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IMPACT OF TERRORIST ATTACKS ON STOCK MARKET PERFORMANCE: A CASE OF PAKISTAN

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ABSTRACT

The purpose of this study is to assess the impact of terrorist attacks on the volatility of Karachi Stock Exchange 100- index over the period from 2004 to 2014 by studying 2714 terrorism events in Pakistan. Using a series of dummy variables, this study assesses how stock market responds to terrorist events in different regions with respect to different type of attacks like, armed assaults, assassination, bomb-blast and hostage and different type of Target; military, journalists, business and education institutions. The results of the study concluded that terrorism adversely affects the stock market and increases its volatility though the stock market recovers itself after one day. Results by location confirm that event in KPK province impact, highly negatively upon KSE returns followed by Karachi. Attacks on military and journalist are giving highest negative impact on returns and hostage has a significant contribution in negative returns of KSE100 index.

Contribution/ Originality: Current study contributes in existing literature in two different ways: one, all terrorism events has not same impact and magnitude as for as economy is concerned. So, different type of attacks and their location has been investigated. Secondly, impact of terrorism attacks on stock market is segregated with respect to their targets.

1. INTRODUCTION

The world is trying to make sense of the ongoing war on terror as it is natural to contemplate how all facets of society will react. The September 11, 2001 incident is one of the most extreme examples of what a terrorist activity can do with the markets and individual stocks. On Sept. 10, the Dow Jones Industrial Average (DJIA) closed at 9,605.51 and dropped by almost 900 base points on the next day. To protect the society along with the economy, such terrorist attacks created the need for proactive security measures for states across the world and Pakistan.

Wars entail heavy costs and Pakistan is bearing the huge cost of being a first line ally in the War against Terrorism. In response to the Pakistan's government actions against terrorism and terrorists; militant groups have intensified suicidal attacks and target killings. Terrorism itself and the War against Terrorism have negatively

affected Pakistan's socioeconomic structures and inflicted negative consequences on the politics and on the economic growth. Empirical research has shown a strong relationship between the stock market returns and unwanted events that takeplace in the country. Stock exchange responds effectively to any adverse event happen in a country (Charles and Darné, 2006). Finding of many studies have proven the negative impacts of political risk, adverse events and news impact on the returns of stock market and volatility. Terrorist events inflict direct and indirect economic costs. The direct economic costs are shorter-term in nature and include the destruction of life and property. While The indirect costs of terrorism can significantly be larger as they affect the economy in the medium-term by undermining consumer and investor confidence (Nedelescu and Johnston, 2005). Ahmed and Farooq (2008); Nikkinen *et al.* (2008) and Aslam (2014) investigated the effect of terrorism on the stock markets and found a negative relationship between the two variables.

Volatility in the financial securities carries substantial importance to determine the price of securities and growth of the economy and financial markets. In volatile market settings, it becomes difficult to mobilize the savings from public and get it into operations of financial market for the growth of economy. In Pakistan, Karachi Stock Exchange-100 index is major index, which reflects the economic progress of the country. The purpose of this empirical research is to investigate the impact of terrorist events on the KSE-100 index in the past two decades and how much time KSE-100 index takes to revert to pre-event position.

This study investigates the impact of terrorist's events on the stock market volatility of Pakistan. Daily Returns of KSE-100 index, for the period from 2006 to 2014 are taken as dependent variable. For the study, 2714 terrorism incidents form Global Terrorism Database (GTD) and South Asian Terrorism Portal (SATP) are selected with three day event window. However, data for the region effect, type of attacks and type of target was limited to 2013 due to non-availability of data segregations on databases. We applied ARCH test developed by Engle (1982) to check whether time series data is hetroskedastic or homoscedastic. GARCH model (1,1) is used to measure the impact of terrorist attacks on the volatility of the stock market whereas EGARCH model is used to capture the leverage effect.

The contribution of this paper is threefold. First, using GARCH (1,1) model, it attempts to assess the magnitude of riskiness of various terrorist attacks on the stock market of Pakistan. Investigating various terrorist attacks on Businesses, Education institutes, Journalists and Military, the present study reveals that attacks on journalists have the highest impact on stock market returns of the country. Second, this study attempts to assess the severity of various types of attacks like armed assault, assassination, bomb blasts and hostage on stock market performance. It identifies that although all the types of attacks have negative impact on the stock market, the hostage has more impact on the KSE-100 index. Third, this study attempts to investigate location wise analysis of various terrorist events in major cities as well as cities with the stock market and finds that KPK province is highly affected by terrorist attacks which in turn have a more severe negative impact on the stock market.

1.1. KSE-100 Index and Terrorism in Pakistan

Started in 1949, Karachi Stock Exchange 100 index (KSE) is the largest stock market operating in Pakistan. Initially KSE started its operation with five companies and capital of Pak Rs.37 Million whereas currently 660 companies are listed on KSE with an estimated capital over US$ 70.0 billion. Today it is the most liquid stock exchange of the country that has achieved many important developments since inception. These developments include; formation of six indices, introduction of electronic trading system via KATs, KSE all share index, banking sector index and inauguration of government debt securities Market at KSE. Since 2000, the political, socioeconomic and financial environment has drastically changed in Pakistan. The 9/11 attack on USA compelled Pakistan to take security measures against terrorists. Military forces and the Government of Pakistan started collective operations against terrorists, target killings and militant groups which intensified the terrorist activities by such militant groups against the different segment of society. This led to increased casualties in such events. Further, this also led to the uncertain environment in Pakistan that halted the financial and economic development. Figure 1 shows the dramatic

increase in the fatalities due to terrorist attacks after 2004. This is the time when the government of Pakistan and security agencies started operations against the terrorist groups and Pakistan is still paying the price in the form casualties and death.

