



Available Online

Journal of Economic Impact

ISSN: 2664-9764 (Online), 2664-9756 (Print)

<http://www.scienceimpactpub.com/jei>

STOCK MARKET REACTION TOWARDS TERRORISM: AN EVIDENCE BASED ON SEASONAL VARIATION IN PAKISTAN

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ARTICLE INFO

Article history

Received: August 18, 2021

Revised: October 04, 2021

Accepted: October 07, 2021

Keywords

Terrorism

Seasonal anomaly

KSE 100 Index

ABSTRACT

This study examined whether the impact of terrorism events on the stock market varies based on seasonal anomalies (i.e., spring, summer, autumn, and winter). For this purpose, this study selected and obtained the data of 344 terrorist events that occurred in Pakistan and daily closing index price data of KSE 100 for the period ranging from 2008 to 2017. To fulfil the study's objective, this study applies the event day analysis by using five days window (-2, -1, 0, +1, +2) by employing the Exponential Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The findings of this study shows that there is no significant impact of terrorist events on stock returns in Pakistan on pre-event day 2 and event day. However, terrorism events have a significant positive impact on stock returns on pre-event day 1 and post-event day 1. On the contrary, stock returns on post-event day 2 showed a significant positive but in negative direction. In addition, this study also found that stock market returns vary significantly based on seasonal anomalies. However, it is also revealed that the impact of terrorism (event day) on the stock market's returns does not significantly vary during all seasons in Pakistan except autumn and similarly, the impact of terrorism (post-event day 1) on the stock market's returns does not significantly vary during said weather seasons in Pakistan. Furthermore, the positive impact of terrorism (during post-event day 2) upon the stock market's returns significantly differs during weather seasons of spring, summer, and autumn in Pakistan. As per the results, this study suggests that the investor should invest on event day and resell/ withdraw his investment on post-event day 1 in order to earn higher profit.

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<https://doi.org/10.52223/jei3032106>

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INTRODUCTION

It is a well-established argument by many researchers that there are several factors due to which stock markets under-react or over-react. The factors that may affect stock prices are not only economic but social or political factors that may also affect stocks. These factors and events therein may be good or bad in nature and become grounds to produce fluctuations in the market and in reaction to the event, structural breaks arise, which can modify a historic tendency named alpha shift, which is the representation of an efficient market. Several studies have been conducted to find the impact of different anomalies on stock market returns (Khan et al., 2017; Halari et al., 2015; Ullah et al., 2016). These types of events may increase uncertainty and insecurity which will result in reduced investor confidence and turn stock market returns negatively. Therefore, this study focuses on capturing the impact of

terrorism events on stock market returns based on seasonal variations. This research considers data for ten years ranging from 2008 to 2017.

A vital characteristic of any market is its level of informational efficiency and to what extent the securities' prices of the market reflect the public information (current and historical) and private information (Insider). In this context, Fama (1970) developed the Theory of Efficient Market wherein markets are considered to be efficient while asset's prices entirely and quickly reflect and incorporate all the relevant available information (all public and private) and nobody can beat the market or earn abnormal return because everybody has equal information at the same time. The fundamental thought behind the EMH (Efficient Market Hypothesis) is the speedy flow of information. Based on this hypothesis, no investor is

smarter than the market, therefore, cannot beat the market. Furthermore, Fama (1970) segregated the market efficiency in three stages (weak-form of efficiency, semi-strong form of efficiency, and strong-form of efficiency). If the past information is useless to predict the trend and investors are unable to get an abnormal return through utilizing just historical information, then a weak form of efficiency will exist. Further, semi-strong form of market efficiency exists when investors are unable to earn an unusual return by means of the past and current information whereas the market efficiency in strong form exists when every kind of information (past, current and private information) become useless for investors to make irregular returns.

The importance of diverse events in the equity market's performance is inevitable as the equity market is extremely perceptive to the occurrence of events. These events can happen around the country and across the country. In response to these events, the stock market might under-react or over-react. Given that, most researchers have examined the effects of the above-mentioned events upon the stock market returns. Javid (2007) has checked the impact of the natural underground eruptions on the Karachi Stock market returns. Likewise, Worthington and Valadkhani (2005) have measured the impact of "natural disasters on the equity market" of Australia. Recent studies have highlighted that terrorist activities are one of the major causes in determining the equity market returns. Gul et al. (2013) have determined the "effect of political events on KSE 100 index". For instance, the impact of terrorism on the emerging markets is examined by Arin et al. (2008). Further, likewise, impact of terrorism on Pakistani equity market returns has been studied by Najam and Mehmood (2019). Irshad et al. (2019) examined the effect of terrorism on six world equity markets by taking data from 1999 to 2016. Among these studies, a number of studies have reported that investor behavior varies during different seasons; therefore, their investment behaviour may also vary during different seasonal variations (Hirshleifer and Shumway 2003; Kathiravan et al., 2021; Nofsinger 2005; Novy-Marx, 2014). All of the above literature motivates the author to attempt to examine the impact of terrorist events on stock market returns based on seasonal variations.

