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ABSTRACT

This study examines the effect of the earthquake of October 8, 2005 on the price behaviour and activities of KSE. Sixty firms are selected from those listed on Karachi Stock Exchange, and the results are informative about the price behaviour of the stock market in response to unanticipated shock. The results reveal the fact that the earthquake had both a positive and a negative information content for KSE stocks. There is an increase in the return and volume of the cement, steel, food, and banking sectors, which indicates that investors have expectations of the upcoming demand of investment in these sectors. Furthermore, there is no significant increase in the volatility, because the investors seem certain about the future outlook and they take into account the March 2005 market crash. These findings support the fact that the stock market of Pakistan is reactive to unanticipated shocks and it takes no time to impact the market activities. The evidence also suggests that the Pakistani stock market is resilient, and that it recovered soon after the catastrophic shock.

JEL classification: G12, C11, C15

Keywords: Catastrophic Shock, Market Model, GARCH Specification, Average Return, Market Volume, Market Volatility

I. INTRODUCTION

The earthquake that struck northern areas and Azad Kashmir in the morning of October 8, 2005 is the most severe earthquake ever struck to this region. A large body of empirical literature suggests that stock prices are highly and instantaneously reactive to such unanticipated disastrous occurring. The stock prices reflect investors' expectations about the future returns, and taken as aggregate stock price movement can generate a tidal wave of activity. Catastrophic events which are unforeseen can have serious implications for stocks and bonds because of their liquidity. The decisions made by investors to buy and sell can quickly, easily and inexpensively reversed. When information becomes available about a catastrophic event, investors often flee the market in search of safe financial instruments and panic is created. This initial panic has potential to turn into chaos and a long term bear market, or it can be reversed if investors' hopes returns.

The information of major events takes no time to impact the stock prices. The importance of particular events and their effect on the stock market has been a subject of study in financial economics literature since long. Such studies attempt to assess the extent to which stock markets' performance stray's from the normal around the time of the occurrence of the events The most successful application of event studies has been in the area of corporate finance. Some examples include the mergers and acquisitions [Jensen and Ruback (1983)]; earning announcement [Barklay and Litzenberger (1988)], issue of new debt or equity [Myers and Mujluf (1984)] and announcements of macroeconomic variables such as trade deficit [McQueen and Roley (1993)]. The event studies are also used in law and economics to measure the impact on the value of the firm due to the change in the regularity environment [Shwert (1981)] and to assess damages in legal liability cases event studies are used [Mitchell and Netter (1994)]. The stock market crash in the USA of October 1987 and related crash in the Far East later in January 1998 have led to several studies of these events [Jung, *et al*. (1992) and Claessens, *et al.* (2002)]. These studies emphasise the need for research to explore what fundamental economic factors trigger the large decline and the institutional and structural factors that are inherent in the trading strategies of investors. Some studies have also

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investigated the effect of natural disaster on the insurance firms listed on the stock exchanges. Natural disasters have two opposite effects on insurance firm value: a negative effect due to payment of policyholders' claim and a positive effect due to expectations of higher premium. The presence and relative strength of these two effects on insurance firms for Hurricane Andrew is studied by Angbazo and Narayanan (1996) and for Oct 17, 1989 California earthquake by Shelor, *et al.* (1992)

The volatility caused by an unexpected event has been largely observed in almost all of the stock exchanges in the world. That is, the volatility caused by an event has a much longer life than the event itself. This behaviour has been consistently observed in a large number of studies including a few for Pakistan [Chou (1988) and Javid and Ahmed (1999)]. It is therefore not surprising that the analysis impact of events on stock market in Pakistan has taken an important position in economic research. The objective of present study is to analyse the impact of October 8, 2005 earthquake on the stock market behaviour in Pakistan. An attempt is made to analyse effect on the stock market average return, volatility and volume around the event on the listed firms of Karachi stock exchange.

The study is organised as follows. The section two briefly reviews the market for the period under study. The review of the previous empirical findings is discussed in section three. The data and methodology is presented in section four. The section five provides the empirical findings and last section offers conclusion of the study.

II. OVERVIEW OF THE MARKET

It is interesting to present a brief overview of the market for the sample period Jan 2005 to Dec 2006. The Karachi Stock Exchange (KSE) came into existence on September 18, 1948. Though two other stock exchanges were latter established in the country, in Lahore and Islamabad in 1970 and 1992 respectively, the KSE remains the main centre of activity where 75 to 80 percent of current trading takes place. It gained momentum in 1960 and made significant progress in listings and capitalisation. However it lost momentum in 1970 due to political unrest and then nationalisation polices adopted by the government. The policy of greater reliance on private enterprise restored the market sentiment in 1980s. The market, however actually regained its momentum in early 1990 when it was opened to international investors. This put a new life in the market giving rise to an unpresidential bullish trend. The size and depth of the market was also improved. In terms of its performance the market has been ranked third among emerging markets. Unfortunately the market could not maintain its performance in latter years because of political and economic instability.

The KSE depicted handsome improvement when the previous government assumed office in February 1997. Due to some extraneous factors, where the government has no control, like sharp fall in far Eastern capital markets and heavy drop in the value of these currencies, the international fund manager started to off load their holdings in the region. The shock wave emitted by the market badly affected our stock market as well. The selling pressure of the foreign fund managers resulted in the fall of KSE-100 index which came down to 1746.31 points on January 1, 1998 due to unremitting selling pressure further declined to 1609.16 points on January 28, 1998.

During 2000 to 2001, Security and Exchange Commission of Pakistan (SECP) implemented various laws and orders to improve the performance of the stock exchanges and to bring their operations in line with the best international practices. The Code of corporate governance was introduced in 2002 and SECP continued to improve the regulatory framework of capital markets during 2003. In addition to the earlier reforms in the areas of rationalisation of trading practices, risk management and enhancement of corporate governance, some other reforms are the Carry-Over Trade (COT) system is rationalised. With respect to the performance of the equity markets, the extended rally at the KSE which started in 2003, accelerated in 2005. This is particularly true especially from December 2004 to mid-March 2005, when the KSE index shows an unprecedented sharp growth and touched a record high level of 10,303 points. However, only a part of this improvement can be supported by the improvement in economic fundamentals. The factors like withdrawal of funds by COT financiers, the lock-in effects of circuit breakers, excessive buying in the ready market and selling in the futures market by certain operators, contributed significantly to the mid-March 2005 market decline. The stock market turned bearish since March 16, 2005 and the KSE 100 index dropped to as low as 6939 as on April 12, 2005 from its peak of 10,303 on 15th March 2005 showing a decline of 32.7 percent. Such a sharp rise in index and a subsequent steep decline represented abnormal and unhealthy movements in the equity market. Notwithstanding sharp fall there were no broker defaults in the stock market and also market was not closed or suspended, as had been the case in some previous market falls. The market was already in the bearish phase when the earthquake of October 8 struck the northern area of Pakistan and Azad Jummu and Kashmir. Overall market did not show much impact, the KSE 100 dropped down from 8542 to 8520 points and this declining trend continued until October 31 when the KSE 100 index was lowest 8247 in this month. But the scripts of banks, cement, food and chemical industry respond to this bad news.

Table 1

Stock Indicators on Karachi Stock Exchange
(KSE-100 Index: November 1991=1000)

Months	2005			2006		
	KSE Index (End Month)	Market Capitalisation (Rs Billion) (End Month)	Turnover of Shares (Billion)	KSE Index (End Month)	Market Capitalisation (Rs Billion) (End Month)	Turnover of Share (Billion)
January	6747.4	1840.5	12.2	10524.2	2990.3	8.5
February	8260.1	2262.7	14.0	11456.3	3221.2	10.3
March	7770.3	2114.8	11.2	11485.9	3218.5	8.1
April	7104.7	2022.9	4.9	11342.2	3160.1	6.0
May	6857.7	1792.8	6.1	9800.7	2743.4	5.1
June	7450.1	2013.2	5.6	9989.4	2801.0	4.0
July	7179.0	2013.7	3.1	10497.6	2905.1	4.4
August	7796.9	2132.5	5.0	10064.1	2786.9	4.0
September	8225.6	2329.7	7.9	10512.5	2874.7	3.0
October	8247.3	2340.8	6.5	11327.7	3074.3	3.2
November	90.25.9	2551.2	7.5	10618.8	2919.7	3.8
December	9556.6	2709.5	7.4	10040.5	2738.4	2.6

Source: Karachi Stock Exchange.

Since November 2005 KSE 100 index have shown constant rise and in 2006 continue to maintain its rising trend. This bull-run continued with one sharp and short lived correction in early March when the index plunged about 14 percent in a week only to recover the very next week. The KSE-100 Index crossed the barrier of 12000 points for the first time in the history of capital market and touched an all time high on April 13, 2006. The KSE-100 index made further inroad and reached 12274 points on April 17, 2006 showing a growth of 64.7 percent over June 2005. The rally that started towards the end of 2005 was primarily driven by the phenomenal rise in the banking sector profits. This sector outperformed the market with the prices of the some of the shares hovering at the record heights without showing any sign of correction. Around the same time cement stocks attracting considerable interest of the investor. Cement plants were running at high capacity utilisation and the commodity was being sold at a premium to its ex-factory price. With the start of post winter season in the earthquake areas, the demand of cement picked up momentum and the cement price in the market touched the record level. To bring down the cement price low and facilitate construction in the quake affected areas, the government allowed duty free import of cement and also offered freight subsidy in a bid to bring down the cement prices. Import of cement was also allowed from India. This boded well for cement industry but outlook of cement remain volatile and adversely effect construction industry. The discoveries of Tal Block injected new life into the oil and gas exploration sector which was lagging behind in last few months. The stock prices of exploration companies responded

massively to this news. Gas distribution companies continued trading at premium to their fair value. The primary reason for such high price has been the privatisation play and interest of some globally reputable organisations in acquiring strategic stake in these companies. In the latter half of 2006 the bulls and bears continued to lock there horns due to rumors and news continued to pour in including imposition of tax on capital gain, enhancement of capital value tax and introduction of universal identification number for investors. The KSE index was 10058 on December 28, 2006 with market capitalisation of 2738.0 billion rupees.

