a]	-0.0001[a]	0.0000	0.0043[a]	0.0123[a]	-0.0017	-0.0015	0.0043[b]	-0.0004	0.928
	(24.73)	(-8.71)	(0.64)	(14.69)	(36.11)	(-1.17)	(-1.24)	(2.05)	(-0.43)	
P1-Small	0.0015[a]	-0.000[a]	0.0000	0.0073[a]	0.0161[a]	-0.0027	-0.0024	0.0096[b]	-0.0003	0.911
	(28.63)	(-6.95)	(0.21)	(12.63)	(43.27)	(-0.95)	(-0.99)	(2.31)	(-0.17)	
P2-Large	0.0009[a]	-0.000[a]	0.0000	0.0013[a]	0.0085[a]	-0.0007[b]	-0.0006[b]	-0.0010[a]	-0.0005[c]	0.945
	(16.65)	(-7.38)	(1.02)	(24.42)	(21.00)	(-2.17)	(-2.41)	(-2.88)	(-1.72)	

Panel C: Foreign Investors

						CS_{FORG}	MS_{FORG}	CB_{FORG}	MB_{FORG}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	β_{FORG}^{NS}	β_{FORG}^{NB}	$\beta_{FORG}^{NB}+\beta_{FORG}^{D*NB}$	$\bar{R}^2$
All	0.0012[a]	-0.0001[a]	0.0000	0.0041[a]	0.0125[a]	0.0036[b]	-0.0016	0.0029	0.0001	0.928
	(24.57)	(-7.96)	(0.63)	(15.59)	(36.68)	(2.45)	(-0.75)	(1.55)	(0.06)	
P1-Small	0.0015[a]	-0.0001[a]	0.0000	0.0070[a]	0.0163[a]	0.0061[b]	-0.0035	0.0056	-0.0003	0.911
	(28.75)	(-6.48)	(0.22)	(13.51)	(43.87)	(2.10)	(-0.81)	(1.53)	(-0.09)	
P2-Large	0.0009[a]	-0.0001[a]	0.0000	0.0012[a]	0.0086[a]	0.0011[a]	0.0002	0.0001	0.0006[c]	0.945
	(16.24)	(-6.61)	(1.00)	(21.78)	(21.31)	(3.27)	(0.83)	(0.36)	(1.88)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 5: Volatility and Decomposed Contrarian-Momentum Trades

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_D D_t + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \sum_{K=1}^{2} \beta_K^{NB} NB_{Kt} + \sum_{K=1}^{2} \beta_K^{D*NB} D_t * NB_{Kt} + \sum_{K=1}^{2} \beta_K^{NS} NS_{Kt} + \sum_{K=1}^{2} \beta_K^{D*NS} D_t * NS_{Kt} + \varepsilon_t$$

Where σ_t is the conditional stock-return volatility estimated from GARCH (1, 1) model on day *t*. *D* is a dummy variable that takes the value of one when stock return from day *t*-5 to day *t*-1 is positive before a transaction and zero otherwise. *M* is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and *R* is the daily stock return. NB_K (NS_K) stands for net buy (net sale) for investor group *K*. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the small-sized portfolio, *P1*, and the large-sized portfolio, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals.