It is momentous to mention here that one of the main problems that Pakistan has faced since Soviet War and the incident of 9/11 is the terrorism. During the years 2006 to 2008, two major events such as assassination of former Prime Minister, Benazir Bhutto and the death of Nawab Akbar Bugti were the crucial in terms of terrorism in the country (Gul et al. 2013). In addition, the terrorist attack on the Army Public School dated 16th December 2014 (BBC News, 2014) has also boosted-up the instability in Pakistan. The terrorist attack on an educational institute leaves a situation of uncertainty for the other educational institution. While terrorism attacks on a business activity drag another investor to shut down the business activity. These types of events may increase uncertainty and insecurity which will result in reduced investor confidence and turn stock market returns negatively. Prior studies have already documented the stock market response to terrorism, tourism, exchange rates, oil prices, economic development and weather changes. However, the

impact of series of terrorist incidents upon equity market based on seasonal variations is non-existent. For instance, Sloboda (2003) reported that the terrorist incidents affect tourism industry in United State of America by taking the sample of events from the year 1988 to 2001.

Further, Chen and Siems (2004) examined the impact of terrorist attacks on global stock markets by employing the Event Study Methodology. Furthermore, Worthington and Valadkhani (2005) documented the Australian stock market response towards industrial and natural disasters. To determine the impact of supra events, Autoregressive Moving Average (ARMA) model was used, and the findings of their study showed that the 9/11 incident had impacted the capital market of Australia.

In addition to the above, Arin et al. (2008) checked the impact of terrorist attacks on the financial markets of six countries (UK, Israel, Spain, Thailand, Turkey, and Indonesia) and found the significant negative effect of terrorist attacks on the financial market instability and on returns. Further, Kollias et al. (2011) focused on determining the volatility of London and Spain stock exchanges with respect to time owing to the effect of terrorist attacks. They found a rapid effect on said stock exchanges; however, the London stock exchange recovers sooner than the stock exchange of Spain. Moreover, Meierrieks and Gries (2013) determined the effect of terrorism on banking crises and selected the sample of 146 banks for the time span of 1972-2006. Their study found the significant impact of terrorism upon the banking crisis.

In addition to the aforementioned studies, Essaddam and Karagianis (2014) focused on examining the impact of terrorism on stock returns of US equity markets and volatility. They utilized the GARCH Model through conducting Cross-Sectional Analysis and found that the effect eliminates after fifteen days.

In addition, Aslam et al. (2018) determined the impact of terrorism on the performance of five Asian stock markets on the basis of attack type and severity. Their study found that these events have a significant impact, and their magnitude will vary depending on the country, type of attack, target, and severity. Nguyen and Enomoto (2009) documented the response of equity markets in Pakistan and Iran towards terrorism events. Their study found that the impact of the terrorist attacks on the Karachi stock market is greater than that of other stock markets that have taken place in countries other than Pakistan and Iran.

In addition, Gul et al. (2010) examined the effects of terrorist activities on the Pakistani financial markets over a period of two years. To do this, their study used the Ordinary Least Squares (OLS) regression and found that the terrorist attacks had a negative impact on both the stock market and Pakistan's economy. In addition, Hassan et al. (2014) examined the three selected events, i) the assassination of the former President of the Pakistan People Party, namely Benazir Bhutto, ii) the attack on Darra Adam Khel and iii) the attack on the Marriott Hotel, using the event study methodology became. According to the statistical results, there was a significant effect of the three events on the sectors of the KSE-100 index.

Moreover, Aslam and Kang (2015) investigated the returns and volatility in Karachi Stock Exchange in response to

different terrorism events in the country. For the objective, they chose the 330 terrorism events and applied the Event Day Analysis (in respect of location-wise, event and target type) through employing the EGARCH Modelling. After empirical analysis, the findings showed that the stock markets started normal functioning in one day after the significant effect of terrorist attacks. Further, another study by Najam and Mehmood (2019) also documented the equity market response towards terrorism and natural disasters events in Pakistan. For this objective, they selected the 289 terrorist and 45 natural disasters events from the year 2003 to 2017. They found that terrorist attacks significantly and negatively affect the banking sector returns and insurance sector returns.

Similarly, Irshad et al. (2019) examined the effect of terrorism on six world equity markets by taking data from 1999 to 2016. Keeping into consideration the above-mentioned studies, this present study is of the view that terrorism creates an atmosphere of fear and uncertainty; resultantly, the confidence level of People decreases, and they show reluctance to invest in stocks even try to withdraw/resell their stocks. Consequentially, the overall performance of the Stock market decreases and, in this way, Terrorist Events affect the capital market of a country. With prior inspiration, the present study also shows its interest by examining the impact of a series of terrorist attacks on PSX based on seasonal variations during a time period ranging from 2008 to 2017.

Seasonal Anomaly

There are many anomalies that oppose the efficiency of the market as calendar anomalies as well as Muslim holiday's anomalies, small firm anomalies, low book value. Fama (1970) stated that when the market is efficient, then prices accurately and quickly incorporate all the information (public and private) and consequently, nobody can earn abnormal returns. But due to these anomalies and inefficiencies, some investors can earn abnormal returns and thus, investors always show their interest in said anomalies and efficiencies. Antoniou et al. (2010) argued that the behaviour of investors (sentiments and emotions) creates impact on judgments and decisions of investors and increases or decreases the stock prices. Cao and Wei (2005) found that investor behaviour is significantly affected by the weather because of the impact of weather on investing behaviour.