III. REVIEW OF LITERATURE

An extensive work in financial economics literature has been done to examine the effect of an event on the stock returns. That event may be in terms of any shock, any policy announced like dividend policy or any natural event like any mishap or disaster. The financial market data is used in an event study to measure the impact of a specific event on the value of a firm. The motivation of undertaking such a study is that, given rationality in the market place, the effect of an event is reflected immediately in the security prices. The study by Dolley (1933) is the first work in this area in which he examines the price effect of stock splits. His findings show that during 1921 to 1931, out of 95 splits, the price increase in 57 instances and declined in 26 cases.

Two noteworthy papers in this area are Brown and Warner (1980, 1985) which have considered the methodological issues regarding event studies based on daily and monthly data respectively. In theoretical analysis of an event on return generating process of a firm due to an economic event, Damodaran (1985) has found two elements—the natural event structure, i.e. the process by which nature effect the value of the firm and the information structure, i.e. the process by which the information about these events is collected and disseminated to the investor. Simple measure of these dimensions of the information structure-that is frequency and accuracy of, and the bias of information releases, are derived from the moments of the return distribution. The study by Salinger (1992) has discussed appropriate methodology for measuring the effect of an event on the value of the firm's equity. This study leads to the conclusion that cumulative abnormal returns do not measure the effect of an event on the firm value if there are dividends during the event window and suggests that it is appropriate to use pre-event parameters in return generating process even if event alters the parameters during the event window and controlling for factors other than return on the market improve the power of estimation.

The most successful application of event studies has been in the area of corporate finance. Important examples include wealth effect of merger and acquisition and price effect of financing decisions by firms. The general result is

that, given a successful takeover, the abnormal returns of targets are large and positive and abnormal returns of acquirer are close to zero. Jarrell and Poulsen (1988) have documented that average abnormal return for target share holders exceeds 20 percent for a sample of 663 successful takeovers from 1960 to 1985. In contrast the abnormal return for the acquirer is close to zero. Jensen and Ruback (1983) and Jarrell, *et al*. (1988) provide survey on event study work in the area of merger and acquisition. As regards the corporation financial decisions, when a corporation announces that it will raise capital from the external market, there is on average a negative abnormal return and the magnetite of it depends on source of external financing. Asquith and Mullins (1986) find for a sample of 266 firms announcing an equity issue in the period 1963 to 1981, the two day average abnormal return is –2.7 percent. Wooldridge and Snow (1990) examines the stock market reaction to public announcements of corporate strategic investment: formation of joint ventures, research and development projects, major capital expenditure and diversification into two products etc. analysis of 767 strategic investment decisions announced by 248 companies in 102 industries indicate that stock market reaction to strategic investments conforms the shareholder value maximisation hypothesis. The implication of a positive reaction by the stock market to the investment announcements is drawn from corporate strategy research and management practices. The less successful application is in areas where event date is difficult to identify or event date is partially anticipated, for example the wealth effect of regulatory changes. Schipper and Thompson (1985) encounter this problem in the study of merger related regulations. They attempt to circumvent this problem of regulatory changes being anticipated by identifying dates when the probability of a regulatory change passed changes. However they find large insignificant results leaving upon the possibility the absence of distinct event dates as the explanation of lack of wealth effect.

The effect of unanticipated natural disaster on the value of listed firms has been studied in the empirical literature on event studies. Angbozo and Narayanan (1996) have examined the impact of Hurricane Andrew on the stock prices of publicly listed US property-liability insurers. They find that Andrew has a large negative effect on insurance stocks that was offset to some extent by the market's expectations of the premium increase. Shelor, *et al.* (1992) have investigated the insurance companies after the October 17, 1989 California earthquake resulted in a positive stock price response for property liability and multiple line insurer. Investors' expectations of higher demand for insurance apparently more than offset the potential earthquake losses.

Chen and Seims (2002) have found that US capital market respond to fifteen cataclysmic events during back to 1929 stock market crash. In examining the global market response to such unforeseeable disastrous occurring (the 1987 stock market crash, Iraq's invasion of Kuwait in 1990, and September 11, 2002

terrorist attack in US), they conclude that global capital markets today appear to be tightly interlinked, news spread rapidly, with quick spillover effect. They also find evidence that suggest that US capital market is more resilient than in the past and they recover sooner from cataclysmic events than other global markets.

The study by Schnusenberg (2000) examines the abnormal return associated with German firms and with American multinational companies with a presence in Germany in response to unification on November 9, 1989. German firms exhibit a positive abnormal return of 2.69 percent in the week immediately following the event and negative abnormal return of 0.67 percent in the year following the event indicating an initial over-estimation in their ability to profit from the newly arising opportunities. The American MNCs operating in Germany showing negative abnormal return of 0.52 percent attributable to a potential competitive advantage of American verses German firms resulting from information asymmetries.

There is no serious work done in this area in Pakistan. Javid and Ahmed (1999) analyse the response of Karachi Stock Exchange, the main Pakistani equity market, to nuclear detonation. The objective of the study is to analyse the consequences of nuclear detonation shock by India followed by Pakistan in May 1998 on the activities at Pakistan's major stock market, the Karachi Stock Exchange (KSE). The study is based on daily data and it covers the period April1995 to June1999 and GARCH model is used for estimation. The results show that the nuclear detonation by India has significant adverse effects on the daily rate of return at the KSE, while trading volume and the level of volatility increased. The events of nuclear detonation by Pakistan, on the other hand, do not have any significant effect on the average rate of return. However it resulted in an increase in volatility and trade volume.

The above review of literature indicates that there is a surge of interest in stock markets among economist in Pakistan. Since, however, economists have started taking interest in this subject only recently, many areas on research are still not covered. In this perspective the present study aims to make a contribution to the literature on stock market behaviour with reference to Karachi Stock Exchange, the main equity market in Pakistan.

IV. DATA AND METHODOLOGY

The main focus of this study is to analyse the effect of Oct 8, 2005 earthquake on the activities of Karachi stock exchange. The importance of particular events and their effect on the stock market can be instantaneously captured by stock market prices, volatility and volume. The catastrophic events usually have negative effect on the capital market because of the uncertainty about the future and about the individual firm's abilities and the resources needed to see them through a crisis often clouds judgment, sending many investors into a panic. But some firms react more negatively (positively) than others.

Data

For this analysis 60 firms are selected out of 779 firms listed on Karachi Stock Exchange, which is the largest stock market in the country in terms of volume and capitalisation. In selecting the firms three criteria were used (1) continuous listing on exchange for the period of analysis, (2) representative of almost all the important sectors and (3) with high turnover in their particular sector. The data on closing price, turnover and KSE 100 index is taken from the website of Business Recorder. Thus the three indicators of stock market activities used for analysis are average return, volume and volatility on the basis of daily data. The study is based on daily observations ranging from January 2005 to December 2006. The data for Karachi Stock Exchange is taken from the web site of business recorder. The data on dividends, rights issue and bonus shares is obtained from the annual reports of the firms,

Methodological Framework

The event study methodology is based on the efficient market hypothesis [Fama, *et al.* (1969)]. This hypothesis states that as new information becomes available as the result of some unexpected event, it is fully taken into account by investors assessing its present and future impact. The investors immediately reassess individual firms and their ability to withstand potential economic, environmental, political, social and demographic changes resulting from an event. The new assessment results in stock price changes that reflect the discounted value of the current and future firm performance. The significant negative and positive price changes can then be attributed to specific event because it is based on the overall assessment of many investors who quickly update all available information in assessing each individual firm's market value [McWilliams and Seigel (1997)].

There are alternative methodologies for carrying out event study [MacKinlay (1997)]. The empirical analysis of this study is based on the market model which is simple econometric model with less strong statistical assumptions than capital asset pricing model (CAPM). The market model relates the return on the individual asset to the return on the market index and an asset specific constant. The estimation and testing is carried out under assumption that the error term and hence the stock returns follow a normal distribution with a constant variance. Schipper and Thompson (1983), Jong, *et al.* (1992), Arora (2001) and several other studies have used market model. The empirical evidence shows that the assumptions of simple market model are violated by actual data. For example the daily data of stock returns are not normally distributed with constant variance. Therefore we extend the model to capture this effect with conditional variance by using the method of GARCH model of Engle (1982) and Bollerslev (1986).

The ARCH models, originally introduced in Engle (1982) are useful to study the pattern of volatility clusters in a series. The family of ARCH models is frequently used for analysing many stylised facts of financial time series, for example, risk-return behaviour of securities, volatility of stock prices, event study, performance evaluation of securities and return predictability etc. These models have been quite successfully applied to test for event study of some other stock market [Jong, Kemna and Klock (1992)] for Dutch Stock Market and Javed and Ahmed (2000) for Pakistani Stock Market and numerous other studies). The variance of ARCH model is specified as conditional upon shocks observed in past, the past estimation of variance and other information in the form of exogenous variable. Bollersher (1986) extended the work of Engle (1982) by developing a technique that considers ARMA process in ARCH variance. This is called generalised ARCH or GARCH model. In GARCH model residuals are decomposed into heteroscedastic and express conditional moments because they provide close and parsimonious approximation to the form of hetroscedasticity typically encountered with financial time series data. Therefore market model-with-GARCH specification given below is most suitable choice to investigate the effect of October 8, earthquake in case of Pakistani market.

$$r_{it} = \beta_{0t} + \beta_{mt} r_{mt} + \sum_{i=1}^{p} \alpha_i r_{t-i} + \sum_{j=0}^{q} \beta_j \varepsilon_{t-j} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$\varepsilon_t = v_t \sqrt{h_t} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

$$h_t = \phi_0 + \sum_{k=1}^{l} \phi_k \varepsilon_{t-k}^2 + \sum_{m=1}^{s} \lambda_m h_{t-m} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

This is our empirical specification of market model-with-GARCH given in Equation (1). In Equation (1) β_{0t} is the constant, β_{mt} are asset sensitivity to market return and ε_{it} is idiosyncratic error term. The terms with p and q are orders of (AR) and moving average (MA) terms to yield ARMA (p, q) process. In Equation (2) the random error term is decomposed into v_t which is homoscedastic with $\sigma_{v_t}^2 = 1$ and h_t which is heteroscedastic with ARMA process. In Equation (3), i and s are order of AR and MA terms in heteroscedastic variance and ϕ_k is called ARCH coefficient of order k and λ_m the GARCH coefficient of order m. If a stock is associated with higher risk it is expected to yield higher return. Hence volatility of risk, represented by variance Equation (3) of return attempts to explain the increase in expected return due to past variances and errors.

