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# Single Stock Futures Trading and its Impact on Feedback Trading and Volatility: A Case Study of Pakistan

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**Abstract**

*In this paper, we examine the possibility of an impact of the resumption of trading in Single Stock Futures (SSFs) on the dynamics (positive feedback trading and price volatility) of the underlying stocks in Pakistan's market. Specifically, we test the hypothesis that trading in SSFs promotes or inhibits positive feedback trading in the spot market. Analyzing SSFs has several advantages over investigation of index futures. First, any impact of futures is more likely to be evident in the behavior of SSFs than index futures. Second, with SSFs it is possible to trade directly in the underlying stocks, and the endogeneity issue can be taken care of by using a relatively weighted portfolio of non-SSFs stocks. The findings of our study suggest that there is a statistically insignificant presence of positive feedback trading in both pre-SSFs period to post-SSFs period for both SSFs-listed stocks and a matching group of non-SSFs stocks. Furthermore, the unconditional volatility has significantly changed in both SSFs and non-SSFs, while asymmetry coefficient is statistically insignificant for SSFs but significant for non-SSFs. Overall our findings suggest that resumption of SSFs neither promotes nor inhibits feedback trading in the underlying spot market in Pakistan.*

**Keywords:** Feedback Trading, SSFs, GJR-GARCH, GED

**JEL Classification:** G1, G13, G14, G17

## 1. Introduction

Asset prices reflect information held by two types of active traders in the market. One type is the well informed trader, who trades on relevant information. Another type is the uniformed trader, who trades on price variability itself misinterpreting randomness and assuming it to be information (Black, 1986).According to the academic literature, there are two types of speculators: rational speculators and noise traders. The standard view (Friedman 1952) views rational speculators as trading on fundamentals, which

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in turn will stabilize the market and reduce excessive short term price fluctuation. As long as trading in futures attracts rational speculators, then, the introduction of future markets should move prices closer to their fundamental value and thus stabilize asset prices. On the other hand, noise trading is an essential part of the market, in the sense that it provides the market with necessary liquidity. On the other hand, it also increases the volatility of the underlying market. Consequently, the informed trader may hesitate to take a position, which might be required to exploit arbitrage opportunities. The argument that asset prices are significantly affected by noise trading is achieving wide acceptance in the literature (Thaler, 1999). Shiller (1989), for example, has observed that asset price volatility cannot be explained solely by dividends and earnings. Similarly, De long et. al. (1990a) shows that the unpredictability of noise traders' philosophy can increase the risk in asset prices which, simultaneously, will deter the participation of rational arbitrageurs. In these cases risk-averse arbitrageurs will not take positions to exploit available arbitrage opportunities leading asset prices to move away from their fundamental values, even in the absence of fundamental risk. This allows noise traders to earn higher than expected rates of return by bearing disproportionate amounts of risk.

Positive and negative feedback trading strategies refer to different types of destabilizing noise trading. In positive (negative) feedback trading, an investor buys when asset prices move up (down) and sells (buys) when prices moves down (up). Such strategies are consistent with technical analysis, stop loss orders, portfolio insurance, and extrapolative expectations. When the market is dominated by the positive feedback traders it is optimal for rational speculators to follow the trend. Moreover, such purchases by rational speculators encourage feedback traders and enhance their influence to move the asset prices further away from their fundamental values, in the short run. Feedback trading is then influential for the short run behavior of asset prices even when asset prices revert to fundamental values in the long run (Delong et. al., 1990b). Cutler et. al. (1990) argue that the implied presence of serial correlation in an asset should be incorporated into models that attempt to gauge the influence of feedback traders. Sentana and Wadhwani (1992) proposed a model that extends the logic of Cutler et. al. (1990) to check the relationship between volatility and serial correlation. Their empirical results depict stock returns that show positive serial autocorrelation when volatility is low and negative autocorrelation when the volatility is high. Using Dow Jones index returns from 1885 to 1988, they show results consistent with the notion that feedback trading strategies exist in practice. These findings are robust across different periods and measures of volatility.

Another string of studies develop a relationship between trading in derivatives and volatility in the underlying market. Extensive research is now consistent that trading in derivatives encourages speculation which, in turn, destabilizes the spot market (measured by greater spot market volatility). For example, Kuprianov (1995) studies the highly publicized and costliest cases of derivative related losses and argues that derivative trading poses a serious threat to the international financial system. Yet, in spite of the extensive empirical literature, the influence of derivatives and their impact on the underlying market has not been sufficiently conceptualized, since changes in volatility could be attributed to (de)stabilizing speculation or fluctuations in the information flow. Kawaller, Koch and Koch (1987) have examined the intraday temporal price relationship between S&P 500 futures and S&P 500 index. Their work provides evidence that futures prices consistently lead the index movements by twenty to forty five minutes whereas the index seldom affects the futures price for over one minute. Similarly, Stoll and Whaley (1990) find that S&P 500 and MM index futures lead stock index returns by five minutes to ten minutes, with an average lead of five minutes. A mild positive predictive impact was also noticed. Although the lead-lag relationship does depict the ability of futures to process information faster than underlying spot markets, this should not be interpreted as destabilizing.

The impact of trading in futures markets on spot market volatility is not fully captured by existing theoretical models. For example, an argument could be made in favor of derivative trading in general, and futures trading in particular, that they bring more investors to the spot market and thus increase market liquidity. This increase in liquidity may result in a decrease in spot market volatility. Cox (1976) found empirical results consistent with an increased information flow to the spot market coming from futures trading activity. In this regard Ross (1989) shows that in an arbitrage free economy, volatility in the market is directly related to the speed of information flow to the market. Here, trading in futures is viewed as increasing the information flow to the spot market which, as a result, increases the volatility of the spot market. There is thus a benefit and cost relationship between market efficiency and volatility in the spot market upon the introduction of derivative trading. With an increase in market efficiency, volatility will also increase and vice versa. For most financial economists an increase in informational efficiency at a cost of a simultaneous increase in volatility is a positive development, unless the information content is noise as defined by Black (1986). However, as a result, futures markets will tend to attract noise traders, in particular. In such a case destabilization becomes highly probable, because trading in futures markets is relatively economical, with lower margin requirements and lower costs. Critics of the futures markets appear to argue that such markets will attract noise traders in general and positive feedback traders, in particular, which will increase the volatility of the futures markets. Subsequently, arbitrage mechanism transmits this volatility to the spot market.

Thus far there has been little work examining whether feedback traders migrate from spot market to futures market. Such a study would be of interest to domestic and international investors who rely on futures markets to arbitrage, hedge and speculate. By examining the extent and nature of serial correlation and the change in volatility from the pre to post futures period, a more reliable conclusion could be drawn. It should also better inform the debate regarding policy and regulation of futures markets; the rules regarding margin requirements, market halts, and taxes on transactions can be better analyzed if the role and significance of the futures markets is well understood.

Antoniou et. al. (2005) use data from six industrialized nations to investigate the influence of futures in inhibiting or promoting feedback trading in spot markets. To do so they adopt the model of Sentana and Wadhwani (1992), which considers the consequences of futures markets for the promotion or inhibition of positive feedback trading and volatility. Antoniou et al. (2005) find that future markets helped to stabilize the spot market by reducing the influence of feedback traders. This, in turn implies futures markets attracted more rational investors who increased market efficiency. Mackenzie et al (2001) states that studies of impact of index futures are helpful in identifying market wide dynamics. In doing so, the index effect on individual stocks could not be identified, as the effect would be dissipated across the many constituent stocks of the index. Moreover, the index itself is not directly traded unlike individual stocks. Therefore the effect of futures on positive feedback trading and volatility should be more obvious in relation to individual stocks. Indeed, the fear that Single Stock Futures (SSFs) might have a serious effect on the dynamics of underlying stocks has resulted in the imposition of more rigid constraints on SSFs than index futures.

One way to evaluate the impact of derivatives is to first identify their users and their intentions upon entering derivative trading. Hedgers, arbitragers and speculators are the three broad categories of users of derivatives in the OTC (Over the Counter) or exchange traded markets. Hedgers are firms or individuals who trade futures for the purpose of establishing a known price (locking in the price) in advance. In this way they protect themselves against unfavorable price changes during the interim. Arbitragers are ad hoc organizations or professionals, who simultaneously purchase and sell to profit from price differentials, in underlying or different financial markets. Speculators are firms or individuals who, on the basis of technical and/or fundamental analysis, take uncovered positions with large risk, in the hope of making short term profits. Instead of using the market to produce, process, and handle, they buy and sell on the basis of price predictions. Speculators' activities create bubbles, but also provide necessary liquidity to the market.

