Dynamic Interaction among
Mutual Fund Flows, Stock Market Return and Volatility

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Abstract:

This study has examined the dynamic interaction between mutual fund flows and security returns and between mutual fund flows and volatility. The results based on the contemporaneous relationship using daily data suggest that a positive relationship exist between stock market returns and mutual fund flows measured as stock purchases and sales. This positive concurrent relationship continues to exist even after controlling for volume. The analysis of causal relationship between mutual fund flows and market returns show that mutual fund out flows (sales) are significantly affected by return in the equity market, however, the latter is not significantly influenced by variation in these flows which suggests negative feedback trading behavior in the Indian market.

The results show that a strong positive relationship exists between stock market volatility and mutual fund flows measured as stock purchases and sales. This positive concurrent relationship continues to exist even after controlling for volume. The analysis on the direction of relationship between volatility and mutual fund flows using the VAR approach suggests that market volatility is positively related to lag flow, and that shock in flow has a positive impact on market volatility. The results provide evidence that the relationship is stable even after including these exogenous variables such as volume and market fundamental variables such exchange rates, dividend and short term interest rates in the model. Increase in the aggregate inflows and outflows are associated with more volatile market.

Introduction

The cash flows into mutual funds have generally been strongly correlated with market returns and this relationship reflects the momentum trading or feedback trading hypothesis (Davidson and Dutia (1989), Delong *et al.* (1990), Hendricks *et al*. (1993), Warther (1995), and Zheng (1999)). The hypothesis suggests that a shock to security returns leads to a change in mutual inflows, which in turn leads to a further change in security returns. It is often stated that mutual fund flows cause security returns to rise and fall and one possible reason attributed for this is the "price pressure hypothesis" (Harris *et al*. 1986; Shleifer, 1986). Price pressure theory suggests that increased inflows into equity mutual funds stimulate a greater demand by individuals to hold stock, and this causes share prices to increase while the "information revelation" hypothesis (Lee *et al.*, (1991) and Warther, (1995)) suggests that if mutual fund investors possess information or if they trade in the same direction as another group of investors who possess information, then their trades will reveal or be associated with new information. Under this scenario, if mutual fund investors are well informed their trades will be a signal to buy stocks and the market in this case will not be responding to fund flows because of price pressure, but rather react efficiently to new information. However, if mutual fund investors are unsophisticated and have a poor track record (noise traders), then the signal would be to sell stocks.

Though, mutual fund flows and stock returns have a high positive correlation as cited in literature, it does not necessarily mean that the former causes the latter and vice versa. Potter (1996) in his study used Granger causality tests to examine the lead–lag relationship between returns and fund flows for several categories of equity funds. The results show the evidence that security returns are useful to predict flows into aggressive growth funds but not into income funds. Some studies (Warther (1995), Remelona *et al.* (1997)) have failed to find evidence that mutual fund flows are affected by lagged security prices and security prices in one period are affected by mutual fund flows in previous periods. Some recent studies (Fortune (1998), Christos *et al.* (2005), Natalie and Parwada (2007) show that feedback exists, i.e.,security returns do affect future fund flows, and some fund flows do affect future security returns. However, it has also been found that fundamentals of firm influences fund flows than the stock returns (Cha and Lee (2001)) and stock volatility influences flow of funds (Goetzmann and Massa (2003)). Overall, the evidence on causal relationship between stock returns and mutual fund flows is mixed and there is need for a model which reveals the interaction among stock returns stock volatility and flow of funds controlling for market fundamentals. Moreover, most of the studies (Warther (1995), Fortune (1998), Mosebach and Najand (1999) etc) have used monthly data to test the causality. A few studies (Edelen and Warner (2001)) have used daily data but for a short period of time i.e. one and half year. The use of daily data and that too for a longer period is of paramount importance for the results to be more informative to investor's.

Hence, this study distinguishes itself from prior work in several ways. Firstly, the study extends earlier studies by placing additional emphasis on role of market fundamentals and risk in examining the relationship between the mutual fund flows and stock market returns. Secondly, the study considers daily data for the mutual fund flows and stock market index. Thirdly, the study focuses on the Indian capital market, namely the National Stock Exchange (NSE), where the interaction between mutual funds flows and security returns is intense and the actions of the institutional investors have significant effect both on the behavior of the investors and on the prices of the securities listed in the NSE.

Thus, the overall objective is to examine whether the information on mutual fund flows can be used to predict the changes in market returns and volatility. Moreover, this study will also enhance the understanding of the dynamics in Indian markets by analyzing the contemporaneous and causal relationships between market returns and mutual fund flows and between market volatility and mutual fund flows. Specifically the major focus of this study is to examine the contemporaneous and causal relationship between: (1). Mutual fund flows and market returns, (2). Mutual fund flows and market returns in presence of control variables i.e. trading volume and in presence of market fundamentals (3). Mutual fund flows and market return volatility and (4). Mutual fund flows and market return volatility in presence of control variables i.e. trading volume and in presence of market fundamentals

The remaining portion of this paper is organized as follows. Section 2 summarizes the findings from literature. The data, sample period and the methodology used for examining the interaction among mutual fund flows, market returns and market volatility is explained in section 3. The empirical results of the study are discussed in section 4. Finally, section 5 summarizes the findings and brings out the implications of the study.

2. Literature review:

Previous studies that have examined the relationship between mutual fund flows and stock market returns have focused on the developed stock markets i.e. the US market. Warther (1995) pioneered the study of security returns and aggregate mutual fund cash flows. He examined the correlation between net inflows and security returns using monthly data for the period January 1984–June 1993. The net money inflows were decomposed into expected and unexpected components. Expected fund flows were estimated by regressing current flows on past flows, and unexpected fund flows were derived as the residual from the expected flow regression. The results provide the evidence that aggregate security returns are highly correlated with concurrent unexpected cash flows into mutual funds but unrelated to concurrent expected flows. His result supports the popular belief that fund inflows and returns are positively related. However, the results reject both sides of a feedback trading model, which means that security returns neither lag nor lead mutual fund flows.

Remelona *et al.,* (1997) used a similar methodology to Warther's (1995) to examine the effects of market returns on aggregate fund flows. However, the study improves upon the work of Warther (1995) in several ways. First of all, they included returns on other securities not held by the fund, as well as own returns, as determinants of unexpected flows. Further, their regression of unexpected flows into a mutual fund group on own returns and other returns was estimated using Instrumental Variables rather than Ordinary Least Squares. The result shows that unexpected equity fund flows were not affected by either contemporaneous or lagged stock returns, while the bond fund flows were affected by contemporaneous bond returns, but not by lagged bond returns.

However, the fact that fund flows and returns have a high positive correlation does not necessarily mean that the former causes the latter and vice versa. Potter (1996) used Granger causality tests to investigate the lead–lag relationship between returns and fund flows for several categories of equity funds. The result provides the evidence that stock returns can be used to predict the flows into aggressive growth funds, but the same does not apply in the case of income funds. Moreover, the result also rejects the hypothesis that the fund flows in the four fund groups lead the security returns.

Fortune (1998) used VAR models with seven variables and monthly data for the period January 1984 through December 1996 to examine the relationship between fund flows and returns. The result provided evidence of positive correlation between fund flows and contemporaneous returns. However, the results show that feedback do exists. Security returns do affect future fund flows and some fund flows do affect future security returns. Overall, the evidence on causal relationship between stock returns and mutual fund flows is mixed. The results of Fortune (1998) are in strong contrast with the conclusions of Warther, Potter, and Remelona *et al.* that flows do not appear to be affected by past security returns.

Potter and Schneeweis (1998) in their study made an attempt to investigate the factors which affect aggregate mutual fund flows. They found competing investment classes to be economically and statistically significant explainers of aggregate mutual fund flows. The results also show that factors impacting flows to riskier groups differ from the factors determining flows to less risky categories among equity sub-categories. Moreover, the empirical results provide the evidence that security returns are useful in predicting flows into aggressive growth funds and growth funds. However, the results reject the hypothesis that equity fund flows lead security returns.

Edwards and Zhang (1998) employed Granger causality test and instrumental variable analysis to examine the relationship between aggregate monthly mutual fund flows and stock and bond monthly returns. The result shows that with one exception, flows into stock and bond funds do not affect either stock or bond returns. However, the magnitude of flows into both stock and bond funds are significantly affected by stock and bond returns.

Mosebach and Najand (1999) applied Engle and Granger error correction model, followed by a state space procedure to examine the long run equilibrium relation between the net flow of funds into equity mutual funds and the S&P 500 index using monthly data from January 1984 to July 1998. The results provide evidence of causal relation between the net inflow of funds and the stock market. The result shows that the net flow of funds invested in the stock market is influenced by the level of the stock market in the previous month. The result also shows that a current strong equity market encourages more investment in the market. This implies that the causality between the level of the stock market and flow of funds into the market is bi-directional.