The GARCH Equation (3) allows heteroscedasticity in the time series of residuals and variances. This heteroscedasticity in time series represents the

special feature of financial variables, especially stock prices. It is typically observed that stock prices series contain periods of large volatility followed by periods of relative stability. The instability in stock markets introduced by some major shocks usually initiates a spell of fluctuations. These fluctuations partly reflect the genuine response of agents to continuously revising information. Another reason could be that not all agents jump on the 'band-wagon' of 'mass psychology' therefore some of to the shock the reaction could be delayed. Furthermore, agents may have sticky expectations regarding the consequence of the shock on share prices.

It is also important to note that the volatility clusters generated by any shock are not made of shocks in the same direction. For example following a bad news not all the price fluctuations are in the downward direction; the period of volatility would include negative as well as positive changes, reflecting 'technical correction' and reaction to delayed information respectively. Therefore the inertia in volatility causes autocorrelation in the size of random fluctuations ignoring their algebraic signs and it cannot be properly captured by the conventional linear autocorrelation in residuals. The GARCH equation that captures this inertia is a simple ARMA process in squared residuals and variances.

After estimating the GARCH model, the next step in our context is to estimate the series of GARCH variance given in Equation (3). The GARCH variance along with the series of average return and volume are then studied to determine their responses to October 8, 2005 earthquake in Pakistan. The period was crucial for the stock market because this disaster occurred at a time when the stock market was recovering rapidly after the crash of March 2005. The shock was unanticipated therefore it is expected that KSE market will response to this unanticipated shock. When the quake struck the northern areas the market was in strong bullish phase so it is difficult to separate the effect of this event. Henderson (1990) has observed that if the type of event under study has a greater probability of occurring in a bull market than bear market, it creates a problem. Thus to analyse the impact of this event on KSE, we define an impulse event dummy *D*, which takes value zero before the earthquake and one from October 10, 2005 to October 31, 2005 and again zero afterwards. The reason is that, after absorbing the shock of massive death and destruction in the quake struck northern areas of Pakistan stocks were back in the rally and investors and brokers resumed their normal positions. However the post quake grief and sorrow still dominated, but the economy could hardly remain uncovered after such huge tragedy.

To determine the response of KSE to the event we postulate the following relationships:

$$r_{it} = \beta_{0t} + \beta_{mt} r_{mt} + \beta_D D + \sum_{i=1}^{p} \alpha_i r_{t-i} + \sum_{j=0}^{q} \beta_j \varepsilon_{t-j} + \varepsilon_t \qquad \ldots \qquad \ldots \qquad (4)$$

$$h_t = \phi_0 + \phi_D D + \sum_{k=1}^{l} \phi_k \varepsilon_{t-k}^2 + \sum_{m=1}^{s} \lambda_m h_{t-m} \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

$$V_{it} = \gamma_0 + \gamma_D D + \sum_{i=1}^{p} \theta_i V_{t-i} + \sum_{j=0}^{q} \delta_j \varepsilon_{t-j} + \varepsilon_t \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

In these equations r_{it}, h_t and V_{it} denote average return, GARCH variance and the natural logarithm of trade volume respectively. D is an event dummy to capture the effect of Oct 8, 2005 event. Then GARCH variance is obtained to analyse volatility behaviour due to earthquake shock by including event dummy. The volume model is also estimated with ARMA specification and event dummy to examine the activity of KSE before and after this event.

V. EMPIRICAL FINDINGS

To analyse the effect of earthquake on return and volatility we need a model of asset pricing that describes the asset pricing behaviour. We used the market model as benchmark model and since return distribution are time varying in nature we extended it to generalised autoregressive heteroscedasticity (GARCH) model. The extended model is applied on 60 listed firms to capture the effect of this event by allowing an event dummy variable. The GARCH variance is obtained to examine the effect on volatility by adding an event dummy and volume is modeled as ARMA specification with event dummy.

The first step of estimation is to calculate the daily stock returns. The returns are calculated as first difference of natural logarithm of dividend adjusted stock prices following Fama (1965).[1] Then to test the stationary properties of returns the Augmented Dicky Fuller (ADF) test is applied and the results indicate that returns are stationary. The Table 2 reports the summary statistics of daily returns of 60 stocks traded at KSE. The KSE 100 is market portfolio. The mean return is negative for 21 stocks and positive for other firms. The standard deviation is lowest for Lever and highest for Maple Leaf Cement. The returns of 33 firms are negatively skewed and remaining firms are positively skewed. All return series have excess kurtosis compared to normal. Therefore all else is same, the main features of daily data include asymmetry, fat tails and volatile.

The market model-with-GARCH model is estimated for all 60 firms. The identification of the properties of the return generating process is important in time series estimation of the model. To diagnose the specification of ARMA and ARCH process Box-Jenkins procedure is used [Box and Jenkin (1976)]. These diagnostic procedures involves determination of order of autoregressive (AR) and moving average (MA) terms in the market model equation and order of

[1] $R_{it} = \ln(P_t) - \ln(P_{t-1})$, where r_{it} is return on i stock and P_t is dividend adjusted price of stock i.

Table 2

The Summary Statistics of the Data

	Mean	Std. Dev.	Skewness	Kurtosis	Observations
ABOT	0.001	0.022	–3.212	34.237	486
AGTL	0.0005	0.020	–2.025	24.931	486
AICL	0.003	0.028	–0.308	3.704	487
ASKB	0.001	0.030	–0.673	6.011	486
ASKL	–0.002	0.030	–0.264	4.592	486
AZAM	–0.003	0.072	–0.373	16.587	486
BATA	0.001	0.26	0.32	3.48	486
BOP	0.001	0.030	–2.423	16.992	486
BTML	–0.002	0.062	–0.54	10.286	486
CHCC	–0.001	0.028	–0.843	9.045	486
CPAP	–0.001	0.022	–1.131	11.116	486
DHCL	0.0002	0.025	–0.029	3.48	4.86
DSFL	–0.001	0.034	1.531	11.148	486
ELCOT	–0.002	0.017	–0.943	10.483	486
EMCO	–0.001	0.040	2.894	24.316	486
ENGRO	0.001	0.023	0.224	3.694	486
FFBQ	–0.0001	0.026	0.031	3.34	486
FFCL	–0.0001	0.031	0.180	3.176	486
FEROZ	–0.004	0.024	–3.761	4.064	486
GULT	–0.002	0.024	–0.420	6.666	486
HONDA	–0.001	0.035	–5.578	8.378	486
HUBC	–0.0002	0.018	0.045	6.343	486
ICI	0.001	0.026	–0.005	3.328	486
INDU	0.001	0.023	0.134	3.795	486
IPCL	–0.001	0.070	0.639	5.986	486
JPPG	–0.001	0.037	1.128	7.84	486
LEVER	0.001	0.014	–0.324	10.286	486
LUCK	0.004	0.025	–0.097	2.903	486
MCB	0.005	0.026	–0.736	5.993	486
METRO	0.001	0.043	0.072	2.914	486
MFTM	–0.002	0.041	0.289	3.613	486
MITCH	–0.001	0.020	0.167	5.968	486
MPLC	0.001	0.759	15.04	2.883	467
MSCL	0.001	0.043	0.072	3.407	470
MKSM	0.003	0.031	–0.008	3.407	486
NBP	0.004	0.027	–1.004	7.897	486
NML	0.002	0.025	–0.229	2.786	486
NATR	–0.0003	0.024	0.218	3.503	486
NESTLE	0.001	0.018	0.098	5.679	486
OGDC	0.002	0.022	–0.109	3.333	486
PKOF	0.003	0.030	–0.455	4.275	486
PICIC	–0.001	0.026	–2.435	19.171	486
PMI	0.000	0.044	1.339	8.508	486
POL	0.004	0.021	–0.017	3.721	486
PSO	0.000	0.019	–0.328	4.216	486
PTCL	–0.002	0.035	–6.454	7.007	486
PHDL	0.0002	0.020	–0.317	6.952	486
PGUM	0.0002	0.025	–1.159	12.007	486
PAKT	0.0003	0.025	0.199	3.212	486
PKSL	0.002	0.021	0.408	5.578	486
PPL	0.001	0.030	–0.035	2.768	486
SIEM	0.004	0.024	–0.025	3.538	486
SELP	–0.001	0.033	0.790	7.050	486
SHELL	0.000	0.023	–3.763	4.478	486
SITC	0.001	0.021	–0.543	9.775	486
SSGC	0.002	0.024	0.190	2.903	486
SNGP	0.0002	0.026	–0.014	3.58	486
SUZUK	0.001	0.035	0.078	2.821	486
UNIM	–0.002	0.118	0.254	13.022	486

ARCH and GARCH terms in ARCH equation [Ender (1995) Green (1993)]. The procedure is based on a careful analysis of correlograms for autocorrelation and partial autocorrelation function. In addition various performance criteria such as Akaike information criteria and Schwartz Baysian Criteria are also used to make choices when more than one specification looks equally good. [Enders (1995)]. The next step is to estimate market model with ARMA terms and check residuals and square residuals for autocorrelation. If some autocorrelation is still present the ARMA specification of equation is adjusted and estimated in the light of additional information. This stepwise procedure is continued until regression residuals are white noise. In the same way ARCH equation and its generalised form are specified except that the correlogram are drawn for square residuals, until Q-statistic for autocorrelation in square residuals turn insignificant at all meaningful lag lengths. These diagnostic steps should involve simultaneous study of correlogeanous for residual and square residuals.