Howarth and Hoffman (1984) said that three climatic conditions have a strong effect on concentration and especially cold temperature has a positive correlation with aggressiveness. Schwarz (1990) gave theories on mood and feelings of people that are linked with their common decision-making, which supports the idea that emotions affect economic decision-making. Environmental and situational factors affect mood (Watson, 2000). Sunny days cause an increase in satisfaction level of people instead of cloudy or rainy days (Schwarz and Clore, 1983), although their prosperity does not change in routine life. In fact, Human behaviour and weather variables are directly linked and large literature supports this fact (Baron and Bell, 1976; Davis et al., 1978; Cunningham, 1979; Bujisic et al., 2017; Howarth and Hoffman, 1984; Rind, 1996). In addition, Cunningham (1979), and Schneider et al. (1980) found that hot and cold

temperature affects people helping behaviour. On the tendency of aggression, researchers like Baron and Ransberger (1978) and Bell (1981) supports that high temperature increases aggression. In the same way, another study found that cold temperature has a positive relation with aggression. Thereafter, Novy-Marx (2014) examined the effect of politics, the weather, global warming, sunspots, and the stars on stock return and anomalies performance in USA. His study obtained the data of the time span from January 1961 to December 2012 and applying the regression, he found that New York City weather significantly predicts investor's sentiments, further suggesting that the weather's influence on anomaly performance operates through its impact on traders' moods. So, it is clear that there is a major impact of weather/temperature on investing behaviour of people, which are very considerable and important factors for decision making and ultimately this effect shows in the stock returns. So, numerous studies are conducted to examine the impact of investor's behaviour on the equity Market under different seasons, but no study has been conducted so far to check the impact of investor behaviour on the KSE-100 index during different seasons such as summer, spring, winter and autumn. Therefore, the present study wants to know that if a terrorist attack occurs in spring, summer, autumn, winter, and then how stock market will react?

Interaction between Terrorism and Seasonal Anomaly

By keeping in consideration, the empirical literature mentioned earlier; it is evident that terrorism creates an atmosphere of fear and uncertainty; resultantly, the confidence level of people decreases and they show reluctance to invest in stocks even try to withdraw/resell their stocks. Consequentially, the overall performance of stock market decreases. In addition, there is a seasonal anomaly of weather e.g., spring, summer, autumn, and winter, which may put impact on the human behaviour of investors by creating different moods and sentiments and consequentially, these changes in investor's sentiments and moods can affect the behaviour of investors towards investment and trading in stocks/financial securities. For instance, it is the possibility that during summer or autumn, investors may have an aggressive mood, and in spring and winter, an investor may have moderate feelings. Resultantly, this changed behaviour can put a major impact on the perception, analysis as well as investment decisions of investors and ultimately, the performance of stock market is affected. Therefore, the present study wants to examine that how Stock Market will react when a terrorist event occurs in different weather season e.g. spring, Summer, winter, Autumn?

METHODOLOGY

Instant study used the data of ten years starting from the year 2008 to 2017. This study has selected the 344 terrorist events that occurred in Pakistan which were obtained through Global Terrorism Database (GTD) and Closing Index price data of KSE 100 for the time span ranging from 2008 to 2017 were obtained by using yahoo finance as well as official website of PSX. To fulfil the objective of this study, EGARCH Model is employed. The sample of this study is chosen as all the events

in which the number of deaths is 10 or more than 10. The Theoretical Framework or Research Framework of this present study is given below wherein Dependent Variable (DV) is Stock Market Returns and Independent Variables (IV) are Terrorism Events (dummy), Spring (dummy), Summer (dummy), Winter (dummy), and Autumn (dummy). The four seasons with months are summer (June–August), autumn (September–November), winter (December–February) and spring (March–May) (Shah and Shaheen, 2010).

There are also limitations for events that occurred on off days (weekend and Eid holidays) / after office timings 3.30 Pm will be considered on the next working day (Aslam and Kang, 2015; Muntermann and Guettler, 2007).

On the basis of research objectives and research Framework, this study has the following hypothesis wherein H1, H2, H3 denotes to alternative hypothesis:

Terrorism and Stock Market Returns: In prior studies' view, it can be stated that terrorism significantly affects stock market's returns as terrorist events create an atmosphere of fear and uncertainty. Consequently, investors feel fear and hesitate to invest in stocks even try to withdraw their investments. In this regard, alternate hypothesis is framed as under:

H1: Terrorism events significantly affect the stock market returns in Pakistan

Seasonal Variations and Stock Market Returns: It has also been witnessed by some researchers that seasonal variations (weathers) affect the equity market returns owing to variation in the moods and sentiments of investors influenced by different weathers and consequently, investing behaviour can be changed. In this context, in order to determine the fluctuations in equity market returns, the following alternative hypothesis is developed:

H2: Stock market returns significantly vary during different seasons in Pakistan

Terrorism, Seasonal Variations and Stock Market Returns: In order to determine the impact of terrorist events on stock market returns during different weather seasons, this study established the below-mentioned alternate-hypothesis. H3: Impact of terrorism on Stock market returns significantly vary during different seasons in Pakistan. This study has used the EGARCH Model to determine the impact of terrorism on Stock Market Returns during different seasons under seasonal variation in Pakistan. In this connection, some previous studies also employed the same methodology (Engle et al., 2012; Aktaş et al., 2012; Van Binsbergen et al., 2012; Anyfantaki and Topaloglou, 2018 and Aslam et al., 2018).

Present study computed the daily returns as:

$$R_{i,t} = \log(P_{i,t}) - \log(P_{i,t-1}) \quad (1)$$

Here $R_{i,t}$ denotes the return for KSE 100 index for the time t , ($P_{i,t}$) is the closing index price of KSE 100 index at time t , and ($P_{i,t-1}$) refers to the closing index price of KSE 100 index at time $t-1$.

