INFLUENCE OF TERRORIST ACTIVITIES ON FINANCIAL MARKETS: EVIDENCE FROM KSE

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Abstract: *This paper investigates the influence of terrorist activities taking place in Pakistan on the KSE (Karachi Stock Exchange) for the period of 01/2005 to 12/2010 using the GARCH & GARCH- EVT to identify the relationship between these two variables; the study establishes that terrorist activities adversely affect the financial markets and in the case of KSE, it is a highly significant relation. The reason why the negative relationship exists is because of the foremost increase in the number of terrorism attacks in Pakistan.*

Keywords: *Terrorism, KSE, Event Study, Pakistan, GARCH*

JEL classification: *G14, G12, O16*

Introduction

Terrorism is the major cause affecting the economy of Pakistan and a curse affecting international trade, investments and financial institutions. Terrorism is a political issue nowadays, the stock exchange can be directly or indirectly affected by terrorism activity (IMF 2005). This study is about terrorism attacks and its negative effects on the Karachi stock exchange (KSE); unfortunately since 2005 to 2010 there has been an increase in terrorist activities in different areas of Pakistan. Although there has not been much relevant studies on this topic but some studies have already been done on the impact of terrorism on the financial market after 9/11. The New York 9/11 terrorist attack has introduced the definition of terrorist. Before then it was not a major topic and prominent issue (Wilkinson and Jenkins, 2003). Terrorist attacks happening anywhere in the world especially Asia pacific or any other countries in the outer rims of the world affects the stock exchange of every country directly or indirectly. Chen and Siems (2004) highlight that global financial market are strongly inter-connected so news from any event spread like fire across countries (particularly shocking news). Unfortunately, terrorist activity in Pakistan since 2001 have been increasing, so this study's main concern is how terrorist attacks in Pakistan affects the stock exchange; the volatility of stock exchange is a result of many other factors

but terrorism activities affects stocks severely. Karolyi (2006) further illustrates that after the 9/11 attack, terrorism became a major geopolitical threat for the global financial markets as well as for the stability of stock markets. Our study differs from the extant literature on two main points, I) Prior studies are confined to the extent of the 9/11 attack, Madrid bombing, London bombing or other attacks, but our study is purely about the major and critical terrorist attacks in Pakistan affecting our stock market. II) No prior study done on the attacks of Pakistan affecting its stock market. We are doing it on the bomb blasts in Pakistan and its impact on the stock exchange KSE, though stocks show a negative trend after the major bomb blast as studied before by many scholars.

1 Literature Review

Terrorist attacks in the past few years has shown an increasing trend and so the importance of its existence and need for the study to be conducted in this field has to be increased too. It is a main issue affecting every economy nowadays. Sandler and Enders (2002) define terrorism as a premeditated use, "threat of violence to obtain political objectives through fear directed at public or civilians". Literature in this field of study is still emerging as Karolyi and Martell (2006) stated that "Not every theory has an intuition behind it for conducting an exercise but a synthesis of research in different areas of this field".

Chen and Siems (2004), investigates the effects of the 9/11 catastrophe and 14 other major terrorist assaults impact on the global and US stock prices and compare its impact on the political and economic activities with the help event study method. The conclusion after the tests is that, after 9/11, financial markets were severely or ruthlessly crashed and stock prices showed a negative down fall but prior to that event it was in a better condition.

Berrebi and Klor (2005) conducted a similar study to evaluate the impact of terrorism on the stock market prices of Israeli companies using the same event method study. Conclusion and results of the study shows that, companies which have involvement or deals in stock of defense, security or antiterrorism security company measurers show a positive outcome but other companies show a negative trend. So it was concluded that terrorism attacks do have a negative impact on stocks and equity markets.

Further Carter and Simkins (2004), also examined the catastrophic 9/11 event and their impact on airline stocks with the help of a multivariate regression model. As the market was closed for about six days, so they only evaluated the stock prices on the first trading day after the major event and their results were stated that it has a different effect on different airline firms because the congress of US passed the Air transport safety and System stabilization Act

(Sep 18,2001). The effect of the terrible catastrophe of 9/11 was also studied by Darkos (2004); in his study, he studied the impact of various airline stock listed in different stock markets with the help of a Market Model and his study concluded that measuring with market Beta (ß) shows that systematic risks have more value than it is on average. The market risks of the airline stocks in different stock markets showed a rising trend after the event.