The results show presence of a significant autoregressive process of first order; the coefficients of AR are significant. This pattern indicates that disturbances experienced as included in information set during any period have permanent effect on future time paths of return. In other words the shocks in rates of returns experienced during a period have a rigid relationship with future returns. However the impact of a shock as given in information set declines geometrically with the increase in lag length. The intercept term in market model with ARMA equation measures systematic component of average rate of return. The ARCH and GARCH equations parameterise conditional variance, and intercept of these equations shows the portion of price volatility that remains constant overtime.

The estimation of MM-with-GARCH is carried out by Maximum Likelihood Estimation procedure. The result of this test is reported in Table 3. The results indicate a positive relation between stock return and market return as shown by market β. In all cases ARCH (1) and GARCH (1) and found to be present at 1 percent significance level these results show that the estimates of lagged square residuals in conditional variance are significant.

After estimating the GARCH model, the next step is to estimate the series of GARCH variances given in Equation (4). This series along with average return and the volume given in the Equations (5) and (6) are studied to determine the responses to the earthquake and the results are reported in Table 4. These results reveal the fact that earthquake had both positive and negative information content for KSE stocks. It is interesting to find that that returns of banking and financial sector experience negative effect on average return but positive effect on the volume (for example, Askari Commercial Bank, Askari Leasing, Bank of Punjab, and National Bank of Pakistan, Unicap Modarba), but Muslim commercial Bank and PICIC Commercial Bank witness appositive effect on return and volume. The investors immediate reaction in the cement, food and chemical and pharmaceutical is positive as indicated by positive

Table 3

Evidence on Market Model-with-GARCH Specification

	β_0	β_m	α_i	ϕ_0	ϕ_k	λ_m	R^2
ABOT	–0.01	0.01*	–0.32*	0.01*	1.77*	0.007*	0.22
	(–3.08)	(2.19)	(–5.99)	(5.88)	(4.70)	(2.26)	
AGTL	0.005	0.04*	–0.04	0.001*	0.22*	0.82*	0.29
	(0.84)	(2.08)	(–0.87)	(3.34)	(5.99)	(34.89)	
AICL	0.001	0.56*	0.08*	0.01*	0.53*	–0.04*	0.29
	(0.61)	(6.71)	(2.15)	(4.01)	(4.05)	(–2.32)	
ASKB	–0.002	0.39*	0.01*	0.01	0.16*	0.67*	0.44
	(–0.39)	(3.79)	(2.06)	(1.37)	(2.09)	(3.72)	
ASKL	0.01	0.21*	–0.09**	0.01*	0.01*	0.86*	031
	(0.76)	(3.49)	(–1.89)	(2.27)	(3.88)	(7.66)	
AZAM	0.02	0.02*	–0.12*	0.01*	0.13*	0.15*	0.20
	(1.35)	(2.31)	(–2.04)	(5.50)	(3.43)	(1.72)	
BATA	0.003	0.02***	0.13*	0.0002*	0.21*	0.47*	0.30
	(0.31)	(1.63)	(2.62)	(3.09)	(3.07)	(3.31)	
BOP	–0.001	0.78	–0.24*	0.01*	1.01*	0.24*	
	(–0.91)	(13.48)	(–2.87)	(4.45)	(6.69)	(5.138)	0.29
BTML	–0.003	0.31*	–0.08**	0.002*	0.07*	0.41**	
	(–1.24)	(2.05)	(–1.83)	(2.76)	(2.11)	(1.91)	0.27
CHCC	–0.001	0.09**	–0.03	0.0003*	0.480*	0.23*	0.41
	(–1.49)	(1.72)	(–1.54)	(5.67)	(6.79)	(2.93)	
CPAP	–0.001	0.004**	0.09*	0.002	–0.02	0.52*	0.24
	(–0.86)	(1.98)	(2.53)	(0.74)	(–1.29)	(2.81)	
DHCL	–0.0001	0.16**	–0.06**	0.0001*	0.16*	0.61*	0.29
	(–0.18)	(2.50)	(–1.98)	(2.34)	(2.86)	(4.80)	
DSFL	0.001	0.17*	0.17*	0.001	0.01	0.95*	0.41
	(0.31)	(2.72)	(3.04)	(1.18)	(1.22)	(3.04)	
ELCOT	–0.002	0.02*	0.15*	0.001*	0.03*	0.91*	0.37
	(–2.16)	(2.49)	(3.21)	(4.03)	(4.25)	(48.77)	
EMCO	–0.003	0.11**	0.01***	0.08*	0.62*	–0.02*	0.22
	(–0.19)	(1.94)	(1.65)	(11.66)	(10.07)	(–6.56)	
ENGRO	0.001	0.11*	–0.06	0.002*	0.22*	0.67*	0.28
	(1.24)	(2.11)	(–1.22)	(2.99)	(3.73)	(8.65)	
FFBQ	0.004	0.09**	–0.03	0.001*	0.17*	0.71*	0.37
	(0.42)	(1.93)	(–0.05)	(2.23)	(3.08)	(7.69)	
FFCL	0.000	0.859*	0.12***	0.0001*	1.72*	0.19*	0.32
	(–0.15)	(15.42)	(1.72)	(3.93)	(19.61)	(12.18)	
FEROZ	–0.001	0.03**	–0.10	0.001*	0.10*	0.12	0.23
	(0.08)	(1.84)	(–1.56)	(10.91)	(10.91)	(1.33)	
GULT	–0.003	0.15*	0.01**	0.003*	0.08*	0.86*	0.29
	(–2.85)	(3.09)	(1.92)	(3.19)	(3.58)	(26.23)	
HONDA	0.001	0.06*	0.22*	0.004*	0.36*	0.72*	0.40
	(0.52)	(2.89)	(3.85)	(2.66)	(4.74)	(13.66)	
HUBC	0.002	0.04*	–0.002	0.0002*	0.08*	0.85*	0.32
	(0.03)	(2.14)	(–0.21)	(3.45)	(3.41)	(22.95)	
ICI	0.001	0.23*	–0.15*	0.001*	0.16*	0.79*	0.28
	(1.37)	(4.08)	(–2.45)	(2.42)	(3.14)	(13.09)	
INDU	0.002	0.34*	0.12	0.01	0.11*	0.74*	0.27
	(0.95)	(6.48)	(1.57)	(1.50)	(2.33)	(3.89)	
IPCL	–0.002	0.01*	–0.22*	0.001*	0.002*	0.97*	0.43
	(–0.72)	(2.07)	(–5.47)	(3.27)	(2.42)	(17.2)	
JPG	–0.001	0.02*	–0.09***	0.001*	0.97*	0.10*	0.56
	(–0.73)	(2.23)	(–1.64)	(3.36)	(8.87)	(2.09)	
LEVER	0.01	0.08*	–0.09*	3.92*	1.49*	–1.44*	0.41
	(3.14)	(2.15)	(–2.26)	(4.49)	(2.29)	(–2.63)	
LUCK	0.002	0.46*	0.12**	0.01	0.19*	0.80*	0.27
	(1.29)	(7.58)	(1.94)	(1.52)	(4.01)	(21.41)	
MCB	0.01	0.71*	–0.15**	0.01	0.11	0.29	0.28
	(2.55)	(10.91)	(–1.98)	(1.44)	(1.14)	(0.61)	
METRO	0.01	0.08*	0.20*	0.003	0.07**	0.75*	0.38
	(0.03)	(2.57)	(4.09)	(1.53)	(1.92)	(5.40)	
MTFM	–0.004	0.28*	–0.15*	0.001*	0.24*	0.16	0.026
	(–2.36)	(3.30)	(–3.27)	(3.69)	(3.11)	(0.82)	
MITCH	–0.001	0.09*	0.16*	0.001*	0.17*	0.52*	0.29
	(–0.89)	(2.00)	(2.84)	(4.36)	(4.52)	(5.71)	
MPLC	0.003	0.04*	0.35*	0.002*	0.88*	0.65*	0.57
	(0.37)	(2.51)	(6.90)	(3.62)	(13.79)	(46.96)	

Table 3—(*Continued*)

