**Asian Economic and Financial Review**
*ISSN(e): 2222-6737*
*ISSN(p): 2305-2147*
*DOI: 10.18488/journal.aefr.2018.83.394.405*
*Vol. 8, No. 3, 394-405*

*URL: www.aessweb.com*

# "THE IMPACT OF MAJOR TERRORIST ATTACKS ON STOCK PRICES: THE CASE OF KARACHI STOCK EXCHANGE"

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**Article History**
Received: 8 January 2018
Revised: 8 February 2018
Accepted: 15 February 2018
Published: 19 February 2018

**Keywords**
Abnormal returns
EGARCH
Event study
KSE 100-index
Terrorist incidents.

**JEL Classification:**
C22, K42, O16, G12, G15.

## ABSTRACT

Terrorist attacks tend to happen concomitantly, begetting widespread violence, perturb individual routine life, bring dire effect on the economy and ultimately cause volatility in stock prices. This research tries to assess the impact of substantial terrorist incidents that took place in the last five years in Pakistan on returns of major stock indices. We divide the methodology section into two segments: Event study is used in the first part to analyze the effect of three baleful terrorist attacks by employing secondary data of stock prices of KSE 100-index and ten major sectors of Karachi Stock Exchange. EGARCH model is employed to model volatility in the second segment of this paper for estimating the impact of eleven major terrorist incidents. With regards to the result obtained, it is concluded that out of eleven terrorist attacks, three prominent terrorist incidents that claimed more than a hundred deaths have significant negative impact on stock returns, however, the eight-minor type of terrorist activities don't impact stock returns of KSE 100-index in a significant way.

**Contribution/ Originality:** This study contributes in the existing literature in a way that very few researches have been conducted to analysis the impact of terrorism on financial market in Pakistan. Moreover, this study uses new estimation methodology i.e. event study which has not been applied by any researcher previously in similar kind of study and then EGARCH model is employed to model the return volatility based on eleven major terrorists attacks in Pakistan.

## 1. INTRODUCTION

Stock markets are extremely sensitive to internal and external advancements. The Stock Exchange could be regarded as the barometer to record good and bad for trading activities, the news of important incidents impact immediately. The study of major events and their impact on the stock prices has been an important subject in finance. Such studies try to capture the intensity to which the performance of stock market deviates from the routine, around the occurrence of the event under study. As suggested by economic theory, future corporate profits are reflected by stock prices. Corporate earnings make a significant part of Gross Domestic Product (GDP) and show a close connection with consumption and investment, which are components of GDP. It can be implied from the prescient characteristics of stock prices that stock prices are a major gauge of economic activities. In the last

twenty years, financing long-term projects and infrastructure has transferred from government institutions to capital market globally. In Pakistan, limited sources are available for public and private sectors because of the absence of a liquid debt market in private sector. Despite these limitations, the capital market of Pakistan has helped private and public sectors in accessing long-term financing (Naqvi, 2014).

Terrorism creates a sense of insecurity among the public and different type of terrorist attacks disturb the usual course of trading activities and other businesses. Foreign investors hesitate to invest in places, where law and order situation is unacceptable. The major concern of investors is the protection of their funds and security of their personal engagements with the traders. According to Alam (2013) all type of terrorist events and political instability that show uncertainty about the future has a negative effect on investments in stock markets. Terrorist attacks are consequential incidents which can drive widespread violence, perturb daily lives of the public, adversely impact the economy and eventually cause volatility in stock prices. The purpose of this research paper is to analyze the consequences of eleven major terrorist attacks, of which five occurred in Karachi, on the stock prices of Karachi Stock Exchange. The basic research questions of the study are if the terrorist attacks impact stock prices and if so, what are the consequences of the attack? What is the intensity of the impact of these incidents on stock prices? Is the nature of the impact of all the terrorist attacks alike? Negative or positive? And finally, does a market sensitivity to terror diminish over time?

Even though terrorism is not novel, the incident of 9/11 modified the horizon of terrorist attacks in terms of geopolitical peril that can impact the global economy and worldwide financial markets. A clear judgment of the manner of terrorist events and its impact on stock trading is necessary to formulate effective policies to deal with non-stop terrorist activities, to decrease its cost and to enhance the investor confidence in stock business. Thus, this paper focuses on the effect of terrorism on stock returns in Pakistan by taking into account major incidents such as Karachi targeted killings, Karachi airport attack and the recent Peshawar School Massacre.