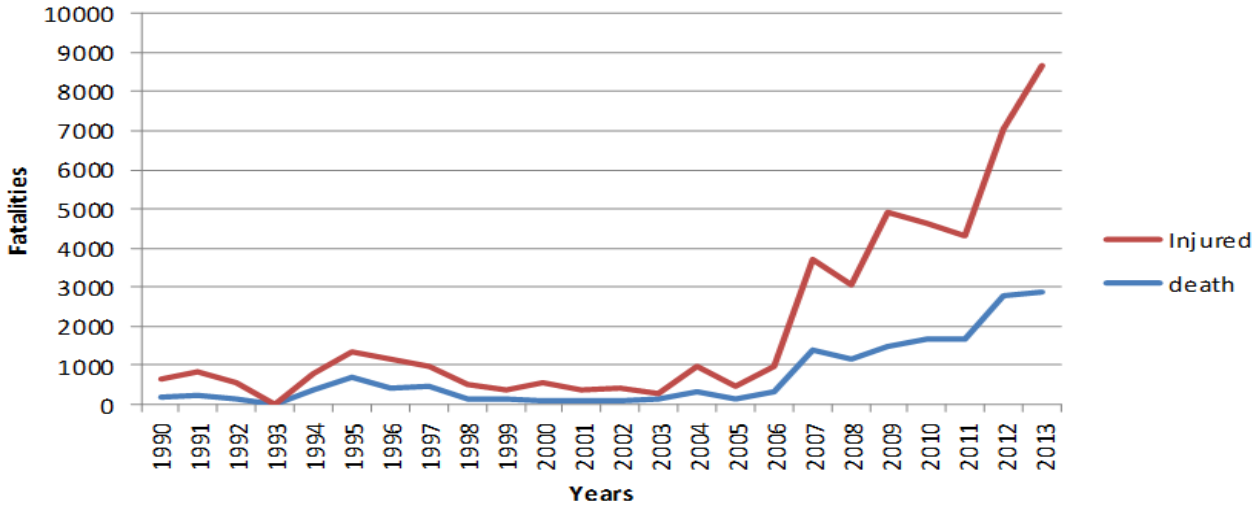

Figure-1. Fatality since 1990-2013 in Pakistan due to terrorist attacks

Source: South Asia Terrorism Portal Database, SATP (2014)

Table 1 shows segregation of terrorist attacks from year 2004 to 2013 (location wise, type of target wise and type of attack wise). One can see from the table that educational institutions are a major target of the terrorist attacks as 59% of the attacks were against them followed by military targets with 18%. The business community was on third number with a 16% target of the terrorist attacks. In type of attack category, bomb blasts are most common, followed by armed assault. Due to proximity to the Afghanistan and the tribal area of Pakistan, the KPK province is most affected by the terrorist attacks.

Table-1. Segregation of terrorist attacks from year 2004 to 2013

Category		**No. of attacks**	**%**
	Business	818	16%
Target Type	Educational Institutions	3017	59%
	Journalists	358	7%
	Military	920	18%
	Total	**5113**	**100%**
	Armed Assault	1687	33%
Type of Attack	Assassination	614	12%
	Bomb Blasts	2761	54%
	Hostage	51	1%
	Total	**5113**	**100%**
	Karachi	614	12%
Location wise	City with Stock Market	818	16%
	KPK	1125	22%
	Others	2556	50%
	Total	**5113**	**100%**

Source: South Asia Terrorism Portal Database, SATP (2014)

Remaining paper is arranged as follows. In section two the literature review followed by theoretical framework and hypothesis development are discussed with details. Methodological issues are discussed in section three whereas section four and five are related to the results and conclusion respectively.

2. LITERATURE REVIEW

Recently Abadie and Gardeazabal (2008) studied the effects of terrorism in an integrated world economy. They defined terrorist activity ($terr_{i,t}$) as a one sided risk producing potentially adverse effects for the stock market. These adverse events also cost the economy as investors divert their investments to other countries that reduces the Foreign Direct Investment in (FDI) the country. Through empirical research, Abadie and Gardeazabal (2008) showed that terrorism may have large impact on the allocation of productive capital across countries. It was found that higher level of terrorist risks are associated with lower level of Foreign Direct Investment (FDI), even after controlling the other type of country risks. The magnitude of the estimated effect was found large, thus suggesting that the impact of terrorism may be substation in "open economy channel".

Earlier, Abadie and Gardeazabal (2003) also investigated the economic impact of conflict, in Basque countries. Basque countries differ from other Spanish countries in the region due to different potential for economic growth. Therefore, comparison not only reflected the effect of terrorism, but also the effect of pre-terrorism difference in the economic growth comparison. For analysis, two strategies were adopted; first the authors used a combination of other regions to construct a "synthetic" control region. Secondly, the study used the unilateral truce declared by ETA in 1998 as a natural experiment to estimate the impact of the conflict. It was found that after the outbreak of terrorism in the 1960's, per Capita GDP in Basque countries dropped about 10% points relative to the synthetic control region without terrorism. Further, the stocks of the firms whose significant part of the business was in Basque country showed a positive relative performance when truce became credible and negative relative performance at the end of cease fire. Barros and Gil-Alana (2009) also reached at a similar conclusion. The core focus of their study was to investigate the effects of ETA terrorist actions on Basque country stock market. Their findings indicate an adverse effect through negative returns i.e. violence significantly reduces the stock market returns in the area. Further, they found volatility processes to be positively correlated with violence but statistically insignificant.