Since futures encourage speculative activity, an important policy concern has been whether the futures market's inherent ability to attract speculators will destabilize the spot market. This debate has intensified in Pakistan following the market crash in 2005 where futures markets were blamed for the hyper volatility that persisted in the market because of their ability to attract noise traders. To assess this case, it is necessary to study the futures market's ability to inhibit or promote positive feedback trading, volatility, liquidity and market efficiency in the spot market and to identify any causal link among the futures market and underlying spot market.

Although considerable empirical analysis has been done on the issue of whether trading in futures stabilizes or destabilizes the underlying spot market, the results do not permit a solid conclusion because researchers differ in their view of how speculators impact asset prices. Cox (1976), on the other hand, argues that since future markets are relatively cheap, have low margin requirements and minimal transaction costs, the introduction of these markets will increase the total number of active traders and, in itself, provide additional information flow to the market. Ross (1989) establishes that this increased information flow will eventually result in an increase in price volatility as prices respond to the greater diversity in the flow of information. Hence, potential destabilization comes from increased volatility which also comes with greater informational efficiency.

The academic literature accepts that speculation based upon noise trading may destabilize the market. The critics of derivatives markets in particular argue that because of the low cost of transactions, the derivative markets will attract risk seeking noise traders, which lead prices away from fundamental values and destabilize underlying markets. Positive feedback trading is one destabilizing form of noise trading.

Futures were introduced to the KSE (Karachi Stock Exchange), the most heavily traded local bourse in Pakistan, on 1st July 2001. Initially, one month SSFs were launched with trade accounting for only a small fraction of overall spot market volume and value. By late 2004 and the early part of 2005, SSFs trading activity had increased dramatically and, for a short span of time, had grown to almost 40% of spot market volume. However weak infrastructure and risk management measures meant that the market could not sustain their ever increasing leveraged position in the stock market (leading to the stock market crash in the 2005). After the stock market crisis, several new risk management measures were taken to reduce inherent risk and with these reformed features trading in 18 new stocks was resumed on July 27 2009. While still under transition, there has now accumulated enough experience to begin an assessment this new trading environment.

This study contributes to the literature by examining a recent financial hypothesis in relation to an emerging economy (for which theory has yet to be developed). In addition, the study is done for a market that has received little attention from researchers. Hence this study tackles an under-explored area of research from the perspective of an emerging economy. The specific objective is to assess whether SSFs inhibit and/or promote positive feedback trading in the spot markets of Pakistan. If feedback is positive and noise traders use derivative markets to leverage their trading strategies, an increase in positive feedback trading following the resumption of derivatives would be evident. If the increase in volatility arises because of feedback trading, such a finding would affirm the claim that trading in derivatives destabilizes the market. On the other hand, if derivative markets attract rational speculators who then use trading strategies to bring the prices close to fundamental values, then a reduction in positive feedback trading would be expected following the resumption of derivative markets. Sentana and Wadhwani (1992) provide evidence that serial correlation is inversely related to the volatility in US spot market data and interpret this as consistent with the notion that traders in the market follow feedback trading strategies. This is analogous to the evidence that the autocorrelation of futures' returns is indirectly related to the different levels of volatility.

The rest of the paper is organized as follows: Section 2 summarizes the brief literature on the impact of future trading, elaborates the main characteristics of the feedback trading model, and constructs the hypothesis to be tested. Section 3 discusses the data and methodology. Results are discussed in Section 4, and Section 5 concludes the study.

## 2. Feedback Trading

Concern with the impact of futures trading on the dynamics of the underlying spot market predates their introduction (Chau et. al., 2008). This extensive literature illustrates researchers' interest in the theoretical reasons for the way financial futures can influence spot markets and has only intensified since their introduction in 1982. For our purposes, writers such as Shiller (1984, 1990) and Cutler et. al. (1990) all associate the presence of positive feedback trading with positive serial autocorrelation. The assumption underlying this argument is that an average investor follows a positive feedback trading strategy for investment purposes. Still, the presence of low and insignificant autocorrelations in asset returns indicates that positive feedback trading models might not replace conventional martingale price models soon. Shriller (1989) does argue that positive feedback trading can translate into negligible or even negative serial autocorrelation and, indeed, recent research show that patterns of serial autocorrelation in asset returns are more cumbersome that previously believed. For example, Lebaron (1992) explores the relationship between serial correlation and volatility for different stock return series for daily and weekly frequencies. He finds serially correlation changing over time with an inverse relationship with volatility at short horizon. In other words, first order autocorrelation of asset price changes is high during periods of tranquility and low during high market volatility. Campbell et. al. (1993) use U.S. stock returns to show that first order autocorrelation and traded volumes are inversely related with first order autocorrelation low on high volume days and high on low volume days. On occasion first order correlation has turned negative on high volume days.

By investigating the role of futures trading in promoting/inhibiting feedback trading, it is possible to determine whether changes in spot market dynamics are due to destabilizing speculation or improved information flow. While a number of studies have been done to determine the influence of future trading on the spot market, most of them have used index futures or single stock options. To date SSFs have received very little attention in the literature. Among the studies which have investigated the influence of future trading on volatility and market efficiency, only a couple of studies have examined the impact on feedback trading. Antoniou, Koutmous and Pericli (2005) using the similar methodology found that introduction of future markets help in stabilizing the underlying market, in the sense that they reduce the impact of feedback traders, and make the market efficient by attracting rational traders. Furthermore, Chau, Holmes and Pudyal (2008) depict limited presence of feedback traders in USF (Universal Stock futures) on London International Financial Futures and Options Exchange (LIFFE). Their analysis suggests that the introduction of USF has reduced it even further.

## 2.1 The Heterogeneous Trading Model

Sentana and Wadhwani (1992) propose a model that assumes two types of investors who demand shares in the stock market--expected utility maximizers (Smart Money investors) and positive feedback traders. Expected utility maximizers base their investment decisions rationally upon expected returns subject to wealth constraint while positive feedback traders base their decisions on previous price changes and ignore fundamental values. The share of the market demand for stocks generated by feedback traders could be expressed as follows:

$$F_t = \gamma R_{t-1} \quad (1)$$

Where, $F_t$ denotes the demand by feedback traders and $R_{t-1} = {}^{P_{t-1}}/_{P_{t-2}}$ where $P_{t-1}$ is the stock price in period t-1.The sign of $\gamma$ 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 declines. Second, $\gamma < 0$ denotes the case of negative feedback traders, who sell after a price rise and buy after a price declines. Delong et. al. (1990b) points out that positive feedback trading in coordination with rational speculators will drag the prices away from their fundamental values. So, feedback traders of either type are held responsible for moving the prices away from what it needs to be. Eventually, if evidence is provided consistent with futures inhibiting/ promoting the feedback trading, then regulations regarding futures need to be reviewed.

On the other hand, the share of the market demand for stocks generated by expected utility maximizers could be expressed as follows:

$$S_t = (E_{t-1}R_t - \propto)/\mu\sigma_t^2 \quad (2)$$

Where$E_{t-1}$is the expectation operatoron use of available information at time t-1, $\propto$ is risk-free return, and $\mu\sigma_t^2$ is risk premium.$\mu\sigma_t^2$is positive function of $\mu$ co-efficient of risk aversion and $\sigma_t^2$ is the conditional variance of stock price. If these two types of traders constitute the whole market, then market equilibrium will be achieved, if and only if all the stocks are held by these two types of traders, as follows:

$$F_t + S_t = 1 \quad (3)$$

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

$$R_t = \propto + \mu\sigma_t^2 - \gamma\mu\sigma_t^2 R_{t-1} + \varepsilon_t \quad (4)$$

Where$\varepsilon_t$ is an innovation with zero mean, and rest of the terms are as defined above.