Event Day Analysis: This study has used the five days window (-2, -1, 0, +1, +2) to examine the effect of terrorist events

around the event day on Stock Market Returns of KSE 100 index. This methodology has been employed by many researchers (Karolyi and Martell, 2010; Hassan et al., 2014; Aslam and Kang, 2015; Aslam et al., 2018; Najam and Mehmood, 2019).

For the said purpose, this study has used the following five dummy variables to capture the impact over five-day event windows surrounding the terrorist events:

$$Day_{i,t} = \begin{cases} 1, & \text{if the date is } i \text{ day from the terrorist event} \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

Where $i = -2, -1, 0, +1, +2$ and 0 is the event day. This model is based on five-day dummies, which are the independent variables in the regression model. The dependent variable is the stock market returns. The day dummies are regressed on stock market returns in a dummy variable regression model to know the equity market response towards these events on event day and on one and two days after the event. This relationship is postulated in equation 3, where α , β are the parameters and ε_t is error term

$$R_{i,t} = \alpha + \sum_{i=-2}^{+2} \beta_{i,t} Day_{i,t} + \varepsilon_t \quad (3)$$

Seasonal Variation and Stock Market Returns: To examine the effect of different seasons (spring, summer, winter, autumn) on Stock Market Return of KSE 100 index, this study has utilized the following three dummy variables by considering the winter as base category (benchmark):

$$Sesn_{i,t} = \begin{cases} 1, & \text{if the season is } i \text{ under seasonal variation} \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

Where $i = \text{spring, summer, autumn}$ is the season/weather, in this model, stock return is taken as dependent where four seasons are taken as four independent variables. This relationship is postulated in equation 5, where α , β are the parameters and ε_t is error term

$$R_{i,t} = \alpha + \sum_{i=1}^3 \beta_{i,t} Sesn_{i,t} + \varepsilon_t \quad (5)$$

Terrorism, Seasonal Variation and Stock Market Returns: To determine the impact of terrorism on Stock Market Returns during different seasons under seasonal variation in Pakistan, this study used equations 3 and 5. One equation describes the impact of day dummies on stock market returns, whereas the other describes the impact of three defined seasons/weather dummy variables by considering the winter as base/benchmark category. This relationship is postulated in equation 6, where α , β are the parameters and ε_t is error term.

$$R_{i,t} = \alpha + \sum_{i=-2}^{+2} \beta_{i,t} Day_{i,t} + \sum_{i=1}^3 \beta_{i,t} Sesn_{i,t} + \varepsilon_t \quad (6)$$

RESULTS AND DISCUSSION

To examine and estimate the volatility of financial data and macroeconomic data, e.g., returns of stocks, indices, etc., Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) Model has a vital consideration.

Impact of Terrorism on Stock Returns

In this part, it has been checked that whether Terrorist Events significantly affect the returns of stock market in Pakistan or not by applying the EGARCH Model under five days window (-2, -1, 0, +1, +2). In Table 1, all the statistical values of coefficient along with their Z-Statics and corresponding P-values for Mean Equation are reported.

It can be clearly stated that the coefficient value of constant or intercept is positive and statically significant, which is showing the average daily return (0.5326) of KSE 100. In addition, P-

value of Lag Returns is also significant, which shows that dependent variable, i.e., Daily Stock Returns of KSE 100, is significantly dependent upon the past returns.

Table 1. Results of EGARCH (Mean Equation) Impact of Terrorism on Stock Index Returns of Pakistan (2008-2017).

Variables	Coefficient	Std. Error	z-Statistic	Prob.
C	0.5326	0.0133	39.919	0.0000***
LAGRETURNS	0.2319	0.0192	12.045	0.0000***
NEG2	0.0002	0.0003	0.681	0.4957
NEG1	0.0004	0.0002	1.819	0.0688*
EVENTDAY	0.0004	0.0002	1.606	0.1082
POSTEVENTDAY1	0.0006	0.0003	2.335	0.0195**
POSTEVENTDAY2	-0.0005	0.0003	-1.961	0.0498**

*Significance Level at 10%, ** Significance Level at 5%, *** Significance Level at 1% significance level.

By looking at the results reported in Table 1, it can also be seen that on two days before the terrorist attacks (NEG2), there is no impact of said events on index returns and Null-Hypothesis is not rejected as P-value (0.4957) is more than the cut-off points. But before one day of terrorist attacks (NEG1), there was a significant positive effect on index returns by rejecting the Null-Hypothesis as P-value (0.0688) is less than the cut-off point of 0.10 at 10% significance level. Whereas on event day of terrorist attacks, interestingly, there is an insignificant impact of attacks on index returns and failed to reject the Null-

Hypothesis. However, after the terrorist attacks, there is significant effect (after-shock) of said events on index returns on post-event day 1 and day 2 but on post-event day 1, the direction of impact is positive and on post-event day 2, the direction of impact is negative. From statistical results of Variance Equation reported in Table 2, it can be easily stated that most of the coefficients of Lag Volatility (EGARCH Effect), Lag Squared Residuals (ARCH Effect) and some exogenous variables are insignificant, and if they are significant, then coefficients are negative.

