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Stock Market Response to Terrorist Attacks: An Event Study Approach

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Abstract

The purpose of this research study is to examine the stock market's response to terrorist attacks. The study uses data of terrorist attacks in different parts of the country (Pakistan) from June 1, 2014 to May 31, 2017. The event window procedure applies to a 16-day window in which 5 days before and 10 days after the attack. In addition, several event windows have been built to test the response of the Pakistan Stock Exchange. KSE-100 index is taken as proxy of response. The total terrorist attacks are classified into four categories: attacks on law enforcement agencies, attacks on civilians, attacks on special places and attacks on politicians, government employees and bureaucrats. The standard market model is used to estimate the abnormal return of the Pakistan Stock Exchange, which takes 252 business days each year. Furthermore, BMP test is used to check statistical significance of cumulative abnormal rate of return (CAAR). The results of this study reveal that total number of terrorist attacks and attacks on law enforcement agencies show long-term effects on Pakistan stock exchange. However, attacks on civilians, attacks on special places and attacks on politicians, government employees and bureaucrats have little effect on the Pakistan Stock Exchange.

Keywords: Stock Market, Terrorist Attacks, Event Study, Abnormal Return, BMP Test

JEL Classification Code: A13, D53, D73, G14, G18

1. Introduction

Chachar, Mangi, Abbasi and Chachar (2013) describe terrorism as suicide attack, harassment, destruction and killing of innocent people on no logical reason. Terrorism annoys the general public, damage infrastructure, cause a

waning macro-economic variable such like GDP, exchange rate, stock markets and foreign direct investment.

It breaks the social network of the society and bring political instability that creates chaos to stop economic growth by declining capital formation and increasing risk perception. Historical overview of the world indicates war affected states, whether in Asia, Europe, Africa or any other regions have suffered alike. Bouchet (2004) indicates terrorism at transport vehicles and airports and civilians lower GDP per capita growth and capital formation as well. International Monetary Fund (2001) reports direct costs of 9/11 attacks at US equal to 21.4 billion USD. Navarro and Spencer (2001) show 50-53 billion USD loss of capital markets due to 9/11. The current research intends to study the influence of terrorist attacks on the performance of Pakistan stock exchange (PSX) by using windows of event study.

The incident of 9/11 and Afghanistan war (2001) have started a new wave of terrorism in the world, marking a significant increase in subsequent measured terrorist incidents (Gul, Hussain, Bangash & Khattak, 2010). Pakistan is unfortunately a country, which is suffering the effects of terrorism, evident in huge numbers of casualties and damage to public and private properties. Mehmood

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(2014) concludes that terrorism has adversely affected socio-economic variables such like poverty, social network, unemployment, cost of doing business, cost of security and especially public sectors. Subject to increased vulnerability through its geographical location, Pakistan's political, social and economic structures have been negatively affected by continuous attacks. The collective impact is massive, with declining growth in all key sectors of the economy. Due to instability and risk of uncertainty the cost of business operation in Pakistan has increased tremendously and the graph of exports is continuously declining day by day. The adverse impact of the terrorism and cost of war against on the on directive of the USA can be measured with the detail of every year losses shown in Table 1.

Table 1 shows the indirect and direct cost experienced during 2001-2017 by Pakistan due to terrorist's attacks estimated Rs. 10, 373.93 billion equivalents to 123.13 billion USD. During the above said period suicidal bombing killed 12, 00,000 innocent civilian peoples and 35,000 army persons. All public as well as private organizations are bearing high social and security expense by either recruiting security persons to outsource. It is billions of dollars in every year in financial terms. The above said fact reveals that huge cost Pakistan is wasting for being involved in terrorism. The study would estimate the impact of terrorism of financial markets of Pakistan.

The stock market has a central position in the economy around the globe. Uncertain investors affect the stock market directly and indirectly, and any uncertainty in markets impacts various sectors of the economy. Back to back terrorist activities create uncertainty in stock market operations, and ultimately the economy activity of a country suffers, bearing the loss from terrorist activity. Terrorists are not only responsible for the disturbance of economy, but are also responsible for the lives of thousand innocent people and damage of public property.