The presence of the lagged return $R_{t-1}$in Equation 4 means that stock returns will exhibit autocorrelation. The sign of $\gamma$(i.e. pattern of autocorrelation) points to the type of feedback trader present in the market. Positive feedback trading ($\gamma > 0$) imply negative autocorrelation in returns, and negative feedback trading ($\gamma < 0$) results in positive autocorrelation. Moreover, the level to which the underlying stock returns depict autocorrelation also fluctuates with volatility i.e. $\mu\sigma_t^2$.Finally, autocorrelation can also be the result of other factors besides feedback trading. To accommodate such factors as market frictions and inefficiencies, the empirical version of Equation 4 could be modified as follows:

$$R_{it} = \propto + \mu\sigma_t^2 + (\varphi_0 + \varphi_1\sigma_t^2)R_{it-1} + \varepsilon_t;\ \ \varepsilon_t \sim N, t, or\ GED(0, \sigma_t^2) \quad (5)$$

where the $R_{it}$ denotes the return to the underlying stock$i$onday$t$.The innovation $\varepsilon_t$ is assumed to follow a normal, student's t, or generalized error distribution (GED, to account for any non-normality present in the stock returns data) with zero mean and conditional variance$\sigma_t^2$.The coefficient $\varphi_0$measures the autocorrelation introduced by other market frictions and inefficiencies and the coefficient $\varphi_1 = -\gamma\mu$ captures autocorrelation arising as a result of persistent positive or negative feedback trading in the market. A negative $\varphi_1$again implies the presence of positive feedback trading and a positive $\varphi_1$is translated as being due to the persistence of negative feedback traders.

The model is completed by using a GARCH specification for conditional variance in Equation 5. The GARCH specification is expressed as GJR-GARCH (1, 1) and the analysis is done using the following equation

$$\sigma_t^2 = \alpha_0 + \alpha_1\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + \delta X_{t-1}\varepsilon_{t-1}^2 \quad (6)$$

Where $\sigma_t^2$ is the conditional variance at time $t$, $\varepsilon_{t-1}$ is an error term at time $t-1$, and $X_{t-1}$ is a dummy variable which takes a value of one for bad news ($\varepsilon_{t-1} < 0$), and zero for good news ($\varepsilon_{t-1} \geq 0$). $\alpha_0$ indicates unconditional volatility, $\alpha_1$ represents the impact of the most recent innovation--often called the news coefficient ($\alpha_1$ is the impact of good news, and $\alpha_1 + \delta$ the impact of bad news)--and $\beta$ measures the persistence of conditional variance. A positive and statistically significant $\delta$ indicates that a negative shock (i.e. bad news) has more influence on the future conditional volatility than a positive shock (i.e. good news) of the same magnitude. It confirms the presence of the leverage effect.

## 2.2 Hypothesis Development and Testing Method

To analyze whether the existence of a futures market has an effect on feedback trading, this study uses a model that links directly autocorrelation and volatility. Specifically, this study looks at the first and second moments of stock returns to answer the following questions: does the resumption of SSFs promote or inhibit positive feedback trading in the spot market and has the resumption of SSFs increased volatility?

The model expressed in Equation 5 and 6 is estimated for data pre-futures and post-futures separately. This permits a direct comparison of the pre and post scenario on the basis of their estimated coefficients. For the mean value equation, the following null hypotheses are tested:

$$H_{01}: Pre\bar{\varphi}_0 = Post\bar{\varphi}_0$$

$$H_{02}: Pre\bar{\varphi}_1 = Post\bar{\varphi}_1$$

For the conditional variance equation, the following null hypotheses are tested:

$$H_{03}: Pre\bar{\alpha}_0 = Post\bar{\alpha}_0$$

$$H_{04}: Pre\bar{\alpha}_1 = Post\bar{\alpha}_1$$

$$H_{05}: Pre\bar{\beta} = Post\bar{\beta}$$

$$H_{06}: Pre\bar{\delta} = Post\bar{\delta}$$

Formally the analysis tests the hypothesis that there is no difference in the coefficients (feedback trading, $\varphi_1$, autocorrelation, $\varphi_0$, and coefficients describing the conditional volatility, $\propto_{0,}$ $\alpha_1, \delta and \beta$) across the two periods.

The resumption of SSFs will have had no effect. On the other hand, if the resumption of futures does improve the information flow to the spot market and subsequent improvement in informational efficiency decreases the impact of noise traders, then the entire set of null hypotheses will be rejected. In such a situation, we would expect a reduction in$\varphi_0, \varphi_1, \delta and \beta$, and increase in $\alpha_1$.Alternatively, if the resumption of futures promotes feedback trading and conditional volatility, the opposite will be expected. Finally, $\propto_0$expresses the unconditional volatility. Here a significant change in $\propto_0$indicates structural change in the unconditional volatility of the underlying stocks due to resumption of SSFs. The remainder of the study examines the differences in findings for SSFs written on underlying stocks listed in different industries.

## 3. Data and Methodology

Two approaches have been used in the literature to study the impact of futures on dynamics of the underlying stock market. First approach, introduced by Harris (1989), compares the pre to post dynamics of the underlying stock. Second approach, used by Faff, Mckenzie and Brailsford (2002), compares the cross-sectional analysis of the dynamics between SSFs and relatively matched non-SSFs. Both the approaches have their own built in advantages. Robustness and difference in cross-sectional determinants are the highlights of the aforementioned approach. The second approach is given significant importance in the recent literature.

Trading in one month SSF contracts was introduced in Pakistan in July 2001 with ten stocks meeting the stringent criteria for listing on the KSE. With the passage of time, the number of SSFs grew to a total of 46 by February 2008. In reaction to market turmoil arising in the global economic crisis, trading in SSFs was discontinued. However, on July 27, 2009 with an improved risk management mechanism, trading in 18[2] stocks resumed. The contract specifications are presented in annexure-I. The features of newer SSFs depict that more cash margin will be required now than before, which will make trading in derivatives more interesting. Contrary to the old future contracts introduced in July' 2001, the newer ones have few differences. Previously, bank/ cash guarantee was 50 percent cash. Now, with newer SSFs,

[2] The SSFs stocks are Adamjee Insurance (Insurance Companies), Azgard Nine (Textile Composite), Bank Al-Falah (Commerical Banks), DG Khan Cement (Cement), Engro Chemcial (Fertilizer), Fauji Fertilizer (BQ) (Fertilizer), Fauji Fertilizer Co (Fertilizer) HUBCO (Power Generation and Distribution), Lucky Cement (Cement), MCB (Commercial Bank), NBP (Commercial Banks), Nishat Mills (Textile Composite), OGDC (Oil & Gas), PPL (Oil & Gas), PSO (Oil & Gas), PTCL (Technology & Communication), POL (Oil & Gas), and UBL (Commercial Banks).

the cash/bank margin is 100 percent. Second, instead of distributing mark to market profit, the exchange will retain all the profit. Third, concentration margin takes will be applied instead of special margin. To be listed each had to meet the stringent criterion set by the Securities and Exchange Commission of Pakistan (SECP) and the KSE to govern the selection of the stocks. The sample period used for this study then spans the re-launching date of the SSFs. Six months' daily closing prices of the stocks on each side of the event date are used to analyze the possible movement of positive feedback traders from spot to futures markets. The data is obtained from the online database of Business Recorder, the premier financial newspaper in Pakistan.

Factors other than the resumption of SSFs may also have affected the underlying dynamics of the spot market. For example, market or industry wide changes around the time of resumption of SSFs may have had a significant impact on the market as well. To ensure that such market or industry wide changes that alter the dynamics of the market may not erroneously be attributed to the resumption of futures trading, it is important to implement a control system to take care of these possible sources of biasness. Thus, in this study, the empirical models are also estimated for a sample of stocks on which SSFs were not written. A relatively matched non-SSFs sample is thus selected for cross-sectional comparison between contracts with and without SSFs written on them. The parameters used for the selection of non-SSFs sample are market capitalization and trading volume[3] in respective sectors as used by Khan Shah and Abbas (2011).

## 4. Empirical Results

To answer the major research question related to the impact of trading in SSFs on the dynamics of the underlying stock markets, Equations 5 and 6 are estimated for the pre and post future market periods in the sample for the 18 SSFs and 16 non-SSFs.

Summary statistics for SSFs and non-SSFS is presented in Table 1 and 2. These tables depict the mean($\mu$), standard deviation($\sigma$), Skewness (S), Kurtosis (K), Jarque Berra test of normality (JB), unit root test for stationarity (U), and ARCH test for 10 lags. Mixed trend regarding departures from

[3] The non-SSFs stocks are ABL (Commercial Banks), ACBL (Commercial Banks), APL (Oil & Gas), ARL (Oil & Gas), BAHL (Commercial Banks), DHC (Fertilizer), EFU (Insurance), FCCL (Cement), ), HBL (Commercial Banks), KAPC (Power Generation and Distribution), KTM (Textile Composite), MGCL (Oil & Gas), MLCF (Cement), NCL (Textile Composite), NRL (Oil & Gas), and TELE (Technology & Communication).

normality and an ARCH effect is evident from both pre and post datasets of SSFs and non-SSFs. Further analysis is required to find out the interrelationship between the autocorrelation and volatility.

