# Effects of Terrorism and Violence on the Karachi Stock Exchange (2005-2015)

By Muhammad Daniyal Shafiq

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Supervisor: Professor Julius Horvath

Budapest, Hungary

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# Abstract

The main focus of this work is the influence of violence and terrorist events on stock exchange. In particular, I conducted research on the influence of the worst terrorist events in Pakistan on return of the Karachi Stock Exchange based on different categories of terrorism (Al-Qaeda/Taliban attacks, sectarian violence, attacks on armed forces and political violence). I used Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model with dummy variables to estimate the effects of violence and terrorist events. Terrorist events and violence data has been collected from various news websites. Dummy variable is set to 1 for the following three days after event took place and 0 for all other days in the sample. Statistical results show significant negative effect of Al-Qaeda/Taliban attacks, other categories did not have significant impact on return.

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# **1. Introduction**

Terrorism has had negative effects on the global economy in the past few years. This is especially true after the 9/11 attack on the World Trade Center and the US led invasion of Iraq which resulted in retaliation by terrorist groups like Al-Qaeda/Taliban. The front line allies of the US on the war on terror are countries like Pakistan, Afghanistan, Iraq and Somalia. These are the countries which also suffered the most as shown in figure 1 below. As per the Global Terrorism Index 2014 these countries are in the top 10 in the list of countries which experienced the highest impact of terrorism. However, there are very few such studies which evaluate the impact of terrorism on the global level or on countries. The majority of the studies discuss the effects of terrorism on the global level or on countries like the US, the UK, Spain and other developed countries.



Figure 1 - Terror Attacks in Afghanistan, Pakistan and Somalia; Source: National Counterterrorism Center Hence, I decided to analyze the effects of terrorism and violence on the Karachi Stock Exchange. To the best of my knowledge there has been no such study conducted to analyze the impact of terrorism on the Karachi Stock Exchange based on different categories of terrorism (Al-Qaeda/Taliban attacks, sectarian violence, attacks on armed forces and political violence), my research will be a significant addition to the literature in this field. It also fills the gap of the previous work done by Enomoto and Nguyen (2009) as they only analyzed the impact on the Karachi Stock Exchange based on the external terrorist events. However, my work analyzes the impact on the Karachi Stock Exchange based on the violence and terrorist events, which took place within Pakistan. Furthermore, it provides the theoretical and analytical framework which may help policy makers in the policymaking process. The case of Pakistan is worthy of analysis for several reasons discussed below.

Pakistan has been a front line ally of the US on the war on terror. In the past fifteen years Pakistan's economy has been affected badly by acts of terrorism. As Arshad Ali has shown, it impacted the country politically, socially and economically (2009). Due to the incessant insecurity, the life of an ordinary citizen is at risk. Business activity has been slowed down due to the loss in exports to competitors, loss of infrastructure and above all the loss of approximately 60,000 innocent lives (South Asia Terrorism Portal as of October 4, 2015). Foreign investors have also been skeptical, which caused a fall in Foreign Direct Investment and portfolio investment according to Gul et al (2010). According to official statistics, the country lost approximately 107 Billion (USD) since 2001. In the fiscal year 2013-14, the losses were incurred mainly due to loss in tax collection, foreign investment, exports and physical infrastructure as shown in Table 1 below (the Economic Survey of Pakistan, 2014).

<b>Fable 1 - Summar</b>	y of Losses	Due to 1	<b>Ferrorist</b>	Attacks in	Pakistan
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Table-1: Summary of Losses Due to Terrorist Attacks					
S.No	Organization	Year	Total		
		2013-14	2014-15*		
1.	Exports	0.53	0.73	1.26	
2.	Compensation to Affectees	0.04	0.01	0.05	
3.	Physical Infrastructure	0.42	0.50	0.92	
4.	Foreign Investment	2.01	0.09	2.10	
5.	Privatization	0.00	0.00	0.00	
6.	Industrial Output	0.03	0.02	0.05	
7.	Tax Collection	2.52	2.00	4.52	
8.	Cost of Uncertainty	0.07	0.002	0.07	
9.	Expenditure Over run	0.29	0.62	0.91	
10.	Others	0.72	0.55	1.27	
	Total Losses	6.63	4.53	11.16	
*: Estimated on the basis of 9 months actual data (July-March)					

Source: M/o Finance, M/o Interior, M/o Foreign Affairs, Joint Ministerial Group

(Source: Ministry of Finance, Ministry of Interior, Ministry of Foreign Affairs, Joint Ministerial Group)