Table 2. Results of EGARCH (Variance Equation) Impact of Terrorism on Stock Index Returns of Pakistan (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C(8)	-6.4347	3.1612	-2.036	0.0418**
C(9)	0.2577	0.0211	12.187	0.0000***
C(10)	-0.2326	0.0323	-7.194	0.0000***
C(11)	0.9326	0.0068	137.252	0.0000***
C(12)	7.9458	4.5698	1.739	0.0821*
C(13)	-0.2020	0.1099	-1.837	0.0663*
C(14)	0.0336	0.0773	0.435	0.6637
C(15)	0.0744	0.1119	0.665	0.5061
C(16)	0.0212	0.0985	0.215	0.8300
C(17)	0.0944	0.0772	1.223	0.2213
R ²	0.034841		MDV	0.693377
Adjusted R ²	0.032499		S.D. DV	0.005685
Durbin-Watson stat	2.107983			

* Significance Level at 10%, ** Significance Level at 5%, *** Significance Level at 1% significance level.

So, by looking at the results, it can be found that coefficient value of the intercept is representing the mean value of base category. In addition, the differential intercept coefficients of dummy variables (spring, summer, autumn) are showing the deviation from the coefficient value of benchmark category i.e., winter. As the coefficient value of spring, summer and autumn is smaller than the base category which is significant and therefore Null hypothesis is rejected. So, keeping in view the above results, it can be concluded that stock market returns significantly vary during different seasonal variations in Pakistan and there is a significant positive impact of all seasons, i.e., spring, summer, winter and autumn, on index returns but the impact in winter is greater than the other three seasons, so the Null-Hypothesis is rejected.

Impact of Seasonal Anomaly on Stock Returns

In this part of study, it has been examined that "whether stock market returns vary during different weather seasons, i.e., Spring, Summer, Winter, and Autumn", by applying the "EGARCH Model" and considering the winter as base/benchmark category.

So, by looking at the "results reported in Table 3 regarding the effect of seasonal variation on dependant Variable", i.e., KSE 100 Returns, it can be found that coefficient value of constant or intercept is representing the mean value of base/benchmark category, i.e., winter, which is positive and statically significant. Results of EGARCH (Variance Equation) Impact of Seasonal Anomaly on Stock Returns are given below in Table 4.

Table 3. Results of EGARCH (Mean Equation) Impact of Seasonal Anomaly on Stock Returns (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C	0.5684	0.0003	2109.455	0.0000***
LAGRETURNS	0.1817	0.0004	423.711	0.0000***
SPRING	-0.0009	0.0002	-4.904	0.0000***
SUMMER	-0.0011	0.0002	-5.606	0.0000***
AUTUMN	-0.0012	0.0002	-8.060	0.0000***

* Significance Level at 10%, ** Significance Level at 5%, *** Significance Level at 1% significance level.

Table 4. Results of EGARCH (Variance Equation) Impact of Seasonal Anomaly on Stock Returns (2008-2017).

Variables	Coefficient	Std. Error	z-Statistic	Prob.
C(6)	-3.9698	3.5199	-1.128	0.2594
C(7)	0.3550	0.0250	14.183	0.0000***
C(8)	-0.2205	0.0328	-6.720	0.0000***
C(9)	0.9184	0.0077	118.819	0.0000***
C(10)	4.0499	5.0681	0.799	0.4242
C(11)	0.0195	0.0200	0.973	0.3308
C(12)	0.0405	0.0195	2.075	0.0380**
C(13)	-0.0039	0.0188	-0.206	0.8369
R2	0.025213		MDV	0.693377
Adjusted R2	0.023638		S.D. DV	0.005685
Durbin-Watson stat	1.982775			

As far as the time-varying volatility in PSX stock index returns is concerned, it can be easily stated that the coefficient of constant variance is negative and insignificant whereas the coefficients of ARCH and EGARCH Terms are significant but one is negative and two are positive. On the other hand, the contribution of Lag>Returns and weather seasons in volatility of index returns is insignificant summer season. In nutshell, it can be concluded that exogenous variable, i.e., seasonal variation, has performed weakly for predicting volatility in dependent variable.

Impact of Terrorism on Stock Returns under Seasonal Anomaly

In this part, it has been checked that whether impact of terrorism on Stock market returns does not significantly vary during different seasonal variations in Pakistan or not by applying the EGARCH Model under three days window (0, +1,

+2) and considering the winter (without terrorist attack) as base/benchmark category. It can be clearly stated that P-value of Lag>Returns is significant.

Moreover, the statistical results of Mean Equation, regarding effect of Terrorist attacks (event day) on dependent variable, i.e., KSE 100>Returns, are also reported in Table 5.

So, by looking at the results reported in Table 5 regarding the effect of terrorism (event day) on dependent variable, i.e., KSE 100>Returns, under seasonal anomaly, it can be found that coefficient value of constant is positive and statically significant. In addition, it can be found that event day of the terrorist attack has significant positive impact on the average daily returns of KSE 100 index. However, the coefficient value of Event Day of attack is more than the base category (0.5428) by 0.0009, which is significant as P-value (0.0205) is less than the cut-off point.

Table 5. Results of EGARCH (Mean Equation) Impact of Terrorism (Event Day) on Stock Returns under Seasonal Anomaly (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C	0.5428	0.0142	38.16749	0.0000***
LAGRETURNS	0.2184	0.0205	10.64743	0.0000***
EVENTDAY	0.0009	0.0004	2.316	0.0205**
SPRING	-0.0008	0.0002	-3.548	0.0004***
SUMMER	-0.0009	0.0002	-3.690	0.0002***
AUTUMN	-0.0009	0.0002	-4.949	0.0000***
EVENTDAY*SPRING	-0.0002	0.0007	-0.276	0.7823
EVENTDAY*SUMMER	-0.0009	0.0007	-1.293	0.1958
EVENTDAY*AUTUMN	-0.0011	0.0007	-1.732	0.0833*

* Significance Level at 10%, ** Significance Level at 5%, *** Significance Level at 1% significance level.