Panel A: Individual Investors

						Dec. of CS_{IND}		*Dec. of* MS_{IND}		*Dec. of* CB_{IND}		*Dec. of* MB_{IND}		
						MB_{INST}	MB_{FORG}	CB_{INST}	CB_{FORG}	MS_{INST}	MS_{FORG}	CS_{INST}	CS_{FORG}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{INST}^{NB}+\beta_{INST}^{D*NB}$	$\beta_{FORG}^{NB}+\beta_{FORG}^{D*NB}$	β_{INST}^{NB}	β_{FORG}^{NB}	β_{INST}^{NS}	β_{FORG}^{NS}	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	$\bar{R}^2$
All	0.0012[a]	-0.0001[a]	0.0000	0.0044[a]	0.0125[a]	0.0005	0.0022	0.0016	0.0041[b]	-0.0023	-0.0002	-0.0021	0.0034[b]	0.928
	(24.85)	(-8.56)	(0.67)	(14.34)	(36.32)	(0.38)	(1.04)	(0.72)	(1.96)	(-1.61)	(-0.08)	(-1.22)	(2.01)	
P1-Small	0.0016[a]	-0.0001[a]	0.0000	0.0075[a]	0.0163[a]	0.0015	0.0036	0.0042	0.0080[c]	-0.0040	-0.0008	-0.0032	0.0054	0.911
	(28.81)	(-6.86)	(0.25)	(12.38)	(43.53)	(0.61)	(0.85)	(0.96)	(1.91)	(-1.41)	(-0.18)	(-0.95)	(1.64)	
P2-Large	0.0009[a]	-0.0001[a]	0.0000	0.0013[a]	0.0086[a]	-0.0006	0.0009[b]	-0.0010[b]	0.0002	-0.0006[c]	0.0005	-0.0010[a]	0.0013[a]	0.946
	(16.63)	(-7.10)	(1.04)	(22.16)	(21.15)	(-1.47)	(2.46)	(-2.55)	(0.62)	(-1.84)	(1.32)	(-2.58)	(3.22)	

Panel B: Institutional Investors

						Dec. of CS_{INST}		*Dec. of* MS_{INST}		*Dec. of* CB_{INST}		*Dec. of* MB_{INST}		
						MB_{IND}	MB_{FORG}	CB_{IND}	CB_{FORG}	MS_{IND}	MS_{FORG}	CS_{IND}	CS_{FORG}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{IND}^{NB}+\beta_{IND}^{D*NB}$	$\beta_{FORG}^{NB}+\beta_{FORG}^{D*NB}$	β_{IND}^{NB}	β_{FORG}^{NB}	β_{IND}^{NS}	β_{FORG}^{NS}	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	$\bar{R}^2$
All	0.0012[a]	-0.0001[a]	0.0000	0.0043[a]	0.0125[a]	-0.0018	-0.0001	-0.0012	0.0023	0.0009	-0.0001	0.0007	0.0045[a]	0.928
	(24.84)	(-8.55)	(0.67)	(13.98)	(36.41)	(-1.13)	(-0.07)	(-0.77)	(1.11)	(0.46)	(-0.04)	(0.53)	(2.73)	
P1-Small	0.0016[a]	-0.0001[a]	0.0000	0.0073[a]	0.0163[a]	-0.0026	-0.0009	-0.0012	0.0035	0.0039	-0.0007	0.0020	0.0076[b]	0.911
	(28.87)	(-7.03)	(0.27)	(11.93)	(43.49)	(-0.81)	(-0.23)	(-0.41)	(0.87)	(0.99)	(-0.14)	(0.75)	(2.34)	
P2-Large	0.0009[a]	-0.0001[a]	0.0000	0.0013[a]	0.0087[a]	-0.0010[a]	0.0006[c]	-0.0011[a]	0.0010[b]	-0.0020[a]	0.0005	-0.0006	0.0013[a]	0.946
	(16.55)	(-6.91)	(1.01)	(22.75)	(21.30)	(-2.63)	(1.65)	(-3.41)	(2.47)	(-4.66)	(1.34)	(-1.52)	(3.62)	