Since independence in 1947, Pakistan has lost one sitting Prime Minister (Liaqat Ali Khan) and one former Prime Minister (Benazir Bhutto) to terrorist activities. The assassination of Benazir Bhutto plunged Pakistan into chaos, invoking riots across the country, 3 to 4 days' country wide lock down, with business, transportation, communication, and other sectors paused. Stock market operations collapsed. Karachi Stock Exchange was suspended for three days and stock markets around the world fell due to fears of civil instability in a nuclear capable country. Terrorist activities affect not only the economic sectors of the economy, but the normal citizen often increasing general travel or living difficulties, or more dangerously, placing them at great personal risk. Many foreign countries restrict Pakistani visas making it difficult to get jobs, students face hurdles gaining study visas for offshore study, and its citizens often face stricter airport processes when entering various countries.

Table 1: Losses Estimated (2001-2017)

Years	Rs in billions	\$ in billions	Percentage Change
2001-2002	163.90	2.67	-
2002-2003	160.80	2.75	3.0
2003-2004	168.80	2.93	6.7
2004-2005	202.40	3.41	16.3
2005-2006	238.60	3.99	16.9
2006-2007	283.20	4.67	17.2
2007-2008	434.10	6.94	48.6
2008-2009	720.60	9.18	32.3
2009-2010	1136.40	13.56	47.7
2010-2011	2037.33	23.77	75.3
2011-2012	1052.77	11.98	-49.6
2012-2013	964.24	9.97	-16.8
2013-2014	791.52	7.70	-22.8
2014-2015	936.30	9.24	20.0
2015-2016	675.76	6.49	-29.8
2016-2017*	407.21	3.88	-40.2
Total	10,373.93	123.13	-

* Source economic Survey of Pakistan, 2016-2017.

1.1. Significance of the Study

Terrorism is a critical global issue, directly and indirectly affecting the world. Countries are increasingly more conscious of risks faced by terrorism, seeking to limit and control terrorist agendas, limit damage to public properties, and loss of thousands of innocents, soldiers, politician's government official lives. Impacting foreign investors 'confidence to invest in the countries subject to terrorist activities, and inducing local investors to move their investment to more stable and less disruptive financial environments, terrorism's effect on stock markets is great and has been shown to impact variables such as liquidity, returns and stock market volatility. This topic is therefore of considerable interest among investors seeking to understand the effects of terror shocks to stock exchanges and to which country they should invest their money.

1.2. Objectives of the Study

The objective of the study is:

- To examine the effect of different terrorist attacks on PSX.
- To undertake a comparative analysis of the intensity of each category of terrorist attack on PSX.
- To suggest potential measures to regularities and policy makers of PSX.

2. Literature Review

Since the terror attack of 9/11 and Afghanistan war (2001), several studies have analyzed the stock markets response to terrorist incidents. These studies concluded that the stock markets responded differently and some terror incidents revealed mixed impact on financial markets (Corbet, Gurdgiev & Meegan, 2018). In some studies, it had been concluded that terror attacks have short lived and limited influences (Narayan & Sriananthakumar 2018). Chen and Siems (2004) argued that institutions along with financial systems have become matured and can easily absorb terrorism turmoil without affecting stock returns. On the contrary some studies have shown after every incident of terrorism both idiosyncratic risk and systematic risk upsurge panicky and their effect remains for the long run (Corbet et al., 2018; El Ouadghiri & Peillex, 2018; Aksoy, 2014; Karolyi & Martell, 2010; Nikkinen & Vahamaa, 2010; Arin, Ciferri & Spagnolo, 2008; Eckstein & Tsiddon, 2004; Drakos, 2004; Melnick & Eldor, 2010). From the review of above said literature, the hypotheses of the study proposed as below:

H_0 : There is no relation between terrorism and performance of PSX.

H_1 : There is a relation between terrorism and performance of PSX.