Eldor and Melnick (2004) analyzed the Palestine terrorism attacks and their impact on stock prices and exchange rates with the help of a time series analysis from 1990 to 2003. The result shows that the suicide bomb blast attacks have impact on both stock variables and foreign exchange rates. However terror suicide attacks on other targets other than civilian transport have effect on the markets. Nevertheless, financial markets are coping with these terror attacks. Glaser and Weber (2005) also conducted a study on level of disagreement of different investors on the stock return and volatility of stocks after the 9/11 event. Result of the study showed that ten days after the 9/11 event, there was a major drop in the stock prices and investor's unexpected trend. The volatility forecast after the attack was elevated or increased.

Panagiotis Liargovas (2010) further conducted a study on the impact of terrorism on Greek banks' stock with the help of an event study method. The study includes the three major terrorist attacks: New York USA terrorist attack (Sep 9, 2001), Madrid train bombing (March 11, 2004) and London train bombing (July 7, 2005). Nevertheless result of the study indicated that the 9/11 attack, London bombing and Madrid bombing shows an abnormal, negative and no effect on Greek banks' stock respectively. The 9/11 attack shows a huge and abnormal effect because of the dominancy of the US economy over the world's economy. Our study's main concern is to identify the impact of terrorism activities (Bomb B lasts) on the KSE 100 index.

2 Data and Methods

2.1 The GARCH Model

Bollerslev (1986) introduced the GARCH model. The GARCH model is a generalized form of ARCH as defined by Engle in 1982. As the ARCH model narrates variance as being dependent on the previous values of squared shocks and the ARCH model can break its non-negative constraints. Moreover it entails a greater number of lags to be included in order to catch most of the variations in the variance. The GARCH provides a better fit because it deals in good manner with non-negativity constraints and requires few numbers of lags to be included in the econometric model. Moreover, the GARCH model is differentiated from the ARCH because it permits the conditional variance to be modeled by previous values of itself in addition to the historic shock. The GARCH model

contains an ARCH segment and indicates an element where today's variance can be expressed by previous variances. A general GARCH (q, p) model is defined as follows:

$$\sigma_t^2 = \psi_0 + \sum_{i=1}^{q} \psi_i \, \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \phi_j \, \sigma_{t-j}^2 \qquad (1)$$

Whereas (p,q) are order of the GARCH and ARCH term respectively. The variance term σ_t^2 is the conditional variance at time "t" and ψ_0 indicates constant, whereas $\psi_i$and ϕ_j are the parameters, ε_{t-i}^2 is the indicator of previous squared shocks and σ_{t-j}^2 reflects prior variances. Various studies employed GARCH (1, 1). Brooks (2008) indicates that a GARCH (1, 1), in most cases is enough to grasp the volatility clustering and that higher order is very rarely used in the field of finance. Negative variance possibility is very rare; limitations have to be generally specified for these parameters particularly. Therefore the GARCH model successfully captures various number of features of the financial time series, such as volatility clustering and thick tailed returns. The GARCH model becomes stationary when the total of alpha and beta are less than one ($\alpha + \beta < 1$). On the other hand, if $\alpha + \beta = 1$,, the process is still stationary because the variance is infinite. The GARCH models applicable in this study will estimate according to maximum likelihood criteria. The εt is assumed to be normally distributed approximately with an average value of zero and time-varying variance is expressed in this manner (εt ~ N (o,σ_t^2)).

2.2 The EGARCH Model

Nelson (1991) introduced the Exponential GARCH model. This model is quite purposeful and useful in comparison to the GARCH because it permits good news and bad news to have a different impact on the volatility. Moreover it also permits big news to have a higher impact on volatility. This particular model works in two stages; firstly it takes into consideration the mean and secondly the variance component. The EGARCH (p, q) model can be defined in this manner:

Whereas $\phi, \lambda, \text{and } \omega$ indicates parameters for conditional variance estimation and λ_i shows the effect of the previous period measures on the conditional variance. In the case if λ_i is positive, it means a positive change in the stock price and is related with more positive change and vice versa. ϕ_j co-efficient measures the impact of last period information set and narrates the prior standardized residuals impact on the present volatility. Moreover, ω_k indicates an asymmetric effect in the variance and negative ω_k interprets that bad news has a greater impact on stock volatility than good one having the same magnitude. EGARCH models indicate the logarithmic time-varying conditional variance, where concerned parameters are permitted to be negative. So this element shows that the model does not require any non-negativity limits

in the parameters. Therefore, the lack of non-negative limits makes the model more attractive than GARCH. The stationary constraint for an EGARCH (1, 1) model is that the beta should be less than one (λ < 1). Hence in the case of symmetry, where the amount of positive and negative shocks is equally impacting on the variance, ω will be equal to zero. On the other hand, if ω < 0 the strength of a negative (positive) shock will reason the variance to increase (fall) and if ω > 0 positive and negative shocks will reason the variance to rise or fall respectively. The natural logarithm of the conditional variance is modeled in EGARCH(1,1), and it is calculated as,

$$ln(\sigma_t^2) = a + \omega \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} - \sqrt{\frac{2}{\pi}} \right| + \beta ln(\sigma_{t-1}^2) \quad (2)$$

Whereas the parameters a, ω, λ and β are constant parameters.