Maximum likelihood estimates for both pre and post periods of SSFs and non-SSFs are computed through empirical version of the feedback trading model and are presented in the Tables 3 and 4. The model allows for asymmetric response of volatility to news. The results are summarized for 8 key coefficients $(\propto, \mu, \varphi_0, \varphi_1, \alpha_0, \alpha_1, \beta and\ \delta)$in the feedback trading model which constitute Equation 5 and 6.

For pre futures periods of SSFs, the feedback trading coefficient $\varphi_1$is negative (Positive feedback trading) for AJI, AN, DGKC, FFC, MCB. For the other 13 stocks, $\varphi_1$is positive (negative feedback trading). It means that 28% of the portfolio stocks show signs of positive feedback trading while the remaining 72% depict signs of negative feedback trading before the resumption of SSFs. For the post futures period of SSFs 50% of the stocks (9 stocks) show positive feedback trading and 50% depict negative feedback trading. Similarly, for pre future period of non-SSFs, APL, DHC, EFU, KAPC and TELE show signs of positive feedback trading. APL is significant at 1% and EFU at 5%, rest are insignificant. ABL, ACBL, ARL, BAHL, FCCL, HBL, KTM, MGCL, MLCF, NCL and NRL possess positive$\varphi_1$, among which only MLCF is significant at 1%. For post-future period of non-SSFs, stocks ABL, ACBL, APL, BAHL, EFU, FCCL, HBL, KAPC, NCL, and TELE depict signs of positive feedback trading. Only FCCL is significant at 1% level of significance. Negative feedback trading is depicted by ARL, DHC, KTM, MGCL, MLCF and NRL. ARL and MGCL are significant at 1%. Evidently, 31% of the non-SSFs portfolio of stocks used in this study showed signs of positive feedback trading and 69% depict negative feedback trading in the pre future period. For the post future period, the proportions reversed with the percentage of positive and negative feedback trading now 63% to 37%.

For the whole sample, Tables 5 and 6 report the non-parametric Kruskal-Wallis test investigating whether the coefficients in pre futures period are significantly different from post future period. As Table 5 indicates, of all the 8 coefficients $(\propto, \mu, \varphi_0, \varphi_1, \alpha_0, \alpha_1, \beta and\ \delta)$ in the AR (1)-GJRGARCH only the coefficient for unconditional variance$\alpha_0$ is statistically significantly different in the post future period at the 1 % level of significance for SSFs. All other coefficients show insignificant difference. This gives prima facie evidence that SSFs trading may not have influenced underlying spot market dynamics. If there is an increase in informational efficiency and decrease in feedback trading due to resumption of derivative trading, then we may expect an increase in$\alpha_1$, decrease in$\beta and\ \delta$, and increase (decrease) in the value of$\varphi_1$, when $\varphi_1$is negative (positive).In SSFs, the stock with increasing$\alpha_1$ and simultaneous decreasing $\beta$are in pre to post scenario are: AN, BAF, EC, HUBCO, NBP, NML, and POL. The SSFs with decreasing $\alpha_1$and increasing $\beta$ are: FFBQ, FFC, MCB, OGDC, PSO and PTCL. The SSFs with simultaneously decreasing $\alpha_1$ and $\beta$are: LUCK, PPL, and UBL. And, SSFs with simultaneously increasing $\alpha_1$ and $\beta$are: AJI and DGKC. In NonSSFs, the stock with increasing $\alpha_1$ and simultaneous decreasing $\beta$ are in pre to post scenario are: DHC, MGCL, MLCF, and TELE. The NonSSFs with decreasing $\alpha_1$and increasing $\beta$ are: ABL, ACBL and APL. The SSFs with simultaneously decreasing $\alpha_1$ and $\beta$ are: ARL, BAHL, FCCL, HBL, KAPC, KTM, NCL, and NRL. And, SSFs with simultaneously increasing $\alpha_1$ and $\beta$ is: EFU. Since the results are not consistent with this pattern, we cannot say that resumption of feedback trading has impacted (promotion of positive feedback traders) the underlying spot market. The influence of SSFs on stock market volatility can be analyzed by comparing the $\alpha_0$coefficient pre and post future period for both SSFs and non-SSFs. For non-SSFs the coefficients for unconditional volatility $\alpha_0$ and asymmetric response $\delta$ to news are significantly different from pre to post future periods. However, it is to be noted that a similar trend is evident in the non-SSFs portfolio.

## 5. Conclusion

This study examines the influence of the resumption of futures trading on the dynamics of the underlying spot markets. The study uses a model that incorporates volatility as well as allowing for changes in the degree to which the future trading inhibits or promotes feedback trading. By investigating the behavior of the underlying stock on which SSFs are traded, it is possible to gain insight that was previously not possible. For example, because the SSFs include a number of stocks from different sectors with different characteristics, it is possible to isolate sector specific effects. This sector variability allows the analysis to address the concern over role of SSFs in relation to less liquid sectors. More basically, we would expect that if futures markets do affect their underlying spot markets, such effects would be more evident in the behavior of tradable individual stocks, rather than in the dynamics of a market index that cannot be traded directly. Finally, in addition to the specific nature of SSFs, endogeneity can also be addressed meaningfully by developing a control sample of non-SSFs.

The results provide meaningful and more reliable insight into the effect of futures trading on the underlying spot market. The findings suggest that the presence of positive feedback trading in both the pre and post period for SSFs and non-SSFs is statistically insignificant. Furthermore, unconditional volatility has changed significantly but for both SSFs and non-SSFs, while the asymmetry coefficient is statistically insignificant for SSFs but significant for non-SSFs.

It follows that resumption of SSFs trading has not negatively impacted the dynamics (arrival of positive feedback traders) of the underlying stock market. Given that KSE index futures exist alongside SSFs, it would be expected that their underlying stocks would be even less affected by the resumption of SSFs trading. The effect of the resumption of SSFs trading on the dynamics of the underlying market, particularly feedback trading and volatility was found to be statistically insignificant. In the period following the resumption of futures trading, there is no evidence to support the hypothesis that futures trading has either inhibited or promoted positive feedback trading. The results are consistent with the view that the reestablishment of a future market is not the cause of destabilization in the underlying stock market.

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**Table 1: Summary Statistics of Portfolio Returns for SSFs**

| | | Mean | Std. Dev. | Skewness | Kurtosis | Normality test | | Unit root test | | ARCH test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Scrip** | | | | | | **Jarque-Bera** | **Prob.** | **t-Statistic** | **Prob.** | **F-statistic** | **Probability** |
| **AJI** | **Before** | 0.003 | 0.017 | -0.435 | 2.579 | 4.797 | 0.091* | -8.632 | 0.000*** | 2.773 | 0.098** |
| | **After** | 0.000 | 0.011 | 0.160 | 2.458 | 2.044 | 0.360 | -10.064 | 0.000*** | 3.967 | 0.010** |
| **AN** | **Before** | 0.003 | 0.019 | -0.455 | 2.629 | 4.958 | 0.084* | -8.247 | 0.000*** | 2.599 | 0.079** |
| | **After** | -0.001 | 0.011 | 0.018 | 2.410 | 1.804 | 0.406 | -9.233 | 0.000*** | 2.645 | 0.037** |
| **BAF** | **Before** | 0.000 | 0.017 | 0.075 | 2.444 | 1.697 | 0.428 | -9.837 | 0.000*** | 2.655 | 0.006*** |
| | **After** | 0.000 | 0.011 | 0.774 | 4.144 | 19.136 | 0.000*** | -12.507 | 0.000*** | 1.524 | 0.001*** |
| **DGKC** | **Before** | 0.004 | 0.016 | -0.276 | 2.013 | 6.548 | 0.038** | -9.571 | 0.000*** | 1.262 | 0.028** |
| | **After** | -0.001 | 0.012 | 0.024 | 2.576 | 0.941 | 0.625 | -9.144 | 0.000*** | 2.465 | 0.011** |
| **EC** | **Before** | 0.001 | 0.014 | 0.154 | 2.723 | 0.883 | 0.643 | -8.408 | 0.000*** | 2.419 | 0.013** |
| | **After** | -0.001 | 0.008 | -0.121 | 3.830 | 3.863 | 0.145 | -11.286 | 0.000*** | 0.887 | 0.005*** |
| **FFBQ** | **Before** | 0.001 | 0.013 | -0.319 | 4.267 | 10.311 | 0.006*** | -14.384 | 0.000*** | 0.932 | 0.005*** |
| | **After** | 0.002 | 0.009 | 0.010 | 3.116 | 0.071 | 0.965 | -9.648 | 0.000*** | 3.662 | 0.000*** |
| **FFC** | **Before** | 0.001 | 0.015 | -2.683 | 17.933 | 1290.430 | 0.000*** | -9.664 | 0.000*** | 0.053 | 0.001*** |
| | **After** | 0.000 | 0.005 | -0.484 | 5.193 | 29.682 | 0.000*** | -9.430 | 0.000*** | 0.850 | 0.005*** |
| **HUBCO** | **Before** | 0.002 | 0.010 | 0.289 | 3.142 | 1.816 | 0.403 | -10.111 | 0.000*** | 2.527 | 0.009*** |
| | **After** | 0.000 | 0.008 | -0.756 | 7.287 | 106.742 | 0.000*** | -12.210 | 0.000*** | 0.637 | 0.007*** |
| **LUCK** | **Before** | 0.003 | 0.014 | -0.206 | 1.919 | 6.857 | 0.032** | -9.807 | 0.000*** | 1.962 | 0.090* |
| | **After** | 0.000 | 0.010 | -0.277 | 3.259 | 1.929 | 0.381 | -9.516 | 0.000*** | 1.064 | 0.003*** |