Market efficiency can be analyzed by conducting two tests; how long market takes to fully recover from the impact of unanticipated incidents such as terror events and have traders with advance information of the terrorist attacks business efficiently around them. Testing market efficiency using terrorist attacks has numerous advantages. First, every incident happens at a detached, clearly recognizable instant; this is a marked deviation from many other events, which are financially significant, especially those with multiple stages involving company transactions. Secondly, although the likelihood of terrorist attacks is discernible, their schedule is completely unexpected, again unlike usual corporate announcements. Finally, it is impossible to have complete information of the attack prior to the incident, which is emphasized by the achievement of officials in ceasing such attacks in case of leaks.

This research will definitely assist investors to form a better assessment of stock prices volatility after diverse kind of terrorist incidents. It will counsel for investment planning at stock markets and will also exhort the authorities to take suitable steps to minimize the effects of terrorist occurrences to protect investor interest in stock markets of Pakistan. The next chapter present evaluation of existing literature on the topic briefly and the subsequent chapters cover research methodology, data analysis & findings and conclusion.

## 2. LITERATURE REVIEW

According to Napoleoni (as cited in Jain and Grosse (2009)) contemporary terrorism is not just a philosophy or a political ideology. It is also propelled by funds provided by the economic system of terror. It is assessed to be worth one and a half trillion dollars per year and is still growing. The analysis about the effect of terrorism on stocks is in an initial stage. Limited literature is available in evaluating the volatility in stock prices at the time of the terrorist event. Karolyi (2006) asserts that little is said about the financial consequences of these events. The sentiments of investors are influenced directly by terrorist activities and thus results in a down turning the stock market. Most of the researchers, such as Barth *et al.* (2006) and Gul *et al.* (2010) have found a negative impact of the

terrorist attack on financial markets. However, Eldor and Melnick (2004) and Chen and Siems (2004) argue that there is no evidence to support that efficient stock markets turn desensitized over the period of time to terrorism. Johnston and Nedelescu (2006) assert that accurate, timely and adjustable response of the officials is crucial in making the stock markets efficient to absorb the terrorist shocks. Mooney, Zuber, Grandar and Lamb (as cited in Paganol and Strother (2009)) observed the effect of alterations in the degree of threat on the prices of asset and found no effect on the stock market.

Buesa *et al.* (2007) estimated the economic price of the terrorist events on 11 March 2004 in the city of Madrid. They discovered that terrorist events caused two hundred and ninety-one fatalities and one thousand six hundred major injuries in addition to material and infrastructural loss and economic damages. Arin *et al.* (2008) inspected the effect of terrorist activities on the stock markets of 6 states (UK, Turkey, Thailand, Spain, Israel and Indonesia). They discovered that terrorist events have a significant inverse impact on the volatility of financial market and returns. Karolyi and Martell (2010) investigated a wide range of terrorist attacks by examining the effect of seventy-five terrorist events in the United States over a time of eight years, considering government trading firms as targets. The authors found that each firm faced an average loss in market capitalization of $400 million per attack after the negative reaction of prices of stock by minus 0.83 percent. Again the impact was different depending on the country. The study of Fathi and Shahraki (2011) focused on the effects of terrorist attacks by considering terrorist incidents that occurred over a period of seventeen years in Iran by using comparing means method. The results revealed a significant impact of terrorist events on Tehran Stock Exchange.

Chesney *et al.* (2010) focused on the impact of terrorist attacks on financial markets. The writers considered the terrorist incidents in twenty-five countries over the period of eleven years employing event study methodology and two other approaches. They concluded that non-parametric approach is an appropriate way to study the impact of terrorist attacks on stock markets and recommended that diversification in investor's portfolio can reduce the terrorism risk. Drakos (2010) assuming that terrorism impacts investor mood and spurred by existing literature on the emotions of investor, focused on the impact of terrorist activities on stock markets by taking the sample of twenty-two countries. The empirical model employed is based on World CAPM and ARCH specifications. The results indicated that terrorist incidents lead to lower stock returns on the day of the terrorist attack. He notes that terrorism is negatively related to the progress of a financial market. Higher psychosocial stresses result when the negative influence of terrorist activities is amplified. The evidence not only elaborates the underlying process through which terrorism influences stock markets, it further supplies justifiable support for the sentiment effect.

