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Impact of Single Stock Futures on Feedback Trading, Trading Volume and Volatility: A Modified Approach

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Abstract: *While an extensive amount of literature exists on the role of futures markets in influencing various dynamics of spot markets, the question whether they stabilize or destabilize the underlying spot market is unresolved. This study addresses this concern and investigates the impact of SSFs (particularly in terms of their destabilizing ability) on the underlying stocks. This study contributes to the literature of financial economics by modifying the famous (Sentana & Wadhwani, 1992) model and adding trading volume as a control variable along with Generalized Error Distribution (GED) to capture leptokurtic nature of financial time series data for introduction episode of SSFs in Pakistan. The results of CAPM augmented GJR-GARCH process suggest an insignificant change in coefficients used to gauge market inefficiencies, feedback trading, trading volume and volatility. The findings do not support the hypothesis that the introduction of futures markets significantly impacts positive feedback trading and volatility dynamics of underlying stocks. The results are consistent with some of the earlier studies that futures markets have, at least, no destabilizing effect on the underlying stock market.*

Keywords: Feedback trading; SSFs, dynamic CAPM, GJR-GARCH, GED.

Introduction

It is a well-established fact that risk is present in every economic activity and no magnitude of regulations can eliminate risk from economic and financial systems (Kuprianov, 1995). Extensive literature presents discussions on the reasons and consequences of the risk present in trading in stocks, also known as stock market volatility. This discussion intensifies whenever stock markets experience crashes or hyper-volatility. One common prevalent explanation associated with stock market destabilization is that volatility increases due to the activities of speculators. This scenario can frequently be observed in emerging economies such as Pakistan. In Pakistan's context, (Ahmad, Shah, & Shah, 2010) provide strong evidence of the high level of speculative activity and volatility in different sectors of the market and the market as a whole. Following the same line of argument, the presence of derivative futures has always been blamed for destabilization of the underlying spot markets (Ahmad et al., 2010). This is because futures are less costly and offer a built-in leverage function, which attracts speculators. A high volatility in the spot market is often considered an indication of the destabilizing effects of parallel futures

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markets. This is why some academics and practitioners consider futures a threat to stability of national and international financial systems (Antoniou, Koutmos, & Pericli, 2005; Kuprianov, 1995).

Several studies have been conducted to identify the nature of the relationship between rational traders and noise traders, explaining the convergence or the divergence of market prices with its fundamental values due to individual activities of these two types of traders in the market. In this regard, (Sentana & Wadhwani, 1992) propose a heterogeneous trading model to check the presence of feedback trading strategies. They use US index returns and proved that returns are positively correlated during tranquility and negatively correlated in volatile periods. This notion is consistent with the presence of positive feedback traders in the market. This model has been used by several studies to capture the impact of rational and irrational feedback traders in different financial markets.

In Pakistan, SSFs were introduced in July 2001. SSFs are additional tools for traders and investors that are better instruments for hedging and investment objectives than index futures. Because of futures contracts, ease of use, and low transaction costs, they attract speculative activity. This creates the need for policy makers to observe their inherent ability to attract noise trading (i.e., feedback trading) that might destabilize the market. This discussion intensified among the stakeholders after the stock market crashes of 2005 and 2008 in the KSE. This study progresses from an initial study conducted by Malik, Shah, and Khan (2013) by using the data for resumption of SSFs.

This study contributes to the literature of financial economics and derivatives by making use of Sharpe (1964); Lintner (1975) dynamic CAPM model to gauge the behavior of rational investors and feedback trading model to measure activities of irrational traders, addition of AR(1) term, trading volume as control variable and use of GED. The AR (1) term and trading volume improves the explanatory power of the model. The promotion or inhibition of feedback traders would also be observed in change in volume from pre to post period. It is established that financial time series data is leptokurtic in nature but no study in Pakistan has ever used made use of non-normal distribution to take care of this aspect. It is the first study in the context of Pakistan which is using GED to accommodate the fat tails of financial time series data.

Literature Review

This section describes the theoretical and empirical studies that have been conducted in active markets around the globe on the impact of the introduction of futures markets on the dynamics of their underlying stock markets.

In the past, the presence of noise traders in financial markets and their relationship with the volatility of the underlying spot market after the introduction of futures markets has been investigated, and contrasting results are presented in literature of derivatives. For example, Laopodis (2005) examine the presence of noise traders' activities and their asymmetric behavior in exchange rates of different emerging and industrial economies with respect to euros and US dollars. He use GARCH augmented feedback trading model on the data from 1990 to 2003 and confirm the presence of feedback trading activities and asymmetric behavior in both types of economies' exchange rates. Similarly, for FOREX markets, Vitale (2000) argue that noise traders use trend chasing strategies to exploit exchange rates and future expectations. Such strategies earn them profit by the efficient use of information. The concern over relationship between a particular form of noise trading i.e., feedback trading activities in the market and its association with the degree of informational efficiency has also remained a point of debate. In this regard, Antoniou, Holmes, and Priestley (1998) examine the asymmetric response of volatility on the arrival of new information. They report an increase in volatility in spot prices, and explained that this increase in volatility is due to frequent information flow and not destabilizing speculation. Later on, Antoniou et al. (2005) add the feedback trading aspect to their work and studied the change in first and second order moment after the introduction of futures. They conclude that the introduction of futures markets helps stabilize the market, because they reduce the impact of feedback traders and attract rational speculators, who eventually make the market efficient.

For futures index, Koutmos (2002) test the hypothesis that participants in the index futures markets engage in feedback trading strategies. They find evidence of negative autocorrelation, which is consistent with the presence of feedback traders. Similarly, Xie, Zhu, and Yu (2012) test the presence of positive feedback trading activity by using an asymmetric feedback trading model i.e., TGARCH on nine index futures markets. They provide evidence which confirms the presence of positive feedback trading in most of the Asian index futures markets. Also, the study confirms that feedback traders have a destabilizing impact on the underlying spot market. Moreover, Koutmos (2002) use the daily index future prices from S&P 500, Nikkei, DAX and FTSE to check the validity of Shiller (1990) hypothesis that positive feedback traders exhibit longer memory, and provide evidence consistent with this hypothesis. In addition, Salm and Schuppli (2010) use an inter-temporal asset pricing model with heterogeneous traders to check the presence of feedback traders in the index futures market from 32 emerging and mature markets. They report strong evidence of activities of positive feedback traders in the 32 international markets.