Ahmed and Farooq (2008) investigated the impact of September 11, terrorist attacks on the volatility dynamics of the stock market in Pakistan through exponential GARCH (EGARCH) model and investigated the important time series characteristics, such as, first order time dependence on the mean & conditional variance. The conditional variance risk premium and the asymmetric response of the conditional variance to innovations changed during the post 9/11 period relative to the characteristics during pre-9/11 period. It was found that volatility behavior during the post 9/11 period is significantly different from pre-reform and post reform period. In contrast to pre-reform and past reform period AR(1) coefficients were negative during the post 9/11 period. Prior to 09-11-2001 period, the major reforms for capital markets in Pakistan were initiated i.e. formation of SECP in 1999. The author claimed that a shift in volatility dynamics were not due to reforms, but the unexpected beneficial effects of terrorist attacks of 9/11.

Arin *et al*. (2008) tested the existence of causality effect between terrorists activities and stock market returns and volatility in six different countries through VAR-GARCH (1,1) in the mean model. The motivation of the study was to check whether terrorist events have an impact on investors' sentiments by looking at two dimensions (mean and variance) of stock returns. The empirical results suggested that the response to terror shocks varies across countries, but there is evidence of statistically significant causality effects both in the mean and variance among all six countries. It was found that index volatility has also an impact on stock market returns. Further, the magnitude of this effect is found larger in emerging markets.

Johnston and Nedelescu (2006) tried to draw lessons for effective policy and regulatory responses to protect financial system from terrorist attacks. The authors examined the cases where financial market became directly or indirectly the victim of terrorist attack. They took into consideration the terrorist attacks in New York (2001) and Madrid (2004). They found that diversified, liquid and sound financial markets were efficient in absorbing the shocks of terrorist attacks when supported by well-organized crisis management response.

Bautista (2003) analyzed the impact of major political and economic events on conditional variance of Philippines stock market during Feb 1987 to Oct 2000 through the regime-switching ARCH method developed by

Hamilton and Susmel (1994). He argued that major events like Gulf war, court attempt, power crises and fiscal crises make the stock market volatile. Beaulieu *et al.* (2006) examined the short run impact of political risk associated with possible independence of Qubec on the volatility of Canadian and Qubec-based 102 firms' stock returns between 1990 and 1996. They were of the view that variations in Canadian political risk are "pure" events that are unrelated, contrary to what occurs in emerging markets. Further, they constructed two components of firm exposure to political risk; the structure of assets and degree of foreign investment. They used bivariate-modified GARCH model for the empirical investigation. The results showed that the uncertainty surrounding the referendum outcome had an impact on the stock returns of Qubec firms.

Charles and Darné (2006) examined the effect of terrorist attack in U.S on Sep 11, 2001 on international stock markets. Using the outlier detecting methodology, they examined 10 daily stock market indexes taking into account the time span of January 3, 2000 to May 17, 2002. They found evidence that international stock market experienced large (permanent and temporary) shocks in response to terrorist attack and aftermath. They argued that these events play a role for improvement in modeling financial risk, especially volatility in stock market and the U.S macroeconomic news announcements. According to them, these events can have a great impact on U.S and European stock markets by detecting large shocks.

Chen and Siems (2004) investigated the response of US capital market to 4 terrorist attacks during 1915-2001. They examined the reaction of the financial market in periods of extreme risk aversion. They included sinking of luxury ocean Liner Lustania by torpedo in 1915, Iraq's invasion of Kuwait in 1990 and 9/11. They used event study methodology with appoint of view that if investors react favorably to an event then we expect positive abnormal returns and vice versa. They found that US market has become more resilient towards the terrorist activities in comparison to the past as it makes a quick recovery to pre-terrorists conditions. They argued that this increased market resilience is possibly due to the sophistication in banking/financial sector that provides adequate liquidity to promote market stability and squelch panic.

Chesney *et al.* (2011) provided a deeper understanding of the impact of this risk on the behavior of various financial market i.e. global, national, regional and industrial levels. They took into account 77 terrorist attacks in 25 countries over a time period of 11 years from 1994 to 2005. They examined the impact of terrorism on bond and commodity market by applying an event-study approach, a non-parametric methodology, and a filtered GARCH–EVT (Extreme Value Theory) approach. Swiss stock market was found to be highly affected by terrorists attacks while US stock market was the least affected. On the industry side, insurance and airline industries were found to be highly sensitive to terrorist attacks while banking industry was the least sensitive. Further, non-parametric approach was found to be the most appropriate method analyzing the impact of terrorism on financial markets.

3. THEORETICAL FRAMEWORK AND DATA

The daily Returns of KSE-100 index, ranges from 2006 to 2014 are taken as depended variable. Daily return is time series variable that is calculated with this formula RKSE= Ln ($\frac{KSEt}{KSEt-1}$). Log of a variable is taken to smooth the variable and to normalize the return of variable. Whereas, the KSE_t is closing price of KSE at time t, and KSE_{t-1} is opening price of KSE-100 index. Data regarding 2714 terrorism incidents is taken from the Global Terrorism Database (GTD) and South Asian Terrorism Portal (SATP) between 2004-2014 with three days event window. However, data for region effect, types of attacks and type of target is limited to 2013 due to non-availability of data segregations on databases. On the right side of the equation different independent variables are taken to investigate the impact of a terrorist attack. Three dummy variable D_{-1}, D_0 and D_1 are introduced to capture around event window. Range of event windows is (-1,0,1) whereas, -1 for return one day before the incident, 0 for return at event day and 1 for returns after one day of the event. Furthermore, another set of dummy variables is also included in the study to

investigate, if terrorist attacks on different regions of the country has the same effect on KSE-100 index or importance of the region is varied in term of impact on KSE-100 index returns volatility. D_i is dummy variable that =1 if the incident took place in major cities of Pakistan, otherwise 0 whereas, "i" = major cities of Pakistan. Similarly, two more sets of dummy variables are introduced to capture the effect of type of target and type of attacks.