Edelen and Warner (2001) examined the relation between stock market returns and aggregate flows into US equity mutual funds using high frequency daily data for the period 2 February 1998–30 June 1999. Their major findings are as follows. First, aggregate mutual fund flow is correlated with concurrent market returns at a daily frequency. This concurrent relation suggests that funds flow and institutional trading affect returns. Second, the results provide limited empirical evidence that mutual fund flow causes security prices to rise and fall (Warther (1995)).Third, the results also find a very strong association between funds flow and the previous days return. This association indicates funds flow reacting to returns or to the information driving returns mainly with a one-day lag, but that investors generally require an overnight period to react.

Papadamou and Siriopoulos (2002) used similar methodology to Warther's (1995) to examine the effect of market returns on aggregate fund flows using monthly data from the Greek equity mutual fund investing spanning January 1998 to March 2002. The result shows that there is small positive concurrent relation between unexpected net flows and market returns, which the author attributed to information revelation. The results also suggest some evidence that mutual fund flows cause prices to raise and to fall. The author finally concludes that there is low correlation between fund flows and returns.

Goetzmann and Massa (2003) examined the relationship between daily index fund flows and asset prices. The results indicate a strong contemporaneous correlation between fund inflows and S&P market returns. The other objective of the study was to examine shocks to prices originated by demand flows into index funds (typically "liquidity trading" types of shocks). The results provide the evidence that the market reacts to daily demand, while only negative reactions appear due to past returns, and that the investors' behavior appears to be mainly motivated by risk aversion instead of return.

Alexakis *et al.* (2005) examined the interaction between mutual fund flows and stock returns in Greece. The statistical evidence derived from the error correction model indicates that there is bidirectional causality between mutual fund flows and stock returns and cointegration results show that mutual funds flow cause stock returns to rise or fall. Thus, inflows and outflows of cash in equity funds seem to cause higher and lower stock returns in Greek stock market.

Oh and Parwada (2007) analysed relations between stock market returns and mutual fund flows in Korea. The results show that there is significant positive correlation between returns and both purchases and sales but a significant negative correlation is observed in the case of net flows. Tests on the direction of causality suggest that it is predominantly returns that contain information on flows, although flows measured as stock purchases may also contain information about returns.

Thus, the review of literature shows that the theoretical literature has suggested several alternative motivations for the trading behavior of mutual funds. The earlier literature tried to address the following fundamental questions: (1) Is institutional trading related to changes in stock prices? (2) Does institutional trading "cause" stock returns or do institutions simply follow movements in stock prices? Most of the studies (Warther (1995), Potter (1996), and Remelona *et al.* (1997), Potter and Schneeweis (1998)) show that fund flows do not appear to be affected by past security returns. Some studies (Mosebach and Najand (1999), Alexakis *et al.* (2005) provide evidence of bi-directional causality between mutual fund flows and stock returns, few studies (Edelen and Warner (2001), Papadamou and Siriopoulos (2002) have shown limited evidence of mutual fund causing stock market to rise and fall. The empirical results on the dynamic relation between mutual fund trading and stock returns are also mixed.

The key problems associated with the previous studies are as follows. First, most of the previous empirical studies have focused primarily on the contemporaneous relation between stock returns and mutual fund flows. The error distribution of the returns series does not exhibit constant variance. The assumption of constant variance over a time period for the return series is not appropriate. Engle and Patton (2001) in his study described the three stylized facts about volatility. First, volatility exhibits persistence. Periods of high and low volatility tend to be clustered. Second, volatility tends to be mean reverting. In other words, there is a normal level of volatility to which volatility eventually returns. Third, innovations may have an asymmetric impact on volatility – positive deviations from the mean have more (or less) of an impact on volatility than negative deviations. There is a need to examine the contemporaneous relationship between mutual fund flows and stock returns after taking heteroscedasticity into account. ARCH/GARCH class of model incorporates heteroscedasticity in a sensible way and they can be extended to include other effects on conditional variance.

Second, most have the studies have examined the contemporaneous or dynamic relationship between returns and mutual fund flows. They have not included volatility in the analysis along with returns and mutual fund flows. It is possible that the dynamic relationship between market return and mutual fund flows may be affected by volatility effects associated with information flow and in part because volatility is a key ingredient of the risk-return tradeoff that permeates modern financial theories (Lee and Rui (2002)). In the last decade, volatility in the stock market has received considerable attention from investors, regulators and academicians and is especially closely monitored by derivatives traders since the derivative contracts is dependent upon the volatility of the underlying asset. Does mutual fund flows affect market volatility? If so, what is the direction of the relationship between mutual fund flows and market volatility? Warther (1998) in his study asks the similar question, whether mutual fund flows have any impact on the market stability, but he does not indicate any empirical evidence on mutual fund flows and volatility relationship. The empirical evidence about the relationship between market volatility and mutual fund flows seems to be absent.

Third, most of the studies (Karpoff (1987), Gallant *et al*. (1992), Blume *et al.* (1994)) on volume and price changes have provided the evidence of positive relationship between volume and price change. However, Elden (1999) indicated the positive relation between gross flow and trading volume. Hence, if mutual fund flows is viewed as replacement of trading volume, then the relationship between mutual fund flows and return and mutual fund flows and volatility would lead to similar results because of the outcome of the trading volume and price change relation. Therefore, there is need to examine the relationship between returns and fund flows and volatility and fund flows after controlling for trading volume. Earlier studies have not included control variable i.e. trading volume while examining the relationship between mutual fund flows and stock market returns.

Moreover, most of the studies in this area have been carried in the well-developed financial markets, usually the U.S. markets. As Khorana *et al.* (2005) point out, there has been relatively little research performed on mutual funds outside the U.S. When compared to developed markets, emerging markets are considerably smaller and less liquid. This dearth of liquidity can play an important role in determining the relationship between stock returns and mutual fund flows; it can potentially alter the previous findings for the developed markets. Nowadays, many international investment bankers and brokerage firms have major stakes in overseas markets. Harvey (1995) found emerging market returns are more likely to be influenced by local information than developed markets; in fact, emerging market returns are generally more predictable than developed market returns. Indian stock markets have received relatively little attention until recently. Now there is more interest and research on Indian market data due to the country's rapid growth and potential opportunities for investors. Since the establishment of National Stock Exchange (NSE), the financial markets in this Asian country have attracted considerable global investments. National Stock Exchange of India Limited, started in 1994 and within a short span of 1 year became the largest exchange in India in terms of volumes transacted. Trading volumes in the equity segment have grown rapidly with average daily turnover increasing from Rs.17 crores during 1994-95 to Rs.6,253 crores during 2005-06.

In India, the 1990s have seen unprecedented growth in mutual funds. Before liberalization (1991-1992) the size of mutual fund industry was just Rs.1, 000 crores. It rose to Rs. 4,100 crores in 1991, and subsequently touched a new height of Rs. 72,000 crore in year 1998. Since then, total assets under management has been increasing exponentially and thus revealing the efficiency of growth in the mutual fund industry in India. The total assets under management of Mutual Fund industry rose by 9.45% from Rs.309953.04 crores to 339232.46 crores in November, 2006 as published by Association of Mutual Funds of India (AMFI). The Indian mutual funds industry has been growing at a very healthy pace of 16.68 per cent for the past eight years and it is expected that the trend will continue. Thus, with the Indian stock markets rallying to newer heights, mutual funds in India are also rallying in terms of total assets under management in the tune with the market.

Given this background, the present study overcomes the drawback identified in the earlier study by examining the contemporaneous as well as the dynamic (causal) relation between mutual fund flows and return. The study also examines the contemporaneous as well as the dynamic (causal) relations between mutual fund flows and volatility of the S&P CNX Nifty Index of the National Stock Exchange of India.