Both of these conflicting views may fine be due to main reason that there are different time scales applied in the relations. To understand the factual link between terrorist attacks and financial market returns, conventional types of methodology may not be appropriate to include time scale structured linkage. Therefore, the study intends to examine empirically the relation between terrorist attacks and return of PSX by using event study. This method is especially designed to compute the effect of particular event on regression and stock price is the commonly used regression and for event studies that provides the abnormal returns to the effects of particular event such like terror attack (Aksoy, 2014). Many research studies used methodology of event study in their work to compute the stock market returns in Pakistan (Batool, Khan, & Haider 2017; Ahmad, Khan, Usman, Ahmad, & Khalil, 2017). While previous studies have largely focused on the effect of terrorism on financial markets, different economic sectors or on foreign direct investment, there is limited research on which type of terrorist attacks has a greater or less impact on stock market stability and volatility. This study seeks to address this issue by applying event study methodology, to categorize and differentiate between different terrorist attacks and each terrorist category's effect on the PSX. This study therefore has the following sub-objectives:

Table 2: Frequency of Terrorist Attacks in Each Category

Categories	Number of Attacks
Attacks on Law Enforcement Agencies	07
Attacks on Civilians	05
Attacks on Special Places like Mosque, Imam Bargahs, Churches, Schools, Colleges, Universities and Courts.	13
Attacks on Politicians, Government Employees and Bureaucrats	05

- Categorizing terrorist attacks into four events comprising: Attacks on Law Enforcement Agencies, on Civilians, on Special Places and on Politicians, Government Employees and Bureaucrats (Table 2 shows the frequency of terrorist attacks in each category).
- Undertaking a comparative analysis on which type of terrorist incidents has a greater or lowest impact on PSX.
- Investigating the impact of each category separately and total attacks on the stock market.

3. Research Methodology

The study uses secondary source of data for the period of three years from June 1, 2014 to May 31, 2017. The KSE-100 index data are acquired from the web of PSX and the data of terrorist attacks are gathered from the web of south Asian terrorist portal.

3.1. Identification of Variables

KSE-100 index is used as dependent variable and the four categories of terrorist attacks are used as independent variables. The categories of major terrorist attacks are:

- Attacks on Law Enforcement Agencies (ALEA): The terrorist attack on Law Enforcement Agencies where casualties or injured more than 10 persons.
- Attacks on Civilians (AC): The terrorist attack on Civilians where causalities more than 40 persons or injured more than 60 persons.
- Attacks on Special Places (ASP): The terrorist attack on Mosque, Imam Bargahs, Churches, Schools, Colleges, Universities, Courts and Shrines where causalities more than 10 persons or injured more than 20 persons.
- Attacks on Politicians, Government Employees and Bureaucrats (APGEB): The terrorist attack on Politicians, Government Employees and Bureaucrats.

3.2. Analytical Technique

Initially, the study uses the standard market model (SMM) for event study (Chavali, Alam, & Rosario, 2020) as originally first time defined by Dodd and Warner (1983) and later by Brown and Warner (1985). The CAR form stock market of Pakistan during the event window $[t_1; t_2]$ contiguous the event per day $t=0$, where $[t_1; t_2] = [-5; +10]$, is calculated by:

$$CAR_{i[t_1, t_2]} = \sum_{t=t_1}^{t_2} (R_{i,t} - \alpha_i - R_{M,t}) \quad (1)$$

Where; $CAR_{i[t_1, t_2]}$ is the Cumulative Abnormal Return of PSX during the event window $[t_1; t_2]$, $R_{i,t}$ is the actual return of stock market in Pakistan on the day t , $R_{M,t}$ is the return benchmark index of stock market in Pakistan, α and β are the regression estimation from an OLS using 252 day per year. After calculated CAR, study find the CAAR by:

Table 3: Event Study Results for Terrorist Attacks

EVENT WINDOW	CAAR	MEDIAN (AR)	B.M.P-Test (Z-Score)	EVENT WINDOW	CAAR	MEDIAN (AR)	B.M.P-Test (Z-Score)
Panel A: Event Study Results for Total Terrorist Attacks							
[-5, +10]	-1.7455%	-0.1138%	-2.2948*	[-5, +10]	-3.8609%	-0.2957%	-3.9574*
[-5, -1]	-0.5860%	-0.1477%	-1.7202*	[-5, -1]	-1.1250%	-0.3232%	-1.8492*
[-5, 0]	-0.7532%	-0.1423%	-1.7314*	[-5, 0]	-1.3003%	-0.2752%	-1.7236*
[-1, 0]	-0.0842%	-0.0265%	1.0106	[-1, 0]	-0.2669%	-0.1658%	-0.1959
[0, +1]	-0.3030%	-0.0856%	-1.7901*	[0, +1]	-0.4643%	-0.2546%	-1.7610*
[+1, +10]	-0.9923%	-0.0814%	-1.7676*	[+1, +10]	-2.5606%	-0.2964%	-2.9710*
[0, +10]	-1.1595%	-0.0873%	-2.0595*	[0, +10]	-2.7359%	-0.2728%	-3.3231*
Panel C: Results for Terrorist Attacks on Civilians							
[-5, +10]	-0.6510%	-0.0928%	-0.4125	[-5, +10]	-1.0921%	-0.0201%	-0.5434
[-5, -1]	-0.5409%	-0.1694%	-0.5338	[-5, -1]	-0.5316%	-0.1413%	-0.6664
[-5, 0]	-0.6510%	-0.1617%	-0.2630	[-5, 0]	-0.7500%	-0.1033%	-0.6126
[-1, 0]	0.4151%	0.4278%	1.1444	[-1, 0]	-0.2001%	0.1222%	0.5415
[0, +1]	-0.1639%	0.0114%	0.0052	[0, +1]	-0.4627%	-0.0347%	-1.0793
[+1, +10]	0.0000%	-0.0715%	-0.2980	[+1, +10]	-0.3419%	0.0111%	0.2196
[0, +10]	-0.1101%	-0.0556%	-0.3049	[0, +10]	-0.5604%	0.0111%	-0.1559
Panel E: Results for Terrorist Attacks on Politicians, Government Employees and Bureaucrats							
EVENT WINDOW	CAAR	MEDIAN (AR)	B.M.P-Test (Z-Score)				
[-5, +10]	-1.0000%	-0.0901%	-0.3691				
[-5, -1]	0.2601%	-0.0327%	-0.2207				
[-5, 0]	0.2101%	-0.0334%	-0.2365				
[-1, 0]	0.0300%	0.1214%	0.9991				
[0, +1]	0.3611%	0.2004%	0.6975				
[1, +10]	-1.2111%	-0.1731%	-0.2752				
[0, +10]	-1.2627%	-0.1731%	-0.4949				

Note: ** shows significance and in which event window stock market reacts towards terrorist attack

$$CAAR_{[t_1, t_2]} = \frac{1}{N} \sum_{s=1}^N CAR_{i[t_1, t_2]} \quad (2)$$

Where; N is the number of attacks in the data sample and CAR is the Cumulative Abnormal Return of PSX during the event window $[t_1; t_2]$.

4. Results and Discussions

The CAAR of stock market are estimated for multiple event widows. The CAAR is estimated by applying the SMM with 252 days per year. BMP-Test, produced by Boehmer, Musumeci and Poulsen (1991), is used to test the significance of CAAR and reaction of PSX toward attacks.

Table 3 (Panel A) shows the reaction of stock market of Pakistan to all terrorist attacks of the sample. Test result shows a significant relationship of all the terrorist attack with stock market of Pakistan on multiple event windows