For single stock derivatives, Chau, Holmes, and Paudyal (2008) investigate the introduction of USFs on the dynamics of the underlying spot market (i.e., feedback trading and volatility), and report a limited presence of feedback trading in the pre future period. They conclude that introduction of USFs has reduced it further. While extending this study, Chau, Deesomsak, and Lau (2011) add another aspect of level of sentiments to the standard feedback trading model of Sentana and Wadhwani (1992). By investigating the three largest Exchange Traded Funds (ETFs) of the U.S., they report that the intensity of positive feedback trading in these markets is associated with the level of investor sentiments. In this vein, Hou and Li (2014) test the impact of CSI 300 index futures on the underlying spot market using feedback trading model. They use univariate AR-GJR-GARCH-M and bivariate VECM-GARCH-M to test whether index futures inhibit or promote positive feedback trading in the spot market. They report increase in positive feedback trading in the corresponding spot market, which increases informational efficiency as well as possibly destabilizing the spot market via arbitrage mechanism. Review of these studies shows that further evidence is required from emerging and developed markets, specifically on SSFs to confirm or refute the hypothesis of the ability of futures to inhibit or promote noise trading.

Data and Methodology

Data Description

In KSE, futures contracts on individual stocks were introduced in July 2001. The SECP reviews the performance of active SSFs after every six months to decide on their listing or delisting on KSE. This procedure continued until the financial crisis of 2008 disturbed Pakistan's financial market along with other economies of the world. Until 2008, 46 stocks were being traded. This study uses sample data for SSFs introduced on different dates between June 1999 and March 2008. Daily closing prices and volume traded for two years pre- and post-event date are collected from an online data source (i.e., www.brecorder.com, a premier financial database). Vo (2017) suggests that high frequency data enhance the GARCH estimates' performance. A number of studies have employed GARCH genre of models for differing reasons (Umer, Coskun, & Kiraci, 2018). Only those stocks are selected for analysis for which at least two years of data are available for the pre- and post-period, separately. In this regard, 23 stocks meet the prescribed criteria. Daily prices of three-month T-bill rates are used as a proxy for RFR, which is obtained from the website of the State Bank of Pakistan (SBP).

Since this study attempts to gauge the impact of an event, an event study mechanism is used. In literature of derivatives markets, two approaches have widely been used to study the impact of futures contracts' listing on the dynamic of underlying spot market. First approach compares spot market volatility from pre to post period. This approach ensures robustness of the results regardless of the cross sectional determinants of the spot market volatility. There might be some other factors (e.g., firm-specific, industry-specific, or macroeconomic changes etc.), besides SSFs that affect the volatility dynamics of underlying spot market. Only pre to post analysis may make us mistakenly attribute a change to the SSFs. This makes it necessary to study a control sample of Non-SSFs in order to separate the effects of SSFs from other factors. This leads to the use of second approach, which compares spot market volatility cross sectionally between SSFs and Non-SSFs. Each approach has mechanical advantages (robustness vs cross-sectional compensations) over the other. Following the study of Mazouz and Bowe (2006), this study employs this two approach methodology that compares pre- and post-event sample to study any perceived change, and also targets a cross-sectional comparison by using a relatively matched sample from other than future contracts listings. For this, a relatively matched (i.e., liquidity, company size, and sector) Non-SSF sample of 22 stocks have also been considered.

Econometric Model

According to Sentana and Wadhwani (1992), rational traders try to enhance their expected utility by selecting suitable levels of risk and return combinations. They proposed a model, which assumes that only two types of investors demand the shares in the stock market, i.e., expected utility maximizers and feedback traders. Expected utility maximizers base their investment decisions rationally upon expected returns subject to wealth constraint, and positive feedback traders irrationally base their decisions on previous changes in prices and ignore fundamental values. The demand of stocks generated by feedback traders could be expressed as follows:

$$F_t = \gamma R_{t-1} \tag{1}$$

Where, F_t denotes the demand by feedback traders. The sign of γ discriminates between the two types of feedback traders. First, $\gamma > 0$ expresses the case of positive feedback traders, who buy when the price of a stock rises, and sell when the price of a stock decline. Second, $\gamma < 0$ denotes the case of negative feedback traders, who sell after a price rise and buy after a price declines.

In contrast, demand for stocks generated by expected utility maximizers could be expressed by the criterion, which is widely used for investment decisions. This study makes use of the Sharpe-Lintner CAPM model, which could be expressed as follows:

$$E_{t-1}(R_{i,t)} = R_f + \beta_t(E_{t-1}(R_{mt}) - R_f) \tag{2}$$

If these two types of traders constitute the whole market, then the market equilibrium will be achieved, if and only if all the stocks are held by these two types of traders, as follows:

$$F_t + S_t = 1 \tag{3}$$

Incorporating equation 1, 2 and 3, and if we assume rational expectation, then we get the following equation:

$$ER_{it} = \alpha + \beta_1 VarER_{it} + \{\varphi_{0,1} + \varphi_{0,2}(D_t)\} ER_{it-1} + \{\varphi_{1,1} + \varphi_{1,2}(D_t)\} VarER_{it}ER_{it-1} + \{\varphi_{2,1} + \varphi_{2,2}(D_t)\} Vol_{i,t} + \epsilon_t;\ \epsilon_t\ GED(0, \sigma_t^2) \tag{4}$$

Where, D_t is a dummy variable, which assumes the value of 0 before and 1 after the introduction of SSFs. The symbols $\varphi_{0,2}, \varphi_{1,2}, \varphi_{2,2}$ and $\alpha_{0,2}$ represent the coefficients of lagged return, positive feedback, volume and unconditional volatility before the introduction of SSFs, and the symbols $\varphi_{0,2}, \varphi_{1,2}, \varphi_{2,2}$ and $\alpha_{0,2}$ present the change in the aforementioned coefficients across the pre and post introduction of SSFs for every stock i. The t-statistics along with the coefficients $\varphi_{0,2}, \varphi_{1,2}, \varphi_{2,2}$ and $\alpha_{0,2}$ are used to identify the statistical significance of potential across the introduction of SSFs. With this model the following hypothesis could be tested. (1) $H_{0,1} : \varphi_{0,1} = \varphi_{0,2}$, (2) $H_{0,2} : \varphi_{1,1} = \varphi_{1,2}$, (3) $H_{0,3} : \varphi_{2,1} = \varphi_{2,2}$, (4) $H_{0,4} : \alpha_{0,1} = \alpha_{0,2}$