Due to the disruption in economic activities, companies' profits have been negatively impacted. Investors became uncertain, which could trigger an exit from the stock market, hence drop in returns (Enomoto & Nguyen, 2009). Thus, analyzing the impact of terrorist events and violence on the Karachi Stock Exchange is an interesting aspect for further research. Karachi Stock Exchange is the largest stock exchange amongst the stock exchanges of the US allies in the war on terror. In addition, Pakistan's case is also interesting because it is not only impacted by the terror attacks by Al-Qaeda/Taliban but several other kinds of terrorist attacks existent in the country. There are attacks related to sectarian violence, political violence and attacks on armed forces, which could have different impacts on the return of the stock exchange.

Therefore, this thesis will evaluate the effects of certain categories (Al-Qaeda/Taliban attacks, sectarian violence, attacks on armed forces and political violence) of terrorist attacks

on the Karachi Stock Exchange. It will also analyze the economic impacts of the worst terrorist attacks, such as the killing of the former Prime Minister, Benazir Bhutto, and the political violence caused in the largest city of Karachi on May 12, 2007 and steps taken by the government in the aftermath. This thesis will probe into the in-depth analysis to understand how the impact could have been reduced to the minimum and if in future such events occur, what steps could be taken by the policy makers to ensure the peace and stability. In addition, although Lal Masjid operation and the killing of Osama bin Laden were not terrorist attacks but I would also briefly analyze how these events impacted the stock exchange. I have taken data from 2005 to 2010 as during this time period Pakistan went through some of the worst terrorist events like the killing of former Prime Minister Benazir Bhutto and attacks on armed forces. The global financial crisis also took place during this time period, however, according to Ali and Afzal (2012), the crisis impacted the stock return on the Karachi Stock Exchange negatively but it was not so strong. This is because the Karachi Stock Exchange is not significantly connected with other international stock markets and the most commonly traded financial instruments are stocks which made it less prone to the global financial crisis.

The Karachi Stock Exchange came into existence in 1947 with only five listed companies. There are two more stock exchanges in Pakistan called the Islamabad Stock Exchange and the Lahore Stock Exchange. However, these two are very small compared to the Karachi Stock Exchange. It has now more than 663 listed companies and has become the most liquid and the largest exchange in the country. Foreign investors have also been able to participate in the secondary market of the exchange since 1991 (Enomoto & Nguyen, 2009). KSE-100 index is a capital weighted index, companies with the highest market capitalization are used to calculate the index. To ensure that the index captures the whole market, companies with the highest market capitalization from each sector is included. According to

Business Week, the Karachi Stock Exchange was the best performing world stock market in 2002.

Pakistan is notorious as the home for the leadership of Al-Qaeda/Taliban. Due to the drop in exports or in domestic demand as a result of the attacks could affect the stocks traded on the Karachi Stock Exchange. The most likely result would be a drop in stock prices. The correlation between stock market returns and the acts of terrorism has been empirically proven (Enomoto & Nguyen, 2009). Siddiqui (2015) showed that sectarian violence based on religious sects is becoming more deadly in the country. This claim is also substantiated by Figure 2 below. However, this type of violence is not expected to have as severe consequences as the violence associated with Al-Qaeda/Taliban as it does not cause disruption in business activities. The chart below also shows the increase in sectarian violence. Shapiro et al (2012) found that all types of violence are on the rise in the country including the political violence. This could have serious repercussions on the economy due to disruptions in the business activities.

#### Pakistan Faces Increases in Sectarian Violence



Incidents of sectarian violence in Pakistan have been trending upward since 2003, while the numbers of those injured and killed in 2008 are at or near 20-year highs.

lote: Number injured for 2000 not available

rce: Institute for Conflict Man ment South Ar "Sectarian Violence in Pakistan," at http://www.sotp.org/sotporgtp/countries/pokiston/ sect-killing.htm (April 30, 2009)

## Figure 2 - Sectarian Violence in Pakistan

Majority of evil terrorist attacks in Pakistan were carried out by either Taliban or Al-Qaeda. Osama bin Laden was the founder of Al-Qaeda which came into existence in the year 1988 to fight against Soviet invasion of Afghanistan. Mohammed Omar was the founder of Taliban and it came into existence later in the year 1996 with the aim of forcefully imposing Sharia/Islamic law. Both organizations were originated in Afghanistan and later their members were dispersed in other neighboring countries of Afghanistan. Religious violence is mainly related to Shia Sunni conflicts which are two main Islamic religious sects in the country. Pakistan is dominantly a Sunni country however, there are always attack on worship places of both sects. The political violence is amongst political parties fighting for power. Pakistan Peoples Party, Pakistan Muslim League, Pakistan Tehrik-e-Insaf, Awami National Party and Muttahida Qaumi Movement are four main parties in the country.