H_1: KSE-100 index volatility pattern respond negatively to the terrorism events in country.

H_2: KSE -100 index riskiness behaves differently to Locality, type of target and type of attacks.

4. METHODOLOGY

The ARCH and related models deal with the volatility and information effect on volatility of time series variables normally. Autoregressive Conditional Heteroskedasticity model is first developed by Engle (1982). The epitome of Engle's model was regarding conditional variance that means current period error term variance is linked with previous or past time squared error term thus called conditional heteroskedasticity. Equation of ARCH (q) model is as follows:

$$\sigma_t^2 = \gamma_o + \sum_1^q \alpha_o \mu_{t-j}^2 \quad (1)$$

Although ARCH (q) was good development but there was one drawback in ARCH model that is it only deals with moving average part of error like current time errors terms are linearly related with past squared innovations but not with past error variance itself. For meditation of this limitation, Bollerslev (1987) developed generalized form of ARCH (q) model that is called Generalized Autoregressive Conditional Heteroskedasticity (GARCH). GARCH model was structured to capture past squared term error variance along with Past innovation variance itself. GARCH equation is as under.

$$\sigma_t^2 = \gamma_o + \sum_1^q \delta_i \sigma_{t-1}^2 + \sum_1^q \alpha_o \mu_{t-j}^2 \quad (2)$$

Although ARCH and GARCH models are good to capture volatility as compare to regression techniques. But there is inherited limitation in ARCH and GARCH. These do not consider asymmetry in volatility. But logically it has been observed that bad news has greater magnitude of variation on volatility as compared to good news positive impact. So to solve this problem, Nelson (1991) came up with solution for problem of GARCH model that don't capture asymmetric in volatility and introduced EGARCH Model. The equation of EGARCH model is as follows:

$$Ln\sigma_t^2 = \omega + \alpha|Z_{t-1}| - \mathrm{E}|Z_{t-1}| + \gamma|Z_{t-1}| + \delta\log(\sigma_{t-1}) \quad (3)$$

"γ" value confirm the existence of leverage effect. Leverage effect means that to what magnitude positive and negative news impact upon the volatility of stock returns.

Hence, GARCH (1,1) and EGARCH model are used in this study. GARCH model is used to measure the impact of terrorist attacks on the volatility of the stock market and EGARCH model is used to capture the leverage effect. The equation of GARCH (1,1) model for this study is as under:

$$\sigma_t^2 = \gamma_o + \sum_1^q \alpha_o \mu_{t-j}^2 + \sum_{i=-1}^1 \beta_i D_{i,t} \quad (4)$$

Whereas, B_iD_{it} is dummy variable to capture the effect of war against terrorism and an event of terrorism are three day window, one day before the event, on event day and on day after event windows. Next model,EGARCH captures the asymmetric effect. Equation of the model is as under:

$$Ln\sigma_t^2 = \omega + \alpha|Z_{t-1}| - \mathrm{E}|Z_{t-1}| + \gamma|Z_{t-1}| + \delta\log(\sigma_{t-1}) + \sum_{i=-1}^1 \beta_i D_{i,t} \quad (5)$$

Series of dummy variables are introduced in this study to capture the stock market returns before the occurrence of the event and at day of occurrence of the event and one day after the event.

The main purpose of setting three day window is to observe the pattern of the return of KSE-100 index in one day before the event, at day of event and post event. These dummy variables first capture the event effect and the three dummy variables are capturing the location of events, whereas purpose of location of event is to observe the effect of terrorism with respect to geographical area as Aslam (2014) investigated in their study that location of event is important due to development of province and city and its urbanization. Furthermore, these authors are of the view that location where stock market is located is more import in term of responsiveness to any terrorist activity.

Different type of attacks can influence the market return in different manner and terrorist action involves hostage and kidnapping has more significant influence as compared to the other type of attacks (Karolyi and Martell, 2006). Next four dummy variable are introduce to capture the effect of type of attack on return of KSE-100 index.

Before applying ARCH and GARCH model it is necessary to estimate ARCH effect in time series data set. We apply ARCH test developed by Engle (1982) to check whether time series data is hetroskedastic or homoscedastic. If data is hetroskedastic then we cannot use simple ordinary least square and need to switch on models like ARCH and GARCH. Hetroskedasticty means that the mean and variance of time series data is equal throughout the time period.

Following equation is used to test the heteroskedasticty of the model:

$$u_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 u_{t-2}^2 \ldots\ldots + \alpha_3 u_{t-p}^2 + v_t$$

Where are residuals and $\alpha_1 u_{t-1}^2$ is lagged error of previous time period goes up to optimal lag length.