If the contract listings of SSFs decrease the magnitude of volatility in the spot market, then the unconditional variance of the error term may be reduced subsequent to the introduction of SSFs. Following equation is used to model the forecasting error:

$$\sigma_t^2 = \alpha_{0,1} + \alpha_{0,2}D_t + \alpha_1\epsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \delta X_{t-1}\epsilon_{t-1}^2 \tag{5}$$

The statistical significance of the unconditional variance in equation 5 is identified by the t-statistic accompanying the dummy variable in the above equation. The coefficients $\alpha_{0,1}$ and $\alpha_{0,2}$ are the unconditional variance before the contract listings and change in the same across pre- to post-contract listings, respectively.

The nonparametric WSRT is employed to check that whether the pre-future coefficients $\varphi_{0,1}, \varphi_{1,1}, \varphi_{2,1}$ and $\alpha_{0,1}$ and the post-future coefficients $\varphi_{0,1} + \varphi_{0,2}, \varphi_{1,1} + \varphi_{2,1}, \varphi_{2,1}$ and $\alpha_{0,1} + \alpha_{0,2}$ belong to the same statistical distribution, without assuming any specific functional form of the variable distribution. Moreover, to check whether the coefficients change after the introduction of SSFs is same for both SSFs and Non-SSFs, MWUT is performed.

Empirical Results

Tables 1 and 2 present the descriptive statistics of the variable of concern. These tables include the summary statistics of mean, median, minimum, maximum, skewedness, kurtosis, followed by Jarque-Berra (JB) test to check the normality assumption.

Tables 3 and 4 show the ARCH effect and the estimation output of the coefficients $\propto, \beta_1, \varphi_{0,1}, \varphi_{0,2}, \varphi_{1,1}, \varphi_{1,2}, \varphi_{2,1}, \varphi_{2,2}$ from the mean equation 4 and $\alpha_{0,1}, \alpha_{0,2}, \alpha_1, \beta\delta$ and their respective p-values from the variance equation 5. From an overview of SSFs and Non-SSFs, it is evident that in all cases the variables of interest are stationary, skewed and show high level of peak, which confirms the need for use of non-normal distribution functions. Additionally, the presence of strong heteroscedastic patterns confirms the choice of GARCH models over others.

In Table 5 along with the mean and median of the important coefficients, the results of WSRT and MWUT are presented. Mean and median of coefficients $\varphi_{0,1}$ and $\varphi_{0,2}$ of SSFs are -.0423 (-.0309) and -.0259 (-.0187), respectively. $\varphi_{0,1}$ is statistically significant at 5% for 22% SSFs with negative sign, which are DGKC, KESC, NBP, PSO, and TELE and positive for MCB., $\varphi_{0,2}$ is significant for 26%, which are BOP, FFC, HUBC, POL, PSO, and PTCL. Z and p-value of WSRT for coefficients $\varphi_{0,1}$ and $\varphi_{0,1} + \varphi_{0,2}$ are -2.251 (.024) suggesting that there is no significant change from pre- to post-period in the coefficient used to measure change due to market frictions. For Non-SSFs, the mean and median of coefficients $\varphi_{0,1}$ and $\varphi_{0,2}$ of SSFs are -.0620 (-.0494) and .004 (-.001) respectively. $\varphi_{0,1}$ is significant at 5% for 23% NonSSF stocks with negative sign, which are PKDATA04, SECPL, SEL, SHELL, and SONERI, and positive for DAWOOD and PKDATA01, while $\varphi_{0,2}$ is significant for 18% of Non-SSFs as follows: BKHB01, DAWOOD, FECTO, and PKDATA01 with negative sign and positive for SEL and SHELL. Finally, MWUT Z (p-value) for the comparison of change across introduction SSFs is -.049 (.961), which confirms that the change in coefficient used to measure market inefficiency and friction is the same for both SSFs and Non-SSFs.

For feedback trading, the coefficients $\varphi_{1,1}$ and $\varphi_{1,2}$ are used. For SSFs, the mean and median of $\varphi_{1,1}$ and $\varphi_{1,2}$ are 33.80 (-23.05) and 61.54 (-35.17), respectively. No SSFs show significant $\varphi_{1,1}$ and, only HUBC depict significant $\varphi_{1,2}$. Z (p-value) for the comparison between pre and post future coefficients $\varphi_{1,1}$ and $\varphi_{1,1} + \varphi_{1,2}$ obtained from WSRT are -1.338 (.181), which confirms that there is no significant change from pre- to post-period in feedback trading after the introduction of SSFs. Moreover, for Non-SSFs, mean and median for $\varphi_{1,1}$ and $\varphi_{1,2}$ are 114.60 (-2.48) and 42.21 (-17.95), respectively. 23% of Non-SSFs have significant $\varphi_{1,1}$ with negative sign, which are DAWOOD, GARTON, HMBL, PNSC, AN, PKDATA04, SEL, and SHELL. 18% of the Non-SSFs depict significant and positive $\varphi_{1,2}$, which are DAWOOD, FECTO, and PKDATA01, similarly 18% show significant but negative $\varphi_{1,2}$ which are CRESCENT, SEL, SHELL, and SILKBANK. Finally, Z (p-value) obtained by employing MWUT is -.500 (.617), which is insignificant at 5% level of significance. Given these results, the notion that the introduction of SSFs can inhibit or promote feedback trading could not be confirmed.