This thesis is organized as follows. In the second chapter, I discuss the relevant literature. Third chapter discusses in detail how Pakistan has been affected by terrorism since the attack on the world trade center, then I define my categories of terrorist activities and discuss in detail the worst violence and terrorist events which took place. In the fourth chapter, I conduct empirical analysis. I used Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model for the empirical analysis because return of the Karachi Stock Exchange depicts changing variance over time hence it is the best suited model in this case. Finally, I summarize and conclude.

## 2. Literature Review

Taking into account the scholarly work done on the subject matter, it is noteworthy to mention that the literature related to the effects of terrorism on the Karachi Stock Exchange is very limited. The majority of terrorism studies done so far are event studies for instance the study done by Chen and Siems (2004), historical analysis by Johnston and Nedelescu (2005), regression analysis or some combination (Kollias et al (2011) study used event study and regression). In my thesis, I have combined historical analysis and regression analysis. Gul et al (2010) analyzed the impact of terrorist events on the forex market, stock market and money market. They concluded only the stock market is significantly impacted by terrorist events. Although forex and money markets have an adverse impact as a result of terrorist events, it is not significant.

Chen and Siems (2004) demonstrated in their study that 9/11 incident adversely impacted average returns on stock markets globally. They used event study methodology to compute abnormal returns (positive or negative) as a result of a terrorist event. After 9/11 incident, it took 40 days for the DJIA (Dow Jones Industrial Average) index level to return to normal. They concluded that US capital markets are less prone to such events and the banking and financial sector also supports the economy well during volatile times. The paper by Johnston and Nedelescu (2005) analyzes the impact of terrorism on financial markets. The focus of their paper was 9/11 terrorist attacks in New York and attacks in Madrid in 2004. They covered the impact on the repo market, government securities market, insurance industry and capital markets, and also thoroughly discuss the economic consequences of terrorism. After assessing the response of the authorities, they put forth some suggestions for tackling such a situation in the future. The financial markets in both countries were resilient and diverse enough to absorb the shock of terrorist events which took place. Central banks in

both countries played a pivotal role and acted in a responsible way to calm the markets in such volatile times. Communication was also very effective between the central banks which helped in controlling the contagion. In response to such attacks associated with Al-Qaeda the government needs to undertake coordinated monetary, financial and fiscal measures in order to restore confidence within and outside financial markets. Two other important aspects which they highlighted in case of such events are operational risk mitigation and countering terrorist financing.

Kollias et al (2011) utilizing event study methodology and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models concluded that the Madrid and the London bombings had significant negative abnormal returns. In the case of Madrid the impact was more widespread across the sectors and the time of recovery was also slower as compared to London's incident.

Abadie and Gardeasabal (2003) studied the effect of terrorism on the economy of the Basque country in Spain. They concluded that the GDP of the Basque country declined 10 percentage points relative to a controlled region without terrorism. Some of the studies used FDI as a proxy for economic performance. Abadie and Gardeazabal's (2007) model predicted that higher levels of terrorism activities result in lower level of net foreign direct investment positions. On average, there is a fall of 5% of GDP in the net foreign direct investment if there is an increase of a standard deviation of terrorism risk, given it is an open economy and other types of risks are constant.

Utilizing time series data and regression with dummy variables, Eldor and Melnick (2004) examined the repercussions of Palestinian terror attacks after 2007 on Israel's stock market and exchange rate market. They used log of stock market index and log of exchange rate as dependent variables. They conducted the research by categorizing the data by location,

type of attack, type of target, number of casualties and the number of attacks per day. The attacks had negative impacts on the Israel stock exchange market.

Ali (2009) in his study gives a very detailed account of the economic cost of terrorism which Pakistan incurred after it became a front line ally of the US in the war on terror. He explained all types of costs which the country incurred, from fiscal costs to cultural costs. In addition, he also gave details of the industries which suffered from terrorism activities. Moreover, he also describes the human cost which impacts the country economically in the long term due to loss of labor force. Shapiro et al (2012) studied the patterns and trends of political violence in Pakistan. They came up with some important findings and their implications. Overall the country has seen an increase in all kinds of violence. Recently, Baluchistan, FATA and Khyber-Pakhtunkhwa provinces which used to be peaceful now has violence on the rise. The province of Punjab has always been plagued by sectarian violence. The province of Sindh has been peaceful but the city of Karachi witnessed extreme levels of political violence. The province of Sindh had the largest number of assassinations.