Similarly, Chulia *et al.* (2009) analyzed the terrorist impact on the stock markets of US and Eurozone by using multivariate GARCH model and found leverage effect in both the markets and showed the difference in impact on both the markets. Nguyen and Enomoto (2009) estimated the impact of 7 international terrorist incidents on the financial markets of Pakistan and Iran. They discovered that terrorist attacks in Indonesia, Iraq, London and Madrid had significant inverse impacts on the reaction of stock returns. The Tehran and Karachi Stock Exchange showed significant negative volatility in response to 9/11 incident. Gul *et al.* (2010) observed the effect of terrorist activities on the stock markets of Pakistan for two years period and estimated that terrorism has an adverse effect on the trading activities of financial markets and economic growth of Pakistan. However, the importance of the impact varied from market to market. They recommended the development of institutions related to investment in the security industry by the government.

Moreover, in Pakistan, Bilal *et al.* (2012) tried to find the effects and association between terrorist attacks and stock prices of Karachi Stock Exchange. They applied co-integration tests to evaluate the long-term relationship between macroeconomic variables and stock returns for the period of six years starting from 2005 to 2010. Granger causality test demonstrated that a unidirectional relationship exists between KSE stock prices and interest rate but no relationship was found between stock prices and inflation for the period under study. They applied ARCH and

GARCH models to confirm the findings. They also analyzed the association between terrorist attacks and stock prices on a daily basis. Their findings indicated that terrorism has significant negative effect on stock prices.

There is no agreement about the causes of terrorism in Pakistan. The shifting of Al Qaida to the northern region of Pakistan from Afghanistan is the main reason. Al Qaeda's surviving leadership continues its activities from the tribal Pakistan known as the Federally Administered Tribal Area (FATA). Although Afghanistan and Iraq are perceived as the pivotal countries by the global community, Pakistan acquires the most pivotal status (Gunaratna and Nielsen, 2008). Khokhar (2007) argues that establishments of madrasas and Shia high schools are the major causes of terrorism. The madaris operating in Pakistan could be regarded as terrorist factories as they have played a crucial role in spreading the philosophies of militant jihadists. Asal *et al.* (2008) study the family role in joining or declining any jihadist organization and concludes that madrasas do not cause terrorism.

Another important research that requires being taken into account is Alam (2013) who analyzed the impact of terrorism on Karachi Stock Exchange 100 index, by testing empirically and found a long run relationship between stock prices and terrorism and asserts that there is no short run relationship between the two variables. Aslam and Kang (2013) choose four hundred and seventy terrorist incidents that took place during the period from Jan. 2000 to Sept. 2012. The daily time series data comprised of 2888 observations for 12 years were used to run the regressions for event study. The results indicated that each additional terrorist incident results in a return of 0.32% on the day the incident occurred. Every terrorist event impact significantly one day before the attack by -0.24% and one day after the event, a positive return of 0.34% results as KSE reacts quickly to recover. Their empirical findings show that the magnitude of impact varies with location and type of attack. Hassan *et al.* (2014) studied the impact of three major terrorist attacks: assassination of former Prime Minister Benazir Bhutto, attack on Marriott Hotel Islamabad and attack in Darra Adam Khel 2010 on Karachi Stock Exchange 100 index by using event study methodology and found out that all the three incidents had negative effect on stock prices, even though the intensity of the effect was different. More is the impact of a terrorist incident on stock returns if the violence produced by the event is greater. They concluded that timely actions taken by the government are helpful in reducing the impact of terrorism on financial markets.

Bandyopadhyay *et al.* (2014) investigated the association between terrorism and foreign direct investment by examining seventy eight developing countries over the period of twenty four years from 1984 to 2008 and found that a relatively slight rise in the number of domestic terrorist events in a country per 100,000 persons, decrease the foreign direct investment sharply. The same type of reduction in net aid resulted if the origin of the attack was a foreign country and it was aimed at foreign firms in the attacked economy. Bandyopadhyay *et al.* (2014) further found that increase in official aid helps in subsiding the cut in foreign direct investment because the greater aid helps recipient countries to fight against terrorism. Bandyopadhyay *et al.* (2015) discussed the work of different researchers regarding the economic cost of terrorism and concluded that terrorism effects smaller countries greater than the rich and diversified economies because if one sector is affected by terrorist incidents, the resources shift to the other flourishing sectors thereby offsetting the damage.