Mean and median of the coefficients $\varphi_{2,1}$ and $\varphi_{2,2}$, which are used to measure any potential movement of feedback traders from spot to future markets are .000 (0.000) and .000 (0.000). Z (p-value) of WSRT for$\varphi_{2,1}$ and $\varphi_{2,1} + \varphi_{2,2}$ is 0.000 (1.000), which confirms that both coefficients can be assumed to belong to the same distribution. 91% of the SSF stock show statistically significant $\varphi_{2,1}$: ACBL, BOP, DGKC, DSFL, ECL, FABL, FFC, HUBC, IBFL, KESC, MCB, MLCF, NBP, NML, PIA, PIOC, POL, PSO, SSGC, and TELE. And 61% of SSFs depict significant $\varphi_{2,2}$, which are DSFL, ECL, FABL, FFC, IBFL, KESC, MLCF, NBP, PIA, PIOC, PSO, SNGPL, and TELE. In contrast, for Non-SSFs mean and median of the coefficients $\varphi_{2,1}$ and $\varphi_{2,2}$ are .000 (.000) and .000 (.000). 82% of Non-SSFs show significant $\varphi_{2,1}$, 86% of Non-SSFs have significant $\varphi_{2,2}$. Z (p-value) resulted by employing MWUT are .000 (1.000), which is consistent with the fact that the change in volume of SSFs and Non-SSFs post future contract list is the same, and cannot be attributed to introduction of SSFs.

Mean and median of the coefficients $\alpha_{0,1}$ and $\alpha_{0,2}$ are .000 (.000) and -.000 (.000), respectively. Z (p-value) obtained from WSRT to check the change between $\alpha_{0,1}$ and $\alpha_{0,1} + \alpha_{0,2}$ is 0.000 (1.000), which confirms that there is no significant change of unconditional variance across pre- to post-future period for SSFs. 100% of SSFs show a significant coefficient of unconditional variance. And only 13% of SSFs show significant $\alpha_{0,2}$. For Non-SSFs, 86% of the stocks show significant unconditional variance. 23% of the stocks show significant $\alpha_{0,2}$. for WSRT is -.272 (.785), which confirms insignificant change from pre- to post-period in Non-SSFs. Also, a value of MWUT -.604 (.546) depicts insignificant change across SSFs and Non-SSFs.

It is evident from the analysis that the coefficients used to measure market frictions and inefficiencies has significantly changed from pre- to post-period for SSFs, while the opposite is observed for Non-SSFs. MWUT is used to measure the simultaneous change across SSFs and Non-SSFs and suggest that this change could not be attributed to contract listings of SSFs. In addition, WSRT which is used to measure feedback trading, results insignificant change from pre- to post-period for both SSFs and Non-SSFs, which is further confirmed by the use of MWUT. Similar results are obtained for the coefficients measuring potential change in volume and volatility coefficients. WSRT shows that the introduction of SSFs contracts' listings does not result in any significant change in SSFs nor in Non-SSFs from pre- to post-period. MWUT also confirms the findings of WSRT.

There are only two studies before this that are conducted to check promotion or inhibition of feedback trading due to introduction of futures markets. Overall, these results are different from the findings of Chau et al. (2008), who reported a limited presence of feedback trading, reduced further after the introduction of USFs in the UK, and Antoniou et al. (2005), who report an increase in positive feedback trading after the introduction of index futures in six industrialized nations. However, the results do not support the Bohl and Siklos (2008) postulation that positive feedback trading strategies are more pronounced in emerging markets. For US market, Chau et al. (2011) report presence of feedback trading activities in three largest Exchange-Traded Fund (ETF) contracts in the US market. The results of this study are consistent with other studies.

Conclusion and Policy Implications

This study contributes to literature on derivative markets by answering the question whether the introduction of SSFs promotes or inhibits noise trading in general, and specifically, positive feedback trading in the context of an emerging economy by using a modified econometric technique. Pakistan's market could be categorized as different from other emerging markets, because it has witnessed episodes of introduction and resumptions of futures markets in the KSE. Overall, the study does not find any significant evidence of inhibition or promotion of noise trading after the introduction of SSFs, which is evident from the insignificant change in the coefficients used to measure the presence and change in the post future periods for both SSFs and Non-SSFs. These results suggest that the introduction of SSFs did not have any destabilizing impact on the underlying stocks. Further, the results of this study are in line with earlier studies (Malik et al., 2013) for resumption episode) that support the notion that the introduction of SSFs does not destabilize the underlying stock market. The futures markets need to be extended and regulated to enhance market liquidity with better formulation and rearrangements of current futures market and upcoming options contracts.

The findings of the study have important implications for the regulators of the stock market regarding regulations of futures markets: Initially, trading in SSFs was introduced in July 1st, 2001 in 10 stocks on KSE. Later on, during the market turmoil and afterwards in the year 2008, the SECP discontinued trading in SSFs at the KSE, on the recommendations of the Continuous Funding System (CFS) Mark II review committee. On July 27th, 2009 SSFs trading in 18 stocks was re-launched with improved and more stringent risk management mechanisms, which seem to imply that the originally issued futures may have played role in destabilizing the overall market. However, the results of this study suggest that futures cannot be blamed for any instability occurred in the market. Therefore, the market could enhance liquidity by easing the regulations of SSFs.

Table 1
Descriptives Statistics for SSFs (Full Sample)