Study by Enomoto and Nguyen (2009) analyzed the impact of major terrorist acts like 9/11, the Indonesia bombing, the Madrid bombing and a few others on the stock markets of Pakistan and Iran. They concluded those events had significant adverse effects on market returns in the Tehran Stock Exchange and the Karachi Stock Exchange. They used Generalized Autoregressive Conditional Heteroskedasticity (GARCH) dummy based model to estimate the variables. In the subsequent section I will define my categories of terrorism activities.

# 3. Categories of Terrorism Activities

As mentioned above Pakistan suffered tremendously since it became an ally of the US on war on terror. It lost countless innocent and precious lives including some of the most influential political figures like Benazir Bhutto (former Prime Minister). In 2009 around 3 million people were displaced due to terrorist operations in the North Western part of the country (Ali, 2009). The country just not only suffers from fundamentalist religious groups but several other kinds of violence. Sectarian violence is also rampant in the country. Pakistan is dominantly a Sunni country, Shias are in minority. However, recently incidents relating to attacks on Sunni and Shia groups are on the rise. Armed forces have also been targeted by terrorist groups. In one of the attacks, terrorists also tried to capture the military headquarters of the country. Fortunately, they were not successful in their endeavor. This event also raised the question of whether nuclear weapons of the country are in safe hands. Lastly, the country has been plagued by political violence within the cities and provinces since its inception. It is a norm for political party's workers to carry weapons; hence whichever party is strong they promote violence in order to achieve their own political interests in their respective city or province.

Consequently, in this research I decided to divide terrorism activities in the country into four categories. In the following sections I will define each category and within the category an analysis of the worst violence and terrorist events would be conducted. Some of the violence and terrorist events could fall into two or more categories, thus these categories only serve as a simplification of the real world in order to study the impacts of terrorism events on the Karachi Stock Exchange.

#### **3.1 Al-Qaeda/Taliban Attacks**

Mainly suicide attacks fall under this category or any terrorism activity for which Al-Qaeda/Taliban later took on the responsibility. Recently, the country has seen many evil attacks. The graph below shows a trend of these attacks according to South Asia Terrorism Portal. At the end of 2014, insurgents entered an army run school killing around 150 people most of them were children. Around six attackers dressed up in army uniform attacked the school which is dominantly attended by children of army personnel. They randomly fired and another blew himself up. This continued for more than four hours. Taliban claimed responsibility saying it was in retaliation of army operation in North Western part of the country. Prime Minister Nawaz Sharif declared it as a national tragedy (Boone &- MacAskill, 2014). Five star Marriott hotel was also bombed few years ago killing 60 people. Two US armed forces personnel, Czech ambassador and his Vietnamese partner were four foreigners who were also killed. The attack was carried out with a truck with explosives, mortar bombs and shrapnel. Manner in which the attack was carried out showed it was Al-Qaeda's work (Borka, 2008). The worst was the killing of former Prime Minister Benazir Bhutto when she came back to the country after being exiled for several years from the country to run her election campaign.



Suicide Attacks in Pakistan

#### Figure 2 - Suicide Attacks in Pakistan (2002-2014)

#### (Source: South Asia Terrorism Portal)

Officially Taliban insurgents were held responsible for the assassination of former Prime Minister Benazir Bhutto, however vast majority of Pakistanis believe that army and government were responsible at least indirectly (Schaffer, 2008). The country suffered 2 billion dollars in forgone production, lost tax revenue and infrastructure damage. In the cities of Karachi and Hyderabad some US company facilities were damaged. In the long run this event dented investment climate image of the country and it saw outflow of around 5.66 Billion USD some of which never returned (2008: Pakistan lost \$2bn in violence, 2011). There were violent mobs running around the country looting valuables from shops and setting them on fire. These mobs were thought to comprise of Benazir Bhutto followers who could not control their emotions. The province of Sindh suffered the most as Benazir Bhutto's hometown is there. Railways also suffered and thousands of vehicles were destroyed. Hence, it could be easily classified as one of the worst attacks in the history of the country. This attack is thought to have the largest impact on the returns of the Karachi Stock Exchange.