5. RESULTS

Table-1. Descriptive statistics

	MARKET_RETURNS	D-1	D1	D0
Mean	0.000723	0.14	0.14	0.65
Median	0.00106	0	0	1
Maximum	0.064108	1	1	1
Minimum	-0.082193	0	0	0
Std. Dev.	0.01	0.35	0.35	0.48
Skewness	-0.67	2.09	2.09	-0.61
Kurtosis	7.02	5.38	5.36	1.38
Jarque-Bera	2029.28	2620.69	2602.26	468.36
Probability	0	0	0	0
Sum	1.96	376	377	1755
Sum Sq. Dev.	0.54	323.91	324.63	620.13
Observations	2714	2714	2714	2714

Descriptive statistics are reported in Table-1. Natural log of market return is taken and that's why these results little meaningful here. The mean return of KSE-100 index is 0.000723. Explanatory variables are dummy variable and mean values of dummy variable D-1, D1 and D0 is not important in this analysis because these variable are coded in the form of 0 and 1. Before applying ARCH and GRACH model it is necessary to test some basic assumptions to run these models that are heteroskedasticity effect in data, unit root and volatility clustering. If heteroskedasticity exit in data we cannot apply simple OLS and we have to find appropriate technique that like ARCH and GARCH models. Heteroskedasticity can be tested through various methods and two of them are tested here, one is ARCH effect and second is Volatility Clustering. Another major assumption for time series data is stationarity of data and we have applied Augmented Dickey Fuller (ADF) test introduced by Dickey and Fuller (1979).

Table-2. Hetroskedasticty Test

F-statistic	269.5648	Prob. F(1,2711)		0.00***
Obs*R-squared	245.366	Prob. Chi-Square(1)		0.00***
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.00014	9.63E-06	14.39506	0.00***
ε^2 (-1)	0.30074	0.018317	16.41843	0.00***
Mean dependent var		0.000198		
S.D. Dependent var		0.000487		
S.E. of regression	0.00046	Akaike info criterion		-12.511
Sum squared resid	0.00059	Schwarz criterion		-12.506
Log likelihood	16972.76	Hannan-Quinn criter.		-12.509
F-statistic	269.5648	Durbin-Watson stat		2.12205
Prob(F-statistic)	0			

*** shows significant at 1% level. Table test the Hetroskedasticty effect in data. Dependent variable is log of market returns and independent variable is lagged error term.

Assumption of Hetroskedasticty is tested and results are reported in Table 2 and Figure 1. Table-2 contains the results of ARCH test and null states that there is no Hetroskedasticty in data against the alternate of Hetroskedasticty in data. Corresponding P-value of observed R^2 (245.366) is sufficient to reject the null of homoscedasticity in data and thus data of the study is hetroskedastic and we cannot use simple OLS technique. The Same phenomenon is again tested with an alternate graphical technique called Volatility Clustering. It is obvious from the pattern of return volatility of KSE-100 index given in figure 1 that period of low volatility generates the period of high volatility and period of high volatility generates another shock of low variation that lead us to conclude that the mean and variance of this time series is not same and data is not homoscedastic.

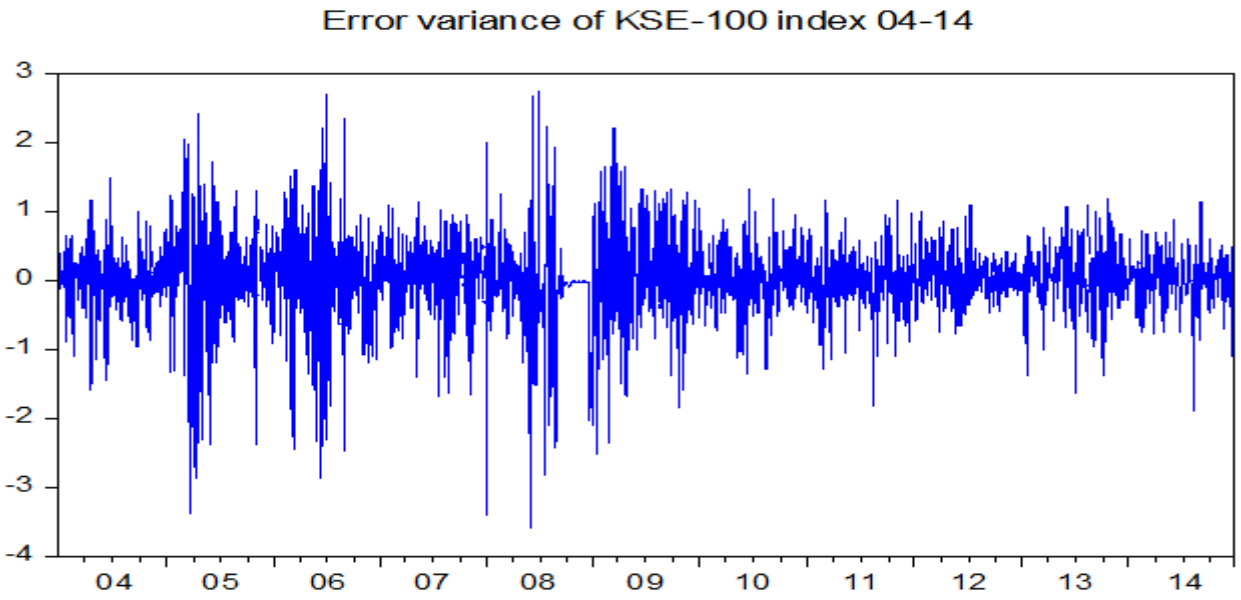

Figure-1. Volatility clustering

5.1. Augmented Dickey Fuller Test

The second assumption of unit root is tested and results are given in Table-2. The null hypothesis of "data has unit root" against the alternate that data is stationary is tested. The t-statistic value and its corresponding P-Value is 0.00 that is sufficient to reject the null hypothesis of data is unit rooted and leads us to accept alternate that is data is stationary or data is not unit rooted.