Panel C: Foreign Investors

						Dec. of CS_{FORG}		*Dec. of MS_{FORG}*		*Dec. of CB_{FORG}*		*Dec. of MB_{FORG}*		
						MB_{IND}	MB_{INST}	CB_{IND}	CB_{INST}	MS_{IND}	MS_{INST}	CS_{IND}	CS_{INST}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta^{NB}_{IND}+\beta^{D*NB}_{IND}$	$\beta^{NB}_{INST}+\beta^{D*NB}_{INST}$	β^{NB}_{IND}	β^{NB}_{INST}	β^{NS}_{IND}	β^{NS}_{INST}	$\beta^{NS}_{IND}+\beta^{D*NS}_{IND}$	$\beta^{NS}_{INST}+\beta^{D*NS}_{INST}$	$\bar{R}^2$
All	0.0013[a]	-0.0002[a]	0.0000	0.0045[a]	0.0125[a]	0.0017	0.0009	-0.0014	0.0020	0.0005	-0.0001	-0.0007	-0.0043[b]	0.928
	(25.08)	(-8.98)	(0.67)	(14.22)	(36.38)	(0.81)	(0.53)	(-0.71)	(0.72)	(0.21)	(-0.06)	(-0.36)	(-2.09)	
P -Small	0.0016[a]	-0.0002[a]	0.0000	0.0075[a]	0.0163[a]	0.0032	0.0023	-0.0020	0.0044	0.0025	0.0000	-0.0014	-0.0075[c]	0.911
	(29.02)	(-7.30)	(0.25)	(12.15)	(43.48)	(0.79)	(0.68)	(-0.51)	(0.78)	(0.50)	(0.01)	(-0.37)	(-1.81)	
P2-Large	0.0010[a]	-0.0002[a]	0.0000	0.0014[a]	0.0087[a]	0.0001	-0.0005	-0.0008[b]	-0.0003	-0.0014[a]	-0.0003	0.0000	-0.0012[a]	0.946
	(16.84)	(-7.37)	(1.03)	(23.38)	(21.26)	(0.28)	(-1.45)	(-2.31)	(-0.74)	(-3.37)	(-0.73)	(0.11)	(-2.97)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 6: Volatility and Net Sales-Purchases by Investor Groups During the Crisis

The following daily regression model is estimated for each stock in the sample for the period between 01.07.2007 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{NB} NB_{Kt} + \varepsilon_t$$

Where NS_K (NB_K) stands for net sale (net buy) for investor group K and is the maximum of zero or the difference between the number of shares sold (purchased) and the number of shares purchased (sold) in millions. NS_K and NB_K are defined for individual, institutional and foreign investor groups. All other variables are as defined previously. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors							
Portfolio	c	β_M	β_{VOL}	β_R	β_{IND}^{NS}	β_{IND}^{NB}	$\bar{R}^2$
All	0.0011[a]	0.0001	0.0051[a]	0.0109[a]	-0.0047[a]	-0.0030[c]	0.933
	(12.88)	(1.11)	(11.07)	(19.85)	(-2.59)	(-1.66)	
P1-Small	0.0013[a]	0.0000	0.0050[a]	0.0018[a]	-0.0082[b]	-0.0029	0.909
	(15.35)	(0.63)	(6.56)	(3.09)	(-2.54)	(-0.95)	
P2-Large	0.0008[a]	0.0001	0.0008[a]	0.0025[a]	-0.0017[a]	-0.0012[a]	0.947
	(8.29)	(1.13)	(10.72)	(3.87)	(-4.91)	(-3.92)	

Panel B: Institutional Investors							
Portfolio	c	β_M	β_{VOL}	β_R	β_{INST}^{NS}	β_{INST}^{NB}	$\bar{R}^2$
All	0.0011[a]	0.0001	0.0056[a]	0.0107[a]	-0.0058[a]	-0.0038[b]	0.933
	(12.95)	(1.12)	(12.36)	(19.48)	(-2.75)	(-2.49)	
P1-Small	0.0014[a]	0.0000	0.0051[a]	0.0018[a]	-0.0060	0.0000	0.909
	(15.47)	(0.66)	(6.55)	(3.00)	(-1.58)	(-0.01)	
P2- Large	0.0008[a]	0.0001	0.0006[a]	0.0023[a]	-0.0008[b]	-0.0007[c]	0.947
	(8.31)	(1.18)	(8.40)	(3.56)	(-2.42)	(-1.88)	