**Table 1: continued**

| | | Mean | Std. Dev. | Skewness | Kurtosis | Normality test | | Unit root test | | ARCH test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Scrip** | | | | | | **Jarque-Bera** | **Prob.** | **t-Statistic** | **Prob.** | **F-statistic** | **Probability** |
| **MCB** | **Before** | 0.003 | 0.015 | -0.368 | 2.537 | 3.876 | 0.144 | -9.045 | 0.000*** | 2.138 | 0.099* |
| | **After** | 0.001 | 0.011 | 0.143 | 2.560 | 1.422 | 0.491 | -10.701 | 0.000*** | 2.019 | 0.039** |
| **NBP** | **Before** | 0.001 | 0.016 | -1.618 | 11.210 | 399.139 | 0.000*** | -8.954 | 0.000*** | 0.225 | 0.009*** |
| | **After** | 0.000 | 0.010 | 0.201 | 2.608 | 1.626 | 0.443 | -11.512 | 0.000*** | 2.724 | 0.070* |
| **NML** | **Before** | 0.002 | 0.014 | -0.151 | 1.833 | 7.442 | 0.024** | -11.121 | 0.000*** | 1.232 | 0.002*** |
| | **After** | 0.001 | 0.013 | -0.093 | 2.347 | 2.387 | 0.303 | -9.526 | 0.000*** | 1.857 | 0.060* |
| **OGDC** | **Before** | 0.001 | 0.012 | 0.102 | 2.480 | 1.601 | 0.449 | -7.975 | 0.000*** | 3.267 | 0.009*** |
| | **After** | 0.001 | 0.008 | 0.179 | 3.176 | 0.825 | 0.662 | -10.750 | 0.000*** | 2.211 | 0.023** |
| **POL** | **Before** | 0.002 | 0.013 | 0.050 | 2.042 | 4.758 | 0.093* | -9.860 | 0.000*** | 1.766 | 0.076* |
| | **After** | 0.001 | 0.009 | 0.234 | 2.668 | 1.702 | 0.427 | -10.041 | 0.000*** | 2.913 | 0.003*** |
| **PPL** | **Before** | 0.001 | 0.011 | -0.127 | 3.188 | 0.510 | 0.775 | -11.645 | 0.000*** | 2.889 | 0.003*** |
| | **After** | -0.001 | 0.016 | -5.223 | 40.057 | 7658.791 | 0.000*** | -8.590 | 0.000*** | 0.043 | 0.012** |
| **PSO** | **Before** | 0.003 | 0.012 | 0.036 | 2.218 | 3.162 | 0.206 | -9.429 | 0.000*** | 2.949 | 0.003*** |
| | **After** | 0.001 | 0.009 | 0.207 | 3.257 | 1.226 | 0.542 | -11.623 | 0.000*** | 1.383 | 0.001*** |
| **PTCL** | **Before** | 0.001 | 0.013 | 0.060 | 2.658 | 0.675 | 0.714 | -9.654 | 0.000*** | 0.594 | 0.008*** |
| | **After** | 0.000 | 0.010 | -0.230 | 2.913 | 1.129 | 0.569 | -8.542 | 0.000*** | 1.018 | 0.004*** |
| **UBL** | **Before** | 0.001 | 0.014 | -0.132 | 2.441 | 1.960 | 0.375 | -10.127 | 0.000*** | 1.831 | 0.064* |
| | **After** | 0.001 | 0.011 | 0.097 | 2.604 | 1.004 | 0.605 | -10.530 | 0.000*** | 0.435 | 0.009*** |

*, **, *** represents significance at 10%, 5% and 1% respectively

**Table 2: Summary Statistics of Portfolio Returns for Non-SSFs**

| | | Mean | Std. Dev. | Skewness | Kurtosis | Normality test | | Unit root test | | ARCH test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Scrip** | | | | | | **Jarque-Bera** | **Prob.** | **t-Statistic** | **Prob.** | **F-statistic** | **Probability** |
| **ABL** | **Before** | 0.003 | 0.014 | -0.453 | 3.446 | 5.218 | 0.074* | -8.521 | 0.000*** | 2.300 | 0.063* |
| | **After** | 0.001 | 0.010 | -40953 | 3.225 | 0.295 | 0.863 | -11.436 | 0.000*** | 1.708 | 0.089* |
| **ACBL** | **Before** | 0.000 | 0.015 | -1.123 | 9.004 | 210.499 | 0.000*** | -10.820 | 0.000*** | 0.424 | 0.009*** |
| | **After** | 0.002 | 0.010 | 0.209 | 2.692 | 1.396 | 0.498 | -10.935 | 0.000*** | 1.244 | 0.002*** |
| **APL** | **Before** | 0.002 | 0.032 | -3.109 | 38.229 | 6558.775 | 0.000*** | -13.204 | 0.000*** | 1.955 | 0.068* |
| | **After** | 0.000 | 0.009 | 0.172 | 3.588 | 2.397 | 0.302 | -13.891 | 0.000*** | 0.723 | 0.007*** |
| **ARL** | **Before** | 0.004 | 0.015 | -0.541 | 2.252 | 8.855 | 0.012** | -8.443 | 0.000*** | 0.960 | 0.004*** |
| | **After** | -0.004 | 0.041 | -9.678 | 103.166 | 53771.430 | 0.000*** | -2.689 | 0.000*** | 0.466 | 0.009*** |
| **BAHL** | **Before** | 0.000 | 0.016 | -4.943 | 44.265 | 9227.781 | 0.000*** | -12.336 | 0.000*** | 0.020 | 0.001*** |
| | **After** | 0.001 | 0.007 | 0.051 | 4.253 | 8.166 | 0.017** | -11.212 | 0.000*** | 2.125 | 0.029** |
| **DHC** | **Before** | 0.001 | 0.013 | 0.094 | 2.459 | 1.680 | 0.432 | -8.872 | 0.000*** | 3.660 | 0.000*** |
| | **After** | 0.001 | 0.011 | -0.224 | 2.807 | 1.229 | 0.541 | -8.619 | 0.000*** | 1.866 | 0.058* |
| **EFU** | **Before** | 0.002 | 0.016 | -0.196 | 2.198 | 4.082 | 0.130 | -7.235 | 0.000*** | 0.645 | 0.007*** |
| | **After** | 0.000 | 0.011 | 0.156 | 2.599 | 1.336 | 0.513 | -10.902 | 0.000*** | 3.115 | 0.002*** |
| **FCCL** | **Before** | 0.002 | 0.018 | 0.310 | 5.400 | 31.496 | 0.000*** | -10.268 | 0.000*** | 0.834 | 0.005*** |
| | **After** | -0.001 | 0.010 | 0.133 | 3.371 | 1.073 | 0.585 | -12.618 | 0.000*** | 0.278 | 0.009*** |
| **HBL** | **Before** | 0.002 | 0.016 | -1.650 | 11.846 | 456.798 | 0.000*** | -10.440 | 0.000*** | 0.094 | 0.001*** |
| | **After** | 0.001 | 0.010 | 0.176 | 2.583 | 1.542 | 0.463 | -11.067 | 0.000*** | 1.587 | 0.001*** |