#### **3.2 Sectarian Violence**

Attacks related to killing of Sunni, Shia or members of any other Islamic sect falls under this category. Sunni and Shia are the two main sects of the country, however, Pakistan is dominantly a Sunni country. Recently, sectarian attacks have become more deadly. As seen in the graphs below from South Asia Terrorism Portal, although the number of attacks has decreased the people killed in sectarian attacks have increased (Siddiqui, 2015). Shia sect and some other minority sects have been the main target of terrorists. The province of Baluchistan has suffered the most from sectarian violence. One of the deadliest attacks was bombing in the city of Quetta in Shiite neighborhood killing 92 people. Minority sect of Ahmadi is also often attacked, in Lahore gunmen entered Ahmadi mosque and opened fire killing 82 people.



Figure 3 - Number Killed or Injured in Sectarian Attacks in Pakistan (1989-2014)

(Source: South Asia Terrorism Portal)



Figure 4 - Number of Sectarian Incidents in Pakistan (1989-2014)

#### (Source: South Asia Terrorism Portal)

Sectarian violence is expected not to impact the economy significantly and the returns of Karachi Stock Exchange as they do not significantly disrupt business activity and confined to a particular city or area. However, sectarian groups are becoming more successful in carrying out the attacks. Sometimes, these sectarian groups serve as partners for political parties in order to achieve their goals. Perhaps sectarian intolerance could be on the rise due to clerics propagating anti Shiite or anti Sunni behavior (Siddiqui, 2015).

#### **3.3 Attacks on Armed Forces**

Attacks on the military of Pakistan and other armed forces like police and private security forces come under this category. Pakistan army is considered to be one of the strongest armies in the world, it is ranked 11th in the world according to Credit Suisse report on globalization (Web Desk, 2015). However, for the past few years, it has been the target of attacks from Al-Qaeda/Taliban. Military is the top target of terrorists followed by police, civil

administration, schools and barber and music shops (Hussain, 2010). Several military operations were conducted against Taliban in the North-Western province of Khyber Pakhtunkhwa the major one was in 2009 and recently in 2014 following the attack on the army run school. Hence, in retaliation, military has been the focus of Al-Qaeda/Taliban attacks.

Taliban claimed the responsibility of massive suicide bombing at the Wagah border with India, death toll reached 60 according to The Seattle Times, 2014. They stated that it was in retaliation of the operation which army conducted in North Waziristan. On the 10<sup>th</sup> of October, 2009 Taliban attacked Army Headquarters in Rawalpindi. In this incident there were not huge losses in terms of people killed, however it dented the morale of Pakistan Army and its citizens. This place is considered to be one of the safest places in the country and still Taliban were able to carry out an attack at this place. Attacks on armed forces are also generally confined to one area and does not result in major disruption of business activity. Therefore, these attacks could have an impact on the return of Karachi Stock Exchange although perhaps not as much as the killing of Benazir Bhutto or other suicide attacks which were deadlier than this.

#### **3.4 Political Violence**

Incidents related to the attacks on political parties or associated with politics falls under this category. Although, killing of Benazir Bhutto was a political incident but officially Taliban took the responsibility of her assassination hence I categorize it under Al-Qaeda/Taliban attacks. In the provinces of Punjab and Sindh the political violence is part of the political culture according to Shapiro et al (2012). They showed that the province of Sindh is the worst in terms of number of incidents of political violence taking place. Sindh has the highest number of assassinations and interestingly these assassinations and political violence are concentrated in the largest city of Karachi. Political parties maintain their militant wings in this city. According to Yusuf, 2012 more than 25% of the country's GDP comes from Karachi, 30% of industrial output, 54% of central government tax revenue and 70% of national income tax revenue. Hence, this relationship is an important one from policy making view point. The following graph by Shapiro et al (2012) depicts casualties per month in major cities of the country.



Karachi Leads Major Pakistani Cities in Casualties from Political Violence

Figure 5 - Political Violence in Pakistani Cities (1988-2010)

#### (Source: Policy Brief by Jacob Shapiro (Princeton) and Saad Gulzar (IGC))

May 12<sup>th</sup>, 2007 was one of the worst days in the history of Karachi. These events left 40 dead, burnt vehicles were seen on main roads and gunmen were seen on rooftops and pedestrian bridges (Ahmad, 2013). Muttahida Qaumi Movement, Pakistan Peoples Party and Awami National Party are the three major political parties in the city on the basis of

ethnicities. On this day, Muttahida Qaumi Movement organized to prevent the arrival of Iftikhar Muhammad Chaudhary, a Supreme Court chief justice deposed by the President, Musharraf. Pakistan Peoples Party and Awami National Party opposed Muttahida Qaumi Movement's plans, Muttahida Qaumi Movement workers were accused of attacking Awami National Party and Pakistan Peoples Party workers leaving forty-three people from Awami National Party/Pakistan Peoples Party killed and fourteen MQM workers were also killed (Yusuf, 2012).