This study improves upon previous studies in several aspects. First, the study examines the relationship between return and mutual fund flows in emerging markets like India after taking heteroscedasticity into account. Here, the variance is 'conditioned' on prior error terms, thus it allows the variance to change over time. Most of the former studies (Warther (1995), Potter (1996), and Remelona *et al.* (1997), Edwards and Zhang (1998), Potter and Schneeweis (1998), Papadamou and Siriopoulos (2002), Mosebach and

Najand (1999)) used monthly data, to examine the relationship between mutual fund flows and stock returns. Using the daily data of S&P CNX Nifty Index, the study examines contemporaneous and causal relations not only between mutual fund flows and market returns but also between mutual fund flows and volatility of returns. Second, important point that distinguishes this study from the existing literature is methodology adopted to investigate the dynamic relationship between variables of interest. The study examines the dynamic relationship between returns and mutual fund flows and volatility and mutual fund flows using the Vector Autoregression (VAR) model. Moreover, the study utilizes the exponential generalized autoregressive conditional heteroscedasticity (EGARCH) model to measure return volatility. The proposed EGARCH model accounts for the time varying volatility process with asymmetric responses to both positive and negative price changes. The study also uses a control variable i.e. trading volume to check whether the contemporaneous and causal relationship is still significant after controlling for trading volume. As an improvement on the linear causality tests and to analyze whether mutual fund flows affect market returns and volatility in the presence of market fundamentals, tests for the effect of mutual fund flows in the presence of variables such as dividends, exchange rates and the interest rate is also been performed in the spirit of Cha and Lee (2001). The usefulness of including market fundamentals lies in the fact that, should causality in this context only be in the direction of stock returns to flows, and not otherwise, then this would prove that it is only market returns that drive mutual fund flows. Thus, this study differs significantly, for it use of appropriate econometric techniques, the uses of control variables and daily data for the emerging market of India, where the interaction between mutual funds flows and security returns is intense and the actions of the institutional investors (either right or wrong) have a wide effect both on the behavior of the less informed investors and on the prices of the securities of the National Stock Exchange of India Limited.

3. Data and Methodology

The data set comprises daily market index of S&P CNX Nifty Index of National Stock Exchange of India Limited. The series span the period from 1st January 2001 to 20th April 2008. The daily stock index returns are continuously compounded rate of return, computed as the first difference of the natural logarithm of the daily stock index value. Given the price level $P_1, P_2, \ldots, P_t$, the return at time t is formed by: $R_t = \ln(P_t/P_{t-1})$.

In any given day, the mutual fund flows in stock market can be aggregated and summarized into two basic measures: sale and purchase, and a corresponding overall measure of net (total purchase – total sales). Hence, this study uses three mutual fund variables namely standardized purchase flow denoted as MFP; standardized sales flow denoted as MFS; standardized net flow denoted as MFN computed as the difference between total purchases and total sales volumes. All flows (Sales, Purchases and Net) are normalized by the trailing 90-day moving average of the S&P CNX Nifty market capitalization to control for market and fund growth as per Warther (1995) and Oh and Parwada (2005). The sampling period is from 4th February 2000 to 20th April 2007.

In order to study the relationship between mutual fund flows and volatility, the daily market volatility estimate is needed. Volatility is unobservable, hence in this study, the conditional return variance (volatility) of the S&P CNX Nifty Index is estimated using the EGARCH (1,1) model proposed by Nelson (1991). The EGARCH model accounts for the time varying volatility process with asymmetric responses to both positive and negative price changes.

The vector autoregression (VAR) model for causality tests assumes that the time series under investigation are stationary. In order to test the stationarity of the market returns, mutual fund purchase, mutual fund sales, mutual fund net, dividend, exchange rate and MIBOR, the study employs Augmented Dickey and Fuller (ADF) test and the Phillip and Perrons (PP) test.

a) Augmented Dickey-Fuller Regression

$$\Delta Y(t) = \rho_0 + \rho Y(t-1) + \sum_{i=1}^{m} \Delta Y(t-i) + \varepsilon_t \qquad (1)$$

b) Phillips-Perron Regression

$$Yt = \alpha_0 + \alpha Y(t-1) + \upsilon_t \qquad (2)$$

The difference between the two unit root tests lies in their treatment of any "nuisance" serial correlation. The PP test tends to be more robust to a wide range of serial correlation and time dependent heteroscedasticity (Lee and Rui (2002)). The testing for stationarity is formulated in the statistical hypothesis testing framework as a test of the null hypothesis H0: Series is non-stationary, against the alternative H1: Series is stationary.

Methodology for examining Contemporaneous Relationship

The error distribution of the stock returns series does not exhibit constant variance. The assumption of constant variance over a time period for the return series is not appropriate. The ARCH/GARCH classes of model (Engle (1982), Bollerslev (1986)) have shown their superiority not only in modeling heterscedasticity of financial time series but can also be extended to include other effects on conditional variance. The estimate of the return volatility is obtained using an EGARCH model (Nelson (1991)). The exponential version of GARCH (EGARCH) to measure return volatility is used for several reasons. The EGARCH model has several advantages over the GARCH model. GARCH model does not take into account the asymmetry and non-linearity in the conditional variance. Moreover, the GARCH model imposes positive constraints on the estimated parameters. EGARCH model imposes no positive constraints on the estimated parameters and it takes care for asymmetry in asset return volatility, thereby avoiding possible misspecification in the volatility process. In addition, EGARCH allows for a general probability density function (i.e., Generalized Error Distribution, GED), which nests the normal distribution along with several other possible densities. The EGARCH model expresses the conditional variance of a given time series as a non-linear function of its own past values and the past values of standardized innovations.

In order to test whether the contemporaneous relationship between mutual fund flows and market returns still exists after controlling for heteroscedasticity, the following EGARCH (1,1) model is estimated.

$$R_t = \alpha_0 + \alpha_1 F_t + \varepsilon_t \tag{3}$$

$$log\sigma_t^2 = \phi_1 + \varphi_1 log\sigma_{t-1}^2 + \gamma_1 \left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \psi_1 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \xi \tag{4}$$

and

$$R_t = \alpha_2 + \varepsilon_t \tag{5}$$

$$log\sigma_t^2 = \phi_2 + \varphi_2 log\sigma_{t-1}^2 + \gamma_2 \left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \psi_2 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \lambda F_t + \xi \tag{6}$$

Another important issue is the relationship between trading volume and price changes. Most of the empirical studies on volume-return and volume volatility have focused primarily on the contemporaneous relation between price changes and volume in three forms of the empirical relationship: a positive relationship between volume and stock returns (Epps (1975), Rogalski (1978)), a positive relationship between volume and absolute returns (Smirlock and Starks (1988)) and an unrestricted V-shaped relationship between volume and return (Karpoff (1987), Gallant *et al*. (1992), Blume *et al.* (1994)). Edelen (1999) in his study provide the evidence of positive relation between gross flow (a half of the sum of inflow and outflow) and trading volume. However, there is no positive relationship between net flow (inflow minus outflow) and trading volume. Hence, if mutual fund flow is merely a substitute for trading volume, then the mutual fund flows and returns and mutual fund flows and volatility relationship will be spurious consequence of trading-return and trading volatility relationship. In order to test the contemporaneous relationship between return-mutual fund flows and volatility-mutual fund flows, trading volume is included in the equation 5 and 8. The trading volume, V_t, is measured as $\ln(TV_t/TV_{t-1})$ where TV_1, $TV_2 \ldots TV_t$ is the daily trading volume. The relationship between mutual fund flows and stock market returns and mutual fund flows and market volatility after including trading volume will be analyzed, by using the equation given below:

$$R_t = \alpha_0 + \alpha_1 F_t + \alpha_2 V_t + \varepsilon_t \tag{7}$$

$$log\sigma_t^2 = \phi_1 + \varphi_1 log\sigma_{t-1}^2 + \gamma_1 \left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right| + \psi_1 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \xi \tag{8}$$

and

$$R_t = \alpha_3 + \varepsilon_t \tag{9}$$

$$log\sigma_t^2 = \phi_2 + \varphi_2 log\sigma_{t-1}^2 + \gamma_2 \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \psi_2 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \lambda F_t + \kappa V_t + \xi \quad (10)$$

The equation 3 represents the EGARCH model with mutual fund flows (purchase, sales and net) in the mean equation. The equations 3 & 4 will be used to test whether contemporaneous relationship between mutual fund flows and returns exists or not. The equation 6 represent the EGARCH model with mutual fund flows (purchase, sales and net) in the variance equation. The equations 5 & 6 will be used to test whether contemporaneous relationship between mutual fund flows and volatility exists or not.

The other objective of the study is to examine the relationship between price and mutual fund flows, after controlling for volume hence trading volume is included into the conditional mean and variance equation. The equation 7 & 8 will used to examine the contemporaneous relation between returns and fund flows after controlling for volume, while equation 9 & 10 will used to examine the contemporaneous relation between volatility and fund flows after controlling for volume

The parameters of the above equations (3 to 10) are estimated by maximum likelihood method. The left hand side of equation 4, 6, 8 and 10 is the log of the conditional variance. This implies that the leverage effect is exponential, rather than quadratic. The exponential nature of the EGARCH ensures that the conditional variance is always positive even if the parameter values are negative, thus there is no need for parameter restrictions to impose nonnegativity. ψ_i captures the asymmetric effect. The presence of leverage effects can be tested by the hypothesis that $\psi_i < 0$. The impact is asymmetric if $\psi_i \neq 0$ .Table 2 to 5 reports the results of the estimated EGARCH (1,1) model.