MKSM	0.003	0.03**	0.27*	0.0002***	0.11*	0.87*	0.65
	(1.99)	(1.97)	(6.11)	(1.87)	(3.62)	(24.82)	
MSCL	0.001	0.06*	0.20*	0.0003	0.08**	0.75*	0.38
	(0.03)	(2.57)	(4.06)	(1.53)	(1.93)	(5.41)	
NATR	–0.001	0.12*	0.01*	0.001*	0.31*	0.56*	0.59
	(–1.03)	(2.03)	(2.17)	(3.50)	(3.89)	(6.39)	
NESTLE	0.005	0.02*	–0.06	0.007*	0.17*	0.61*	0.32
	(0.72)	(2.50)	(–1.14)	(5.28)	(4.55)	(9.73)	
NBP	0.002	0.93*	–0.22*	0.01**	0.10*	0.92*	0.33
	(1.92)	(15.23)	(–3.12)	(1.87)	(3.93)	(58.40)	
NML	0.01	0.91*	–0.05	0.01*	0.43*	0.46*	0.27
	(0.34)	(15.22)	(–1.61)	(3.23)	(3.82)	(4.44)	
OGDC	0.001	0.16	0.03	0.002	0.16	0.79	0.35
	(1.49)	(2.51)	(1.68)	(2.7)	(3.69)	(16.27)	
PAKT	–0.002	0.14*	–0.05	0.007*	0.15*	0.73*	0.26
	(–0.17)	(2.68)	(–0.93)	(2.49)	(2.97)	(8.85)	
PHDL	–0.005	0.10*	0.29*	0.004*	0.24*	0.70*	0.39
	(–0.05)	(2.38)	(4.77)	(8.28)	(5.85)	(24.41)	
PICIC	–0.003	0.46*	–0.19	0.01*	0.30*	0.02	0.28
	(–1.83)	(6.90)	(–1.59)	(6.92)	(4.02)	(0.18)	
PMI	–0.003	0.70*	–0.29*	0.01*	0.09*	0.87*	0.31
	(–1.24)	(9.00)	(–4.07)	(2.27)	(2.91)	(23.63)	
POL	0.003	0.75*	–0.14***	0.01*	0.26*	0.69*	0.23
	(2.88)	(14.36)	(–1.75)	(2.57)	(2.94)	(8.75)	
PSO	–0.002	0.14*	–0.04	0.02*	0.19*	0.77*	0.25
	(–0.30)	(2.78)	(–0.72)	(2.58)	(3.99)	(15.50)	
PTCL	–0.002	0.88*	–0.03*	0.01*	0.35*	0.49*	0.33
	(–1.99)	(13.47)	(–2.55)	(3.42)	(3.62)	(5.58)	
PPL	0.001	0.24*	0.03	0.003**	0.15*	0.81*	0.35
	(0.97)	(3.29)	(1.69)	(1.89)	(3.12)	(13.52)	
PGUM	–0.004	0.04*	0.07	0.003*	0.04*	0.91*	0.41
	(–0.36)	(2.60)	(1.39)	(2.16)	(2.93)	(27.99)	
PKSL	0.002	0.004*	0.07	0.002*	0.19*	0.76*	21
	(0.34)	(2.11)	(1.37)	(9.05)	(7.16)	(43.32)	
SIEM	0.002	0.09**	0.06	0.01*	0.08*	0.88*	0.32
	(1.31)	(1.89)	(0.85)	(2.32)	(2.35)	(16.2)	
SEPL	–0.001	0.06**	–0.09	0.001*	0.10*	0.83*	0.28
	(=0.79)	(1.87)	(–1.65)	(3.09)	(3.65)	(19.51)	
SHELL	0.001	0.28**	0.01*	0.02*	–0.01*	1.00*	0.42
	(0.84)	(5.50)	(2.16)	(2.67)	(–24.09)	(17.86)	
SITC	–0.001	0.11**	–0.04	0.002*	0.16*	0.43**	0.39
	(–0.65)	(1.79)	(–0.50)	(2.24)	(2.41)	(1.96)	
SELP	–0.001	0.06*	–0.09***	0.001*	0.09*	0.83*	0.21
	(–0.79)	(2.87)	(1.65)	(3.09)	(3.65)	(19.51)	
SKML	0.003	0.35*	–0.22*	0.002*	0.14*	0.37*	0.35
	(–1.31)	(2.66)	(–3.76)	(3.64)	(3.47)	(2.36)	
SSGC	–0.003	0.15*	0.07*	0.01	0.18*	0.82*	0.27
	(–0.29)	(2.09)	(2.17)	(1.43)	(5.11)	(26.91)	
SSNG	–0.001	0.14**	–0.03	0.004*	0.18*	0.75*	0.25
	(–0.16)	(1.97)	(–0.42)	(2.75)	(4.08)	(14.99)	
SUZUB	–0.003	0.18*	0.04***	0.003*	0.13*	0.63*	0.33
	(–1.63)	(2.17)	(0.72)	(2.04)	(2.31)	(4.04)	
UNIM	–0.002	0.09*	0.59*	0.002*	0.10*	0.76*	0.37
	(–2.16)	(2.36)	(8.45)	(3.26)	(3.99)	(12.61)	

Note: The analysis id based on the daily data of 60 stock representative of all sector of the market. KSE 100 Index is taken as market return. The CAPM-with-GARCH model is used, given in the following equations**,**

$$r_{it} = \beta_0 + \beta_m r_{mt} + \sum_{i=1}^{p} \alpha_i r_{t-i} + \sum_{j=0}^{q} \beta_j \varepsilon_{t-j} + \varepsilon_t$$

$$\varepsilon_t = \nu_t \sqrt{h_t}$$

$$h_t = \phi_0 + \sum_{k=1}^{l} \phi_k \varepsilon_{t-k}^2 + \sum_{m=1}^{s} \lambda_m h_{t-m}$$

The values in the parenthesis give the t-values, * represents significant at 1 percent, ** significant at 5 percent and *** significant at 10 percent respectively.

Table 4

The Effect of Earthquake on Return, Volume, and Volatility of KSE Firms

RETURN	ABOT	AICL	ASKB	ASKL	BATA	BOP	BTML	CHCC	DHCL	FFBQ
β_0	0.001 (–0.34)	0.00 (1.34)	0.002 (0.44)	0.0004 (0.20)	–0.001 (–0.29)	0.001 (1.63)	–0.005 (–1.11)	–0.001 (–0.07)	0.002 (0.01)	0.0004 (0.22)
β_m	0.57* (2.21)	0.38* (4.45)	0.34* (3.44)	0.14** (1.96)	0.01* (2.10)	0.61* (6.26)	0.32* (2.13)	0.09*** (1.71)	0.16* (2.39)	0.13* (2.02)
β_D	0.00 (–0.01)	0.00 (–1.57)	0.0001** (–1.92)	–0.001** (–1.94)	0.003** (1.87)	–0.02* (–3.08)	0.003 (0.59)	0.002*** (1.82)	0.001 (0.51)	–0.001 (–0.48)
α_1	0.11 (1.63)	0.16* (2.48)	0.14* (2.44)	–0.05 (–1.26)	0.20* (4.35)	–0.12** (–1.91)	–0.10* (–2.23)	0.11 (1.63)	–0.03*** (–1.67)	–0.12 (–1.61)
R^2	0.39	0.27	0.05	0.39	0.40	0.16	0.29	0.22	0.21	0.29
F	19.33	17.54	25.22	15.06	72.46	14.46	31.29	19.33	20.09	21.96
VARIANCE										
Φ_0	0.0001 (1.6)	0.007 (9.68)	0.002 (8.65)	0.001 (10.06)	0.0001 (14.78)	0.0001 (1.06)	0.004 (33.35)	0.001 (9.97)	0.001 (13.28)	0.001 (5.86)
ϕ_D	0.004 (0.61	0.0001 (1.15)	0.0001 (–0.24)	–0.001 (1.37)	0.13 (0.23)	0.001*** (1.85)	0.002 (0.14)	0.002* (4.59)	0.004 (0.07)	0.001 (0.68)
ϕ_1	0.09 (3.13)	0.16 (0.12	0.74* (17.08)	0.76* (20.82)	0.67* (13.57)	0.20 (1.12)	0.58* (7.60)	0.35* (2.11)	0.76* (20.52)	0.90* (41.96)
λ_1	0.17 (0.65)	0.12 (0.09)	0.12 (0.65)	–0.03 (–0.57)	–0.001 (–0.13)	0.11 (0.54)	–0.13 (–1.42)	–0.03 (–0.17)	0.07* (2.14)	0.13* (2.61)
R^2	0.63	0.36	0.55	0.60	0.45	0.3	0.29	0.24	0.63	0.85
F	53.38	64.25	145.71	241.50	132.32	16.97	47.70	22.28	267.53	884.6
Volume										
γ_0	17.26 (76.13)	8.60 (32.50)	8.24 (50.30)	0.34 (5.39)	5.94 (3.68)	15.37 (42.17)	4.29 (3.51)	14.02 (32.21)	12.55 (6.11)	19.55 (17.56)

Continued—

Table 4—(*Continued*)

γ_D	–0.37** (–1.85)	0.31 (0.85)	0.09* (2.42)	–1.12 (–0.70)	0.51 (0.27)	0.69 (1.58)	–0.68 (–0.48)	0.086*** (1.67)	1.26* (4.71)	–0.33 (–1.09)
θ_1	0.76* (11.91)	0.80* (8.52)	0.57* (3.53)	0.98* (64.91)	0.95* (46.11)	0.87* (21.27)	0.96* (50.16)	0.94* (47.17)	0.76* (11.51)	–0.87* (–29.5)
δ_1	–0.19* (–1.96)	–0.55* (–4.37)	–0.29 (–1.55)	–0.89* (–28.53)	–0.77* (–17.80)	–0.23* (–2.83)	–0.84* (–22.48)	–0.64* (–13.92)	–0.48* (–5.36)	–0.31* (–5.48)
R^2	0.45	0.28	0.30	0.26	0.37	0.70	0.28	0.54	0.29	0.56
F	54.65	142.67	9.08	31.76	59.57	181.03	361.7	192.29	68.69	211.15
RETURN	HONDA	HUBC	ICI	IPCL	JPPG	LEVER	LUCK	MCB	NBP	NTML
β_0	0.001 (0.40)	–0.002 (0.940	0.001 (0.56)	–0.004 (–1.08)	–0.001 (–0.91)	–0.002 (–0.03)	0.002 (1.15)	0.003 (2.18)	0.01 (1.89)	0.001 (0.03)
β_m	0.05** (1.86)	0.01* (2.21)	0.25* (3.88)	0.03* (2.21)	0.04* (2.41)	0.47* (7.64)	0.47* (7.64)	0.72* (10.42)	0.92* (15.17)	0.62* (7.84)
β_D	–0.003 (–0.82)	0.002 (1.01)	0.008* (2.48)	0.01 (1.07)	0.001 (0.48)	0.001** (1.93)	0.01** (1.84)	0.001* (1.97)	–0.002*** (–1.69)	0.001 (0.03)
α_1	0.21* (4.55)	0.04 (0.92)	–0.07 (–1.31)	–0.21* (–4.63)	–0.13* (–2.94)	–1.07* (–3.67)	0.10 (1.54)	–0.11 (–1.63)	–0.22* (–3.16)	–0.07 (–1.06)
R^2	0.43	0.44	0.25	0.45	0.28	0.29	0.36	0.28	0.37	0.21
F	73.54	71.01	20.86	77.21	30.96	48.39	61.88	87.71	71.57	28.57
Variance										
Φ_0	0.001 (1.19)	0.0002 (5.36)	0.001 (6.20)	0.01 (129.1)	0.001 (6.55)	0.002 (6.69)	0.00 (3.39)	0.00 (18.25)	0.00 (2.24)	0.00 (2.52)
ϕ_D	0.001 (0.72)	0.001*** (1.71)	–0.002*** (1.86)	0.002 (0.14)	–0.01 (–0.07)	–0.002 (–0.50)	0.00 (0.33)	–0.001 (–0.06)	0.00 (0.19)	0.00 (1.35)
ϕ_1	0.72 (16.65)	0.91* (47.89)	0.94* (57.53)	0.97* (8.87)	0.83* (31.04)	0.93* (12.00)	0.91* (33.37)	0.41* (6.83)	0.96* (53.08)	0.62* (12.08)