Another political violence which the country saw recently was related to the protests against the democratically elected Prime Minister Nawaz Sharif. These protestors were backed by Imran Khan the leader of second largest political party in the opposition. In August, 2014 these protestors became more active and approximately 30,000 antigovernment protestors were gathered in Islamabad. They demanded Sharif to resign from the office. Finally, at the end of August these protests become violent killing three and injuring hundreds of people (Kronstadt and Kumar, 2014). These events may have an adverse impact on the stock exchange due to disruption in business activities and political instability facing the country.

In summary, Pakistan has suffered from these four main categories of terrorist attacks and violence. In the category of Al-Qaeda/Taliban attacks in the past decade the country saw several evil attacks including the killing of Benazir Bhutto which also resulted in huge financial and political losses, bombing of Marriot hotel in Islamabad which killed foreign nationals as well and last year attack on army run school killing mostly children. In sectarian violence category mostly, attacks have been carried out on Shia and Sunni Muslims and on some occasions other Muslim sects for instance Ahmadis are also attacked. Although, Pakistan's army is considered to be one of the strongest armies in the world however, recently terrorist groups like Al-Qaeda and Taliban were able to successfully attack army facilities. Pakistan Army headquarters which should be one of the most secure places in Pakistan was also the target of one of these attacks. Since its inception political violence is rampant in the country. Major political parties have militant wings amongst them having all kinds of weaponries. They use violence against common man in order to attain power.

In the following chapter I will be discussing the methodology which I used in order to analyze the effect of different categories of terrorism on the Karachi Stock Exchange. I will discuss in detail the model which is used and the data which is collected in order to estimate that model.

# 4. Methodology and Results

Financial time series usually show periods of low volatility and periods of high volatility called volatility clustering or heteroskedasticity (as shown in Figure-7 below of the market index returns of the Karachi Stock Exchange). Conditional expectation of a process given the past is modeled using ARMA models. However, while using ARMA models it is assumed that the conditional variance given the past is constant which is not the case with financial time series. Hence, I have used the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to estimate the effect of the biggest violence and terrorist events category wise on the returns of the Karachi Stock Exchange (Ruppert, 2010).



Figure 6 - Karachi Stock Exchange Market Return

# (Source: http://finance.yahoo.com/q/hp?s=%5EKSE+Historical+Prices)

Under the assumption of volatility clustering or heteroskedasticity Engle (1982) suggested the Autoregressive Conditional Heteroskedasticity (ARCH) model and later on Bollerslev (1986) came up with Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. GARCH (1, 1) is the most widely used specification as shown below.

$$r_t = \mu + \varepsilon_t \tag{1}$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{2}$$

Equation (1) is a mean equation and equation (2) is a variance equation of a Generalized Autoregressive Conditional Heteroskedasticity (GARCH (1, 1)) model. The model is called (1, 1) because the variance equation contains one lagged value of the variance of error term and one lagged value of the squared error term.  $\sigma_1^2$  is the variance of the error term and it is no longer constant. The variable  $\varepsilon_{t-1}^2$  and its coefficient take into account the effect of information on volatility in the last period on the current period's volatility. The variable  $\sigma_{t-1}^2$  takes into account the variance forecasted last period on the current period's volatility. The volatility of market returns is highly persistent when the sum of the coefficients of  $\varepsilon_{t-1}^2$  and  $\sigma_{t-1}^2$  is close to 1. This condition should be met with stock index returns and other financial time series. In order to take into account the systematic effects of terrorist activities on market returns and volatility the baseline Generalized Autoregressive Conditional Heteroskedasticity (GARCH) econometrical model is modified as follows.

$$r_{t} = \mu + \sum \rho_{i} D_{i} + \varepsilon_{t}$$
(3)  
$$\sigma_{t}^{2} = \omega + \alpha \varepsilon_{t-1}^{2} + \beta \sigma_{t-1}^{2} + \sum \lambda_{i} D_{i}$$
(4)