<u>Methodology for examining Dynamic Relationship</u>

The earlier section mainly emphasizes on the contemporaneous relationship between market returns and mutual fund flows and conditional volatility and mutual fund flows. This section presents the Granger causality method to examining the dynamic (causal) relationship.

In bivariate case, the presence of Granger causality is tested by investigating whether the past of one time series improves the predictability of the present and future of another time series. The study uses vector autoregression (VAR) model to examine the presence of linear Granger causality. The benefit of VAR models is that they account for linear inter-temporal dynamics between variables, without imposing a priori restrictions of a particular model.

A VAR model including S&P CNX Nifty stock index returns and mutual fund flows can be expressed as:

$$R_t = \alpha + \sum_{i=1}^{m} \beta_i R_{t-1} + \sum_{i=1}^{m} \chi_i F_{t-1} + \varepsilon_{RF} \tag{11}$$

and

$$F_t = \eta + \sum_{i=1}^{m} \mu_i R_{t-1} + \sum_{i=1}^{m} \pi_i F_{t-1} + \varepsilon_{FR} \tag{12}$$

Similarly a VAR model including index returns volatility and mutual fund flows can be expressed as:

$$h_t = \phi + \sum_{i=1}^{n} \Omega_i h_{t-1} + \sum_{i=1}^{n} \square_i F_{t-1} + \varepsilon_{hF} \tag{13}$$

and

$$F_t = \varphi + \sum_{i=1}^{n} \eta_i h_{t-1} + \sum_{i=1}^{n} \psi_i F_{t-1} + \varepsilon_{Fh} \tag{14}$$

where R_t, F_t and h_t represent stock index returns, mutual fund flows (purchase, sales and net) and conditional volatility, ε_{RF}, ε_{FR}, ε_{hF} and ε_{Fh} are orthogonal error terms and m and n denote autoregressive lag lengths.

i.Causality in Presence of Volume

As an improvement on the causality tests and to analyze whether mutual fund flows affect market returns and volatility in the presence of trading volume, tests for the effect of mutual fund flows in the presence of trading volume has also been performed. The usefulness of including trading volume lies in the fact that, should causality in this context only be in the direction of stock returns to flows and volatility to flows, and not otherwise, then this would prove that it is only market returns that drive mutual fund flows. The following regression equations incorporating trading volume are used:

A VAR model including S&P CNX Nifty stock index returns and mutual fund flows can be expressed as:

$$R_t = \alpha + \sum_{i=1}^{m} \beta_i R_{t-1} + \sum_{i=1}^{m} \chi_i F_{t-1} + \delta V_t + \varepsilon_{RFV} \tag{15}$$

and

$$F_t = \eta + \sum_{i=1}^{m} \mu_i R_{t-1} + \sum_{i=1}^{m} \pi_i F_{t-1} + \gamma V_t + \varepsilon_{FRV} \tag{16}$$

Similarly a VAR model including index returns volatility and mutual fund flows can be expressed as:

$$h_t = \phi + \sum_{i=1}^{n} \Omega_i h_{t-1} + \sum_{i=1}^{n} \square_i F_{t-1} + \nu V_t + \varepsilon_{hFV} \tag{17}$$

and

$$F_t = \varphi + \sum_{i=1}^{n} \eta_i h_{t-1} + \sum_{i=1}^{n} \psi_i F_{t-1} + \theta V_t + \varepsilon_{FhV} \qquad (18)$$

ii.Causality in Presence of Market Fundamentals

As an improvement on the causality tests and to analyze whether mutual fund flows affect market returns and volatility in the presence of market fundamentals, tests for the effect of mutual fund flows in the presence of variables such as dividends, exchange rates and the interest rate is also been performed in the spirit of Cha and Lee (2001). The usefulness of including market fundamentals lies in the fact that, these variables reflect the short run variations in the fundamentals of the Indian economy, have been used together with the equity market-related variables to see whether or not mutual fund investors take into account their expectations about the state of the Indian economy. The other reasons for including market fundamentals lies in the fact that, should causality in this context only be in the direction of stock returns to flows, or volatility to flows and not otherwise, then this would prove that it is only market returns that drive mutual fund flows.

A VAR model including S&P CNX Nifty stock index returns and mutual fund flows can be expressed as:

$$R_t = \alpha + \sum_{i=1}^{m} \beta_i R_{t-1} + \sum_{i=1}^{m} \chi_i F_{t-1} + \partial_1 Div + \phi_1 Axrate + \rho_1 D\text{int} + \varepsilon_{RF} \qquad (19)$$

$$F_t = \eta + \sum_{i=1}^{m} \mu_i R_{t-1} + \sum_{i=1}^{m} \pi_i F_{t-1} + \partial_2 Div + \phi_2 Axrate + \rho_2 D\text{int} + \varepsilon_{FR} \qquad (20)$$

Similarly a VAR model including index returns volatility and mutual fund flows can be expressed as:

$$h_t = \alpha + \sum_{i=1}^{m} \beta_i V_{t-1} + \sum_{i=1}^{m} \chi_i F_{t-1} + \partial_1 Div + \phi_1 Axrate + \rho_1 D\text{int} + \varepsilon_{hF} \qquad (21)$$

$$F_t = \eta + \sum_{i=1}^{m} \mu_i V_{t-1} + \sum_{i=1}^{m} \pi_i F_{t-1} + \partial_2 Div + \phi_2 Axrate + \rho_2 D\text{int} + \varepsilon_{Fh} \qquad (22)$$

Within the context of this VAR model, linear Granger causality restrictions can be defined as follows: If the null hypothesis that χ's jointly equal zero is rejected, it is argued that mutual fund flows (purchase, sales and net) Granger causes returns. Similarly, if the null hypothesis that μ's jointly equal zero is rejected, returns Granger cause mutual fund flows. If both of the null hypotheses ar
e rejected, a bi-directional Granger causality, or a feedback relation, is said to exist between variables. Similar null hypothesis can be defined for the VAR model including the index returns volatility and mutual fund flows. Different test statistics have been proposed to test for linear Granger causality restrictions. To test for strict Granger

causality for pairs of $\{R_t, F_t)$ and (F_t, h_t) in this linear framework, a standard joint test (F-test) is used to determine whether lagged value of one time series has significant linear predictive power for current value of another series.

5. Results

The Augmented Dickey Fuller test and Philip Perrons test statistics as given in Table 1 indicate that the all series are stationary as the absolute value of statistics is greater than the critical value.

Contemporaneous Relationship

Most of the studies (Warther (1995, 1998), Goetzmann and Massa (1998), Elden and Warner (2001) etc) have reported that mutual fund flows and stock market prices tend to move together over time. In order to gain insight into the relationship between mutual fund flows and market returns the study estimates the EGARCH model. Table 2 and 3 presents the estimation of EGARCH model.

In Table 2, EGARCH model is estimated with fund flows in the mean equation. It is observed that market returns are highly related with purchase, sales and net fund flows respectively. Since α_1 coefficient reflects the relationship between concurrent returns and flow and is significant at 1 % level. Thus, our results using longer time period is consistent with the contemporaneous relationship presented in Warther (1995, 1998), Goetzmann and Massa (1998), Elden and Warner (2001).

In order to get a more direct evidence of the relationship among fund flow, market returns and volatility, the study reconstructs EGARCH (1,1) model. The daily mutual fund flows (purchase, sales and net) are included in EGARCH (1,1) model as exogenous variable, respectively. The empirical results are shown in Panel B of Table 3.

It can be inferred that the relationship between concurrent volatility and mutual fund flows is significantly positive. This implies that an increased fund flow is associated with increased market volatility. The relationship between concurrent returns and flow is significant at 1 % level.

Another issue that catches our attention is the well documented relationship between price changes and trading volume (Karpoff (1987), Gallant *et al*. (1992), Blume *et al.* (1994)). Edelen (1999). Hence, this study includes trading volume as a repressor in the mean and variance equation of EGARCH (1,1) model, to check whether fund flows coefficient is still statistically significant after controlling for trading volume, thus getting more consistent and unbiased results. The results are presented in Table 4 and 5.

The results in Table 4 suggests that flows are still strongly positively related to market returns after controlling for trading volume. Moreover, results in the Table 5 suggests that fund flows are positively related to volatility after controlling for trading volume.