In this paper, we have considered the most recent attacks as the experts in the field suggested that our investor is accustomed to such attacks and don't panic when terrorism strikes. However, the findings reveal that the most dreadful attacks do create fears among investors thus resulting in a sharp drop in stock returns.

## 3. RESEARCH METHODOLOGY

The philosophies applied in this research are positivism and post-positivism with the methodical choice of mono-method quantitative by employing deductive approach. The strategy practised is the case study of Karachi Stock Exchange 100 index. The time horizon is longitudinal utilizing secondary data.

In the first part, Event study analysis is employed to evaluate the impact of Quetta bombing 10 January 2013, Karachi airport attack 8 June 2014 and Peshawar school massacre 16 December 2014. The major recent terrorist

attacks have been determined on the basis of the violence created by the event or the one which produced the greatest number of casualties. This section uses the time series secondary data of the stock prices and tries to find the impact of three major terrorist incidents on stock returns. The prices of KSE 100-index are extracted from KSE's website and sectoral prices from Thomson database. The data for terrorism are taken from South Asia Terrorism Portal (SATP) http://www.satp.org/. Assessment record of all terrorist incidents is also provided by SATP official website in detail. The prices are changed into returns by taking log difference. The period of 252 days before the event window is used for Beta estimation for each sector and 21 days event window is used for CAR calculation. Event Study is a methodology for testing the semi-strong version of the efficient market hypothesis. We use Event Study when we are interested in seeing how stock prices move around some event. The event is considered to be time period 0 and we look at price movements before and after the event (the event window). To capture the movement in price, we evaluate the abnormal returns around the event (Moy, 2015). A Constant Mean Return Model is presented by the following equation:

$$R_{it} = \mu_i + \varepsilon_{it} \quad (1)$$

Whereas, $E(\varepsilon_{it}) = 0$ $\quad var(\varepsilon_{it}) = \sigma^2_{\varepsilon i}$

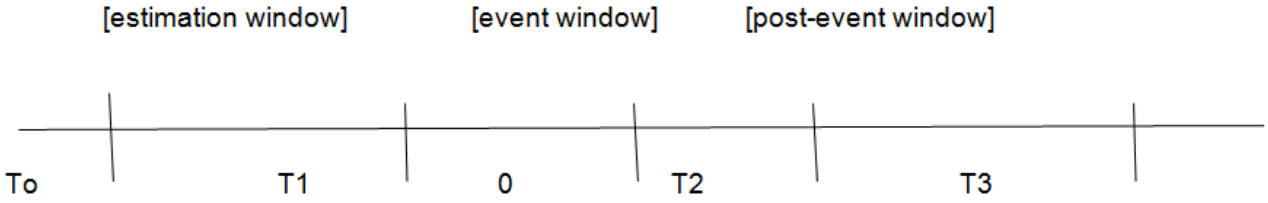
The Market Model for calculating returns is as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (2)$$

Whereas, $E(\varepsilon_{it}) = 0$ $\quad var(\varepsilon_{it}) = \sigma^2_{\varepsilon i}$

Three estimation windows are used in this study; the pre-event window is estimated ten days before the terrorist attack, the event day window on the day of the event, while the post-event window is estimated by considering the prices ten days after the event window. This explains the overall deviation of stock prices as a result of the terrorist incident.

**Time Line for an Event Study**




Market Model is widely used in Event Study analysis for determining the abnormal returns. It is estimated using ordinary least squares method, using data from the pre-event window which shouldn't overlap with the event window. We can employ this model to estimate the return for each sector at each time period. These estimates are used to find out the abnormal return, which is a difference between the actual return and what the model predicts. So the abnormal return for sector"i" in time period" t" is:

$$AR_{it} = R_{it} - \hat{\alpha}_i + \hat{\beta}_i R_{mt} \quad (3)$$

One sector's abnormal return in a period doesn't provide much insight, so we average over all the sectors in our sample for each period.