To study the impact on KSE 100 index, data of five years have been collected through Yahoo finance and Karachi Stock Exchange. The data is collected on a daily basis for analyzing the fact in depth. The collected 100 index data ranges from January 2005 to December 2010 and indexes are taken into account after converting them into returns by using a formula (index value on current day/ index value on previous day). EGARCH test is applied to study the negative impact on the KSE index value due to the bomb blasts taking place in any area of Pakistan but categorized is only the major bomb blast impacts. The GARCH–EVT or EGARCH model presented by Nelson have been used to calculate the negative impact of the terrorism activity on the KSE 100 index. For proving the fact, we take the day of bomb blast represented as "1" & when no activity has taken place we represented it as "0". Resultant coefficient of the test can indentify whether there is the negative relationship or positive relationship and as well as reflecting the past impact & present impact on the particular variable.

3 Results

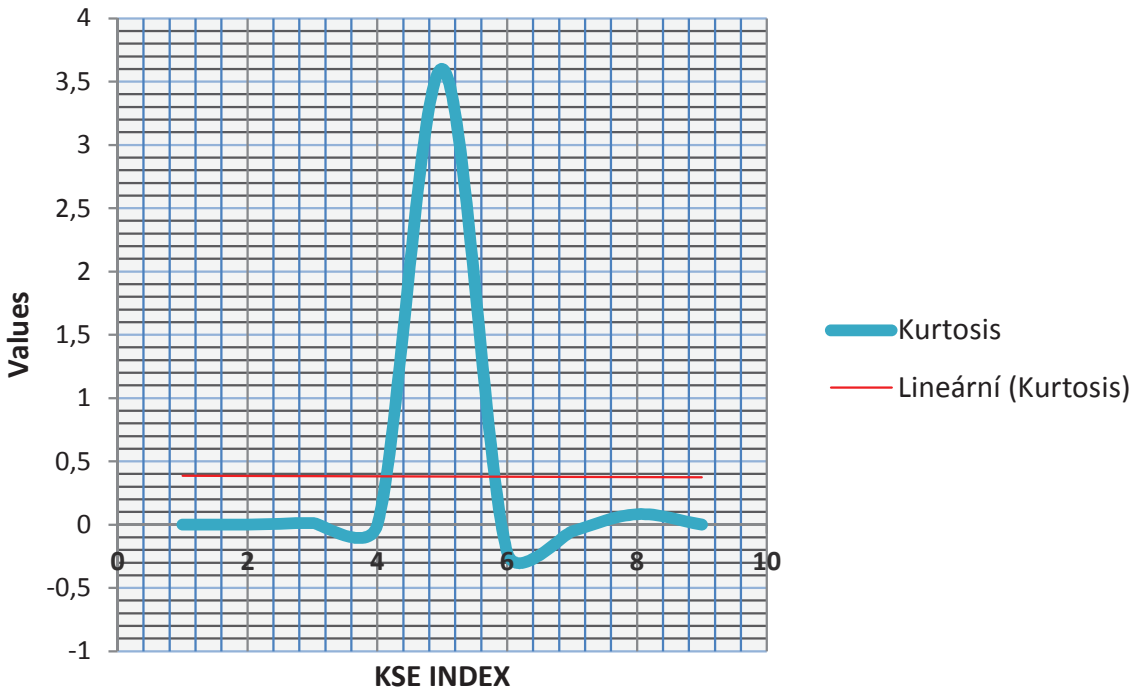
The data is analyzed in steps; first of all, the descriptive statistics are checked for the KSE indices the results are mentioned in the Table 1 below as we can see in the figure. If standard deviation which is 13%, it shows that there is high volatility in the equity returns. Form the figure of maximum and minimum it can be inferred that the highest figure for gain is 0.082 and the highest figure for loss is 0.052. The values for kurtosis is > 3 which can be interpreted that the data has leptokurtic characteristics which means that the values are clustered in the mean and the explanation cannot be meaningful. It can also be observed form the Figure 1 pictorial diagram showing the peakedness in the data which can be interpreted as the data has heteroskedastic qualities, for this purpose the BDS test and Arch -LM test is used to confirm this data characteristics.