The evidence using daily data suggests that there exists a strong positive relationship between contemporaneous fund flows and market returns and fund flows and volatility. The major findings using daily data is a strong positive concurrent relationship between stock market returns and mutual funds purchase, sales and net. The positive relationship between returns and fund flows and between volatility and fund flows may be because of two reasons. One, the individual investors may play an important part in the market by buying (redeeming) mutual funds shares when market is up (down). Uninformed (or less informed) investors face more difficulty in interpreting the price signals. Moreover, uninformed investors tend to revise their beliefs more frequently, thus resulting in slower disappearance of price fluctuations from their trading than those from their informed counterparts after the new public information. Thus, uninformed investors would more likely overreact to fundamental price movements, which would lead to increased price volatility. Second, the trading strategies of mutual fund managers would also exert significant influence on the market. Thus, the findings of concurrent positive relationship between returns and fund flows and between volatility and fund flows can be explained in a unified framework of the impact of individual investors and mutual fund managers.

Dynamic Relationship

Mutual fund flows and market returns have a high positive correlation does not necessarily mean that the former causes the latter and vice versa since there could be other explanations for this phenomenon. In order to gain more insights into the relationship between mutual fund flows and market returns, the study employs various VAR based test.

Relationship between Fund Flows and Market Index Returns

Granger causality test in the VAR frame work is performed between returns and mutual fund flows defined as purchase, sales and net. The correct lag length is determined by using Schwarz information criteria. The results are reported in Table 6 whose columns designate the dependent, or "caused," variables and whose rows define the independent, or "causing" variables.

The mutual fund flows defined as Purchases, Sales and Net, fails to show any significant impact on the market return. The R^2 is low, however, at about 2%, which implies that flows capacity to explain the market return is only marginal.

The market return is positive and significant by its past two lags for all fund flows, while fund flows is significantly influenced by its past lags. This result implies that an increase or decrease in mutual fund flows tends to spur other mutual fund investors to act in the same direction.

There is significant positive correlation between returns and *Sales* fund flows but a significant negative correlation is observed in the case of *Net* fund flows. It can be concluded that returns have a strong effect on mutual fund outflows and net. This finding suggests that at an aggregate level, negative feedback trading is indicated, which is inconsistent with the U.S. mutual fund findings (Edelen and Warner, 2001), but similar to Japanese institutions (Kim and Nofsinger, 2005) and Korean market (Natalie and Parwada, 2005). Moreover, the empirical evidence also suggests that mutual fund sales and net can be predicted by the daily lagged flows and by the lagged S&P CNX Nifty Index returns.

Direction of Relationship:

The results of Granger causality test based on VAR framework is reported in Table 7. The value of the Chi-square statistic suggests, whether the "causing" variable Granger-causes the "caused" variable or not. This is the test of the joint hypothesis that all coefficients on the causing variables (rows) in regressions with the caused variables (columns) as dependent variables are zero. The significance level associated with each Chi-square statistic is the probability that a value of Chi-square equal to or greater than the observed sample value would occur by chance. A significance level of 0.05 or less indicates that Granger-causation exists; if the significance level exceeds 0.05, any effect of the causing variable observed in the data is attributed to chance.

The hypothesis that 'returns does not Granger-cause flow' is rejected for sales and net but accepted for purchase at high levels of statistical significance (Chi-Square statistics on Sales and Net are significant at the 1% level). The results suggest that, market returns may contain information about mutual fund sales in Indian equity mutual funds. However, the result accepts the hypothesis that 'flow does not Granger-cause return' for *Purchases, sales and net.* The result of Granger causality corroborates the negative feedback trading hypothesis in Indian market. Low past security returns motivates mutual fund investors to involve in a feedback trading process, by redeeming mutual fund shares.

This evidence is examined further in the Granger causality tests designed to detect causal relationship between mutual fund flows and market returns after incorporating volume and market fundamentals. The results reporting the direction of the equity fund flows-stock market returns relationship in the presence of volume are presented in Table 8 and 9. Granger causality tests from equity fund flows to stock market returns are performed by incorporating Volume as exogenous variable in the VAR framework. The volume is appropriately modified to meet the stationarity condition.

The results in Table 9 show that the null hypothesis that fund flows do not Granger-cause equity market returns in the presence of volume is not rejected. This result is consistent with that of Table 7 in that equity fund flows do not affect stock market returns directly in the presence of volume. Moreover, the results in Table 9 also show that the null hypothesis that market returns do not Granger-cause equity fund flows in the presence of volume is rejected for sales and net but accepted for purchase. Again the results are consistent with that of Table 7.

The results reporting the direction of the equity fund flows-stock and market returns relationship in the presence of market fundamentals variables such as dividends, exchange rates and MIBOR rates are presented in Table 10 and 11.

The findings in Table 11 reject the hypothesis that equity fund flows "do not Granger-cause market returns". In Table 11 the hypothesis that returns do not Granger-cause flows in the presence of market fundamentals is more robustly rejected for Sales and Net but accepted for purchase.

The fund flows-market returns relationship in the presence of volume and market fundamentals consistently suggests negative feedback trading by mutual fund investors. In summary, stock market returns contain additional information about equity fund flow(sales and net) while equity fund flows do not contain any additional information about market returns implies that equity fund flows may be responding to changes in market returns.

The results of our study can be summarized as follows. We find that a positive relationship exists between stock market returns and mutual fund flows, and stock market volatility and mutual fund flows. The tests on the direction of causality suggest that it is predominantly returns that contain information on flows.

Dynamic Relationship between Mutual Fund Flows and Volatility:

There are two school of thoughts through which the fund flow and return volatility are related. First school of thought suggests that the cash inflows (or outflows) into (or out of) funds at the individual fund level over a short period of time (e.g., at daily frequency). This cash flow might be related to past fund performance. Fund managers who follow positive feed back strategies rely on past performance of stock to predict future returns. They buy securities when the market goes up and sell it when the market goes down thus, pushing security prices away from their fundamental values. Other fund managers may follow negative feedback (contrarian) strategies, and their trades drive security prices toward their fundamental values. Since positive (negative) feedback strategies increase (decrease) short-term volatility, the extent to which flow-induced trades depend on past return is important (Cao *et al.* 2008). A second school of thought (Black (1986) and Lee *et al*. (1991)) conclude that noise traders cause wide swings away from fundamentals, and that investor sentiment and noise traders are an important factor in the overall market movement. It is a common belief that mutual fund investors are the least informed investors. Thus, it is reasonable to use mutual fund flow as a proxy for uninformed investor sentiment. Reports in the popular press claim that fund flow is a good indicator of retail investor sentiment, and this sentiment is often irrational. To the extent that investor sentiment is important in the market place and aggregate flow is a good proxy of the sentiment, flow into (or out of) mutual funds will be related to market-wide returns and volatility (Cao *et al.* 2008).

In our bi-variate VAR, the coefficients of market volatility and fund flows with one day lag characterize the relationship between volatility and fund flow. Table 12 reports coefficient estimates of the bivariate VAR models. The lag length is selected based on the SBIC criteria.

Looking first at the bivariate model, the results suggest that market volatility is positively related to purchase (inflows) at lags 1 suggesting that flow has a positive impact on subsequent market volatility. Moreover, market volatility is also positively related to the sales (outflow). These results indicate that, holding everything else constant, purchase and sales are associated with higher volatility on the next day. The results in Table 12 also suggests that mutual fund flows (purchase and sales) are negatively related to previous day volatility, which suggests that mutual fund investors might time market volatility.

The study also examines the Granger causality between volatility and flow based on the VAR results. The other objective of the study is to investigate the dynamic relation between mutual fund flow and market volatility, hence, the focus is to test (1) whether flow Granger-causes market volatility and (2) weather volatility Granger-causes flow. Table 13 presents the Chi-Square test results and corresponding p-values.

The results reject the null hypothesis that mutual fund flow (purchase and sales) does not Granger-cause market volatility at the 5% significance level for both VAR specifications. The chi-square statistics for the null "Purchase does not granger cause Volatility" and "Sales does not granger cause Volatility" are 22.61 and 11.18 respectively and their corresponding p-values are 0 and 0.0479. These results support our earlier finding that flow has a significant impact on volatility and vice verse.

Karpoff (1987) in his study concludes that trading volume is related to volatility. This correlation between volume and volatility raises the concern of whether the volatility-flow dynamic is a spurious manifestation of the volatility-volume dynamic. In order to rule out this issue, the study includes volume as a exogenous variable in the VAR model. The results in Table 14 and 15 present coefficient estimates and causal relationship based on the VAR model.