except the event window of $[-1, 0]$ which shows no reaction of stock market toward terrorist attacks on that event window. The significance is high at the event window of $[-5, +10]$ and low at the event window of $[-5, -1]$. All-significant multiple event windows show a negative impact of terrorist incidents on Pakistani stock market. The results of the study are consistent with Koo (2020). Table 3 (Panel B) shows the reaction of PSX to attacks on Law Enforcement Agencies. Test result shows a significant relationship of the terrorist attack on Law Enforcement Agencies with stock market of Pakistan on all event window ($[-5, +10]$, $[-5, -1]$, $[-5, 0]$, $[0, +1]$, $[+1, +10]$, $[0, +10]$) except the event window of $[-1, 0]$ which shows no response of PSX to attacks on that event window. All significant multiple event windows show a negative effect of attacks toward PSX. Table 3 (Panel C) shows the reaction of PSX to attacks on Civilians. The results show no significant reaction of PSX towards terrorist attack on civilians on the multiple event windows. Table 3 (Panel D) shows the reaction of PSX to attacks on Special Places. The results show no significant reaction of PSX towards terrorist attack on Special Places on the multiple event windows. Table 3 (Panel E) shows the reaction of PSX to attacks on Government Employees, Politician and Bureaucrats. Again the results show no significant reaction of PSX towards attacks on Government Employees, Politician and Bureaucrats on the multiple event windows.

In Panel A of Table 4, the difference between the event study results of total attacks with the event study results of attacks on Law Enforcement Agencies is illustrated. This difference is made to estimate the significance of total terrorist attacks on PSX without the attacks on Law Enforcement Agencies. The Table shows no significance of terrorist attacks on PSX on the event windows. In Panel B of Table 4, the difference is made to estimate the significance of total terrorist attacks over stock market of Pakistan without the attacks on Civilians. The result shows significant response of stock market toward terrorist attacks over event window of $[-5, +10]$, $[-5, 0]$, $[0, +10]$ and shows no reaction on $[-5, -1]$, $[-1, 0]$, $[0, +1]$, $[1, +10]$. In Panel C of Table 4, the difference is made to estimate the significance of total terrorist attacks over stock market of Pakistan without the attacks on Special Places. The outcome shows significant response of stock market toward terrorist attacks over event windows $[-5, +10]$, $[1, +10]$ and $[0, +10]$ and shows no significant reaction on the event windows of $[-5, -1]$, $[-5, 0]$, $[-1, 0]$, $[0, +1]$ and has no reaction on $[-5, 0]$, $[-1, 0]$, $[0, +1]$. In Panel D of Table 4, the difference is made to estimate the significance of total terrorist attacks over stock market of Pakistan without the attacks on Government Employees, Politician and Bureaucrats. The outcome shows significant response of stock market toward terrorist attacks over the event window of $[-5, +10]$, $[0, +1]$, $[0, +10]$ and shows no reaction on $[-5, -1]$, $[-5, 0]$, $[-1, 0]$, $[1, +10]$.

Table 4: Comparison of the Results of Total Terrorist Attacks with Each Type of Attacks

EVENT WINDOW	CAAR	MEDIAN (AR)	B.M.P-Test (Z-Score)	EVENT WINDOW	CAAR	MEDIAN (AR)	B.M.P-Test (Z-Score)
Panel A: Difference between the Results of Total Terrorist Attacks and Attacks on Law Enforcement Agencies				Panel B: Difference between the Results of Total Terrorist Attacks and Attacks on Civilians			
$[-5, +10]$	2.1154%	0.1819%	1.6626	$[-5, +10]$	-1.0945%	-0.0210%	-1.8823*
$[-5, -1]$	0.5390%	0.1755%	0.2490	$[-5, -1]$	-0.0452%	0.0217%	-1.0664
$[-5, 0]$	0.5471%	0.1329%	0.1222	$[-5, 0]$	-0.1022%	0.0194%	-1.7384*
$[-1, 0]$	0.1827%	0.1393%	1.2065	$[-1, 0]$	-0.4994%	-0.4543%	-0.1338
$[0, +1]$	0.1614%	0.1690%	-0.0291	$[0, +1]$	-0.1391%	-0.0970%	-1.1953
$[1, +10]$	1.5683%	0.2150%	1.5034	$[1, +10]$	-0.9923%	-0.0099%	-1.1696
$[0, +10]$	1.5764%	0.1855%	1.2636	$[0, +10]$	-1.0493%	-0.0316%	-1.7546*
Panel C: Difference between the Results of Total Terrorist Attacks and Attacks on Special Places				Panel D: Difference between Results of Total Attacks and Attacks on Politicians, Employees and Bureaucrats			
$[-5, +10]$	-0.6520%	-0.0975%	-1.7514*	$[-5, +10]$	-0.7439%	-0.0197%	-1.9257*
$[-5, -1]$	-0.0551%	-0.0109%	-0.9338	$[-5, -1]$	-0.8424%	-0.1204%	-1.3795
$[-5, 0]$	-0.0014%	-0.0385%	-0.9888	$[-5, 0]$	-0.9620%	-0.1151%	-1.3649
$[-1, 0]$	0.1160%	-0.0512%	0.4691	$[-1, 0]$	-0.1182%	-0.1484%	0.0115
$[0, +1]$	0.1567%	-0.0584%	-0.1108	$[0, +1]$	-0.6582%	-0.2905%	-1.8876*
$[1, +10]$	-0.6506%	-0.0885%	-1.7872*	$[1, +10]$	0.2182%	0.0852%	-1.1924
$[0, +10]$	-0.5968%	-0.1009%	-1.9036*	$[0, +10]$	0.0985%	0.0793%	-1.7646*