$$\overline{AR_s} = \frac{\sum_{j=1}^{N_s} AR_{js}}{N_s} \quad (4)$$

Ns is the number of events

We look at the cumulative effect of the event by computing Cumulative Average Returns. The impact of the event can be seen visually by plotting the CAR. The graph of CAR also tells us whether the market is efficient or not.

$$CAR_s = \sum_{k=-19}^{s} \overline{AR_k} \quad (5)$$

In the second part of this paper, we analyze the effect of eleven major terrorist incidents of last five years by modelling volatility using EGARCH model (Suleman, 2012). EGARCH model is used to analyze the effect of major terrorist attacks as it accounts for asymmetries that is, good and bad news impact differently on stock market returns and volatility. Daily secondary data of stock prices are collected for the period starting from 3rd January 2011 to 28th May 2015 from the official website of Karachi Stock Exchange.

$$\ln(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[ \frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \frac{2}{\sqrt{\pi}} \right] \quad (6)$$

## 4. DATA ANALYSIS AND FINDINGS

The period considered to estimate Beta for Quetta bombing 10th January 2013 is from 9th January 2012 to 26th December 2012. The 21 days window used to estimate Cumulative Abnormal Returns for Quetta bombing is from the day 27th December 2012 till 24th January 2013. The abnormal returns for the period of 10 days before the event and 10 days after the event provided an insight to examine the impact of the terrorist attack on ten major sectors of Karachi Stock Exchange.

**Table-1.** Abnormal Returns for Quetta bombing 10 January 2013

| Sector | Abnormal Return | t-value | Decision |
|---|---|---|---|
| Oil and Gas | -0.48 | -2.93 | Significant impact |
| Banking | -0.51 | -2.47 | Significant impact |
| Cement | -0.39 | -1.55 | Insignificant |
| Chemicals | -0.21 | -1.04 | Insignificant |
| Electricity | -0.64 | -2.20 | Significant impact |
| Financials | -0.67 | -3.29 | Significant impact |
| Food and Beverages | 0.12 | 0.44 | Insignificant |
| Telecom | -1.34 | -5.20 | Significant impact |
| Automobiles | -0.03 | -0.11 | Insignificant |
| Utilities | -0.63 | -2.15 | Significant impact |
| 6 significant negative abnormal returns. | | | |

**Source:** Table represent abnormal returns before and after Quetta bombing on ten major sectors of Karachi Stock Exchange.

The abnormal returns are significant at 5% for six of the sectors. The negative abnormal return in the pre-event period for Oil and gas sector was significant just for one day; however, the negative abnormal returns were significant on the event day and marginally significant on the fourth and sixth day of the event. In the banking sector, negative abnormal returns were significant for one day in the pre-event period and then significant on event day and fourth day of the event. Cement industry shows significant negative abnormal returns for one day in the pre-event window and later on the fourth day of the event. There was no significant negative abnormal return in chemicals sector in the pre-event period but abnormal returns are negative and significant on the fourth day of the event. In the pre-event window, negative abnormal returns are significant for four days in the electricity sector and are also significant on the event day and fourth day of the event. Abnormal returns for financials industry are negative and significant for almost all the days in the pre-event period, on the event day and for the post-event window. Food and beverages sector reveal negative abnormal returns in the pre-event window for nine days out of ten days but the abnormal returns are significant just for two days. The post-event period shows significant negative abnormal returns for almost all the days, which means that this sector was affected by Quetta bombing the

most. Next, the telecom sector negative abnormal returns are significant for three days in the pre-event window, on the event day and for a third and fourth day of the event in the post-event window. The abnormal returns are negative and significant for three days in the pre-event period for automobiles industry but are insignificant on the event day and later got significant on the fourth day of the event. Finally, our last sector under study is utilities, which shows significant negative abnormal returns for four days in the pre-event window, on the event day and on the fourth day of the event.

Similarly, the time period considered for Beta estimation for Karachi airport attack 8 June 2014 is 252 days before the event window and 21 days period is used to calculate CAR for ten major sectors of Karachi Stock Exchange. The period considered to estimate Beta for Karachi airport attack is from 5th June 2013 till 23rd May 2014. The 21 event window to compute CAR for 10 major sectors of KSE is for the period starting from 26th May 2014 to 23rd June 2014.