Sr No:	Stock	Mean	Median	Min	Max	S	K	JB	Prob
1	acbl	0.0004	-0.0001	-0.1333	0.0374	-2.5226	31.2543	34254.7000	0.0000
2	bop	0.0006	-0.0001	-0.0931	0.0442	-0.9620	10.3241	2386.9220	0.0000
3	dgkc	0.0009	-0.0001	-0.0733	0.0502	-0.1777	5.3079	226.9683	0.0000
4	dsfl	-0.0006	-0.0004	-0.2127	0.0653	-2.9363	48.2219	86559.6900	0.0000
5	ecl	-0.0003	-0.0004	-0.0852	0.0834	-0.2446	11.4959	3014.4910	0.0000
6	fabl	0.0005	-0.0001	-0.0826	0.0386	-0.9296	9.7736	2053.7380	0.0000
7	ffc	0.0001	-0.0002	-0.0339	0.0367	-0.0380	7.0353	678.0580	0.0000
8	hubc	-0.0001	-0.0003	-0.0751	0.0642	-0.3256	8.8454	1439.9400	0.0000
9	ibfl	0.0001	-0.0003	-0.1197	0.0577	-0.6057	17.3650	8650.5050	0.0000
10	kesc	-0.0005	-0.0003	-0.0586	0.0820	1.1192	9.2620	1840.7830	0.0000
11	luck	0.0009	-0.0001	-0.0396	0.0446	0.2594	3.9652	49.9866	0.0000
12	mcb	-0.0001	-0.0003	-0.0712	0.0568	-0.3772	7.4788	858.6529	0.0000
13	mlcf	0.0005	-0.0002	-0.0485	0.0545	0.3153	3.9268	52.3077	0.0000
14	nbp	0.0009	0.0003	-0.0768	0.0313	-0.8449	10.0875	2209.7760	0.0000
15	nml	0.0001	-0.0003	-0.1248	0.0668	-0.4870	11.0869	2761.6530	0.0000
16	pia	-0.0004	-0.0004	-0.0688	0.1081	0.8413	8.6332	1438.7190	0.0000
17	pioc	0.0000	-0.0003	-0.0860	0.0388	-0.0898	4.8574	144.9456	0.0000
18	pol	0.0006	0.0008	-0.0207	0.0249	-0.5000	5.0034	208.6792	0.0000
19	pso	-0.0001	-0.0003	-0.0768	0.0554	-0.2196	8.7974	1407.0390	0.0000
20	ptcl	-0.0002	-0.0003	-0.0551	0.0610	0.0040	8.7174	1360.6790	0.0000
21	sngpl	0.0002	-0.0003	-0.0763	0.0963	0.1033	10.2465	2187.6000	0.0000
22	ssgc	0.0003	-0.0002	-0.0469	0.0353	0.2376	4.1382	63.3218	0.0000
23	tele	-0.0002	-0.0003	-0.1362	0.0474	-0.4886	11.7225	3203.4250	0.0000

Table 2
Descriptives Statistics for Non-SSFs (Full Sample)

Sr No:	Stock	Mean	Median	Min	Max	S	K	JB	Prob
1	garton	-0.0002	-0.0003	-0.1048	0.0411	-3.3490	36.2738	47952.2800	0.0000
2	bkhb06	0.0000	-0.0003	-0.1526	0.0312	-5.9238	78.4928	243070.4000	0.0000
3	Cherat	0.0003	-0.0002	-0.0958	0.0314	-0.5009	9.9697	2063.7630	0.0000
4	crescent	0.0001	-0.0003	-0.2006	0.1757	-0.3201	32.0438	35129.4900	0.0000
5	dawood	-0.0001	-0.0003	-0.1481	0.0957	-1.7428	34.2977	41279.2000	0.0000
6	fecto	0.0008	-0.0001	-0.0733	0.0727	0.3398	5.9852	390.1572	0.0000
7	garton	0.0005	-0.0003	-0.1054	0.1233	0.6510	15.3887	6459.1980	0.0000
8	hmbl	0.0003	-0.0001	-0.1474	0.0313	-3.4175	45.0520	75553.1200	0.0000
9	kel01	0.0001	-0.0003	-0.0923	0.0553	-0.3348	10.8097	2557.4150	0.0000
10	kel06	-0.0003	-0.0003	-0.0255	0.0281	0.2079	4.2132	68.3990	0.0000
11	kohat	-0.0004	-0.0003	-0.1713	0.0312	-3.6045	46.0611	79346.8300	0.0000
12	mari	0.0004	-0.0002	-0.0248	0.0313	0.3138	3.3465	21.3892	0.0000
13	pkdata01	-0.0004	-0.0003	-0.1254	0.1955	0.7203	28.6758	27527.5400	0.0000
14	pkdata04	0.0008	-0.0001	-0.0413	0.0641	0.4482	4.7924	167.0222	0.0000
15	pnsc	0.0005	-0.0003	-0.1600	0.2215	1.1786	15.1847	6411.2230	0.0000
16	secpl	-0.0007	-0.0003	-0.0625	0.0760	0.5370	8.0006	1088.9160	0.0000
17	sel	-0.0005	-0.0003	-0.0358	0.0371	0.1236	3.6954	22.6723	0.0000
18	shell	0.0002	-0.0001	-0.1004	0.0313	-0.9054	18.4021	10010.9900	0.0000
19	silkbank	0.0001	-0.0002	-0.0645	0.0837	0.5404	6.3738	522.4286	0.0000
20	soneri	0.0002	-0.0001	-0.1363	0.0358	-3.7591	46.1135	79724.3300	0.0000
21	ssgc	0.0000	-0.0003	-0.0705	0.1370	1.3749	22.0540	15426.9400	0.0000
22	tele	0.0000	-0.0003	-0.0705	0.1370	1.3749	22.0540	15426.9400	0.0000