Note: ** shows significance and in which event window stock market reacts towards terrorist attack

5. Discussions and Conclusions

After the incident of 9/11 and Afghan war (2001) a new stream of terrorism has been started. It had adverse effects on USA and the whole world by directly and indirectly. The economy of USA has collapsed down due to these attacks. Pakistan has also affected with these attacks. Pakistan is still suffering with this issue from many years. The foreign direct investment decreases due to terrorism. Even the local investors are shifting their investment from Pakistan to other countries.

This research analyzes the influence of different terrorist attacks on PSX. The study period starts from June 1, 2014 and ends on May 31, 2017. The SMM for event study is applied to test the hypothesis. Study uses the event window of 16 days; 5 days previous and 10 days later the attacks. Multiple event windows are constructed to check the reaction of stock market of Pakistan to terrorist attacks. The study has constructed four categories of terrorist attacks (Attacks on Law Enforcement Agencies, on Civilians, on Special Places and on Politicians, Government Employees and Bureaucrats).

The model is applied to examine the effect of all attacks jointly and separately on each category. And then a comparative analysis is made for total attacks with each category of attack. The results show that the stock market of Pakistan reacts severely on total attack on multiple event windows. The total terrorist Attacks (TTA) have negative relation with Pakistani stock market and the terrorist Attacks on Law Enforcement Agencies (ALEA) have significant long-term impact on PSX. This may be because of the fact that attacks on ALEA create more thrill and terror to surroundings. Media displays gloomy picture, resultantly investor's show strong reaction to terror incidents. These attacks have negative link with stock market in Pakistan in the long run. These results are in line with the prior studies (Alam, Alam, & Chavali, 2020, Corbet et al., 2018; El Ouadghiri & Peillex, 2018; Aksoy, 2014; Karolyi, & Martell, 2010; Nikkinen, & Vahamaa, 2010; Arin et al., 2008; Eckstein & Tsiddon, 2004; Drakos, 2004; Melnick & Eldor, 2004).

The attacks on Civilians (AC), Special Places (ASP), Politicians, Government Employees and Bureaucrats (APGEB) have short-run influence on PSX. The PSX reacts only for 2 or 3 days to the attacks on AC, ASP and APGEB. The previous studies (e.g., Narayan & Sriananthakumar, 2018; Chen & Siems, 2004) also support these findings. So, H_1 is accepted which shows terrorism has impact on PSX. The reason for short run impact may be due to an improvement of situation regarding terrorism in Pakistan. Zarb-E-Aazab (Military Operation against Terrorism) and National Action Plan which are initiated by Civil and Military leadership of Pakistan which brought change in investor's behavior.

Investors are more resilient on the attacks on Civilians, Special Places, Government Employees, Politicians and Bureaucrats. But some terrorist attacks on Special places have severe impact on stock market such as the attack on Army Public School Peshawar. Keeping in view the conclusions of research, it would be suggested to Federal and Provincials Governments of Pakistan and security institutions to tighten up the security of law enforcement agencies that reduces the effects of terrorism on PSX.

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