**Table 2: continued**

| | | Mean | Std. Dev. | Skewness | Kurtosis | Normality test | | Unit root test | | ARCH test | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Scrip** | | | | | | **Jarque-Bera** | **Prob.** | **t-Statistic** | **Prob.** | **F-statistic** | **Probability** |
| **KAPC** | **Before** | 0.001 | 0.009 | 0.107 | 3.491 | 1.471 | 0.479 | -10.934 | 0.000*** | 2.093 | 0.032** |
| | **After** | 0.000 | 0.007 | -0.187 | 4.812 | 17.681 | 0.000*** | -10.920 | 0.000*** | 2.536 | 0.060* |
| **KTM** | **Before** | 0.001 | 0.027 | 0.544 | 4.811 | 23.103 | 0.000*** | -9.865 | 0.000*** | 2.333 | 0.047** |
| | **After** | 0.002 | 0.020 | 0.743 | 3.491 | 12.644 | 0.002*** | -11.274 | 0.000*** | 2.528 | 0.061* |
| **MGCL** | **Before** | 0.003 | 0.014 | -0.219 | 2.094 | 5.188 | 0.075* | -8.299 | 0.000*** | 1.328 | 0.002*** |
| | **After** | 0.000 | 0.029 | -8.410 | 85.944 | 37007.020 | 0.000*** | -10.180 | 0.000*** | 0.008 | 0.002*** |
| **MLCF** | **Before** | 0.002 | 0.022 | 0.473 | 5.288 | 31.414 | 0.000*** | -12.398 | 0.000*** | 1.338 | 0.02** |
| | **After** | -0.002 | 0.012 | -0.076 | 4.347 | 9.487 | 0.009*** | -11.492 | 0.000*** | 2.063 | 0.034** |
| **NCL** | **Before** | 0.000 | 0.021 | 0.148 | 3.060 | 0.467 | 0.792 | -11.802 | 0.000*** | 2.406 | 0.041** |
| | **After** | 0.003 | 0.017 | 0.148 | 2.261 | 3.273 | 0.195 | -8.859 | 0.000*** | 0.838 | 0.005*** |
| **NRL** | **Before** | 0.003 | 0.013 | -0.084 | 2.078 | 4.504 | 0.105 | -9.657 | 0.000*** | 2.432 | 0.012** |
| | **After** | -0.001 | 0.008 | -0.143 | 3.873 | 4.363 | 0.113 | -9.872 | 0.000*** | 1.167 | 0.032** |
| **TELE** | **Before** | 0.002 | 0.037 | -0.413 | 15.668 | 826.002 | 0.000*** | -15.618 | 0.000*** | 0.053 | 0.001*** |
| | **After** | 0.001 | 0.029 | 1.001 | 5.946 | 65.549 | 0.000*** | -9.705 | 0.000*** | 4.406 | 0.000*** |

*, **, *** represents significance at 10%, 5% and 1% respectively

**Table 3: Maximum Likelihood Estimates of AR(1)-GJRGARCH for SSFs**

| | | $\alpha$ | Prob. | M | Prob. | $\phi_0$ | Prob. | $\phi_1$ | Prob. | $\alpha_0$ | Prob. | $\alpha_1$ | Prob. | $\beta$ | Prob. | $\Delta$ | Prob. | Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AJI** | **B** | 0.021 | 0.29 | -69.4 | 0.3 | 0.9 | 0.00b | -2652.07 | 0.03a | 0 | 0.68 | -0.01 | 0.99 | 0.46 | 0.72 | -0.09 | 0.85 | Student's t |
| | **A** | -0.002 | 0.64 | 20.7 | 0.6 | 0.26 | 0.6 | -1455.38 | 0.66 | 0 | 0.54 | 0.12 | 0.45 | 0.64 | 0.18 | 0 | 0.98 | Normal |
| **AN** | **B** | 0.022 | 0.13 | -72.8 | 0.12 | 1.12 | 0.05[a] | -2837.14 | 0.11 | 0 | 0.38 | -0.16 | 0.31 | 0.88 | 0.00b | 0.18 | 0.33 | Student's t |
| | **A** | 0.001 | 0.88 | -8.75 | 0.79 | -0.4 | 0.37 | 3828.85 | 0.21 | 0 | 0.49 | 0.11 | 0.49 | 0.62 | 0.17 | 0.04 | 0.87 | Normal |
| **BAF** | **B** | 0.000 | 0.9 | 1.56 | 0.8 | -0.2 | 0.4 | 766.33 | 0.1 | 0 | 0.26 | 0.05 | 0.00[b] | 1.01 | 0.00[b] | -0.09 | 0.45 | Normal |
| | **A** | 0.001 | 0.68 | -9.55 | 0.5 | 0.32 | 0.11 | -2910.12 | 0.02[a] | 0 | 0.37 | 0.09 | 0.3 | 0.88 | 0.00[b] | -0.01 | 0.95 | GED |
| **DGKC** | **B** | 0.009 | 0.32 | -34.1 | 0.39 | 1.41 | 0.00[b] | -5465.14 | 0.01[b] | 0 | 0.01[b] | -0.4 | 0.03[a] | 0.67 | 0.00[b] | 0.51 | 0.07* | Student's t |
| | **A** | -0.001 | 0.69 | 0.29 | 0.99 | 0.25 | 0.3 | -489.13 | 0.79 | 0 | 0.61 | -0.08 | 0.18 | 1.03 | 0.00[b] | 0.07 | 0.34 | Normal |
| **EC** | **B** | 0.001 | 0.57 | -3.22 | 0.82 | 0.07 | 0.74 | 1005.65 | 0.42 | 0 | 0.67 | 0.02 | 0.6 | 1.01 | 0.6 | -0.08 | 0.34 | Normal |
| | **A** | 0.001 | 0.4 | -27.1 | 0.19 | -0.2 | 0.49 | 1508.24 | 0.44 | 0 | 0.02* | 0.66 | 0.05[a] | 0.24 | 0.19 | -0.31 | 0.35 | Normal |
| **FFBQ** | **B** | 0.004 | 0.01[a] | -20.2 | 0.14 | -0.3 | 0.21 | 502.92 | 0.73 | 0 | 0.33 | 0.18 | 0.01[a] | 0.93 | 0.00[b] | -0.25 | 0.00[b] | GED |
| | **A** | 0.003 | 0.01[b] | -24.9 | 0.01[a] | 0.06 | 0.7 | 1054.31 | 0.54 | 0 | 0.31 | 0.06 | 0.21 | 0.99 | 0.00[b] | -0.21 | 0.04[a] | Normal |
| **FFC** | **B** | -0.017 | 0.19 | 107 | 0.16 | 0.05 | 0.69 | -802.17 | 0.2 | 0 | 0.56 | 0.13 | 0.71 | 0.49 | 0.57 | -0.15 | 0.68 | GED |
| | **A** | 0.002 | 0.00[b] | -81.5 | 0.00[b] | -0.1 | 0.35 | 5407.69 | 0.15 | 0 | 0.00[b] | 0.05 | 0.12 | 0.96 | 0.00[b] | -0.23 | 0.00[b] | GED |
| **HUBCO** | **B** | 0.000 | 0.85 | 18.5 | 0.16 | -0.1 | 0.64 | 1848.57 | 0.33 | 0 | 0.02[a] | 0.02 | 0.23 | 1 | 0.00[b] | -0.01 | 0.81 | GED |
| | **A** | 0.002 | 0.21 | -43.7 | 0.24 | -0 | 0.86 | -832.95 | 0.78 | 0 | 0.53 | 0.17 | 0.35 | 0.62 | 0.21 | -0.03 | 0.91 | GED |
| **LUCK** | **B** | 0.004 | 0.04[a] | -12.2 | 0.17 | -0 | 0.85 | 899.05 | 0.4 | 0 | 0.46 | 0.06 | 0.54 | 1.01 | 0.00[b] | -0.18 | 0.16 | Student's t |
| | **A** | 0.000 | 0.92 | 2.07 | 0.96 | -0 | 0.95 | 1793.91 | 0.58 | 0 | 0.29 | -0.05 | 0.51 | 0.86 | 0.00[b] | 0.13 | 0.25 | GED |
| **MCB** | **B** | 0.001 | 0.77 | 2.36 | 0.93 | 0.56 | 0.18 | -1282.22 | 0.47 | 0 | 0.13 | 0.38 | 0.22 | -0.3 | 0.61 | -0.22 | 0.56 | Normal |
| | **A** | -0.001 | 0.54 | 9.01 | 0.44 | -0.2 | 0.36 | 1353.33 | 0.16 | 0 | 0.5 | -0.02 | 0.85 | 1.03 | 0.00[b] | -0.03 | 0.8 | Student's t |