Panel C: Foreign Investors							
Portfolio	c	β_M	β_{VOL}	β_R	β_{FORG}^{NS}	β_{FORG}^{NB}	$\bar{R}^2$
All	0.0011[a]	0.0001	0.0046[a]	0.0110[a]	0.0009	-0.0015	0.933
	(12.76)	(1.16)	(11.58)	(19.99)	(0.41)	(-0.50)	
P1-Small	0.0013[a]	0.0000	0.0048[a]	0.0018[a]	0.0002	-0.0124	0.909
	(15.32)	(0.66)	(6.76)	(3.08)	(0.06)	(-1.97)	
P2- Large	0.0008[a]	0.0001	0.0006[a]	0.0025[a]	0.0004	-0.0005	0.947
	(8.14)	(1.18)	(7.69)	(3.81)	(0.91)	(-1.20)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 7: Volatility and Trading Style During the Crisis

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2007 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \beta_D D_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{D*NS} D_t * NS_{Kt}$$

$$+ \beta_K^{NB} NB_{Kt} + \beta_K^{D*NB} D_t * NB_{Kt} + \varepsilon_t$$

Where σ_t is the conditional stock-return volatility on day *t* and is the square root of the conditional variance estimated from GARCH (1, 1) model. *D* is a dummy variable that takes the value of one when stock return from day *t*-5 to day *t*-1 is positive before a transaction and zero otherwise. *M* is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and *R* is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group *K*. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

						CS_{IND}	MS_{IND}	CB_{IND}	MB_{IND}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	β_{IND}^{NS}	β_{IND}^{NB}	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	$\bar{R}^2$
All	0.0012[a]	-0.0002[a]	0.0001	0.0051[a]	0.0118[a]	-0.0049[b]	-0.0059	-0.0061	-0.0022	0.933
	(13.89)	(-7.49)	(1.13)	(11.09)	(20.71)	(-2.15)	(-1.63)	(-1.61)	(-0.97)	
P1-Small	0.0014[a]	-0.0001[a]	0.0000	0.0052[a]	0.0026[a]	-0.0078[c]	-0.0077	0.0011	-0.0044	0.909
	(15.66)	(-4.06)	(0.66)	(6.69)	(4.24)	(-1.94)	(-1.28)	(0.23)	(-0.98)	
P2-Large	0.0009[a]	-0.0002[a]	0.0001	0.0008[a]	0.0034[a]	-0.0013[a]	-0.0021[a]	-0.0016[a]	-0.0009[c]	0.947
	(9.13)	(-6.27)	(1.16)	(10.84)	(5.04)	(-2.96)	(-4.07)	(-4.39)	(-1.71)	

Panel B: Institutional Investors

						CS_{INST}	MS_{INST}	CB_{INST}	MB_{INST}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	β_{INST}^{NS}	β_{INST}^{NB}	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	$\bar{R}^2$
All	0.0012[a]	-0.0002[a]	0.0001	0.0056[a]	0.0116[a]	-0.0035	-0.0072[b]	0.0010	-0.0058[a]	0.933
	(13.96)	(-7.27)	(1.13)	(12.28)	(20.40)	(-1.23)	(-2.06)	(0.29)	(-2.79)	
P1-Small	0.0014[a]	-0.0001[a]	0.0000	0.0051[a]	0.0027[a]	0.0009	-0.0062	0.0105[b]	-0.0050	0.909
	(15.80)	(-3.95)	(0.64)	(6.46)	(4.32)	(0.15)	(-1.22)	(2.25)	(-1.53)	
P2-Large	0.0009[a]	-0.0002[a]	0.0001	0.0006[a]	0.0032[a]	-0.0008	-0.0007[c]	0.0004	-0.0009[c]	0.947
	(9.05)	(-5.42)	(1.21)	(8.30)	(4.78)	(-1.21)	(-1.93)	(0.57)	(-1.95)	