Furthermore, as far as the impact of interaction dummies and main objective is concerned, it can be concluded, by seeing the statistical values in the Table 5, that when a terrorist attack (event day) takes place in a seasons of spring and summer then

there is insignificant impact of terrorist attack (Event Day) on dependent variable, i.e. Daily>Returns of KSE 100, during spring and summer as the coefficients of respective interactive dummies (i.e., Event day*Spring, Event day*Summer) are less

than the coefficient of benchmark but insignificant since P-values are more than the cut off points and failed to reject the Null-Hypothesis. But the coefficient of third interactive dummy (Event Day*autumn) is smaller than the benchmark and significant as P-value (0.0833) is less than the cut-off point of .10 at 10%, significance level. So, it can be claimed that the impact of terrorism (event day) on the stock market's returns significantly varies during the autumn season in Pakistan.

So, keeping in view the above results, it can be found that stock market's returns significantly vary owing to terrorist attack

(event day) as well as during different seasonal variations in Pakistan and there is a significant positive impact of Event Day of attack as well as different seasons, i.e., Spring, Summer, Winter and Autumn, on index returns but the impact of Event Day of attack is greater than the other seasons as compare to base category. Further, the impact of terrorism (event day) on the stock market's returns significantly varies only during season of autumn in Pakistan but does not vary during spring and summer seasons. Table 6 given below shows the results of EGARCH (Variance Equation).

Table 6. Results of EGARCH (Variance Equation) Impact of Terrorism (Event Day) on Stock Returns under Seasonal Anomaly (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C(10)	0.6293	3.7468	0.168	0.8666
C(11)	0.3451	0.0250	13.802	0.0000***
C(12)	-0.2014	0.0361	-5.571	0.0000***
C(13)	0.9078	0.0073	124.374	0.0000***
C(14)	-2.7512	5.4147	-0.508	0.6114
C(15)	0.01591	0.0292	0.544	0.5864
C(16)	0.0672	0.0267	2.519	0.0118**
C(17)	-0.0147	0.0276	-0.531	0.5954
C(18)	0.1216	0.1231	0.988	0.3232
C(19)	-0.0065	0.1570	-0.041	0.9670
C(20)	-0.2449	0.1482	-1.653	0.0983*
C(21)	0.0681	0.1429	0.476	0.6338
R2	0.026465		MDV	0.693377
Adjusted R2	0.023314		S.D. DV	0.005685
Durbin-Watson stat	2.067038			

As far as the time-varying volatility in PSX stock index returns is concerned, it can be easily stated that the coefficient of constant variance is positive but insignificant whereas the coefficients of ARCH and EGARCH Terms are significant but one is negative and two are positive. On the other hand, the contribution of Lag>Returns and weather seasons including interactive dummies in volatility of index returns is insignificant except summer season and its negative interactive dummy. In nutshell, it can be concluded that exogenous variables, i.e., terrorism (event

day), seasonal variation and interaction dummies, have performed weakly for predicting volatility in dependent variable. Furthermore, in Table 7, the statistical results of EGARCH Model (Mean Equation), for the impact of terrorism (post-event day 1) on stock returns under seasonal anomaly by considering the base/benchmark category of winter (without terrorist attack), has been reported. Keeping in view the results reported in Table 7, it can be clearly stated that P-value of Lag>Returns is significant.

Table 7. Results of EGARCH (Mean Equation) Impact of Terrorism (Post Event Day-1) on Stock Returns under Seasonal Anomaly (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C	0.5325	0.0139	38.259	0.0000***
LAGRETURNS	0.2330	0.0201	11.609	0.0000***
SPRING	-0.0008	0.0003	-3.043	0.0023***
SUMMER	-0.0009	0.0003	-3.574	0.0004***
AUTUMN	-0.0009	0.0002	-4.232	0.0000***
POSTEVENTDAY1	0.0006	0.0005	1.291	0.1966
POSTEVENTDAY1*SPRING	0.0003	0.0007	0.449	0.6528
POSTEVENTDAY1*SUMMER	-0.0003	0.0007	-0.385	0.7004
POSTEVENTDAY1*AUTUMN	-0.0003	0.0007	-0.356	0.7218

* Significance Level at 10%, ** Significance Level at 5%, *** Significance Level at 1% significance level.

So, by looking at the results reported in Table 7, regarding the effect of terrorism (post-event day 1) on dependent variable, under seasonal anomaly, it can be found that the coefficient

value of constant is positive and statically significant. In addition, the differential intercept coefficients of dummy variables are showing the deviation from the coefficient value

of benchmark category, i.e., winter (without attack). As it can be found that post-event day 1 of terrorist attack has no significant impact on the average daily returns of KSE 100 index since the coefficient value of post-event day-1 of attack is insignificant. In the same way, the coefficient value of summer and autumn is smaller than the benchmark and is significant.

Furthermore, as far as the impact of interaction dummies and main objective is concerned, it can be concluded, by seeing the statistical values in Table 7, that when a terrorist attack takes place in a seasons of spring, summer, and autumn, then after

day 1, there is insignificant impact of terrorist attack (post-event day) on the dependent variable.