The results provide the evidence that the fund flow-volatility dynamic still holds, even after controlling for volume. Market volatility is positively related to fund flows (purchase and sales) at the first lags, with *t*-statistics of 4.45162 and 1.73068, respectively. Moreover, the results also corroborate our earlier findings that there is bi-directional causality between fund flows and volatility. Hence, it can be concluded that the impact of fund flow on volatility is not a spurious manifestation of the impact of overall volume on volatility. This result is consistent with the study of Cao *et al.* (2008).

In order to gain further insights about the relationship between volatility and fund flows, the study includes market fundamentals variables in the VAR framework. Table 16 and 17, presents the results of the bivariate causality test between volatility and fund flows with fundamental variables as exogenous variable. Thisanalysis suggests that the fund flow-volatility dynamics still hold even after controlling for market fundamentals.

Market volatility is positively related to fund flows (purchase and sales) at the first lags, with *t*-statistics of 4.25 and 1.71 respectively.

Conclusion:

This study has examined the dynamic interaction between mutual fund flows and security returns and between mutual fund flows and volatility in an emerging capital market, namely the India. The results based on the contemporaneous relationship using daily data suggest that a positive relationship exist between stock market returns and mutual fund flows measured as stock purchases and sales. This positive concurrent relationship continues to exist even after controlling for volume. In order to investigate the causal relationship between mutual fund flows and market returns, Granger causality test has been performed in the VAR framework. The statistical evidence suggests that mutual fund out flows (sales) are significantly affected by return in the equity market, however, the latter is not significantly influenced by variation in these flows. Investors in the Indian market extrapolate trends in stock price changes, and thus, after some price decrease, they anticipate further dip in stock prices and hence sell shares. Such actions, when taken by a large number of investors, would suggest that stock prices will continue to decline in future. Therefore, investor's expectations lead them to sell mutual fund units after a decrease in stock prices, respectively (Alexakis *et al.* 2005). This suggests the negative feedback trading behavior in the Indian market. Mutual fund managers selling decisions get affected by the market returns. The results are inconsistent with the U.S. mutual fund findings (Edelen and Warner, 2001), but similar to Japanese institutions (Kim and Nofsinger, 2005) and Korean market (Natalie and Parwada, 2005).

The other objective of the study is to examine the dynamic relationship between aggregate mutual fund flow and market-wide volatility. The results based on the contemporaneous relationship using daily data suggest that a strong positive relationship exists between stock market volatility and mutual fund flows measured as stock purchases and sales. This positive concurrent relationship continues to exist even after controlling for volume. The results are consistent with the results of Oh and Parwada (2005) for the Korean market. Further analysis on the direction of relationship between volatility and mutual fund flows using the VAR approach suggests that market volatility is positively related to lag flow, and that shock in flow has a positive impact on market volatility. The study also attempted to uncover the dynamic relationship between mutual fund flows and volatility using exogenous variable such as volume and market fundamental variables such exchange rates, dividend and short term interest rates. The results provide evidence that the relationship is stable even after including these exogenous variables in the model. Increase in the aggregate inflows and outflows are associated with more volatile market.

Overall, the study using daily data enabled us to conduct more rigorous test and shed light on the importance of the relationship between mutual fund flows and market returns and mutual fund flows and volatility. The results of the study can be incorporated in the trading model used by practitioners and investors. Regulators can consider the bidirectional influence of fund flows and volatility of stock market and the fund flows changes in the market returns affects fund flows in their policy decisions. Further

Variable	Purchase		Sales		Net	
	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic
α_0	-0.002528	-4.58710*	-0.000935	-1.418680	0.001207	4.234197*
α_1	16.03404	8.22632*	8.508474	3.730819*	7.933399	7.265736*

research on the mutual fund industry, possibly on an individual mutual fund level and the complementary use of event studies, may help in improving our understanding of the relationship between mutual fund flows and stock returns.

Table 1. Unit Root Test

Series	Augmented Dickey Fuller Test		Philip Perron Test	
	Statistic	**Critical Value**	**Statistic**	**Critical Value**
Index Returns	-31.24544	-3.433767	-38.24342	-3.433765
Purchase	-7.061475	-3.433775	-34.06603	-3.433765
Sales	-8.952931	-3.433771	-33.54594	-3.433765
Net	-15.16418	-3.433771	-38.89456	-3.433765
Dividend Yield	-17.56443	-3.433773	-43.61545	-3.433765
MIBOR	-17.38818	-3.433793	-69.49705	-3.433765
Exchange Rate	-40.23161	-3.433765	-40.27702	-3.433765

Table 2: Contemporaneous relationship between Mutual Fund flows and Market Returns

ϕ_1	-1.054558	-7.06754*	-1.076154	-7.18870*	-1.088250	-7.17005*
φ_1	0.903285	58.12283*	0.900686	56.80045*	0.900216	55.86814*
γ_1	0.255507	6.500515*	0.258118	6.762921*	0.268258	6.876445*
ψ_1	-0.156523	-7.06401*	-0.151524	-6.60555*	-0.145578	-6.30923*

Table 3: Contemporaneous relationship between Mutual Fund flows and Volatility

Variable	Purchase		Sales		Net	
	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic
α_2	0.001029	3.585105*	0.001119	3.894182*	0.001091	3.773720*
ϕ_2	-1.065283	-7.4757*	-1.036973	-7.67669*	-1.080040	-7.007419*
φ_2	0.908208	61.8068*	0.914193	65.38519*	0.900308	55.15223*
γ_2	0.232730	6.207861*	0.232707	6.663792*	0.259328	6.559121*
ψ_2	-0.150155	-7.12670*	-0.153000	-7.37340*	-0.142970	-6.261944*
Variable	Purchase		Sales		Net	
λ	301.6912	4.80829*	398.4545	4.331705*	158.9206	1.892674***

Table 4: Mutual fund flows and Volume in mean Equation

Variable	Purchase		Sales		Net	
	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic
α_0	-0.002411	-4.519259*	-0.000600	-0.975482	0.001202	4.379340*
α_1	15.56901`	7.973458*	7.316071	3.391586*	8.678202	7.964277*
α_2	0.001308	1.766506***	0.002030	1.806790***	0.002440	2.198313*
ϕ_1	-0.842691	-6.910330*	-0.875308	-7.008411*	-0.926205	-7.17463*
φ_1	0.927011	72.51025*	0.923063	69.52694*	0.918592	66.84039*
γ_1	0.262789	6.941947*	0.262214	7.047389*	0.277187	7.230995*
ψ_1	-0.137235	-6.442917*	-0.135536	-6.287405*	-0.133360	-6.03477*

Table 5: Mutual fund flows and Volume in Variance Equation

	Return	Flow	Return	Flow	Return	Flow
Return(-1)	0.109139	-0.000124	0.110113	0.000234	0.110831	-0.000267
	[4.31005]	[-0.66534]	[4.34709]	[1.42883]	[4.38057]	[-1.01531]
Return(-2)	-0.110546	-9.24E-05	-0.109816	0.000511	-0.109015	-0.000705
	[-4.34146]	[-0.49425]	[-4.30774]	[3.09713]	[-4.28267]	[-2.66702]
Return(-3)	0.018973	-0.000235	0.017101	0.000180	0.020376	-0.000369
	[0.74525]	[-1.25676]	[0.66944]	[1.08963]	[0.79954]	[-1.39490]
Return(-4)	0.063188	8.18E-05	0.060948	0.000542	0.065209	-0.000513
	[2.49524]	[0.43988]	[2.39741]	[3.29489]	[2.57103]	[-1.94874]
Flow(-1)	1.977673	0.379395	1.642589	0.360313	0.642447	0.192151
	[0.58099]	[15.1822]	[0.42341]	[14.3440]	[0.26443]	[7.61591]
Flow(-2)	5.835034	0.137150	-1.191487	0.164344	4.082802	0.130362
	[1.61116]	[5.15844]	[-0.28938]	[6.16455]	[1.65766]	[5.09668]
Flow(-3)	-2.199506	0.133845	3.469150	0.081940	-2.004477	0.092845
	[-0.60687]	[5.03039]	[0.84389]	[3.07838]	[-0.81415]	[3.63128]
Flow(-4)	-2.471934	0.162730	-0.971969	0.118341	-1.308124	0.086035
	[-0.72547]	[6.50541]	[-0.25177]	[4.73430]	[-0.53905]	[3.41395]
Constant	-0.000144	4.61E-05	-9.70E-05	6.69E-05	0.000622	1.96E-06
	[-0.17245]	[7.54054]	[-0.09376]	[9.98199]	[1.71640]	[0.51997]
Adj R^2	0.024649	0.462025	0.022615	0.372232	0.023980	0.119838