**Table 3: continued**

| | | $\alpha$ | Prob. | M | Prob. | $\phi_0$ | Prob. | $\phi_1$ | Prob. | $\alpha_0$ | Prob. | $\alpha_1$ | Prob. | $\beta$ | Prob. | $\Delta$ | Prob. | Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NBP** | **B** | -0.002 | 0.28 | 15.3 | 0.08* | -0.3 | 0.06 | 2671.33 | 0.00[b] | 0 | 0.14 | -0.23 | 0.10* | 0.7 | 0.00[b] | 0.56 | 0.11 | GED |
| | **A** | 0.016 | 0.19 | -167 | 0.19 | -1.5 | 0.05[a] | 12933.7 | 0.06* | 0 | 0.25 | 0.16 | 0.4 | -0 | 0.97 | -0.03 | 0.93 | Normal |
| **NML** | **B** | 0.004 | 0.02[a] | -15.6 | 0.05* | -0.4 | 0.04[a] | 1649.03 | 0.07* | 0 | 0.5 | 0.07 | 0.46 | 0.99 | 0.00[b] | -0.23 | 0.21 | Student's t |
| | **A** | -0.003 | 0.26 | 27.9 | 0.18 | 0.15 | 0.68 | 14.65 | 0.99 | 0 | 0.47 | 0.08 | 0.48 | 0.84 | 0.00[b] | 0.06 | 0.64 | Student's t |
| **OGDC** | **B** | 0.003 | 0.07* | -12.5 | 0.37 | -0.3 | 0.12 | 3452.93 | 0.00[b] | 0 | 0.3 | 0.28 | 0.1 | 0.7 | 0.00[b] | -0.17 | 0.43 | Normal |
| | **A** | 0.003 | 0.07* | -38.1 | 0.18 | 0.32 | 0.35 | -4073.95 | 0.45 | 0 | 0.75 | 0.04 | 0.00[b] | 1.01 | 0.00[b] | -0.09 | 0.04[a] | Normal |
| **POL** | **B** | 0.000 | 0.98 | 6.53 | 0.68 | -0.3 | 0.68 | 1950.95 | 0.10* | 0 | 0.48 | 0.03 | 0.67 | 1.01 | 0.00[b] | -0.07 | 0.51 | Student's t |
| | **A** | 0.000 | 0.98 | 14.2 | 0.63 | 0.22 | 0.55 | -1406.62 | 0.71 | 0 | 0.52 | 0.1 | 0.39 | 0.83 | 0.00[b] | 0.02 | 0.89 | Normal |
| **PPL** | **B** | 0.003 | 0.04[a] | -25.6 | 0.11 | -0.4 | 0.06* | 3396.26 | 0.07* | 0 | 0.56 | 0.13 | 0.13 | 0.92 | 0.00[b] | -0.16 | 0.07* | Normal |
| | **A** | 0.014 | 0.45 | -103 | 0.45 | -0.1 | 0.87 | -1088.49 | 0.74 | 0 | 0.81 | -0.01 | 0.99 | 0.49 | 0.81 | -0.04 | 0.95 | GED |
| **PSO** | **B** | 0.001 | 0.77 | 9.83 | 0.57 | 0.04 | 0.88 | 267.32 | 0.86 | 0 | 0.42 | 0.24 | 0.33 | 0.67 | 0.01[b] | -0.02 | 0.93 | Student's t |
| | **A** | 0.000 | 0.84 | 6.58 | 0.77 | 0.14 | 0.61 | -1814.45 | 0.51 | 0 | 0.57 | 0.11 | 0.1 | 0.89 | 0.00[b] | -0.03 | 0.69 | Normal |
| **PTCL** | **B** | 0.002 | 0.13 | -6.82 | 0.33 | -0.3 | 0.16 | 1829.05 | 0.01[a] | 0 | 0.61 | 0.1 | 0.00b | 0.98 | 0.00[b] | -0.2 | 0.00[b] | Normal |
| | **A** | 0.004 | 0.02* | -45 | 0.01[b] | -0.2 | 0.43 | 4845.3 | 0.09* | 0 | 0.84 | 0.01 | 0.95 | 1.03 | 0.00[b] | -0.09 | 0.07* | Normal |
| **UBL** | **B** | -0.001 | 0.75 | 9.31 | 0.5 | -0.1 | 0.85 | 439 | 0.75 | 0 | 0.73 | 0.06 | 0.00[b] | 0.98 | 0.00[b] | -0.07 | 0.14 | Normal |
| | **A** | -0.001 | 0.8 | 20.8 | 0.57 | 0.31 | 0.48 | -2095.74 | 0.55 | 0 | 0.86 | 0.07 | 0.3 | 0.9 | 0.00[b] | 0.03 | 0.82 | Normal |

**B** stands for **Before**
**A** stands for **After**
*, [a], [b] represents significance at 10%, 5% and 1% respectively.

**Table 4: Maximum Likelihood Estimates of AR(1)-GJRGARCH for Non-SSFs**

| | | α | Prob. | M | Prob. | $\phi_0$ | Prob. | $\phi_1$ | Prob. | $\alpha_0$ | Prob. | $\alpha_1$ | Prob. | Β | Prob. | Δ | Prob. | Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ABL** | **B** | 0.00 | 0.75 | 4.21 | 0.78 | -0.13 | 0.57 | 263.50 | 0.79 | 0.00 | 0.20 | 0.48 | 0.01[b] | 0.51 | 0.00 | -0.18 | 0.42 | GED |
| | **A** | 0.00 | 0.45 | -3.62 | 0.86 | 0.09 | 0.74 | -677.32 | 0.74 | 0.00 | 0.26 | 0.14 | 0.25 | 0.85 | 0.00 | -0.07 | 0.72 | Normal |
| **ACBL** | **B** | 0.00 | 0.91 | -4.15 | 0.60 | -0.19 | 0.25 | 214.48 | 0.61 | 0.00 | 0.30 | 0.21 | 0.05* | 0.81 | 0.00 | -0.11 | 0.53 | GED |
| | **A** | 0.00 | 0.20 | -3.33 | 0.85 | 0.07 | 0.78 | -425.62 | 0.83 | 0.00 | 0.17 | 0.08 | 0.16 | 0.97 | 0.00 | -0.19 | 0.02[a] | Normal |
| **APL** | **B** | 0.00 | 0.85 | 2.53 | 0.00[b] | 0.04 | 0.55 | -11.63 | 0.00[b] | 0.00 | 0.35 | 0.78 | 0.20 | 0.42 | 0.34 | -0.67 | 0.23 | GED |
| | **A** | 0.00 | 0.63 | -17.00 | 0.41 | -0.17 | 0.39 | -590.87 | 0.81 | 0.00 | 0.67 | -0.01 | 0.83 | 0.93 | 0.00 | 0.15 | 0.04[a] | Normal |
| **ARL** | **B** | 0.00 | 0.33 | 3.78 | 0.68 | 0.15 | 0.42 | 332.76 | 0.67 | 0.00 | 0.37 | 0.03 | 0.67 | 1.01 | 0.00 | -0.07 | 0.53 | Student's t |
| | **A** | -0.01 | 0.00[b] | 19.80 | 0.00[b] | -0.63 | 0.00[b] | 1326.04 | 0.00[b] | 0.00 | 0.35 | -0.46 | 0.01[a] | 0.62 | 0.14 | 0.83 | 0.24 | GED |
| **BAHL** | **B** | 0.00 | 0.74 | 9.85 | 0.78 | -0.34 | 0.39 | 107.31 | 0.95 | 0.00 | 0.60 | 0.04 | 0.96 | 0.53 | 0.56 | -0.06 | 0.94 | GED |
| | **A** | 0.01 | 0.58 | -92.09 | 0.59 | 0.85 | 0.33 | -8738.54 | 0.34 | 0.00 | 0.54 | 0.02 | 0.88 | -0.18 | 0.92 | 0.11 | 0.68 | Normal |
| **DHC** | **B** | 0.00 | 0.82 | 0.63 | 0.94 | 0.15 | 0.36 | -96.89 | 0.89 | 0.00 | 0.03[a] | 0.05 | 0.31 | 0.98 | 0.00 | -0.08 | 0.36 | Normal |
| | **A** | 0.00 | 0.01[a] | -36.01 | 0.03[a] | -0.25 | 0.27 | 2045.17 | 0.18 | 0.00 | 0.03[b] | 0.61 | 0.09* | 0.16 | 0.52 | -0.13 | 0.75 | GED |
| **EFU** | **B** | 0.00 | 1.00 | -0.40 | 0.99 | 1.65 | 0.01[b] | -6311.35 | 0.03[a] | 0.00 | 0.00[b] | -0.18 | 0.09* | -0.41 | 0.14 | 0.25 | 0.13 | Normal |
| | **A** | 0.00 | 0.83 | 0.01 | 1.00 | 0.09 | 0.69 | -462.76 | 0.71 | 0.00 | 0.44 | 0.24 | 0.07* | 0.74 | 0.00 | -0.02 | 0.90 | Normal |
| **FCCL** | **B** | 0.00 | 0.87 | -5.29 | 0.50 | -0.24 | 0.18 | 38.48 | 0.93 | 0.00 | 0.67 | 0.08 | 0.26 | 0.92 | 0.00 | -0.09 | 0.44 | GED |
| | **A** | 0.00 | 0.45 | 18.70 | 0.69 | 0.35 | 0.11 | -6480.22 | 0.01[b] | 0.00 | 0.29 | -0.11 | 0.16 | 0.82 | 0.00 | 0.11 | 0.27 | Normal |
| **HBL** | **B** | 0.00 | 0.13 | 21.54 | 0.08* | 0.17 | 0.13 | 15.29 | 0.94 | 0.00 | 0.01[b] | 1.09 | 0.02[a] | -0.16 | 0.37 | -0.78 | 0.23 | GED |
| | **A** | 0.01 | 0.58 | -92.09 | 0.59 | 0.85 | 0.33 | -8738.54 | 0.34 | 0.00 | 0.54 | 0.02 | 0.88 | -0.18 | 0.92 | 0.11 | 0.68 | Normal |
| **KAPC** | **B** | 0.00 | 0.05[a] | -15.66 | 0.37 | 0.13 | 0.53 | -1014.39 | 0.58 | 0.00 | 0.41 | 0.19 | 0.04[a] | 0.84 | 0.00 | -0.12 | 0.36 | Normal |
| | **A** | 0.00 | 0.31 | -21.00 | 0.08* | 0.00 | 0.97 | -280.88 | 0.74 | 0.00 | 0.44 | -0.05 | 0.66 | 0.67 | 0.11 | 0.29 | 0.55 | GED |