So, keeping in view the above results, it can be claimed that stock market's returns significantly vary during different seasonal variations in Pakistan and there is a significant positive impact of different seasons, i.e., spring, summer, and winter and autumn, on index returns but there is no impact of post-event day 1 of attack on index returns. Further, the impact of terrorism (post event day 1) on the stock market's returns does not significantly vary during said weather season in Pakistan.

Table 8. Results of EGARCH (Variance Equation) Impact of Terrorism (Post Event Day-1) on Stock Returns under Seasonal Anomaly (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C(10)	-5.6014	3.4820	-1.6087	0.1077
C(11)	0.3040	0.0224	13.5462	0.0000***
C(12)	-0.2535	0.0329	-7.6981	0.0000***
C(13)	0.9112	0.0067	136.2334	0.0000***
C(14)	6.3024	5.0147	1.2568	0.2088
C(15)	0.0436	0.0258	1.6893	0.0912*
C(16)	0.0921	0.0241	3.8133	0.0001***
C(17)	0.0292	0.0251	1.1600	0.2461
C(18)	0.2555	0.0988	2.5863	0.0097***
C(19)	-0.1535	0.1274	-1.2047	0.2283
C(20)	-0.3740	0.1242	-3.0113	0.0026***
C(21)	-0.0871	0.1234	-0.7057	0.4804
R2	0.02844		MDV	0.693377
Adjusted R2	0.025294		S.D. DV	0.005685
Durbin-Watson stat	2.096772			

As far as the time-varying volatility in PSX stock index returns is concerned, by looking at the statistical results of Variance Equation reported in Table 8, it can be easily stated that the coefficient of constant variance is negative and insignificant whereas the coefficients of ARCH and EGARCH Terms are significant. On the other hand, the contribution of Lag>Returns and weather seasons including interactive dummies in volatility of index returns is significant as well as insignificant and in case of significant, some are negative. Keeping in view the results reported in Table 9, it can be clearly stated that P-value of Lag Returns is significant. Moreover, the statistical results of Mean

Equation are also reported in Table 9. By looking at the results it can be found that coefficient value of constant is positive and statically significant. In addition, the differential intercept coefficients of dummy variables and interaction dummies are showing the deviation from the coefficient value of the benchmark category i.e. winter (without attack) as it can be found that post-event day 2 of terrorist attack has significant positive impact. However, the coefficient value of post event day-2 of attack significant. Further, the coefficient values of all remaining seasons are significant and less than the coefficient of winter except spring (insignificant).

Table 9. Results of EGARCH (Mean Equation) Impact of Terrorism (Post Event Day-2) on Stock Returns under Seasonal Anomaly (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C	0.5617	0.0154	36.407	0.0000***
LAGRETURNS	0.1906	0.0222	8.585	0.0000***
SPRING	-0.0006	0.0004	-1.579	0.1142
SUMMER	-0.0010	0.0004	-2.433	0.0150**
AUTUMN	-0.0006	0.0002	-2.339	0.0193**
POSTEVENTDAY2	-0.0019	0.0005	-3.826	0.0001***
POSTEVENTDAY2*SPRING	0.0017	0.0009	1.959	0.0501*
POSTEVENTDAY2*SUMMER	0.0030	0.0007	4.089	0.0000***
POSTEVENTDAY2*AUTUMN	0.0017	0.0009	1.863	0.0624*

* Significance Level at 10%, ** Significance Level at 5%, *** Significance Level at 1% significance level.

So, keeping in view the above results, it can be stated that stock market's returns significantly vary owing to terrorist attack (post-event day 2) as well as during different seasonal variations in Pakistan except for spring and there is a

significant positive impact of post-event day 2 of attack as well as different seasons. The results of EGARCH (Variance Equation) Impact of Terrorism (Post Event Day-2) on Stock Returns under Seasonal Anomaly are given below in Table 10.

Table 10. Results of EGARCH (Variance Equation) Impact of Terrorism (Post Event Day-2) on Stock Returns under Seasonal Anomaly (2008-2017).

Variables	Coefficient	Std. Error	Z-Statistic	Prob.
C(10)	0.8395	0.6247	1.3438	0.1790
C(11)	0.2591	0.0150	17.2638	0.0000***
C(12)	-0.1871	0.0074	-25.1975	0.0000***
C(13)	0.8858	0.0040	223.2468	0.0000***
C(14)	-3.3264	0.9537	-3.4878	0.0005***
C(15)	0.0517	0.0112	4.6259	0.0000***
C(16)	0.0838	0.0113	7.3865	0.0000***
C(17)	0.0139	0.0093	1.4987	0.1340
C(18)	0.4479	0.0432	10.3691	0.0000***
C(19)	-0.2619	0.0624	-4.1983	0.0000***
C(20)	-0.5241	0.0537	-9.7567	0.0000***
C(21)	-0.0663	0.0651	-1.0192	0.3081
R2	0.033046		MDV	0.693377
Adjusted R2	0.029916		S.D. DV	0.005685
Durbin-Watson stat	2.020664			

As far as the time-varying volatility in PSX stock index returns is concerned, it can be easily stated that the coefficient of constant variance is positive but insignificant whereas the coefficients of ARCH and EGARCH Terms are significant. On the other hand, the contribution of Lag>Returns and weather seasons including interactive dummies in volatility of index returns is insignificant as well as significant and in case of significant, some are negative.

In nutshell, it can be concluded that exogenous variables, i.e., terrorism (post-event day 2), seasonal variation and interaction dummies, have performed weakly for predicting volatility in dependent variable, i.e., PSX Stock Index Returns and have very low predictive ability in future for volatility in index returns and high likelihood ratio as well as low value of AIC (Akaike Information Criteria) are favorable for the model.