Continued—

Table 4—(*Continued*)

λ_1	0.01 (0.17)	0.14* (2.89)	–0.002 (–0.06)	0.10* (2.09)	0.45* (9.39)	–0.90* (–9.78)	–0.02* (–2.33)	–0.001* (–3.31)	0.02 (0.98)	–0.003* (2.89)
R^2	0.53	0.87	0.89	0.95	0.84	0.88	0.84	0.25	0.36	0.40
F	182.6	1040.8	1377.2	322.11	852.78	142.8	597.49	30.09	148.9	79.50
VOLUME										
γ_0	13.18 (44.97)	17.97 (59.24)	17.53 (30.65)	9.71 (6.57)	13.86 (29.38)	10.93 (14.92)	14.48 (17.85)	15.41 (62.66)	16.71 (94.10)	14.97 (58.44)
γ_D	0.26 (0.42)	0.03 (0.83)	–0.43 (–0.69)	–1.82 (–1.41)	0.19 (0.37)	0.30 (0.35)	1.12** (1.81)	1.07* (3.40)	0.29* (1.97)	0.84* (2.53)
θ_1	0.86* (23.58)	0.91* (36.25)	0.95* (55.95)	0.98* (69.86)	0.94* (54.44)	0.95* (30.74)	0.95* (40.90)	0.81* (15.13)	0.84* (15.06)	0.83* (15.30)
δ_1	–0.48* (–7.79)	0.51* (–9.72)	–0.53* (–11.62)	–1.02* (63.77)	–0.53* (–11.57)	–0.91* (–19.78)	–0.40* (–5.92)	–0.22* (–2.51)	–0.44* (–4.75)	–0.31* (–3.41)
R^2	0.56	0.58	0.65	0.42	0.64	0.34	0.86	0.63	0.41	0.61
F	204.04	220.46	302.66	70.88	282.48	57.71	498.26	133.71	55.34	89.97

RETURN	**MFTM**	**MITCH**	**NATR**	**NESTLE**	**MPLC**	**OGDC**	**PKSL**	**PAKT**	**PICIC**	**ORIX**
β_0	–0.003 (–1.46)	–0.001 (–0.66)	0.006 (0.33)	0.001 (0.12)	–0.001 (–0.15)	0.002 (0.94)	0.001 (0.57)	0.001 (0.07)	–0.002 (0.11)	0.0001 (–0.11)
β_m	0.26* (2.60)	0.09* (1.99)	0.06* (2.82)	0.02* (2.44)	0.05* (2.28)	0.26* (3.92)	0.02* (2.43)	0.17* (2.79)	0.31* (3.49)	0.18* (2.77)
β_D	0.002 (0.67)	0.002* (2.14)	–0.002 (–0.71)	0.002** (1.87)	0.01* (3.79)	–0.002 (–0.81)	0.002 (0.76)	0.04 (0.02)	0.003* (1.95)	–0.001 (–0.42)
α_1	–0.13* (–2.84)	0.16 (2.82)	0.11* (2.14)	–0.07 (–1.59)	–0.08*** (–1.69)	0.09** (1.91)	0.15* (3.37)	–0.09** (1.90)	0.09 (0.14)	–0.13* (–2.00)
R^2	0.28	0.30	0.29	0.36	0.36	0.40	0.25	0.23	0.21	0.46
F	47.08	64.24	31.86	44.51	71.32	66.80	41.93	38.17	42.16	387.1

Continued—

Table 4—(*Continued*)

VARIANCE										
Φ_0	0.002 (19.78)	0.003 (13.61)	0.007 (8.62)	0.003 (9.40)	0.004 (0.20)	0.005 (2.72)	0.004 (4.88)	0.006 (12.56)	0.001 (4.64)	0.001 (1.75)
ϕ_D	–0.001 (–0.46)	0.02 (0.42)	–0.001** (–1.80)	0.004 (1.43)	0.02 (0.82)	0.001** (1.73)	–0.001 (–0.48)	0.001** (1.83)	–0.001 (–0.42)	–0.001 (–0.87)
ϕ_1	0.62* (7.88)	0.66* (12.36)	0.76* (20.17)	0.74* (18.62)	0.73* (15.38)	0.96* (66.96)	0.88* (37.22)	0.82* (26.86)	0.73* (17.41)	0.98* (44.62)
λ_1	–0.29* (–2.97)	–0.03 (–0.49)	0.02 (0.30)	–0.004 (–0.08)	–0.09 (–1.33)	0.07 (1.41)	0.19* (3.99)	0.17* (3.21)	0.05 (0.08)	–1.03* (–35.79)
R^2	0.37	0.49	0.60	0.57	0.46	0.91	0.84	0.76	0.54	0.67
F	82.39	111.06	248.6	210.03	133.09	1623.9	823.2	507.56	190.59	57.13
VOLUME										
γ_0	10.47 (–10.90)	4.26 (5.85)	15.97 (69.96)	4.46 (6.94)	9.31 (1.90)	21.81 (87.67)	1.52 (2.18)	8.86 (11.08)	15.51 (17.17)	8.60 (32.49)
γ_D	–0.55 (–0.50)	–0.07 (–0.75)	–0.43 (–1.49)	2.57* (3.03)	1.52** (1.7 6)	–0.13 (–0.40)	1.90* (2.11)	3.81* (3.76)	0.35** (1.97)	0.31 (0.85)
θ_1	0.93* (42.1)	0.79* (13.22)	0.75* (14.56)	0.65* (5.03)	1.00* (14.66)	–0.83* (24.23)	0.77* (12.27)	0.85* (19.03)	0.87* (23.61)	0.80* (8.52)
δ_1	–0.58* (11.99)	–0.55* (–6.62)	0.27* (–3.70)	–0.49* (–3.22)	–0.69* (–18.99)	–0.25* (–4.11)	–0.50* (36.19)	–0.64* (–9.24)	–0.39* (–6.97)	–0.55* (–4.37)
R^2	0.47	0.56	0.35	0.38	0.83	0.54	0.28	0.28	0.52	0.77
F	147.91	29.73	86.18	64.41	805.38	186.91	36.19	61.52	176.63	71.10

RETURN	**POL**	**PSO**	**PTCL**	**PPL**	**PHDL**	**SHELL**	**SSGL**	**SNGL**	**SUZUKB**	**SEIM**
β_0	0.003 (2.05)	0.001 (0.86)	–0.007 (–0.41)	0.001 (0.55)	0.007 (0.37)	0.002 (0.43)	–0.001 (–0.51)	0.02 (0.14)	–0.003 (–1.09)	0.001 (0.43)

Continued—

Table 4—(*Continued*)

β_m	0.57* (8.84)	0.12** (1.83)	0.88* (13.42)	0.27* (2.62)	0.07* (2.32)	0.28* (3.71)	0.09* (2.06)	0.04* (.2.40)	0.15* (2.70)	0.14** (1.82)
β_D	–0.001 (–0.27)	0.001 (0.29)	0.01* (2.09)	0.001 (0.17)	–0.001 (–0.36)	0.003 (0.24)	0.001 (1.36)	–0.02 (–0.06)	0.004 (1.10)	0.003* (0.12)
α_1	–0.18* (–2.82)	0.03 (0.45)	–0.03 (–0.83)	0.10* (2.24)	0.30* (6.90)	0.04 (0.54)	0.11*** (1.78)	0.08 (1.92)	0.09** (1.95)	0.06 (0.88)
R^2	0.22	0.37	0.25	0.40	0.29	0.57	0.25	0.47	0.22	0.24
F	31.05	27.69	21.59	67.25	96.29	48.35	42.48	94.10	35.38	19.39
VARIANCE										
Φ_0	0.0002 (2.16)	0.005 (4.04)	0.003* (2.11)	0.001 (6.01)	0.004 (5.30)	0.001 (1.97)	0.006 (5.65)	0.07 (5.35)	0.001 (17.17)	0.005 (6.84)
ϕ_D	0.002* (2.10)	–0.004 (–0.29)	0.001 (0.70)	–0.001 (–0.70)	–0.02 (–0.02)	0.001 (0.16)	0.003 (0.33)	–1.63 (–0.11)	0.004 (0.51)	0.002 (0.39)
ϕ_1	0.76* (16.59)	0.93* (52.76)	0.63* (9.63)	0.93* (53.52)	0.80)* (24.22)	0.99* (88.01)	0.93* (53.19)	0.91* (44.56)	0.79* (21.83)	0.94* (38.41)
λ_1	0.26* (4.12)	0.17* (3.59)	0.30* (3.71)	0.09* (2.06)	0.08 (1.43)	–0.003 (–0.05)	0.22* (4.39)	0.10** (1.98)	–0.02 (–0.32)	0.05 (0.71)
R^2	0.76	0.90	0.59	0.89	0.68	0.97	0.91	0.85	0.61	0.89
F	249.4	1515	113.3	1430	344.54	268.4	1546	956.6	251.69	641.3
VOLUME										
γ_0	15..87 (89.95)	21.77 (99.75)	17.76 (11.67)	21.05 (14.81)	2.14 (3.84)	10.01 (22.62)	17.66 (37.95)	19.19 (46.94)	6.91 (8.09)	5.47 (29.56)
γ_D	–0.09 (–0.37)	–1.35* (–4.93)	0.002 (0.04)	0.44* (2.45)	–0.28 (–0.39)	0.11 (0.17)	–0.07 (–0.15)	–1.01* (–2.13)	0.87 (0.80)	0.93* (3.80)
θ_1	0.76 (11.12)	0.85* (24.04)	0.71* (8.83)	0.77* (15.96)	–0.78* (10.24)	0.85* (21.91)	0.95* (64.28)	0.92* (41.64)	0.82* (15.42)	0.78* (9.31)