Table-3. Augmented Dickey Fuller Test

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Market Returns	-0.90621	0.019117	-47.4029	0.00***
C	0.028466	0.011711	2.430785	0.0151
R-squared	0.453119	Mean dependent var		-7.52E-05
Adjusted R-squared	0.452917	S.D. dependent var		0.823725
S.E. of regression	0.609268	Akaike info criterion		1.84762
Sum squared resid	1006.715	Schwarz criterion		1.851972
Log likelihood	-2505.22	Hannan-Quinn criter.		1.849194
F-statistic	2247.032	Durbin-Watson stat		2.001115
Prob(F-statistic)	0			

*** shows significant at 1% level. Table tests the unit root effect in data. Dependent variable is log of market returns

When this assumption is fulfilled, we can apply most of time series data analysis techniques along with ARCH and GARCH.

Table-4. ARCH model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Variance Equation				
C	0.00014	6.38E-06	21.9716	0.00***
ε^2 (-1)	0.512105	0.03089	16.57833	0.00***
D_1	-6.21E-05	8.81E-06	-7.04196	0.00***
D1	4.10E-06	9.11E-06	0.449579	0.653
D0	-3.54E-05	6.68E-06	-5.30313	0.00***
		Mean dependent var		0.000723
		S.D. dependent var		0.014088
S.E. of regression	0.014106	Akaike info criterion		-5.87749
Sum squared resid	0.539842	Schwarz criterion		-5.86444
Log likelihood	7981.76	Hannan-Quinn criter.		-5.87277
Durbin-Watson stat	1.807771			

'***' shows significant at 1% level. Table test the volatility pattern of KSE due to terrorism events. Dependent variable is log of market returns and independent variable are lagged error term, D0, D1 and D-1. D-1variable is coded 1 for event before the date of actual event otherwise 0 .D0 is coded 1 at the date of event occurred otherwise 0 and D1is coded 1 for one day after the event otherwise zero.

Results of ARCH model are given in Table-4 one year lagged error term of KSE-100 is highly significant that means KSE-100 present volatility and variation is return based on past year returns as well. Father more we are interested to investigate the effect of terrorism events occurred in a country on the variation of returns of KSE-100. For this purpose three dummy variable D0, D-1 and D1 are introduced to measure the effect on market returns as on the event date, on the day before the event day and one day after the event day respectively. The value of D0 is highly significant and negative that confirms that when the terrorist event takes place in country KSE behave negatively in term of return.

Robustness and model reliability is tested in Table-5. Good models must have not serial correlation problem, non-normality problem and ARCH problem in the data. Post-estimation Hetroskedasticity and autocorrelation are tested in panel A and panel B of Table-5 respectively. The null hypothesis that there is no ARCH effect in model is tested in panel A and P-value of F stats (.0301) is sufficient to accept the null hypothesis that leads to confirm that our model is reliable and with respect to post estimation diagnostic test and there is no ARCH effect exits in data. Furth more, panel B of Table-5 tests the null hypothesis of no autocorrelation and P-values of 12 lags is greater than the critical value of 5% and sufficient to accept the null of no autocorrelation in the data.

Table-5. Diagnostic Post estimation Test

Panel A Hetroskedasticity				
F-statistic	**4.71112**	**Prob. F(1,2711)**		**0.0301****
Obs*R-squared	4.706417	Prob. Chi-Square(1)		0.0301**
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	1.041977	0.04868	21.4037	0.00***
WGT_RESID^2(-1)	-0.041651	0.01919	-2.17051	0.0301
Panel B Autocorrelation				
	AC	**PAC**	**Q-Stat**	**Prob**
	0.011	0.011	0.3031	0.582
	-0.002	-0.002	0.3105	0.856
	-0.007	-0.007	0.4559	0.928
	-0.003	-0.003	0.478	0.976
	0.012	0.012	0.8413	0.974
	-0.007	-0.007	0.9747	0.987
	-0.016	-0.016	1.7069	0.974
	-0.011	-0.01	2.0089	0.981
	-0.006	-0.006	2.121	0.989
	0.003	0.003	2.1439	0.995
	0	0	2.144	0.998

Reliability of ARCH model is tested in Table-5. Panel A tests post estimation Hetroskedasticity and panel B test post estimation autocorrelation. "***" denotes significance at 1% level.

The assumption of normality of residual is tested in Figure-2 and values of Skewness and Kurtosis of Jarque-Bera test show that residual of ARCH model are approximately normally distributed around the mean and variance. The acceptable range of Skewness of data is -1 to 1 and the value of Skewness given in figure-2 is -0.50 whereas, value of kurtosis is deviate from acceptable range.