CONCLUSIONS AND POLICY IMPLICATIONS

This comprehensive study determined the impact of terrorism on the stock market's returns during different seasons (i.e., spring, summer, autumn, and winter) under seasonal variations in Pakistan. For this objective, this study used the Event Day Analysis by using five days window (-2, -1, 0, +1, +2) and employed the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) Model under Dummy Variable Regression Approach.

For this study, KSE 100 index of Pakistan Stock Exchange is purposively selected as the sample. In order to obtain the objective of this study, this study has selected the 344 terrorist events occurred in Pakistan for the period ranging from 2008 to 2017, which were obtained through Global Terrorism Database (GTD) and Closing Index price data of KSE 100 for

the period ranging from 2008 to 2017 were obtained by using the yahoo finance as well as official website of PSX.

The findings of this study show that as per the results of EGARCH Model (Mean Equation), dependent variable, i.e., Daily Stock Returns of KSE 100, is significantly dependent upon the past returns and therefore, the past returns have strength to predict the current stock returns during different seasons (i.e., spring, summer, autumn, and winter) as well as during terrorist attacks around five days window under seasonal variations. Further, this study found that two days before the terrorist attacks (NEG2), there was no impact of said events on index returns. But before one day of terrorist attacks (NEG1), there was a significant positive effect on index returns. While on event day of terrorist attacks interestingly there is insignificant impact of attacks on index returns. However, after the terrorist attacks, there is significant effect (after-shock) of said events on index returns on post-event day 1 and day 2 but on post-event day 1, the direction of impact is positive.

Similarly, this study also concluded that stock market returns significantly vary during different seasonal variations in Pakistan and there is a significant positive impact of all seasons, i.e., spring, summer, winter and autumn, on index returns but the impact in winter is greater than the other three seasons.

Furthermore, as per the statistical results of EGARCH Model (Mean Equation), it is also found that stock market's returns significantly vary because of terrorist attack (event day) as well as during different seasonal variations in Pakistan and there is a significant positive impact of Event Day of attack as well as different seasons, i.e., Spring, Summer, Winter and

Autumn, on index returns but the impact of Event Day of attack is greater than the other seasons as compared to base/benchmark category. Further, the impact of terrorism (event day) on the stock market's returns significantly varies only during the season of autumn in Pakistan but does not vary during spring and summer season. Whereas, after the event day, it is observed that stock market's returns significantly vary during different seasonal variations in Pakistan and there is a significant positive impact of different seasons, i.e., spring, summer, winter and autumn, on index returns but there is no impact of post-event day 1 of attack on index returns. Further, the impact of terrorism (post-event day 1) on the stock market's returns does not significantly vary during said weather season in Pakistan.

While on the second day after terrorist attack, stock market's returns significantly vary because of terrorist attack as well as during different seasonal variations in Pakistan except spring and there is a significant positive impact of post-event day 2 of attack as well as different seasons, i.e., Summer, Winter and Autumn, on index returns but the positive impact of post-event day 2 of attack and said seasons on index returns is smaller than the base/benchmark category. Further, the positive impact of terrorism (on post-event day 2) on the stock market's returns significantly varies during weather seasons of spring, summer, and autumn in Pakistan.

As far as the time-varying volatility in PSX stock index returns is concerned, by looking at the statistical results of EGARCH Model (Variance Equation), it can be easily concluded that ARCH and EGARCH Terms fulfil the stability conditions of variance, which expresses the persistence of conditional volatility in PSX returns and the effect of shock will remain in volatility of PSX returns for many years. On the other hand, the contribution of Lag>Returns and weather seasons including interactive dummies in volatility of index returns is insignificant as well as significant and in case of significant, some are negative. In nutshell, it can be concluded that exogenous variables, i.e., terrorism, seasonal variation and interaction dummies, have performed weakly for predicting volatility in dependent variable i.e., PSX Stock Index Returns and have very low predictive ability in future for volatility in index returns and high likelihood ratio as well as low value of AIC (Akaike Information Criteria) are favourable for the model. As per the results, this study suggests that the investor should invest on event day and resell/withdraw his investment on post-event day one in order to earn higher profit. This study is helpful for investors, managers, and policymakers in creation of a well-diversified portfolio.

This study faces some limits that the data terrorist attacks and weather seasons were not easily available from different sources for the required period. Due to data rarity this study could not focus on other victim countries by terrorism and non-economic variables like political events and natural disasters.

Although this study has contributed to empirical literature but still, the research on the present study topic is at an early stage, and further work is required. For future research, this study recommends that more countries, who got victimized by terrorism (like Iran, Indonesia, India, Israel, etc.), maybe added "to this research to know the impact of terrorism on

stock markets as well as the impact of seasonal variations on stock market. It is also suggested that the impact of "other noneconomic events, e.g., political events, natural events may be examined under seasonal variations and terrorism. In addition, researchers should need to know about the existence of different anomalies in Islamic markets by "examining the semi-strong and strong-form of informational efficiency of Islamic markets as well as the existence of Capital Asset Pricing Model in Islamic Indices. In addition, the effects of monetary shocks on Islamic indices and the effect of competition on the efficiency of Islamic banks and conventional banks, as well as the impact of terrorism on Islamic financial markets can be determined (Aslam et al., 2015) as well as seasonal anomalies. Moreover, the investors can make their investment more fruitful as well safe by determining the contribution of Islamic Markets in Systemic Risk.

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