Variable	Purchase		Sales		Net	
	Coefficient	Z-statistic	Coefficient	Z-statistic	Coefficient	Z-statistic
α_3	0.000854	3.126084*	0.000955	3.503905*	0.000953	3.470319*
ϕ_2	-0.811033	-7.12850*	-0.786010	-724310*	-0.908556	-6.98411*
φ_2	0.934499	78.63464*	0.939391	82.02499*	0.919863	66.35015*
γ_2	0.233462	6.725973*	0.231960	7.074834*	0.267288	7.163725*
ψ_2	-0.152698	-7.59436*	-0.152775	-7.70044*	-0.151157	-6.89363*
λ	234.9813	4.122767*	309.9079	4.000021*	86.45846	0.985540
κ	0.708145	5.937637*	0.694489	5.842162*	0.699187	5.591657*

Table 6: Causal Relationship between Flows and Return

Table 7: Granger Causality between Flows and Return

Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Purchase	0.62224	0.64668

Purchase does not granger cause Return	1.11759	0.34650
Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Sales	5.98444	8.9E-05
Sales does not granger cause Return	0.30645	0.87378
Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Net	3.69589	0.00531
Net does not granger cause Return	0.85055	0.49314

Table 8: Causal Relationship: Flows versus Return With Volume

Variable	Purchase		Sales		Net	
	Return	Flow	Return	Flow	Return	Flow
Return(-1)	0.104606	-0.00021	0.109187	2.39E-05	0.109001	-0.00013
	[4.42654]	[-1.40020]	[4.62320]	[0.17512]	[4.61695]	[-0.56673]
Return(-2)	-0.09167	-0.00018	-0.09229	0.000517	-0.091	-0.00075
	[-3.86688]	[-1.18413]	[-3.89323]	[3.76840]	[-3.83877]	[-3.30517]
Return(-3)	0.011594	-0.00011	0.008478	0.000269	0.012585	-0.00038
	[0.48908]	[-0.70784]	[0.35695]	[1.95770]	[0.52998]	[-1.68498]
Return(-4)	0.05244	2.67E-05	0.049166	0.000492	0.05383	-0.00056
	[2.22489]	[0.17547]	[2.07784]	[3.59084]	[2.27736]	[-2.48252]
Flow(-1)	5.221878	0.412203	4.389267	3.98E-01	0.721752	0.181252
	[1.52574]	[18.6374]	[1.13722]	[17.8364]	[0.29326]	[7.72375]
Flow(-2)	4.279912	0.192021	-3.75795	0.178902	4.179198	0.140566
	[1.21304]	[8.42191]	[-0.93375]	[7.68259]	[1.68188]	[5.93286]
Flow(-3)	-1.51841	0.113455	8.073199	0.073591	-2.73985	0.093895
	[-0.42942]	[4.96529]	[2.00803]	[3.16346]	[-1.10413]	[3.96844]
Flow(-4)	-3.79374	0.117465	-5.78969	0.107181	0.04754	0.071043
	[-1.12411]	[5.38605]	[-1.53019]	[4.89579]	[0.01940]	[3.04092]
Volume	0.002174	0.000165	0.001734	0.000114	0.001568	3.01E-05
	[1.59599]	[15.4005]	[1.28124]	[14.5308]	[1.17550]	[2.36632]
Constant	-0.00054	4.05E-05	-0.00024	5.64E-05	0.000445	1.76E-06
	[-0.67136]	[7.08786]	[-0.25082]	[10.1802]	[1.25117]	[0.51879]
Adj R^2	0.020641	0.528375	0.020915	0.456356	0.019278	0.119208

Table 9: Granger Causality Flows versus Return With Volume

Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Purchase	6.261724	0.1804
Purchase does not granger cause Return	4.343745	0.3615
Null Hypothesis	Chi-Sqr	P-Value

Return does not granger cause Sales	32.17208	0.0000
Sales does not granger cause Return	6.764204	0.1489
Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Net	21.65042	0.0002
Net does not granger cause Return	3.758327	0.4397

Table 10: Causal Relationship - Flows versus Return with Market Fundamentals

Variable	Purchase		Sales		Net	
	Return	Flow	Return	Flow	Return	Flow
Return(-1)	0.084685	-2.29E-05	0.088101	0.000121	0.087109	-4.08E-05
	[3.73203]	[-0.13948]	[3.88744]	[0.83440]	[3.84274]	[-0.18075]
Return(-2)	-0.092792	-0.000197	-0.092604	0.000529	-0.092522	-0.00076
	[-4.08496]	[-1.19848]	[-4.08070]	[3.64974]	[-4.07777]	[-3.36667]
Return(-3)	-0.004084	-0.000142	-0.004759	0.000263	-0.002456	-0.00037
	[-0.17951]	[-0.86375]	[-0.20906]	[1.81041]	[-0.10789]	[-1.60941]
Return(-4)	0.064712	3.39E-05	0.064438	0.000531	0.066622	-0.00054
	[2.85794]	[0.20682]	[2.83778]	[3.66102]	[2.93698]	[-2.39698]
Flow(-1)	2.308033	0.343621	1.597408	0.345866	0.649142	0.178282
	[0.71544]	[14.7169]	[0.43713]	[14.8245]	[0.27570]	[7.60899]
Flow(-2)	2.755264	0.18669	-4.260274	0.168299	3.742071	0.14239
	[0.81270]	[7.60839]	[-1.10497]	[6.83702]	[1.57276]	[6.01374]
Flow(-3)	0.125233	0.137578	8.84439	0.093196	-2.53388	0.093466
	[0.03701]	[5.61735]	[2.30052]	[3.79689]	[-1.06655]	[3.95336]
Flow(-4)	-1.865565	0.144365	-5.236726	0.122051	1.068261	0.070664
	[-0.57778]	[6.17759]	[-1.44731]	[5.28345]	[0.45545]	[3.02745]
Div	-0.112458	-0.000194	-0.1119	-3.08E-05	-0.112543	-0.00017
	[-9.85303]	[-2.35173]	[-9.81665]	[-0.42296]	[-9.86720]	[-1.50216]
Exc	-1.307245	0.002555	-1.336855	-0.00184	-1.326118	0.004965
	[-7.92640]	[2.14050]	[-8.13878]	[-1.75521]	[-8.08638]	[3.04260]
Int	-0.002511	1.28E-05	-0.002537	2.72E-05	-0.002539	-1.49E-05
	[-0.81672]	[0.57691]	[-0.82591]	[1.38549]	[-0.82588]	[-0.48536]
Constant	-0.000336	4.45E-05	0.000222	6.31E-05	0.000442	1.84E-06
	[-0.43890]	[8.02804]	[0.24219]	[10.8071]	[1.29907]	[0.54229]
Adj R^2	0.101093	0.456992	0.103076	0.393638	0.101716	0.121236

Table 11: Granger Causality :Flows versus Return with Market Fundamentals

Null Hypothesis	Chi-Sqr	P-Value

Return does not granger cause Purchase	2.464713	0.651
Purchase does not granger cause Return	2.542214	0.6371
Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Sales	32.0101	0
Sales does not granger cause Return	6.436018	0.1689
Null Hypothesis	Chi-Sqr	P-Value
Return does not granger cause Net	20.89395	0.0003
Net does not granger cause Return	3.711823	0.4464

Table 12: Causal Relationship :Volatility versus Flows

Variable	Purchase		Sales		Net	
	Volatility	Flow	Volatility	Flow	Volatility	Flow
Volatility(-1)	1.005394	-0.047215	1.016978	-0.004566	1.012135	-0.020482
	[39.5949]	[-1.96085]	[40.0394]	[-0.21479]	[39.8664]	[-0.59426]
Volatility(-2)	-0.310082	0.036133	-0.322863	-0.017763	-0.319258	0.043541
	[-8.58827]	[1.05533]	[-8.91613]	[-0.58609]	[-8.83799]	[0.88788]
Volatility(-3)	0.148039	-0.032772	0.156470	-0.038375	0.150804	0.019504
	[4.02381]	[-0.93934]	[4.24125]	[-1.24278]	[4.09470]	[0.39009]
Volatility(-4)	0.012038	-0.034170	0.004231	0.027399	0.002974	-0.043007
	[0.33334]	[-0.99778]	[0.11681]	[0.90382]	[0.08231]	[-0.87679]
Volatility(-5)	-0.004687	0.005756	-0.010232	-0.007344	-0.005845	-0.016543
	[-0.18543]	[0.24012]	[-0.40187]	[-0.34461]	[-0.23070]	[-0.48102]
Flow(-1)	0.132715	0.350685	0.035807	0.346079	0.055865	0.193925
	[4.99609]	[13.9216]	[1.68240]	[13.7682]	[2.99227]	[7.65146]
Flow(-2)	-0.024436	0.121337	-0.012076	0.157691	0.005895	0.128687
	[-0.87099]	[4.56068]	[-0.38037]	[5.93435]	[0.31039]	[4.99099]
Flow(-3)	0.007138	0.112735	0.022044	0.058707	0.001444	0.082002
	[0.25429]	[4.23506]	[0.68791]	[2.18883]	[0.07567]	[3.16504]
Flow(-4)	-0.003646	0.123735	-0.051381	0.064897	0.020791	0.069151
	[-0.13010]	[4.65556]	[-1.61941]	[2.44378]	[1.09445]	[2.68148]
Flow(-5)	-0.050178	0.133593	0.022985	0.145664	-0.018855	0.056234
	[-1.88525]	[5.29293]	[0.76849]	[5.81860]	[-1.00756]	[2.21353]
Constant	1.45E-05	5.31E-05	2.65E-05	6.41E-05	3.14E-05	4.07E-06
	[2.03223]	[7.87852]	[2.94143]	[8.49580]	[7.58804]	[0.72393]
Adj R^2	0.731850	0.477804	0.727467	0.381007	0.728992	0.115967