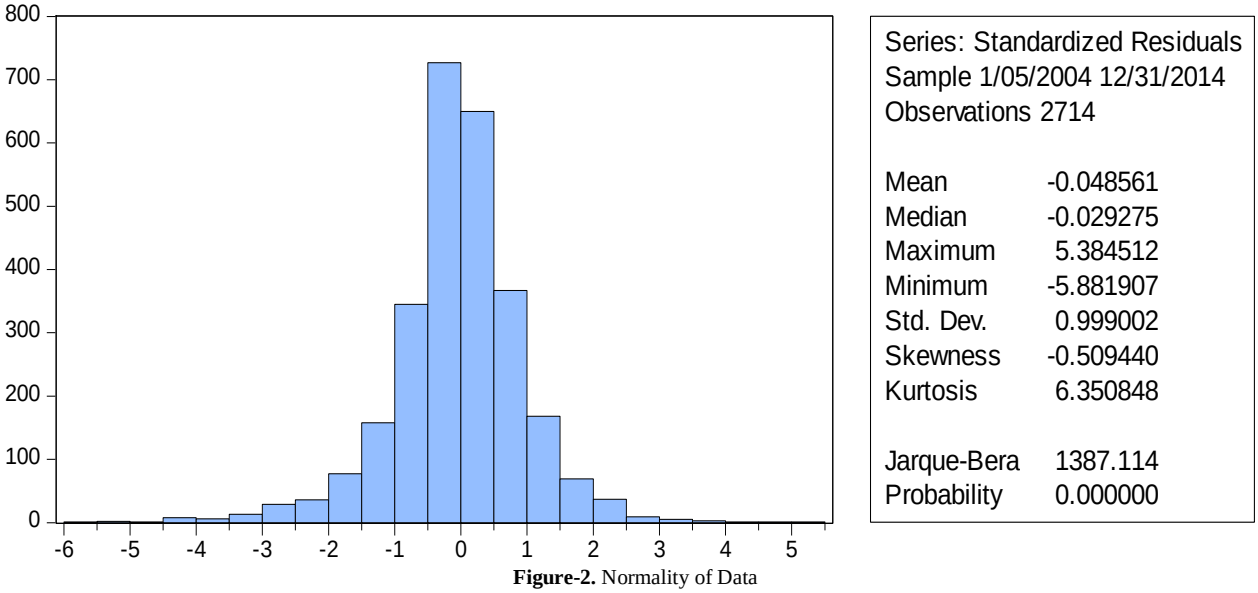

Figure-2. Normality of Data

5.2. Target Type

Divergent types of targets have different magnitude of riskiness for the stock markets and investors have accordingly diverse perception about the severity of attacks. They regard some attacks more dangerous for economy whereas others less.

Table-6. GARCH (1, 1) Model

Variance Equation				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
ϵ(-1)^2	0.107631	0.026283	4.095039	0.000***
GARCH(-1)	0.528735	0.056715	9.322709	0.000***
BUSINESS	-0.157742	0.036804	-4.285951	0.000***
EDU_INTI	-0.138784	0.020062	-6.917741	0.000***
JOURNALISTS	-0.278127	0.022642	-12.28343	0.000***
MILITARY	-0.178218	0.040933	-4.353893	0.000***
Mean dependent var		0.030506		
S.D. dependent var		0.631218		
S.E. of regression	0.631708	Akaike info criterion		1.929938
Sum squared resid	984.0683	Schwarz criterion		1.958165
Log likelihood	-2372.438	Hannan- criteria		1.940191
Durbin-Watson stat	1.813093			

'***' shows significant at 1% level. Table test the volatility pattern of KSE due to target wise terrorism events. The dependent variable is log of market returns and independent variable are Business, Education institutes, journalists and Military. Business, Education institutes, journalists and Military variables are coded 1 where the targets of terrorism are these variables otherwise 0. ϵ and GARCH(-1) are lagged error coded 1 where the targets of terrorisz are these variables otherwise 0. ϵ and GARCH(-1) are lagged error variance to capture the volatility pattern

For example, Chen and Siems (2004) investigated the effect of six major categories of terrorist event upon global capital market. Different type of attacks has different impact upon returns of the stock markets (Karolyi and Martell, 2006). We investigated four major type of attacks effect upon KSE-100 index. As Pakistan is indulged in War against Terrorism since 2001, militant groups are giving their response against this war. Terrorist attacks are now normal routine in the country. To this continuous routine investor are giving different importance to different events while trading on the stock exchange.

Results by type of target are reported in Table-6. α and β Coefficients are positive and highly significant that means KSE-100 index returns effect with previous year volatility and variance of the previous year. The value of these coefficients also shows that the stock market significantly and rationally behaves to the news and event takes place in markets. Our variables of interest are four categories of attacks in the country. Four major types of targets are segregated namely; attacks on business operations, education institutes, journalist, and military. Results of Table-6 show that attacks on journalists have highest impact on the market returns as a journalist exaggerates even trivial issues when the media industry is attacked. Attacks on military are the second most important type that creates chaos for the stock market. The military is well organized and highly prestigious institution with significant powers. An attack on the military creates perturbation among investors that leads to uncertainty in the market. The third important attacks that affect the stock market is the business community.

5.3. Type of Attacks

As different types of targets have divergent impacts on the stock market, likewise, diverse types of attacks also differently impact the stock market. In this section, we have segregated four major types of attacks that are namely; armed assault, assassination, hostage and bomb blast. Results are reported in Table-7. Findings related to $\alpha and \beta$ Coefficients are similarly as reported in Table-6 but the findings of types of attacks are different. It is worth noticing that all types of attacks have negative effect on KSE-100 index. Moreover, the hostage has highly negative and significant impact on the returns of KSE-100 index. These results are similar with previous researches

(Chen and Siems, 2004); (Karolyi and Martell, 2006). News of kidnaping the foreigner and local high profile person is highlighted in national and international electronic media overwhelmingly and thus creates the situation of unrest among investors that leads to higher negative impact upon KSE-100 index. Assassination may have less negative impact due to less number of incidents since war against terrorism is started. Although bombing attacks and armed assaults have a significant and negative impact on stock returns but with less magnitude.