Continued—

Table 4—(*Continued*)

δ_1	–0.29 (–2.87)	–0.37* (–6.04)	–0.25* (–2.26)	–0.32* (–4.44)	–0.57* (–5.72)	–0.26* (–3.39)	–0.51* (–11.39)	–0.33* (–6.41)	–0.56* (–7.22)	–0.46* (–3.89)
R^2	0.35	0.64	0.44	0.39	0.22	0.60	0.71	0.72	0.79	0.41
F	42.06	281.4	61.38	64.41	805.38	117.9	396.77	410.91	351.1	55.45

RETURN	**AGTL**	**CPAP**	**EMCO**	**ENGRO**	**GULT**	**MKSM**	**MMPL**	**FEROZ**	**SKML**	**SEPL**
β_0	0.003 (0.23)	–0.002 (–1.07)	0.001 (–0.51)	0.004 (0.29)	–0.001 (–0.74)	0.003 (0.98)	–0.0002 (–0.57)	–0.001 (–0.34)	–0.002 (–0.49)	–0.003 (–1.19)
β_m	0.03* (2.63)	0.01* (2.11)	0.06** (1.86)	0.12* (2.08)	0.13* (2.93)	0.07** (1.95)	0.08** (1.71)	0.03** (1.96)	0.30* (1.99)	0.02* (2.23)
β_D	0.001 (0.64)	0.001 (0.34)	0.001 (0.29)	0.001* (2.01)	–0.02* (–7.29)	0.003 (0.47)	0.005 (0.98)	0.002 (0.09)	0.001 (0.26)	0.002 (0.72)
α_1	0.10* (2.14)	0.06 (1.26)	–0.002 (–1.04)	–0.003 (–0.56)	–0.10* (2.11)	0.25* (5.47)	0.18* (3.92)	–0.04 (–0.89)	–0.19* (–4.11)	–0.06 (–1.29)
R^2	0.24	0.38	0.33	0.25	0.22	0.66	0.04	0.29	0.38	0.54
F	22.79	61.75	31.31	41.45	54.86	49.11	65.45	31.90	63.52	39.34
VARIANCE										
Φ_0	0.001 (3.69)	0.005 (12.38)	0.002 (4.55)	0.005 (–5.90)	0.0005 (5.40)	0.001 (8.08)	0.002 (27.29)	0.001 (28.29)	0.004 (19.38)	0.001 (7.83)
ϕ_D	–0.003 (–1.39)	0.002 (0.55)	0.04 (0.92)	–0.002 (–0.20)	0.0033 (0.39)	–0.002*** (–1.66)	–0.003* (–2.96)	–0.002 (–0.70)	–0.002 (–0.99)	0.001 (0.71)
ϕ_1	0.85* (31.12)	0.54 (1..52)	0.67 (1.18)	0.88* (36.70)	0.93* (10.57)	0.93* (51.14)	0.78* (23.28)	0.03 (–0.07)	0.48* (6.33)	0.87* (34.32)
λ_1	0.02 (0.41)	–1.001 (–0.93)	–0.67** (1.78)	–0.03 (–0.59)	–0.02 (–0.49)	0.05 (1.05)	0.07 (1.25)	0.07 (0.15)	0.08 (0.88)	0.08 (1.50)
R^2	0.75	0.31	0.29	0.76	0.95	0.89	0.70	0.22	0.29	0.79
F	47.29	72.81	30.83	540.7	3741	1369	363.9	71.65	64.55	302.9

Continued—

Table 4—(*Continued*)

VOLUME										
γ_0	11.74 (0.55)	8.53 (7.03)	22.71 (4.94)	17.85 (54.79)	4.95 (4.06)	7.94 (12.24)	7.24 (6.90)	11.22 (5.33)	9.28 (9.63)	13.68 (26.67)
γ_D	0.07* (0.05)	1.22 (0.83)	–11.66** (–1.95)	0.36** (1.72)	0.28 (0.12)	3.95* (4.78)	2.42** (1.88)	–0.50 (–0.27)	–0.61 (–0.53)	0.62 (1.20)
θ_1	0.98* (69.53)	0.95* (43.07)	0.71 (1.20)	0.90* (37.31)	0.92* (33.62)	0.85* (15.23)	0.94* (33.45)	0.99* (88.52)	0.93* (34.22)	0.96* (64.82)
δ_1	–0.88 (–28.64)	–0.79* (–18.22)	–0.73 (–1.26)	–0.40* (–7.72)	–0.72* (–14.26)	–0.66* (–8.34)	–0.77* (–15.42)	–0.90* (–33.40)	0.73* (–14.57)	–0.66* (–15.84)
R^2	0.72	0.24	0.76	0.69	0.24	0.28	0.25	0.38	0.22	0.58
F	33.49	49.54	1239	356.77	94.80	61.84	52.76	37.04	44.88	218.3

RETURN	**PSML**	**FASM**	**FCCL**	**METRO**	**PMOD**	**UNIM**	**PGUM**	**ELCOT**	**SITC**	**DSFL**
β_0	–0.002 (–0.97)	–0.003 (–1.88)	–0.11 (–1.54)	–0.002 (–0.57)	–0.001 (–0.41)	–0.004 (–1.96)	–0.001 (–0.66)	–0.002 (2.16)	0.001 (0.13)	0.001 (0.39)
β_m	0.05** (1.93)	0.05* (1.91)	2.00* (2.83)	0.07* (2.72)	0.73* (9.25)	0.06* (3.31)	0.04** (1.86)	0.01* (2.31)	0.14** (1.93)	0.18** (1.95)
β_D	–0.001 (–0..41)	0.003 (1.04)	0.12* (2.21)	0.005 (0.97)	–0.003 (–0.69)	0.004** (1.92)	0.003 (1.04)	–0.02* (–9.69)	0.001 (0.02)	–0.002 (–0.23)
α_1	0.05 (1.08)	0.31* (7.17)	0.06 (0.97)	0.18* (3.92)	–0.29* (–4.04)	0.61* (11.12)	0.10* (2.10)	0.14* (2.50)	–0.01 (–0.14)	0.19* (3.31)
R^2	0.47	0.25	0.20	0.47	0.48	0.29	0.27	0.68	0.21	0.42
F	75.72	19.36	121.1	65.84	19.89	66.25	91.11	54.59	12.33	43.92
Φ_0	–0.005 (11.11)	0.001 (11.35)	2.43 (1.69)	0.002 (27.29)	0.002 (4.27)	0.01 (6.44)	0.93 (2.59)	0.003 (0.34)	0.004* (23.70)	0.001 (21.21)
ϕ_D	0.003 (0.13)	–0.005** (–1.75)	–2.42** (–1.84)	–0.002* (–2.96)	–.001 (–.0.21)	0.04** (1.91)	0.63 (0.46)	0.004 (0.88)	–0.001 (–0.58)	–0.002 (–0.10)

Continued—

Table 4—(*Continued*)

ϕ_1	0.96* (75.71)	0.60* (8.33)	0.20* (3.10)	0.79* (23.28)	0.92* (32.66)	0.85* (29.03)	0.94* (34.67)	0.90* (50.14)	0.60* (8.14)	0.96* (93.01)
λ_1	0.08 (1.56)	–0.16** (–1.79)	–0.09 (–1.76)	0.07 (1.25)	0.001 (0.12)	–0.12* (–2.20)	–0.80* (–16.70)	0.02 (0.32)	0.03 (0.34)	0.001 (0.02)
R^2	0.93	0.25	0.69	0.70	0.84	0.69	0.25	0.85	0.39	0.96
F	237.7	53.76	368.1	363.93	428.4	350.38	72.86	101.7	64.65	298.4
γ_0	2.24 (4.71)	–1.84 (1.20)	15.37 (42.17)	7.24 (6.90)	10.20 (31.25	4.21 (4.73)	0.006 (11.05)	1.82 (2.93)	0.001 (13.22)	0.01 (3.64)
γ_D	–0.25 (–0.41)	1.51 (0.89)	0.69 (1.58)	2.42 (1.88)	0.86* (2.02)	0.44 (0.40)	–0.002 (–0.31)	–1.99 (–1.39)	0.002** (1.98)	0.01* (2.02)
θ_1	0.72 (8.56)	0.96 (62.39)	0.87 (21.27)	0.93 (33.45)	0.86 (14.74	0.91 (27.29)	0.92* (46.63)	0.95* (52.13)	0.67* (16.22)	0.17* (12.01)
δ_1	–0.53 (–5.05)	–0.81 (–22.59)	–0.23 (–2.83)	–0.77 (–15.42)	–0.62 (–6.56	–0.72* (–12.93)	0.02 (0.48)	–0.85* (–23.72)	–0.05 (–0.85)	0.02 (1.57)
R^2	0.79	0.30	0.70	0.25	0.33	0.80	0.85	0.66	0.57	0.60
F	71.33	68.82	181.03	52.76	39.69	35.38	910.8	32.11	37.88	95.27