Table 3
Maximum Likelihood Estimates for SSFs

Sr. No:	Stock	ARCH test		α	Prob.	β_1	Prob.	$\varphi_{0,1}$	Prob.	$\varphi_{0,2}$	Prob.	$\varphi_{1,1}$	Prob.	$\varphi_{1,2}$	Prob.	$\varphi_{2,1}$	Prob.	$\varphi_{2,2}$	Prob.
1	acbl	0.200	1.000	0.000	0.155	-0.158	0.951	-0.103	0.095	0.051	0.481	265.9	0.266	-192.7	0.440	0.000	0.000	0.000	0.106
2	bop	0.830	0.600	0.002	0.000	2.779	0.093	-0.080	0.055	-0.154	0.004	54.71	0.366	71.22	0.337	0.000	0.000	0.000	0.158
3	dgkc	4.670	0.000	0.003	0.000	4.843	0.161	-0.165	0.020	-0.098	0.292	134.0	0.628	235.1	0.520	0.000	0.000	0.000	0.544
4	dsfl	0.810	0.620	0.002	0.000	-3.370	0.113	-0.030	0.387	-0.071	0.283	-12.53	0.676	-22.59	0.906	0.000	0.000	0.000	0.000
5	ecl	3.290	0.000	0.001	0.000	-4.499	0.036	-0.013	0.735	-0.022	0.719	-61.84	0.296	-75.83	0.684	0.000	0.000	0.000	0.008
6	fabl	1.120	0.350	0.001	0.005	1.033	0.7138	-0.059	0.278	0.056	0.410	186.7	0.483	-181.8	0.545	0.000	0.000	0.000	0.000
7	ffc	13.39	0.000	0.001	0.000	-0.895	0.708	-0.016	0.616	-0.114	0.048	23.05	0.502	190.6	0.489	0.000	0.000	0.000	0.000
8	hubc	14.40	0.000	0.001	0.000	-4.303	0.0791	0.035	0.421	-0.168	0.011	-152.03	0.181	469.86	0.011	0.000	0.000	0.000	0.292
9	ibfl	0.380	0.960	0.001	0.029	-3.520	0.286	-0.030	0.462	0.041	0.547	-64.55	0.434	308.1	0.205	0.000	0.000	0.000	0.000
10	kesc	9.900	0.000	0.003	0.000	-0.093	0.970	-0.199	0.000	0.072	0.300	146.3	0.094	-268.8	0.055	0.000	0.000	0.000	0.000
11	luck	9.190	0.000	0.002	0.006	-1.034	0.823	-0.061	0.495	-0.154	0.199	178.7	0.688	590.4	0.355	0.000	0.000	0.000	0.127
12	mcb	8.590	0.000	0.001	0.001	-1.083	0.716	0.106	0.037	-0.13	0.114	-173.1	0.181	274.6	0.401	0.000	0.000	0.000	0.642
13	mlcf	6.910	0.000	0.002	0.002	-0.819	0.844	-0.069	0.428	0.11	0.365	473.7	0.141	-356.1	0.473	0.000	0.000	0.000	0.042
14	nbp	2.530	0.010	0.002	0.000	-6.145	0.024	-0.191	0.000	-0.068	0.235	-73.98	0.618	318.06	0.141	0.000	0.000	0.000	0.000
15	nml	5.130	0.000	0.002	0.000	1.401	0.5937	0.0115	0.800	-0.097	0.217	-20.17	0.788	169.3	0.389	0.000	0.000	0.000	0.561
16	pia	5.620	0.000	0.002	0.000	0.172	0.951	-0.113	0.222	-0.013	0.901	126.3	0.709	-51.03	0.885	0.000	0.000	0.000	0.000
17	pioc	4.340	0.000	0.002	0.000	1.056	0.814	0.036	0.656	0.014	0.911	5.601	0.986	273.8	0.646	0.000	0.000	0.000	0.007
18	pol	0.060	1.000	0.001	0.000	-2.305	0.087	-0.048	0.113	-0.155	0.000	23.97	0.359	23.54	0.576	0.000	0.000	0.000	0.187
19	pso	3.790	0.000	0.001	0.000	-4.107	0.033	0.090	0.031	-0.260	0.000	-198.9	0.072	276.7	0.116	0.000	0.000	0.000	0.000
20	ptcl	8.030	0.000	0.000	0.230	-2.321	0.512	0.028	0.544	-0.151	0.032	-380.04	0.117	424.7	0.231	0.000	0.728	0.000	0.000
21	sngpl	7.170	0.000	0.001	0.123	-0.838	0.750	0.000	0.993	-0.0517	0.509	-22.60	0.844	-102.5	0.655	0.000	0.306	0.000	0.027
22	ssgc	9.090	0.000	0.000	0.573	-7.636	0.047	0.065	0.397	-0.012	0.910	42.32	0.906	-227.02	0.701	0.000	0.000	0.000	0.570
23	tele	0.520	0.880	0.002	0.002	-8.952	0.006	-0.165	0.018	0.117	0.175	275.76	0.269	-307.31	0.249	0.000	0.000	0.000	0.000

None of the reported values are zero however, values are reported upto three decimal places only to mention the arithmetic signs.

Table 3 (Contd.)

Sr. No:	Stock	Prob.	$\alpha_{0,1}$	Prob.	$\alpha_{0,2}$	Prob.	α_1	Prob.	β	Prob.	δ	Prob.	Distribuiton
1	acbl	0.106	0.000	0.000	0.000	0.040	0.317	0.000	0.478	0.000	0.124	0.239	GED
2	bop	0.158	0.000	0.000	0.000	0.002	0.480	0.000	0.381	0.000	0.218	0.267	GED
3	dgkc	0.544	0.000	0.004	0.000	0.476	0.265	0.000	0.622	0.000	0.044	0.665	GED
4	dsfl	0.000	0.000	0.001	0.000	0.866	0.173	0.018	0.672	0.000	0.094	0.283	GED
5	ecl	0.008	0.000	0.000	0.000	0.149	0.468	0.000	0.429	0.000	-0.070	0.644	GED
6	fabl	0.000	0.000	0.035	0.000	0.515	0.071	0.061	0.882	0.000	0.030	0.501	GED
7	ffc	0.000	0.000	0.000	0.000	0.244	0.348	0.009	0.517	0.000	-0.069	0.629	GED
8	hubc	0.292	0.000	0.004	0.000	0.768	0.255	0.000	0.726	0.000	-0.061	0.435	GED
9	ibfl	0.000	0.000	0.003	0.000	0.290	0.201	0.011	0.642	0.000	0.073	0.473	GED
10	kesc	0.000	0.000	0.000	0.000	0.257	0.289	0.003	0.402	0.000	0.164	0.242	GED
11	luck	0.127	0.000	0.008	0.000	0.090	0.132	0.007	0.753	0.000	0.075	0.233	GED
12	mcb	0.642	0.000	0.003	0.000	0.103	0.216	0.007	0.667	0.000	-0.045	0.603	GED
13	mlcf	0.042	0.000	0.000	0.000	0.153	0.273	0.001	0.523	0.000	0.118	0.313	GED
14	nbp	0.000	0.000	0.004	0.000	0.000	0.330	0.000	0.683	0.000	0.005	0.954	GED
15	nml	0.561	0.000	0.004	0.000	0.871	0.192	0.008	0.696	0.000	-0.022	0.766	GED
16	pia	0.000	0.000	0.020	0.000	0.132	0.092	0.021	0.818	0.000	0.000	0.999	GED
17	pioc	0.007	0.000	0.012	0.000	0.507	0.154	0.001	0.744	0.000	0.111	0.087	GED
18	pol	0.187	0.000	0.011	0.000	0.186	0.262	0.001	0.788	0.000	-0.024	0.768	GED
19	pso	0.000	0.000	0.004	0.000	0.169	0.271	0.000	0.694	0.000	0.002	0.974	GED
20	ptcl	0.000	0.000	0.016	0.000	0.254	0.147	0.004	0.808	0.000	-0.012	0.821	GED
21	sngpl	0.027	0.000	0.003	0.000	0.374	0.109	0.007	0.829	0.000	0.071	0.162	GED
22	ssgc	0.570	0.000	0.002	0.000	0.318	0.160	0.000	0.745	0.000	0.113	0.140	GED
23	tele	0.000	0.000	0.006	0.000	0.178	0.214	0.001	0.649	0.000	0.063	0.485	GED