Panel C: Foreign Investors

						CS_{FORG}	MS_{FORG}	CB_{FORG}	MB_{FORG}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	β_{FORG}^{NS}	β_{FORG}^{NB}	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	$\bar{R}^2$
All	0.0011[a]	-0.0002[a]	0.0001	0.0045[a]	0.0119[a]	0.0077[b]	-0.0003	0.0035	-0.0021	0.933
	(13.58)	(-6.93)	(1.17)	(11.29)	(20.96)	(2.56)	(-0.04)	(0.54)	(-0.53)	
P1-Small	0.0014[a]	-0.0001[a]	0.0000	0.0046[a]	0.0027[a]	-0.0085	0.0197[a]	-0.0036	-0.0082	0.909
	(15.75)	(-4.31)	(0.67)	(6.48)	(4.35)	(-1.60)	(2.83)	(-0.33)	(-0.98)	
P2-Large	0.0008[a]	-0.0002[a]	0.0001	0.0005[a]	0.0034[a]	-0.0001	0.0010[c]	0.0003	-0.0012[c]	0.947
	(8.78)	(-5.06)	(1.18)	(7.54)	(5.11)	(-0.20)	(1.74)	(0.52)	(-1.85)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 8: Realized Volatility and Net Sales-Buys by Investor Groups

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{NB} NB_{Kt} + \varepsilon_t$$

Where σ_t is the realized volatility on day t and measured as the square root of the sum of the squared daily returns over twenty four trading days. M is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and R is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group K and is the maximum of zero or the difference between the number of shares sold (purchased) and the number of shares purchased (sold) in millions. NS_K and NB_K are defined for individual, institutional and foreign investor groups. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{IND}^{NS}	β_{IND}^{NB}	$\bar{R}^2$
All	0.0020[a]	0.0001	0.0120[a]	0.0351[a]	0.0022	-0.0018	0.978
	(14.62)	(0.56)	(16.95)	(28.04)	(0.74)	(-0.62)	
P1-Small	0.0024[a]	0.0001	0.0194[a]	0.0441[a]	0.0064	-0.0003	0.976
	(18.55)	(0.35)	(14.05)	(36.66)	(1.06)	(-0.05)	
P2-Large	0.0016[a]	0.0001	0.0045[a]	0.0261[a]	-0.0019[b]	-0.0033[a]	0.980
	(9.65)	(0.69)	(21.11)	(16.11)	(-1.96)	(-3.85)	

Panel B: Institutional Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{INST}^{NS}	β_{INST}^{NB}	$\bar{R}^2$
All	0.0021[a]	0.0001	0.0123[a]	0.0348[a]	-0.0020	-0.0020	0.978
	(14.77)	(0.57)	(16.81)	(27.95)	(-0.77)	(-0.87)	
P1-Small	0.0025[a]	0.0001	0.0201[a]	0.0439[a]	-0.0008	-0.0008	0.976
	(18.62)	(0.34)	(14.07)	(36.59)	(-0.16)	(-0.17)	
P2- Large	0.0017[a]	0.0001	0.0044[a]	0.0257[a]	-0.0032[a]	-0.0033[a]	0.980
	(9.85)	(0.72)	(20.89)	(15.97)	(-3.92)	(-3.80)	

Panel C: Foreign Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{FORG}^{NS}	β_{FORG}^{NB}	$\bar{R}^2$
All	0.0020[a]	0.0001	0.0124[a]	0.0351[a]	0.0018	0.0000	0.978
	(14.64)	(0.58)	(18.45)	(28.42)	(0.60)	(0.01)	
P1-Small	0.0025[a]	0.0001	0.0207[a]	0.0444[a]	0.0031	-0.0006	0.976
	(18.72)	(0.35)	(15.75)	(36.99)	(0.53)	(-0.09)	
P2- Large	0.0016[a]	0.0001	0.0042[a]	0.0259[a]	0.0004	0.0006	0.980
	(9.56)	(0.73)	(19.15)	(16.27)	(0.49)	(0.65)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 9: Realized Volatility and Trading Style

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_D D_t + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{D*NS} D_t * NS_{Kt}$$

$$+ \beta_K^{NB} NB_{Kt} + \beta_K^{D*NB} D_t * NB_{Kt} + \varepsilon_t$$

Where σ_t is the realized volatility on day t and measured as the square root of the sum of the squared daily returns over twenty four trading days. D is a dummy variable that takes the value of one when stock return from day t-5 to day t-1 is positive before a transaction and zero otherwise. M is a dummy variable that takes the value of one for Mondays and zero otherwise. Volume is the trading volume and R is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group K. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