Note: The analysis is based on the daily data of 60 stock representative of all sector of the market. KSE 100 Index is taken as market return. The Market Model-with-GARCH specification is used and a dummy is introduced to capture the impact of earthquake. The following equations describes the model,

$$r_{it} = \beta_{0t} + \beta_{mt} r_{mt} + D + \sum_{i=1}^{p} \alpha_i r_{t-i} + \sum_{j=0}^{q} \beta_j \varepsilon_{t-j} + \varepsilon_t$$

$$h_t = \phi_0 + \phi_D D + \sum_{k=1}^{l} \phi_k \varepsilon_{t-k}^2 + \sum_{m=1}^{s} \lambda_m h_{t-m}$$

$$V_{it} = \gamma_0 + \gamma_D D + \sum_{i=1}^{p} \theta_i V_{t-i} + \sum_{j=0}^{q} \delta_j \varepsilon_{t-j} + \varepsilon_t$$

The values reported in the parenthesis are the *t*-value, * represent significance at 1 percent, ** significance at 5 percent and *** significance at 10 percent level respectively.

effect on the average returns and volume of these sectors (Nestle Milkpack, Michelle fruit, Lever Brothers, ICI Pakistan, Engro Chemical Maple Leaf Cement, Lucky Cement, Fauji Cement. The firms Pakistan Tobacco, Pakistan Services have experienced positive effect on volume and no effect on return. In textile sector Gul Ahmed, Elcot Spinning and Dewan Salman Fabrics show a negative effect on return but experience a positive effect on volume. Satara Chemicals, Metropolitan Steel, Mirpurkhas Sugar, Mandviwala Plastic and Prime Modarba have positive effect on volume, negative impact on volatility and no impact on return. The National refinery, Faisal Spinning, Fauji Cement, Metropolitan Steel, Mirpurkhas Sugar and Mandviwala Plastic have shown negative trend in volatility where as the volatility of Bank of Punjab, Cherat Cement, OGDC, Pakistan Tobacco, Unicap Modarba has positive volatility effects The post quake trading period was marked by fresh buying orders in bank, oil and cement sector. The price rise on the leading stocks continued bullish but low daily volume reflected that investors generally played safe as the crash of the last March remained a guiding force for them. After absorbing the shock, stocks were back in the rally as investors covered their position in the cement, food, oil, pharmaceuticals and banking sector followed by the prediction of higher sales when the reconstruction work in the devastated area started. Some other sectors including textile and those which were directly associated with construction work and also remained in active demand had high return.

These results are expected the increase volume obviously resulted from extraordinary selling pressure on food, chemical and pharmaceutical, cement industry and banks as investors attempted to off-loaded their holdings. There is increase in the volatility which is most significant in the case of only 10 firms (Bank of Punjab, Muslim Commercial Bank, Cherat Cement, Metropolitan Steel, Hub power, ICI, Pakistan Oil, Unicap Moderaba and Mandiviwala Plastic) and in the rest of the firms it is mix but not significant. One explanation could be that after crash of March 2005, the investors were taking safe positions hock did not affect the volatility much. The overall significance of the model is tested by applying the F-Test. The results of the three equations of average return, volatility and volume show the F-Statistics is reasonably high which shows that the overall model is significant at 5 percent level.

These results have interesting interpretation; the increase in the return and volume of cement, and banking sector indicates that investors have expectation for the upcoming demand of investment in these sectors. Furthermore there is no significant increase in the volatility because the individuals were seemed certain about the future outlook and crash of March 2005 also provided them guidelines. These expectations are formed in the backdrop of generally held perception that demand of commodities needed for reconstruction increase and in such firms started producing in full capacity. It was also expected that Pakistan will receive response in the form of foreign aid and to some extent

these expectations turn out to be true. This evidence suggests that firms activities listed at the Karachi Stock Market are responsive to unanticipated events and it takes no time to show this response. After absorbing the shock the stocks were back in the rally as investors covered their positions in the cement, steel, pharmaceuticals and banking sector followed by the perdition of higher sales when the construction work in the devastated areas started.

The evidence suggests that earthquake both having positive and negative effects with offsetting each other and the overall market did not show any dominated effect of this event. The market was recovering rapidly after the crash of March 2005 was in bullish phase so the overall response of the market was not dominated by any significant impact of this natural disaster. Henderson (1990) observes that the event study can capture the effect of an event only if it is in bearish phase. McWilliams and Siegel (1997) have noted that the abnormal return associated with an event can only be truly identified when markets are efficient, event was unanticipated and there is no confounding effect during the event. The quake was unanticipated but market was facing recovery phase so the overall market did not show much impact. However, the firm level analysis suggests that cement, steel, food, chemical and pharmaceutical and banking and financial sectors have shown immediate response due to future expected rising demand and by the end of October these shocks are absorbed and the KSE gained the grounds. The implication which comes out of this study is that one can argue that the reaction of stock market to this natural disaster was not unexpected with any directions in any sense; it is consistent with the expectations of investors, policy maker, regulatory bodies, media and common people. Furthermore evidence suggests that the Pakistani stock market is resilient and it recovered sooner from the catastrophic shock.

VI. CONCLUDING REMARKS

This study has examined the effect of event of Oct 8, 2005 on the price behaviour and activities of KSE. For this analysis sixty firms are selected listed on Karachi Stock Exchange, which is the largest stock market in the country in terms of volume and capitalisation. In selecting the firm's considerations were to select those firms which have continuous listing on exchange for the period of analysis, representative of almost all the important sectors and have high turnover in their particular sector. Thus the three indicators of stock market activities used for analysis are average return, volume and volatility on the basis of daily data from January 2005 to Dec 2006.

The MM-with-GARCH specification is estimated for all 60 firms by Maximum Likelihood Estimation procedure. The results indicate a positive relation between stock return and market return as shown by market β. In all cases ARCH (1) and GARCH (1) and found to be present at 1 percent significance level. These results show that the estimates of lagged square

residuals in conditional variance are significant. After estimating the MM-with-GARCH specification is estimated the next step is to estimate the series of GARCH variances equation. In this study to the impact of this event of earthquake on the average return, volatility and volume of KSE model containing three equations for average return, volatility and volume are estimated. An event dummy is defined to capture the effect of quake.

These results have given some insight about the price behaviour of the stock market in response to unanticipated shock. The increase in the return and volume of cement, steel, food, chemicals and pharmaceuticals and banking sector indicates that individual has expectation for the upcoming demand of investment in these sectors. Furthermore there is no significant increase in the volatility because the investors took lessons from the crash of March 2005 and were also seemed certain about the future outlook. These expectations are formed in the backdrop of generally held perception that Pakistan will receive response in the form of foreign aid and to some extent these expectations turn out to be true. The implication which comes out of this study is that one can argue that the reaction of stock market to this natural disaster was not unexpected with any directions in any sense; it is consistent with the expectations of investors, policy-maker, regulatory bodies, media and common people. Furthermore evidence suggests that the Pakistani stock market is resilient and it recovered sooner from the catastrophic shock.

APPENDIX

Table A1

List of Companies

Symbol	Company Name
ABOT	Abbott Laboratories Pakistan Ltd
AGTL	Al-Gazi Tractors
AICL	Adamjee Insurance Company Limited
ASKB	Askari Commercial Bank
ASKL	Askari Leasing Limited
AZAM	Azam Textile Mills Ltd
BATA	Bata Pakistan Ltd
BOP	Bank of Punjab Ltd
BTML	Brother Textile Mills Ltd
CHCC	Charet Cement Co. Ltd
CPAP	Cherat Papersack Ltd
DHCL	Dawood Harcules Chemical Ltd
DSFL	Dewan Salman Fabric Ltd
ELCOT	Elcot Spinning Ltd
EMCO	Emco Industries Limited
ENGRO	Engro Chemical Pakistan
FASM	Faisal Spinning Mills Ltd
FFBQ	Fauji Fertilizer Co. Ltd
FCCL	Fauji Cement Ltd
FEROZ	Ferozsons Laboratories
GULT	Gul Ahmed Textile Limited
HONDA	Honda Atlas Cars Ltd
HUBC	Hub Power Co Ltd
ICI	ICI Pakistan Ltd
INDU	Indus Motors Co limited
IPCL	Indus Polyester Co Ltd
JPPG	Japan Power Generation
LEVER	Lever Brothers Pakistan
LUCK	Lucky Cement
MCB	Muslim Commercial Bank
METRO	Metropolitan Steel Corporation
MFTM	Mohammad Farooq Textile mills
MITCH	Michells Fruit Farms
MPLC	Maple Leaf Cement

Symbol	Company Name
MMPC	Mandviwal Mansaur Plastic Co.
MKSM	Mirpurkas Sugar Mill Ltd
NBP	National Bank of Pakistan
NTML	Nishat Textile Mills Ltd
NATR	National Refinery Ltd
NESTLE	Nestle Milkpack Ltd
OGDC	Oil and Gas Development Corporation
ORIX	Orix Leasing
PICIC	PICIC Commercial Bank
PMI	Prudential Modarba
POL	Pakistan Oil Ltd
PSO	Pakistan State Oil
PTCL	Pakistan Telecommunication Ltd
PHDL	Pakistan Hotel Development Ltd
PGUM	Pakistan Gum and Chemicals
PAKT	Pakistan Tobacco Co.
PSML	Paramount Spinning Mills Ltd
PKOF	Pakistan Oil Fields Ltd
PKSL	Pakistan Services Ltd
PPL	Pakistan Petroleum Ltd
SING	Singer Pakistan Ltd
SELP	Southern Electric Power
SHELL	Shell Pakistan Ltd
SITC	Sitara Chemicals Ltd
SKML	Sakrand Sugar Mills Ltd
SSGC	Sui Southern Gas Pipeline
SNGP	Sui Northern Gas Pipeline
SUZUK	Suzuki Motorcycle Pakistan
UNIM	Unicap Modarba

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