Table 4
Maximum Likelihood Estimates for Non-SSFs

Sr. No:	Stock	ARCH test		α	Prob.	β_1	Prob.	$\varphi_{0,1}$	Prob.	$\varphi_{0,2}$	Prob.	$\varphi_{1,1}$	Prob.	$\varphi_{1,2}$	Prob.	$\varphi_{2,1}$	Prob.	$\varphi_{2,2}$	Prob.
1	bkhb01	0.056	1.000	-0.001	0.092	3.313	0.531	0.002	0.958	-0.091	0.038	161.85	0.263	-21.059	0.883	0.000	0.038	0.000	0.000
2	bkhb06	0.052	1.000	0.000	0.113	-2.087	0.427	-0.027	0.510	-0.014	0.802	-14.27	0.732	35.17	0.485	0.000	0.000	0.000	0.007
3	crescent	0.206	0.996	0.000	0.213	-9.128	0.002	-0.124	0.110	-0.019	0.832	174.04	0.610	-245.581	0.487	0.000	0.000	0.000	0.000
4	crescent	9.075	0.000	0.000	0.984	-2.956	0.181	-0.043	0.253	0.090	0.100	3.012	0.890	-185.3	0.013	0.000	0.000	0.000	0.003
5	dawood	2.400	0.008	-0.009	0.000	2.568	0.000	0.168	0.000	-0.278	0.000	-47.825	0.000	78.628	0.000	0.000	0.000	0.000	0.000
6	fecto	4.011	0.000	-0.001	0.158	4.155	0.281	0.100	0.102	-0.333	0.000	-323.3	0.093	1549.3	0.000	0.000	0.000	0.000	0.015
7	garton	5.541	0.000	0.000	0.112	-0.038	0.057	0.019	0.251	0.026	0.383	-4.086	0.007	-5.374	0.252	0.000	0.278	0.000	0.293
8	hmbl	0.037	1.000	0.001	0.002	-12.42	0.000	0.060	0.203	-0.054	0.272	-783.87	0.039	752.78	0.060	0.000	0.000	0.000	0.000
9	kel01	0.826	0.603	0.000	0.862	-7.534	0.062	-0.084	0.142	-0.029	0.726	1.938	0.991	164.71	0.611	0.000	0.000	0.000	0.000
10	kel06	9.278	0.000	-0.001	0.000	5.774	0.032	-0.073	0.159	-0.040	0.562	484.2	0.352	392.42	0.571	0.000	0.831	0.000	0.975
11	kohat	0.052	1.000	-0.001	0.318	2.901	0.486	0.015	0.713	0.004	0.964	-1.677	0.966	35.558	0.902	0.000	0.000	0.000	0.000
12	mari	26.78	0.000	0.000	0.647	-17.10	0.000	-0.056	0.550	-0.116	0.323	-209.64	0.736	1591.6	0.019	0.000	0.000	0.000	0.000
13	pkdata01	3.533	0.000	0.000	0.000	-0.003	0.000	0.004	0.000	-0.007	0.000	-0.179	0.000	0.731	0.000	0.000	0.000	0.000	0.000
14	pkdata04	10.351	0.000	0.000	0.411	-9.952	0.003	-0.304	0.000	0.151	0.089	718.71	0.000	244.59	0.442	0.000	0.000	0.000	0.666
15	pnsc	0.854	0.576	-0.001	0.261	1.332	0.627	-0.030	0.560	0.010	0.900	-141.28	0.003	102.93	0.347	0.000	0.000	0.000	0.000
16	secpl	3.672	0.000	-0.001	0.154	-11.360	0.000	-0.175	0.006	0.065	0.464	291.8	0.260	-342.89	0.314	0.000	0.000	0.000	0.000
17	sel	7.376	0.000	0.000	0.349	-1.508	0.570	-0.281	0.000	0.385	0.000	1304.5	0.001	-2036.5	0.000	0.000	0.225	0.000	0.000
18	shell	0.526	0.873	-0.001	0.003	-3.269	0.203	-0.292	0.000	0.262	0.000	841.8	0.000	-818.6	0.001	0.000	0.000	0.000	0.000
19	silkbank	14.247	0.000	0.000	0.117	0.286	0.763	0.003	0.932	0.053	0.340	19.29	0.756	-329.09	0.014	0.000	0.000	0.000	0.000
20	soneri	0.072	1.000	-0.001	0.004	-3.297	0.342	-0.100	0.009	0.090	0.095	37.67	0.580	-53.52	0.409	0.000	0.000	0.000	0.000
21	ssgc	10.72	0.000	-0.001	0.032	-1.652	0.449	-0.062	0.087	0.066	0.275	-42.200	0.529	-21.33	0.923	0.000	0.058	0.000	0.000
22	tele	24.42	0.000	-0.002	0.000	-5.067	0.014	-0.084	0.055	-0.126	0.055	51.34	0.255	39.58	0.669	0.000	0.000	0.000	0.001

None of the reported values are zero however, values are reported upto three decimal places only to mention the arithmetic signs.

Table 4 (Contd.)