						CS_{IND}	MS_{IND}	CB_{IND}	MB_{IND}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	β_{IND}^{NS}	β_{IND}^{NB}	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	$\bar{R}^2$
All	0.0022[a]	-0.0003[a]	0.0001	0.0121[a]	0.0369[a]	0.0057	-0.0014	-0.0003	-0.0066	0.978
	(15.44)	(-5.50)	(0.56)	(16.87)	(28.35)	(1.52)	(-0.27)	(-0.09)	(-1.61)	
P1-Small	0.0027[a]	-0.0004[a]	0.0001	0.0197[a]	0.0463[a]	0.0120	0.0016	0.0025	-0.0088	0.976
	(19.34)	(-5.39)	(0.34)	(14.00)	(36.77)	(1.64)	(0.15)	(0.34)	(-1.08)	
P2-Large	0.0018[a]	-0.0003[a]	0.0001	0.0045[a]	0.0275[a]	-0.0006	-0.0043[a]	-0.0032[a]	-0.0044[a]	0.981
	(10.21)	(-3.82)	(0.71)	(20.97)	(16.36)	(-0.55)	(-2.84)	(-3.00)	(-3.43)	

Panel B: Institutional Investors

						CS_{INST}	MS_{INST}	CB_{INST}	MB_{INST}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	β_{INST}^{NS}	β_{INST}^{NB}	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	$\bar{R}^2$
All	0.0022[a]	-0.0003[a]	0.0001	0.0123[a]	0.0366[a]	-0.0038	-0.0030	0.0022	0.0013	0.978
	(15.56)	(-5.40)	(0.57)	(16.64)	(28.26)	(-0.98)	(-0.84)	(0.42)	(0.46)	
P1-Small	0.0027[a]	-0.0004[a]	0.0001	0.0201[a]	0.0461[a]	-0.0041	-0.0039	0.0069	0.0056	0.976
	(19.41)	(-5.55)	(0.34)	(13.94)	(36.71)	(-0.54)	(-0.57)	(0.67)	(1.03)	
P2-Large	0.0018[a]	-0.0003[a]	0.0001	0.0044[a]	0.0272[a]	-0.0035[a]	-0.0020[c]	-0.0025[c]	-0.0030[a]	0.981
	(10.35)	(-3.56)	(0.73)	(20.62)	(16.23)	(-2.85)	(-1.87)	(-1.83)	(-2.58)	

Panel C: Foreign Investors

						CS_{FORG}	MS_{FORG}	CB_{FORG}	MB_{FORG}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	β_{FORG}^{NS}	β_{FORG}^{NB}	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	$\bar{R}^2$
All	0.0022[a]	-0.0003[a]	0.0001	0.0123[a]	0.0370[a]	0.0097[b]	0.0015	0.0088	-0.0041	0.978
	(15.24)	(-4.72)	(0.58)	(18.14)	(28.65)	(2.25)	(0.26)	(1.57)	(-0.76)	
P1-Small	0.0026[a]	-0.0003[a]	0.0001	0.0204[a]	0.0466[a]	0.0180[b]	0.0027	0.0165	-0.0082	0.976
	(19.37)	(-5.07)	(0.36)	(15.46)	(37.14)	(2.12)	(0.24)	(1.49)	(-0.77)	
P2-Large	0.0017[a]	-0.0002[a]	0.0001	0.0042[a]	0.0273[a]	0.0013	0.0003	0.0011	0.0000	0.981
	(9.86)	(-2.94)	(0.72)	(18.86)	(16.43)	(1.03)	(0.24)	(0.77)	(0.01)	

a indicates significance at 1% level. b indicates significance at 5% level. c indicates significance at 10% level.