Table 1 Descriptive Statistics for KSE Returns Indices from 2005-2010

Mean	0.00015
Standard Error	0.00038
Standard Deviation	0.013345
Sample Variance	0.00018
Kurtosis	3.60060
Skewness	-0.21788
Minimum	-0.05279
Maximum	0.08255
Confidence Level(95.0%)	0.00074

Source: author's calculation

Figure 1 Leptokurtosis Characteristics of data for KSE Return indices



Source: author's processing

In the below tables the heteroskedastic quality of the data is confirmed via the BDS test and ARCH-LM test in Table 2 and 3 respectively. The BDS test signifies that the data is highly significant in all dimensions, same as that for the ARCH-LM test which confirms that the data has the above mentioned characteristics.

Table 2 BDS Test results for KSE Return Indices

KSE	Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
	2	0.041545	0.003126	13.29123	0.0000
	3	0.078994	0.004975	15.87931	0.0000
	4	0.106050	0.005935	17.86913	0.0000
	5	0.120163	0.006198	19.38613	0.0000
	6	0.126452	0.005991	21.10817	0.0000

Source: author's calculation

Table 3 ARCH-LM Heteroskedasticity for KSE Indices

Heteroskedasticity Test: ARCH	F-statistic	Obs*R-squared	Prob. F
KSE	182.3909	159.2759	0.000*

Source: author's calculation

The model econometric equations are under equations 3 and 4:

$$\sigma_t^2 = \beta_0 + \beta_i \varepsilon_{t-i}^2 + \beta_j \sigma_{t-j}^2 - \beta_k BB \quad (3)$$

$$GARCH\ Equation = \lambda C + \lambda RESID(-1)^2 + \lambda GRACH(-1) - BOMB\ BLAST \quad (4)$$

The results of the test prove that there is a negative relation between terrorism activities & the Karachi Stock Exchange 100 index with the help of the ARCH approach (Autoregressive Conditional Heteroskedasticity). Two variables are studied to show the impact bomb blast "BB" & "RKSE". Return of the KSE index and bomb blast variable were assigned as "0 & 1" or known as Dummy variables. 0 represents that no bomb blast had taken place & 1 represents that terrorism activities had taken place. Outcomes from the GARCH shows that there is a negative relation, between the Karachi Stock Exchange & terrorism activity (bomb blasts) through coefficient -2.88E-03 and they are highly significant. RESID (- 1)^2 signifies that there was no effect of the bomb blast on the KSE with the coefficient of 0.327332 and GARCH (-1) represents that there has been a current relationship between the KSE & the bomb blast.

Table 4 GARCH results

	Coefficient	**Std. Error**	**z-Statistic**	**Probability**
σ_t^2	0.147478	0.068873	2.141285	0.0323
β_0	0 .002972	3.04E-05	97.66242	0.00000
$\beta_i \varepsilon_{t-1}^2$	0.327332	0.004388	74.60118	0.00000
$\beta_j \sigma_{t-1}^2$	0.001812	0.002169	0.83511	0.40370
$\beta_k\, BB$	-2.88E-03	3.04E-05	-94.71174	0.00000

Source: author's calculation

Conclusions and Discussions

The main focus of our research is to study the impact of terrorism on the KSE with the help of GARCH methodology, with the daily index value from the past five years & major bomb blasts affecting the KSE market of Pakistan. Study shows that there is a negative relation between the KSE (Karachi Stock Exchange) 100 index value & bomb blasts (terrorism activity) with the help of the EGARCH model method dummy variable of (0, 1) of terrorism and daily data of KSE rating; the results are highly significant. Terrorism bomb blast events are taken on a daily basis from the past five years along with the KSE index ratings & the consequences or the impact is proved to be negative. There could several other reasons for the change in the value of the KSE index and unfortunately, terrorism in our country is one of them. Terrorism is the key variable which is influencing the Stock exchange of Karachi. Instability in the economy and politics is another vital variable which can also influence the equity market of the country, so recommenced future research can be related to these factors to see the impact on the stock exchange. Finally it is important to note that for future study on this topic, researchers should adopt alternative methods & techniques to evaluate the impact of terrorism on stock exchanges because the event study methodology has received a lot of criticism.

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