Sr. No:	Stock	Prob.	$\alpha_{0,1}$	Prob.	$\alpha_{0,2}$	Prob.	α_1	Prob.	β	Prob.	δ	Prob.	Distribuiton
1	bkhb01	0.000	0.000	0.000	0.000	0.068	0.302	0.043	0.110	0.449	-0.175	0.262	GED
2	bkhb06	0.007	0.000	0.000	0.000	0.002	0.345	0.002	0.457	0.000	0.070	0.579	GED
3	crescent	0.000	0.000	0.009	0.000	0.832	0.239	0.001	0.656	0.000	0.146	0.206	GED
4	crescent	0.003	0.000	0.000	0.000	0.000	0.264	0.008	0.351	0.003	-0.166	0.086	GED
5	dawood	0.000	0.000	0.201	0.000	0.048	1.282	0.036	0.668	0.000	0.201	0.775	GED
6	fecto	0.015	0.000	0.003	0.000	0.514	0.259	0.003	0.703	0.000	-0.102	0.256	GED
7	garton	0.293	0.000	0.000	0.000	0.052	0.196	0.000	0.706	0.000	-0.014	0.755	GED
8	hmbl	0.000	0.000	0.023	0.000	0.539	0.293	0.046	0.522	0.001	-0.044	0.809	GED
9	kel01	0.000	0.000	0.000	0.000	0.132	0.153	0.001	0.688	0.000	0.138	0.075	GED
10	kel06	0.975	0.000	0.046	0.000	0.073	0.214	0.001	0.836	0.000	-0.032	0.673	GED
11	kohat	0.000	0.000	0.007	0.000	0.148	0.262	0.024	0.544	0.000	-0.114	0.334	GED
12	mari	0.000	0.000	0.026	0.000	0.804	0.123	0.002	0.864	0.000	-0.027	0.543	GED
13	pkdata01	0.000	0.000	0.096	0.000	0.117	16.57	0.179	0.618	0.000	-16.16	0.184	GED
14	pkdata04	0.666	0.000	0.004	0.000	0.998	0.286	0.002	0.653	0.000	-0.128	0.173	GED
15	pnsc	0.000	0.000	0.000	0.000	0.006	0.096	0.001	0.737	0.000	-0.001	0.988	GED
16	secpl	0.000	0.000	0.005	0.000	0.056	0.099	0.062	0.621	0.000	0.241	0.048	GED
17	sel	0.000	0.000	0.053	0.000	0.107	0.175	0.040	0.705	0.000	0.061	0.567	GED
18	shell	0.000	0.000	0.001	0.000	0.240	0.310	0.011	0.500	0.000	0.125	0.473	GED
19	silkbank	0.000	0.000	0.000	0.000	0.011	0.360	0.001	0.545	0.000	0.184	0.206	GED
20	soneri	0.000	0.000	0.000	0.000	0.391	0.407	0.019	0.139	0.202	0.087	0.674	GED
21	ssgc	0.000	0.000	0.016	0.000	0.967	0.101	0.011	0.835	0.000	0.055	0.251	GED
22	tele	0.001	0.000	0.000	0.000	0.749	0.344	0.001	0.484	0.000	-0.018	0.876	GED

References

Ahmad, H., Shah, S. Z. A., & Shah, I. A. (2010). Impact of futures trading on spot price volatility: Evidence from Pakistan. *International Research Journal of Finance and Economics*, *59*, 145–165.

Antoniou, A., Holmes, P., & Priestley, R. (1998). The effects of stock index futures trading on stock index volatility: An analysis of the asymmetric response of volatility to news. *Journal of Futures Markets: Futures, Options, and Other Derivative Products*, *18*(2), 151–166.

Antoniou, A., Koutmos, G., & Pericli, A. (2005). Index futures and positive feedback trading: evidence from major stock exchanges. *Journal of Empirical Finance*, *12*(2), 219–238.

Bohl, M. T., & Siklos, P. L. (2008). Empirical evidence on feedback trading in mature and emerging stock markets. *Applied Financial Economics*, *18*(17), 1379–1389.

Chau, F., Deesomsak, R., & Lau, M. C. (2011). Investor sentiment and feedback trading: Evidence from the exchange-traded fund markets. *International Review of Financial Analysis*, *20*(5), 292–305.

Chau, F., Holmes, P., & Paudyal, K. (2008). The impact of universal stock futures on feedback trading and volatility dynamics. *Journal of Business Finance & Accounting*, *35*(1-2), 227–249.

Hou, Y., & Li, S. (2014). The impact of the CSI 300 stock index futures: Positive feedback trading and autocorrelation of stock returns. *International Review of Economics & Finance*, *33*, 319–337.

Koutmos, G. (2002). Testing for feedback trading in index futures: A dynamic CAPM approach.

Kuprianov, A. (1995). Derivatives debacles: Case studies of large losses in derivatives markets. *FRB Richmond Economic Quarterly*, *81*(4), 1–39.

Laopodis, N. T. (2005). Feedback trading and autocorrelation interactions in the foreign exchange market: Further evidence. *Economic Modelling*, *22*(5), 811–827.

Lintner, J. (1975). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. In *Stochastic optimization models in finance* (pp. 131–155). Elsevier.

Malik, I. R., Shah, A., & Khan, S. (2013). Single stock futures trading and its impact on feedback trading and volatility: A case study of Pakistan. *Forman Journal of Economic Studies*, *9*, 81–107.

Mazouz, K., & Bowe, M. (2006). The volatility effect of futures trading: Evidence from lse traded stocks listed as individual equity futures contracts on liffe. *International Review of Financial Analysis*, *15*(1), 1–20.

Salm, C. A., & Schuppli, M. (2010). Positive feedback trading in stock index futures: International evidence. *International Review of Financial Analysis*, *19*(5), 313–322.

Sentana, E., & Wadhwani, S. (1992). Feedback traders and stock return autocorrelations: Evidence from a century of daily data. *The Economic Journal*, *102*(411), 415–425.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425–442.

Shiller, R. J. (1990). Market volatility and investor behavior. *The American Economic Review*, *80*(2), 58.
Umer, U. M., Coskun, M., & Kiraci, K. (2018). Time-varying return and volatility spillover among eagles stock markets: A multivariate garch analysis. *Journal of Finance and Economics Research*, *3*(1), 23–42.
Vitale, P. (2000). Speculative noise trading and manipulation in the foreign exchange market. *Journal of International Money and Finance*, *19*(5), 689–712.
Vo, L. H. (2017). Estimating financial volatility with high-frequency returns. *Journal of Finance and Economics Research*, *2*(2), 84–114.
Xie, C., Zhu, Z., & Yu, C. (2012). A study of feedback trading in stock index futures: An empirical analysis on Asian markets. In *2012 IEEE Fifth International Conference on Advanced Computational Intelligence (ICACI)* (pp. 900–902).