The dependent variable  $r_t$  in equation (3) is daily stock index returns of KSE-100 Index which are calculated as percentage changes in the daily index figures. In equation (3) and (4)  $D_i$  is a dummy variable for a given violence and terrorist event and  $\rho_i$  is the coefficient associated with the dummy. The value of the dummy variable is 1 from the next day of the date of the attack until the following 3 days and 0 for all the other days in the sample. For instance, if an attack occurred on December the 27<sup>th</sup> then the dummy variable is equal to 1 for the three days following the day of the event and is 0 for every other day in the sample. Hence, if the violence and terrorist event adversely impacted the expectations of investors for the companies' future profits then  $\rho_i$  should be negative. Estimation has also been done while setting dummy variables equal to 1 for 10 days after attacks and it resulted in less significant results. This 10 day period has a greater probability of overlapping with some other events which impact returns of the stock exchange. Hence, estimation while setting dummy variables equal to 1 for 3 days after attacks is used as it has a lesser probability of overlapping with other events.

Daily stock index figures for KSE-100 index from January 3, 2005 to August 25, 2015 were taken from http://finance.yahoo.com/q/hp?s=%5EKSE+Historical+Prices. The worst violence and terrorist events category wise were collected from different news websites. The dummy variables used in equations (3) and (4) are described as follows.

#### Dummy variable D1: October 18, 2007, bomb attack on former Prime Minister

Former Prime Minister Benazir Bhutto was returning from a 9 years exile from Dubai. She was being transported from the airport to her residence in the city of Karachi by a big truck decorated with her Party's flags. The convoy was bombed leaving hundreds dead and injured. Most of the dead belonged to Pakistan Peoples Party. Officially Taliban were held responsible for this attack (Gall and Masood, 2007).

#### Dummy variable D2: December 27, 2007, Benazir Bhutto was killed

While campaigning for the upcoming elections in January 2008 in Rawalpindi, Pakistan she was shot dead along with a suicide bomb attack following the shooting. Dozens of people were killed in this incident. This event is one of the worst events in the history of the country as many cities were completely shut down for several days after the killing. Similarly, officially Taliban were held responsible for this attack as she was always openly speaking against them (Naqvi, 2007).

#### Dummy variable D3: October 28, 2009, a car bomb destroyed Peshawar market

It was one of the deadliest attacks from Taliban in the city of Peshawar. It left hundreds dead and injured. It was one of the attacks which Taliban carried out in response to military operation in South Waziristan, an area in the North West of Pakistan ("Car bomb kills 90 in Pakistan city of Peshawar", 2009).

#### Dummy variable D4: December 16, 2014, Taliban attacked an army run school

Again this attack was carried out in the North Western city of Peshawar. All of the militants were foreigners. They entered the school and opened fire on school children and staff. I categorized this attack in the category of Al Qaeda attacks rather than attacks on armed forces as the attack was on children and school staff and not on armed forces directly (Boone and MacAskill, 2014).

#### Dummy variable D5: January 10, 2013, suicide attack in a Shiite neighborhood

A double suicide attack on snooker club happened in the city of Quetta in a predominantly Hazara neighborhood killing almost hundred people (Zafar, 2013).

#### Dummy variable D6: January 21, 2014, bomb exploded in bus of Shiite pilgrims

A bomb planted in a bus carrying Shiite pilgrims exploded in South West of the province of Baluchistan leaving two dozen dead (Shah, 2014).

#### Dummy variable D7: August 16, 2012, shooting of Shiite Muslims in a bus

Around two dozen Shiite Muslims were killed, this time in the North Western city of Mansehra in Pakistan (Hussain, 2012).

#### Dummy variable D8: May 28, 2010, Ahmadi religious minority was attacked

Extremists stormed the mosque of Ahmadi Muslims in the city of Lahore leaving around hundred dead (Mohammaed and Brulliard, 2010).

#### Dummy variable D9: November 2, 2014, Wagah border suicide attack

Wagah border is the border between India and Pakistan. Close to the city of Lahore in Pakistan and Amritsar in India. As the target place is secured by the armed forces of Pakistan, I categorize this attack in the attacks on armed forces. It left more than fifty dead (Boone, 2014).

#### Dummy variable D10: October 11, 2009, attack on Army General Head Quarters

This attack followed a series of bombing by Pakistan Army in the North West of Pakistan. It left approximately two dozen dead (Gallagher, 2009).