**Table-2.** Abnormal Returns for Karachi airport attack 8 June 2014

| Sector | Abnormal Return | t-value | Decision |
|---|---|---|---|
| Oil and Gas | 0.00 | 0.01 | Insignificant |
| Banking | -0.07 | -0.29 | Insignificant |
| Cement | 0.13 | 0.41 | Insignificant |
| Chemicals | 0.09 | 0.35 | Insignificant |
| Electricity | -0.77 | -2.44 | Significant impact |
| Financials | -0.07 | -0.29 | Insignificant |
| Food and Beverages | -0.02 | -0.05 | Insignificant |
| Telecom | 0.35 | 1.05 | Insignificant |
| Automobiles | -0.26 | -0.72 | Insignificant |
| Utilities | -0.36 | -1.17 | Insignificant |
| 1 significant negative abnormal return. | | | |

**Source:** Table represent abnormal returns before and after Karachi airport attack on ten major sectors of Karachi Stock Exchange.

The abnormal returns of the major sectors of KSE on the day of Karachi airport attack are presented in the Table. Even though the abnormal returns are negative for six, out of ten sectors but are significant only for the electricity sector. The abnormal returns are negative for some days in the post-event period for oil and gas sector but are not significant. Similarly, Karachi airport attack doesn't show any significant impact on banking and cement industry. The abnormal returns are negative and significant for two days in the pre-event period for chemicals but are not significant for event day and post-event period. Electricity sector was affected by Karachi airport attack with significant negative abnormal returns for three days in the post-event window, on event day and on the third, fourth and seventh day of the event. Financials and food & beverages were not affected at all by the attack.

**Table-3.** Abnormal Returns for Peshawar school massacre 16 December 2014

| Sector | Abnormal Return | t-value | Decision |
|---|---|---|---|
| Oil and Gas | -1.58 | -7.18 | Significant impact |
| Banking | 0.22 | 1.07 | Insignificant |
| Cement | -0.55 | -2.25 | Significant impact |
| Chemicals | -0.10 | -0.44 | Insignificant |
| Electricity | -0.82 | -2.80 | Significant impact |
| Financials | 0.19 | 0.96 | Insignificant |
| Food and Beverages | -0.18 | -0.58 | Insignificant |
| Telecom | -0.97 | -3.22 | Significant impact |
| Automobiles | 0.10 | 0.34 | Insignificant |
| Utilities | -0.63 | -2.18 | Significant impact |
| 5 significant negative abnormal returns. | | | |

**Source:** Table represent abnormal returns before and after Peshawar school massacre on ten major sectors of Karachi Stock Exchange.

The telecom sector was also affected by the significant negative abnormal returns on the fifth, seventh, eighth, ninth and tenth day of the event. The negative AR for automobiles is significant for one day in the post-event period and for the sixth day of the event. For utilities, negative AR are significant for two days in the post-event period and then on the seventh and ninth day of the event.

The 252 day period considered for the estimation of Beta for Peshawar school massacre is from 12th December 2013 to 1st December 2014 and the 21 day period for the computation of CAR for ten major sectors of KSE starts from 2nd December 2014 till 30th December 2014.

The AR for seven of the sectors is negative on the event day, revealing the impact of Army school incident on stock prices. The impact on five of the sectors is significant at 5% with the t-values greater than 2. The negative AR for oil and gas industry is significant for two days in the pre-event period, event day and for a second, the ninth and eleventh day of the event. There is no significant negative AR for the banking sector, which shows that Army school event didn't impact banking sector. There are no significant negative AR in the cement industry in the pre-event period but it is significant on the event day and second and ninth day of the event. The chemical sector shows significant negative AR for two days in the pre-event period and no significant negative AR in the post-event window. The negative AR for electricity sector is significant for one day in the pre-event period and for the event day but no significant negative AR is found in the post-event period. There is no significant negative AR in all the windows for financials revealing no impact on financials. Only one day effect is found in the pre-event period for food and beverages sector. The negative AR is significant for telecom for three days in the pre-event period and then on the event day; however, no impact is found in the post-event period. The negative AR for automobiles is significant for one day in the pre-event period and fourth day of the event and for utilities for one day in the pre-event period and on the event day. Quetta bombing 10 January 2013 and Peshawar school massacre 16 December 2014 show the significant negative impact on the stock returns of KSE 100-index.