Table 10: Standard Deviation of Returns and Net Sales-Buys by Investor Groups

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{NB} NB_{Kt} + \varepsilon_t$$

Where σ_t is the standard deviation of daily stock returns on day t and is the square root of daily return variance calculated on a rolling basis with a window length of past twenty four trading days. M is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and R is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group K NS_K and NB_K are defined for individual, institutional and foreign investor groups. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{IND}^{NS}	β_{IND}^{NB}	$\bar{R}^2$
All	0.0004[a]	0.0000	2.4434[a]	0.0066[a]	0.5381	-0.6041	0.978
	(14.69)	(0.27)	(16.50)	(25.15)	(0.84)	(-1.00)	
P1-Small	0.0005[a]	0.0000	3.9754[a]	0.0078[a]	1.4877	-0.4606	0.975
	(18.60)	(0.1387)	(13.71)	(30.77)	(1.19)	(-0.39)	
P2-Large	0.0003[a]	0.0000	0.9114[a]	0.0055[a]	-0.4115[b]	-0.7475[a]	0.980
	(9.74)	(0.37)	(20.06)	(16.01)	(-2.02)	(-4.09)	

Panel B: Institutional Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{INST}^{NS}	β_{INST}^{NB}	$\bar{R}^2$
All	0.0004[a]	0.0000	2.5227[a]	0.0066[a]	-0.8560	-0.4691	0.978
	(14.85)	(0.28)	(16.51)	(25.04)	(-1.56)	(-0.95)	
P1-Small	0.0005[a]	0.0000	4.1382[a]	0.0077[a]	-0.8666	-0.2116	0.975
	(18.68)	(0.13)	(13.84)	(30.69)	(-0.80)	(-0.22)	
P2-Large	0.0004[a]	0.0000	0.9072[a]	0.0054[a]	-0.8454[a]	-0.7266[a]	0.980
	(9.95)	(0.39)	(20.14)	(15.88)	(-4.84)	(-3.94)	

Panel C: Foreign Investors

Portfolio	c	β_M	β_{VOL}	β_R	β_{FORG}^{NS}	β_{FORG}^{NB}	$\bar{R}^2$
All	0.0004[a]	0.0000	2.5087[a]	0.0066[a]	0.4586	-0.2877	0.978
	(14.69)	(0.30)	(17.77)	(25.49)	(0.73)	(-0.38)	
P1-Small	0.0005[a]	0.0000	4.1771[a]	0.0078[a]	0.8145	-0.6289	0.975
	(18.75)	(0.15)	(15.18)	(31.09)	(0.66)	(-0.42)	
P2-Large	0.0003[a]	0.0000	0.8403[a]	0.0054[a]	0.1027	0.0535	0.980
	(9.62)	(0.41)	(18.11)	(16.16)	(0.57)	(0.26)	

a indicates significance at 1% level. b indicates significance at 5% level . c indicates significance at 10% level.

Table 11: Standard Deviation of Returns and Trading Style

The following daily regression model is estimated for each stock in the sample for the period between 01.01.2004 and 30.12.2010:

$$\sigma_t = c + \beta_D D_t + \beta_m M_t + \sum_{j=1}^{12} \beta_j \sigma_{t-j} + \beta_{VOL} Volume_t + \beta_R R_{t-1} + \beta_K^{NS} NS_{Kt} + \beta_K^{D*NS} D_t * NS_{Kt}$$
$$+ \beta_K^{NB} NB_{Kt} + \beta_K^{D*NB} D_t * NB_{Kt} + \varepsilon_t$$

Where σ_t is the standard deviation of daily stock returns on day t and is the square root of daily return variance calculated on a rolling basis with a window length of past twenty four trading days. D is a dummy variable that takes the value of one when stock return from day t-5 to day t-1 is positive before a transaction and zero otherwise. M is a dummy variable that takes the value of one for Mondays and zero otherwise. *Volume* is the trading volume and R is the daily stock return. NS_K (NB_K) stands for net sale (net buy) for investor group K. Cross-sectional averages of coefficient estimates for individual stocks are reported in the body of the table for three portfolios: the portfolio consisting of full sample of stocks, *All*, the portfolio of small-sized stocks, *P1*, and the portfolio of large-sized stocks, *P2*. In the parentheses are the t-statistics for the mean coefficient estimates which are adjusted for cross-correlations in the residuals of the regression equation. The coefficients for the lagged volatilities are estimated but not reported.