Table 13: Granger Causality: Volatility versus Flows

Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Purchase	30.24209	0
Purchase does not granger cause Volatility	22.61729	0
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Sales	22.00295	0.0005
Sales does not granger cause Volatility	11.18400	0.0479
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Net	6.361380	0.2726
Net does not granger cause Volatility	13.04799	0.02287

Table 14: Causal Relationship: Volatility versus Flows in Presence of Volume

Variable	Purchase		Sales		Net	
	Volatility	Flow	Volatility	Flow	Volatility	Flow
Volatility(-1)	1.001243	-0.027178	1.010731	-0.01163	1.004006	0.00497
	[42.3906]	[-1.30313]	[42.8169]	[-0.62298]	[42.5236]	[0.15888]
Volatility(-2)	-0.253964	0.007309	-0.263878	-0.02361	-0.25892	0.023414
	[-7.58857]	[0.24734]	[-7.87210]	[-0.89036]	[-7.74418]	[0.52859]
Volatility(-3)	0.112808	-0.003853	0.11851	-0.02335	0.11235	0.026084
	[3.32775]	[-0.12872]	[3.49129]	[-0.86976]	[3.31532]	[0.58098]
Volatility(-4)	0.022005	-0.025368	0.016623	0.027344	0.017505	-0.02971
	[0.65751]	[-0.85847]	[0.49595]	[1.03140]	[0.52325]	[-0.67034]
Volatility(-5)	-0.007171	-0.008473	-0.013287	-0.0064	-0.00949	-0.03321
	[-0.30375]	[-0.40648]	[-0.56062]	[-0.34132]	[-0.40216]	[-1.06276]
Flow(-1)	0.111642	0.379753	0.036822	0.391722	0.045237	0.183764
	[4.45162]	[17.1490]	[1.73068]	[17.5477]	[2.54447]	[7.80179]
Flow(-2)	-0.025257	0.168562	-0.035496	0.172176	0.015313	0.13789
	[-0.98011]	[7.40812]	[-1.21363]	[7.44261]	[0.85000]	[5.77721]
Flow(-3)	0.017566	0.088907	0.031201	0.05336	0.004478	0.082645
	[0.67693]	[3.88030]	[1.05579]	[2.28276]	[0.24724]	[3.44397]
Flow(-4)	-0.016423	0.077954	-0.07363	0.059441	0.021362	0.053568
	[-0.63657]	[3.42191]	[-2.51962]	[2.57164]	[1.18546]	[2.24376]
Flow(-5)	-0.035097	0.140179	0.056643	0.125849	-0.02856	0.057548
	[-1.42381]	[6.44050]	[2.05084]	[5.76078]	[-1.60829]	[2.44649]
Volume	1.20E-05	0.000143	4.44E-06	0.000111	3.57E-06	3.16E-05
	[1.22108]	[16.5156]	[0.45296]	[14.2835]	[0.37057]	[2.47938]
Constant	1.55E-05	4.70E-05	2.56E-05	5.51E-05	3.00E-05	2.64E-06
	[2.32380]	[7.96755]	[3.10613]	[8.44990]	[7.65891]	[0.51048]
Adj R^2	0.764267	0.532285	0.762271	0.452366	0.762758	0.111109

Table 15: Granger Causality: Volatility versus Flows in Presence of Volume

Panel B		
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Purchase	25.27323	0.0001
Purchase does not granger cause Volatility	23.98200	0.0002
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Sales	19.08513	0.0019
Sales does not granger cause Volatility	11.25264	0.0466
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Net	6.399565	0.2693
Net does not granger cause Volatility	13.04732	0.0229

Table 16: Causal Relationship: Volatility versus Flow in Presence of Market Fundamentals

Variable	Purchase		Sales		Net	
	Volatility	Flow	Volatility	Flow	Volatility	Flow
Volatility(-1)	1.003528	-2.73E-02	1.009478	-0.02039	1.0042	1.25E-02
	[42.4639]	[-1.20735]	[42.7267]	[-1.01787]	[42.4703]	[0.39765]
Volatility(-2)	-0.258729	-0.000945	-0.264886	-0.01702	-0.261493	0.009359
	[-7.75260]	[-0.02958]	[-7.92607]	[-0.60071]	[-7.83965]	[0.21159]
Volatility(-3)	0.120836	-0.004314	0.123404	-0.02673	0.118165	0.036378
	[3.61976]	[-0.13494]	[3.69173]	[-0.94326]	[3.54070]	[0.82202]
Volatility(-4)	0.007826	-0.027133	0.002358	0.019579	0.00407	-0.06106
	[0.33113]	[-1.19859]	[0.09933]	[0.97262]	[0.17248]	[-1.95148]
Volatility (-5)	-0.006723	-0.001054	-0.01301	0.002808	-0.00928	-0.031914
	[-0.28491]	[-0.04718]	[-0.54941]	[0.14212]	[-0.39375]	[-1.02258]
Flow(-1)	0.103419	3.35E-01	0.041785	3.48E-01	0.043998	1.85E-01
	[4.25098]	[14.3705]	[1.71371]	[14.8664]	[2.48845]	[7.86932]
Flow(-2)	-0.029593	0.184266	-0.029498	0.172811	0.012811	0.144228
	[-1.15791]	[7.52792]	[-1.01224]	[6.99445]	[0.71465]	[6.06768]
Flow(-3)	0.011144	0.137595	0.042683	0.092846	-0.000366	0.090314
	[0.43683]	[5.63131]	[1.46763]	[3.76551]	[-0.02041]	[3.79953]
Flow(-4)	-0.027796	0.151539	-0.051666	0.119793	0.014952	0.063747
	[-1.14121]	[6.49602]	[-1.89049]	[5.17004]	[0.84472]	[2.71591]
Flow(-5)	-0.03483	0.149644	0.057558	0.145188	-0.029099	0.055812

	[-1.41283]	[6.41464]	[2.08894]	[6.31512]	[-1.64078]	[2.37646]
Div	0.000117	-0.000186	0.000112	-3.22E-05	0.000109	-0.00016
	[1.36458]	[-2.26667]	[1.30459]	[-0.44094]	[1.26302]	[-1.39765]
Exc	0.0012	0.002652	0.001006	-0.00191	0.0009	0.005162
	[0.97067]	[2.23960]	[0.81214]	[-1.81702]	[0.72885]	[3.15367]
Int	-3.34E-05	1.32E-05	-3.20E-05	2.70E-05	-3.30E-05	-1.48E-05
	[-1.44393]	[0.59769]	[-1.38029]	[1.37360]	[-1.42287]	[-0.48112]
Constant	1.47E-05	5.86E-05	2.82E-05	7.29E-05	3.01E-05	1.62E-06
	[2.26892]	[9.42114]	[3.54212]	[10.8076]	[7.82817]	[0.31766]
Adj R^2	0.764508	0.463352	0.762567	0.390222	0.763052	0.113372

Table 17: Granger Causality: Volatility versus Flow in Presence of Market Fundamentals

Panel B		
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Purchase	21.64024	0.0002
Purchase does not granger cause Volatility	23.82121	0.0001
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Sales	21.7845	0.0002
Sales does not granger cause Volatility	7.802917	0.0567
Null Hypothesis	Chi-Sqr	P-Value
Volatility does not granger cause Net	4.805134	0.3079
Net does not granger cause Volatility	10.48911	0.0329

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