There is a certain guideline to run the ARCH-type models. The data should be stationary to run such models, so first, we change the stock prices into returns by taking log difference.

**Table-4.** ADF Test Results

| Series | ADF t-stat | p-value | Decision |
|---|---|---|---|
| KSE 100-index Stock Prices | 0.28 | 0.98 | Non-stationary at level. The series contains a unit root. |
| KSE 100-index Stock Returns | -29.82 | 0.00 | The series becomes stationary at taking the first difference. |
| Changed prices into returns to attain stationarity | | | |

**Source:** Table represent ADF test results to determine the stationarity of the data

Then we run the regression by taking stock returns as a dependent variable, C as a constant and all terrorism dummies as independent variables.

$$r_t = \square_0 + \sum_{i=1}^{p} \square_i r_{t-i} + D_1 + D_2 + D_3 + D_4 + D_5 + D_6 + D_7 + D_8 + D_9 + D_{10} + D_{11} + \varepsilon_t \qquad (7)$$

Whereas, $\varepsilon_t \sim N(0, \sigma_t^2)$

Where, $D_1$ is PNS Mehran attack 22 May 2011; $D_2$ is Peshawar airport attack 15 December 2012; $D_3$ is Quetta bombing 10 January 2013; $D_4$ is Karachi bombing 3 March 2013; $D_5$ is QissaKhawani Bazar bombing 29 September 2013; $D_6$ is Wagah border bombing 2 November 2014; $D_7$ is Shikarpur bombing 30 January 2015; $D_8$ is Karachi bus

attack 13 May 2015; $D_9$ is the Karachi targeted killings July/August 2011;$D_{10}$ is Karachi airport attack 8 June 2014;$D_{11}$is Peshawar school massacre 16 December 2014.

We check the residuals from this model. The data consists of 1,094 observations from 3rd January 2011 to 28th May 2015. We can check by ARCH test that whether we should run EGARCH model or not.

**Table-5.** Heteroskedasticity Test: ARCH

| Obs*R-squared | p-value | Decision |
|---|---|---|
| 27.63 | 0.00 | There is ARCH effect in KSE 100-index returns. |
| ARCH effect confirms. | | |

**Source:** Table represent Heteroskedasticity test results to determine ARCH effect

The p-value for observed R-squared is 0.0000, we can reject the null hypothesis of no ARCH effect. This model has two parts. The first part of the model is the mean equation, where stock returns are the dependent variable and the residual derived from the mean equation has been used in the variance equation. Log(GARCH) is our dependent variable in the variance equation.

**Table-6.** Mean Equation

| Variable | Coefficient | Z-Statistic | Prob. | Decision |
|---|---|---|---|---|
| C | 0.14 | 5.52 | 0.00 | Significant |
| Dummy1 | 0.19 | 0.33 | 0.74 | Insignificant |
| Dummy2 | -0.10 | -0.21 | 0.84 | Insignificant |
| Dummy3 | -1.01 | -4.28 | 0.00 | Significant |
| Dummy4 | -0.97 | -6.15 | 0.00 | Significant |
| Dummy5 | -0.34 | -0.36 | 0.72 | Insignificant |
| Dummy6 | 0.46 | 1.12 | 0.26 | Insignificant |
| Dummy7 | -0.06 | -0.14 | 0.89 | Insignificant |
| Dummy8 | -0.56 | -0.46 | 0.64 | Insignificant |
| Dummy9 | -0.26 | -1.77 | 0.08 | Significant at 10% level |
| Dummy10 | 0.02 | 0.04 | 0.96 | Insignificant |
| Dummy11 | -0.58 | -2.43 | 0.01 | Significant at 5% level |
| 5 dummy variables are significant. | | | | |

**Source:** Table represent mean equation to determine residuals

**Table-7.** Variance Equation

| Variable | Coefficient | Z-Statistic | Prob. |
|---|---|---|---|
| C(13) | -0.32 | -7.26 | 0.00 |
| C(14) | 0.35 | 7.33 | 0.00 |
| C(15) | -0.17 | -6.83 | 0.00 |
| C(16) | 0.86 | 33.81 | 0.00 |
| Asymmetric term C(15) is negative and significant, confirms leverage effect. | | | |

**Source:** Table represent variance equation to determine leverage effect

Our model shows that Quetta bombing 10 January 2013; Karachi bombing 3 March 2013; Karachi targeted killings July/August 2011 and Peshawar school massacre 16 December 2014 had a significant negative impact on stock returns of KSE100-index. Hassan *et al.* (2014) described major incidents as ones, which produce a greater number of casualties. All these incidents resulted in more than 100 deaths except the Karachi bombing on 3rd March 2013, when at least 48 people got killed and more than 180 got injured. Our results show that some major terrorist incidents have significant negative impact on stock returns.