Panel A: Individual Investors

						CS_{IND}	MS_{IND}	CB_{IND}	MB_{IND}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	β_{IND}^{NS}	β_{IND}^{NB}	$\beta_{IND}^{NS}+\beta_{IND}^{D*NS}$	$\bar{R}^2$
All	0.0005[a]	-0.0001[a]	0.0000	0.0025[a]	0.0070[a]	0.0011	0.0004	-0.0005	-0.0013	0.978
	(15.62)	(-5.39)	(0.27)	(16.40)	(25.61)	(1.36)	(0.34)	(-0.69)	(-1.48)	
P1-Small	0.0005[a]	-0.0001[a]	0.0000	0.0040[a]	0.0081[a]	0.0023	0.0015	-0.0003	-0.0017	0.975
	(19.27)	(-4.55)	(0.12)	(13.64)	(30.92)	(1.51)	(0.71)	(-0.20)	(-1.00)	
P2-Large	0.0004[a]	-0.0001[a]	0.0000	0.0009[a]	0.0058[a]	-0.0002	-0.0008[b]	-0.0008[a]	-0.0009[a]	0.980
	(10.56)	(-4.35)	(0.37)	(20.04)	(16.47)	(-0.76)	(-2.45)	(-3.40)	(-3.12)	

Panel B: Institutional Investors

						CS_{INST}	MS_{INST}	CB_{INST}	MB_{INST}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	β_{INST}^{NS}	β_{INST}^{NB}	$\beta_{INST}^{NS}+\beta_{INST}^{D*NS}$	$\bar{R}^2$
All	0.0005[a]	-0.0001[a]	0.0000	0.0025[a]	0.0069[a]	-0.0013	-0.0010	0.0010	-0.0001	0.978
	(15.70)	(-5.17)	(0.29)	(16.41)	(25.53)	(-1.62)	(-1.35)	(0.90)	(-0.20)	
P1-Small	0.0005[a]	-0.0001[a]	0.0000	0.0042[a]	0.0081[a]	-0.0017	-0.0014	0.0024	0.0004	0.975
	(19.29)	(-4.50)	(0.13)	(13.78)	(30.85)	(-1.10)	(-0.98)	(1.12)	(0.38)	
P2-Large	0.0004[a]	-0.0001[a]	0.0000	0.0009[a]	0.0057[a]	-0.0009[a]	-0.0006[b]	-0.0004	-0.0007[a]	0.980
	(10.68)	(-4.08)	(0.40)	(19.92)	(16.37)	(-3.40)	(-2.53)	(-1.57)	(-2.73)	

Panel C: Foreign Investors

						CS_{FORG}	MS_{FORG}	CB_{FORG}	MB_{FORG}	
Portfolio	c	β_D	β_M	β_{VOL}	β_R	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	β_{FORG}^{NS}	β_{FORG}^{NB}	$\beta_{FORG}^{NS}+\beta_{FORG}^{D*NS}$	$\bar{R}^2$
All	0.0005[a]	-0.0001[a]	0.0000	0.0025[a]	0.0070[a]	0.0020[b]	0.0004	0.0021[c]	-0.0011	0.978
	(15.40)	(-4.74)	(0.30)	(17.56)	(25.88)	(2.26)	(0.37)	(1.83)	(-0.99)	
P1-Small	0.0005[a]	-0.0001[a]	0.0000	0.0041[a]	0.0082[a]	0.0037[b]	0.0009	0.0040	-0.0021	0.975
	(19.32)	(-4.41)	(0.15)	(14.98)	(31.26)	(2.09)	(0.36)	(1.74)	(-0.96)	
P2-Large	0.0004[a]	-0.0001[a]	0.0000	0.0008[a]	0.0058[a]	0.0004	0.0000	0.0002	-0.0001	0.980
	(10.17)	(-3.50)	(0.40)	(17.98)	(16.55)	(1.35)	(0.17)	(0.81)	(-0.30)	

a indicates significance at 1% level. b indicates significance at 5% level . c indicates significance at 10% level.