**Table 4: continued**

| | | α | Prob. | M | Prob. | $\phi_0$ | Prob. | $\phi_1$ | Prob. | $\alpha_0$ | Prob. | $\alpha_1$ | Prob. | B | Prob. | Δ | Prob. | Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **KTM** | **B** | 0.00 | 0.27 | -2.31 | 0.50 | -0.31 | 0.00[b] | 1.24 | 0.99 | 0.00 | 0.13 | 0.74 | 0.08* | 0.65 | 0.00 | -0.68 | 0.11 | GED |
| | **A** | 0.00 | 0.86 | -6.19 | 0.56 | -0.07 | 0.72 | 220.89 | 0.61 | 0.00 | 0.00[b] | 0.05 | 0.52 | -0.49 | 0.01 | -0.06 | 0.69 | GED |
| **MGCL** | **B** | 0.00 | 0.25 | -16.21 | 0.44 | 0.04 | 0.90 | 1303.65 | 0.40 | 0.00 | 0.68 | 0.10 | 0.56 | 0.97 | 0.00 | -0.21 | 0.32 | Student's t |
| | **A** | 0.00 | 0.00[b] | -11.61 | 0.00[b] | -0.60 | 0.00[b] | 1758.71 | 0.00[b] | 0.00 | 0.38 | 0.32 | 0.00[b] | 0.83 | 0.00 | -0.31 | 0.00[b] | GED |
| **MLCF** | **B** | 0.00 | 0.12 | -7.61 | 0.04[a] | -0.58 | 0.00[b] | 727.77 | 0.01[b] | 0.00 | 0.18 | 0.05 | 0.20 | 1.00 | 0.00 | -0.18 | 0.04[a] | GED |
| | **A** | 0.00 | 0.45 | -8.58 | 0.54 | -0.28 | 0.16 | 754.28 | 0.36 | 0.00 | 0.13 | 0.17 | 0.32 | 0.46 | 0.08 | 0.21 | 0.54 | GED |
| **NCL** | **B** | 0.00 | 0.66 | -2.47 | 0.23 | -0.34 | 0.01[b] | 397.28 | 0.15 | 0.00 | 0.43 | -0.02 | 0.00[b] | 1.02 | 0.00 | -0.09 | 0.22 | Normal |
| | **A** | 0.00 | 0.96 | 6.41 | 0.82 | 0.81 | 0.02[a] | -1804.04 | 0.12 | 0.00 | 0.56 | -0.02 | 0.87 | 0.71 | 0.12 | 0.16 | 0.54 | Normal |
| **NRL** | **B** | 0.00 | 0.19 | -6.48 | 0.66 | 0.13 | 0.57 | 129.25 | 0.92 | 0.00 | 0.63 | 0.07 | 0.13 | 0.98 | 0.00 | -0.10 | 0.00[b] | Normal |
| | **A** | 0.00 | 0.74 | 0.81 | 0.99 | -0.29 | 0.31 | 3401.11 | 0.43 | 0.00 | 0.50 | 0.00 | 0.98 | 0.83 | 0.00 | 0.10 | 0.55 | Normal |
| **TELE** | **B** | 0.00 | 0.10* | -5.12 | 0.06* | -0.28 | 0.00[b] | -25.81 | 0.59 | 0.00 | 0.26 | 0.15 | 0.22 | 0.83 | 0.00 | -0.17 | 0.21 | GED |
| | **A** | 0.00 | 0.12 | -3.92 | 0.12 | 0.05 | 0.61 | -9.16 | 0.86 | 0.00 | 0.19 | 0.34 | 0.03[a] | 0.75 | 0.00 | -0.23 | 0.47 | GED |

**B** stands for **Before**
**A** stands for **After**
*, [a], [b] represents significance at 10%, 5% and 1% respectively

**Table 5: Test Statistics[a,b]**

| | AlphaS | MeauS | PhiknotS | PhioneS | AlphaknotS | AlphaoneS | BetaS | SaiiS |
|---|---|---|---|---|---|---|---|---|
| **Chi-Square** | 0.786 | 0.4 | 0.626 | 0.169 | 18.156 | 0.016 | 0.144 | 1.851 |
| **Df** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Asymp. Sig.** | 0.375 | 0.527 | 0.429 | 0.681 | 0 | 0.899 | 0.704 | 0.174 |

a. Kruskal Wallis Test

b. Grouping Variable: PretopostS

**Table 6: Test Statistics[a,b]**

| | AlphaN | MeauN | PhiknotN | PhioneN | AlphaknotN | AlphaoneN | BetaN | SaiiN |
|---|---|---|---|---|---|---|---|---|
| **Chi-Square** | 0 | 1.642 | 0.091 | 0.688 | 26.592 | 1.945 | 2.273 | 6.765 |
| **Df** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Asymp. Sig.** | 1 | 0.2 | 0.763 | 0.407 | 0 | 0.163 | 0.132 | 0.009 |

a. Kruskal Wallis Test

b. Grouping Variable: PretopstN

**Annexure I: Contract Specifications of Deliverable Future Contracts**

| | |
|---|---|
| **Contract Size** | 500 Shares |
| **Position Limits** | As prescribed under Regulations Governing Risk Management of Karachi Stock Exchange, as amended from time to time |
| **Daily Price Limits** | As provided under Regulations Governing Risk Management of the Exchange |
| **Contract Period** | 1 calendar month |
| **Opening of Contract** | Monday preceding the last Friday of the month, if Monday is not a trading day, then immediate next trading day |
| **Overlapping Period** | Maximum Five Days (not less than two days). |
| **Expiration Date/ Last Trading Day** | Last Friday of the calendar month, if last Friday is not a trading day, then immediate preceding trading day |
| **Settlement** | T+2 settlements falling immediate after the close of contract |
| **Depository of Underlying Security** | Central Depository Company of Pakistan Limited |