Table-7. Type of attacks GARCH (1,1)

Variance Equation				
Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
C	0.337	0.061	5.500	0.00***
ϵ (-1)^2	0.122	0.029	4.145	0.00***
GARCH(-1)	0.538	0.078	6.862	0.00***
ARMD_ASSAUTLS	-0.085	0.035	-2.419	0.02***
ASSASSI	-0.110	0.031	-3.535	0.00***
BOMB_BLAST	-0.076	0.036	-2.084	0.04***
HOSTAGE	-0.207	0.040	-5.231	0.00***
Mean dependent var		0.030506		
S.D. dependent var		0.631218		
S.E. of regression	0.63	Akaike info criterion		1.88
Sum squared resid	983.00	Schwarz criterion		1.91
Log likelihood	-2316.602	Hannan-Quinn criter.		1.89
Durbin-Watson stat	1.819074			

'***' shows significant at 1% level. Table test the volatility pattern of KSE due to attacks wise terrorism events. Dependent variable is log of market returns and independent variable are armed assaults, assassinations, bomb blasts and hostage. Armed assaults, assassinations, bomb blasts and hostage are coded 1 where the attacks of terrorism are these variables otherwise 0. ϵ and GARCH(-1) are lagged error variance to capture the volatility pattern.

Table-8. GARCH (1 1)

Variable	**Coefficient**	**Std. Error**	**z-Statistic**	**Prob.**
Variance Equation				
C	0.24	0.01	36.42	0.00***
ϵ (-1)^2	0.47	0.03	14.15	0.00***
KPK	-0.10	0.01	-8.23	0.00***
KARACHI	-0.10	0.02	-5.11	0.00***
CITY_SM	0.05	0.02	2.18	0.03***
Mean dependent var	0.03			
S.D. dependent var	0.63			
S.E. of regression	0.632297	Akaike info criterion		1.72
Sum squared resid	986.3052	Schwarz criterion		1.74
Log likelihood	-2111.66	Hannan-Quinn criter.		1.72
Durbin-Watson stat	1.815183			

'***' shows significant at 1% level. Table test the volatility pattern of KSE due to location wise terrorism events. Dependent variable is log of market returns and independent variable are KPK province of Pakistan, Karachi city and city with stock markets (Lahore, Islamabad and Karachi). KPK province of Pakistan, Karachi city and city with stock markets (Lahore, Islamabad and Karachi) are coded 1 where the attacks of terrorism had taken place in these locations otherwise 0. ϵ and GARCH(-1) are lagged error variance to capture the volatility pattern

5.4. Location Wise Analysis

This last section is related to the terrorist incidence effect on the returns of KSE-100 index with respect to location of incidence. Results of location wise analysis are provided in Table-8. Overall results are similar to results reported in Table-6 and Table-7 with respect to alpha and beta coefficient. Moreover it is worth noticing that coefficient of variable 'City with Stock Market' is statistically significant and positive. That means that incident in Lahore and Islamabad does not have significant negative impact upon return. The major reason behind this is no significant severe terrorist activity has been initiated in these two cities since war against terrorism is started. The security condition of these two cities is much better relative to other part of country. KPK province is highly suffered by terrorist attacks and that is why coefficient of KPK is highly negatively significant.

6. CONCLUSION AND POLICY IMPLICATIONS

During the previous decade, political, socio-economic and financial environment has drastically changed in Pakistan for various socio-political reasons. Since 9/11 attacks on USA, Pakistan took plentiful security measures against terrorist inside its territory. Military forces and Government of Pakistan collectively started operation against terrorist and in response of these operations militant groups started suicide booming attacks, target killing, bomb blast in mosques and public area that creates uncertain environment in Pakistan and thus financial and economic development also halt due to war against terrorism.

In this study, we investigated the impact of these terrorists' attacks on the KSE of Pakistan. Analysis of study concludes that both α and β value of ARCH and GARCH models are highly statistically significant that means Karachi Stock exchange current volatility is depend of past volatility and on variance of past volatility. It is also confirmed with these coefficients that KSE is highly responsive toward events happened in the region and behaves rationally. Additionally, KSE behaves negatively and significant on occurrence of terrorism event in country. But after one day, absorbing the negative effect due to bad event, KSE recovers itself and return become positive. That shows that KSE keeps high mean reverting point that is a good signal for economy. Furthermore, investigation of type of target concludes that terrorist attacks on journalists and military result in significantly negative returns of KSE whereas, all types of attacks have negative impact upon returns. Similarly, hostage and assassination highly impact upon returns of KSE-100 index.

If we combine the results of both types of analysis i.e. type of target, type of attack, we can conclude that hostage and assisnation of journalists and military personnel have significantly affected the stock market returns. Reason behind is that terrorism activity involving human being hostage or assisnation, is rapidly highlighted in electronic and print media nationally and internationally. Our results are similar with previously conducted study upon type of target for example (Chen and Siems, 2004; Karolyi and Martell, 2006). Moreover, we have included location of event to investigate the impact of location on returns of KSE. Results of location confirm that terrorism event in KPK impact highly negatively upon KSE returns and Karachi is at number second.

This study urges the policy makers and Governmnt of the country to devise policies to strengthen safety and security situation in KPK and Karachi where terrorists event have seriously affected stock market return. This research has implications for further research at industry level, which industry has been significantly affected by these terrorists events. Other countries can also be included for further research and a larger sample can be analysed to assess if types of attacks, types of targets in other countries are same or different and whether they are affecting same or different types of industries, business units or institutions.

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