As the asymmetric term C(15) is negative and significant, there is leverage effect in the stock returns of KSE 100-index. Leverage effect is a negative correlation between past returns and future volatility of returns. Log(GARCH) is called the volatility of the returns and is also called the conditional variance. When the returns go

down, volatility goes up. In another way leverage effect is the ratio between debt/equity; higher the leverage effect, greater the risk or volatility or variance of a firm. The higher leverage occurs due to negative returns which translates to low equity prices that result in a higher debt to equity ratio of a firm. A positive shock has less effect on the conditional variance compared to a negative news in KSE 100-index. When there is volatility in KSE 100-index returns, the risk of the business goes up and the investors shift their funds to less risky investment.

To check if our model is good or bad from the statistical point of view, we ran tests to check the serial correlation, ARCH effect and normality of the residuals. All the p-values for Q-statistics are greater than 0.05, which means there is no serial correlation in the residuals. Next, we check ARCH- LM effect.

**Table-8.** Heteroskedasticity Test: ARCH

| Obs*R-squared | p-value | Decision |
|---|---|---|
| 0.14 | 0.71 | There is no ARCH effect in the EGARCH model. |
| Null hypothesis not rejected | | |

**Source:** Table represent Heteroskedasticity test results to determine ARCH effect in the EGARCH model

The p-value for observed R-squared is greater than 0.05 meaning that, we cannot reject the null hypothesis of no ARCH effect. No serial correlation and no ARCH effect in the EGARCH model tells us that our model is a good model. The normality of the residuals is checked by running normality test.

**Table-9.** Standardized Residuals

| Jarque-Bera | p-value | Decision |
|---|---|---|
| 150.82 | 0.00 | Residuals are not normally distributed. |
| Residuals are not normal | | |

**Source:** Table represent standardized residuals to check the normality of the residuals

The probability for Jarque-Bera test is 0.00 so that we can reject the null hypothesis of the normal distribution. The residuals are not normally distributed. That is the only weakness of our model but many experts say that we can still accept the model.

## 5. CONCLUSIONS AND RECOMMENDATIONS

On the basis of these findings, we can conclude that all the major terrorist incidents which result in more than 100 deaths have a significant negative impact on the stock returns of KSE 100-index. We reject the null hypothesis and accept the alternative hypotheses H1, H3, H6 and H7 that Karachi targeted killings July/August 2011; Quetta bombing 10 January 2013; Karachi bombing 3 March 2013 and Peshawar school massacre 16 December 2014 had a significant negative impact on stock returns of KSE 100-index. The results are statistically insignificant for seven of the incidents; so that we fail to reject the null hypothesis that these incidents strike stock market. Four out of these seven incidents occurred in other areas and not in Karachi. According to Abadie and Gardeazabal (2003) the terrorist events occurring in other locations impact the market slightly. Moreover, the incidents which do not perturb the regular business activities also have little effect on the financial markets.

The results of this study are consistent with the existing literature that terrorism has a negative impact on stock markets. The government should allocate more budgets to research sector of the security services to find the motivation behind terrorist attacks. All the institutions should be under the strict scrutiny of the concerned authorities as our academic foundations are blamed to play a role in militant training by various researchers.

This research studies stock market reaction at the time of terrorist attack only but it points to the need of analyzing the terrorist behaviour that can be undertaken with available data and used to further our understanding of terrorism risk. One such research has been conducted by Phillips (2009). The analysis of returns and risk is performed from the point of view of the terrorist group. Phillips threw new light on the nature of the attack method

selected by the terrorist group and the efficiency of that method. Researchers in this field will assist in mitigating the dilemma.

**Funding:** This study received no specific financial support.
**Competing Interests:** The authors declare that they have no competing interests.
**Contributors/Acknowledgement:** All authors contributed equally to the conception and design of the study.

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