#### Dummy variable D11: August 16, 2012, Minhas base of Air Force was attacked

Minhas base at Kamra, Pakistanwas attacked at night. Militants armed with rockets and weapons carried out the attack (Nauman, 2012).

#### Dummy variable D12: May 23, 2011, Navy Mehran base in Karachi was attacked

In the city of Karachi Pakistan's Navy Mehran base was attacked. Later on after 17 hours they were able to counter the attack from militants carrying guns, bombs and rockets (Haque et al, 2011).

#### Dummy variable D13: May 12, 2007, violence in the city of Karachi

This day was one of the worst days in the history of Karachi. Several people were killed as MQM tried to stop former Chief Justice of the Supreme Court to come to Karachi. There were clashes between MQM and other two major political parties of PPP and ANP (Baloch, 2011).

#### Dummy variable D14: September 11, 2013, Karachi city shutdown

Following the arrest of prominent politician violence erupted in the city of Karachi. Various incidents of violence took place and the city was shut down throughout the day (Akhtar, 2013).

#### Dummy variable D15: August 9, 2014, clashes erupt in the city of Lahore

Clashes took place in several cities after clashes between the Police and Qadri's supporters in the city of Lahore. Qadri is a cleric who was criticizing the government of being corrupt and demanded the resignation of the Prime Minister (Bukhari and Tanveer, 2014).

#### Dummy variable D16: August 30, 2014, protests in Islamabad

Later on in the month of August Qadri joined forces with Politician Imran Khan and they were both demanding the resignation of the Prime Minister. Thousands of protestors were gathered in Islamabad marching towards the parliament building and Prime Minister's official residence. The police charged against the protestors which left more than hundred people injured (Haider and Haider, 2014).

#### Dummy variable D17: July 3, 2007, Start of Lal Masjid Operation in Islamabad

Lal masjid came into existence in 1965. It is called Lal because of its red walls and interiors. The leaders of the mosque were associated in spreading terrorism amongst the students. Hence, the government decided to carry out this operation in order to clean up the mess which in turn resulted in several deaths (Gall and Masood, 2007).

#### Dummy variable D18: May 2, 2011, killing of Osama bin Laden

He was living in Abbottabad, Pakistan when US Navy launched a raid at his place and killed him. The operation was conducted from Afghanistan. It would be interesting to see the effect of his killing on the stock market (Thompson, 2011).

The following table summarizes which dummy variables fall into which category.

#### Table 2 - Dummy Variables category wise

Al-Qaeda Attacks	D1, D2, D3, D4
Sectarian violence	D5, D6, D7, D8
Attacks on armed forces	D9, D10, D11, D12
Political violence	D13, D14, D15, D16
Others	D17, D18

I have regressed dummy variables on the independent variable using two equations. The first equation regresses all dummy variables in the categories of Al-Qaeda attacks and sectarian violence and Lal Masjid operation in others category on the return of the Karachi Stock Exchange. Similarly the second equation regresses all dummy variables in the categories of attack on armed forces and political violence and killing of Osama bin Laden in others category on the return of the Karachi Stock Exchange. The results from the first equation are summarized below.

Table 3 – Eq. 1:	<b>GARCH model</b>	with Dummy	Variables (	for 3 days	after attack) <sup>*</sup>

Mean Equation			
Variable	Coefficient	Z-statistic	P-value
Intercept	0.001047*	2.581223	0.0098
D1	-0.007162	-1.549395	0.1213
D2	-0.016938*	-2.289798	0.0220
D3	-0.015857*	-8.695959	0.0000
D4	0.002422	0.163722	0.8699
D5	-0.010534	-0.936501	0.3490
D6	-0.002502*	-2.571089	0.0101
D7	0.003529	0.732598	0.4638
D8	-0.004738	-0.209601	0.8340
D17	-0.004072	-0.499107	0.6177
Variance Equation			
Intercept	0.000114*	5.379749	0.0000
$\varepsilon_{t-1}^2$	0.130400*	5,335888	0.0000
<u>_</u> 2	0.120100	5.555000	0.0000
0 <sub>t-1</sub>	0.438133*	4.713026	0.0000
D1	-0.000129*	-6.699738	0.0000
D2	0.000195	0.919554	0.3578
D3	-0.000132*	-10.59284	0.0000
D4	-0.000138*	-5.601966	0.0000
D5	-1.35E-05	-0.045627	0.9636
D6	-0.000125*	-2.092770	0.0364
D7	-0.000117	-1.006263	0.3143
D8	-0.000124*	-7.772282	0.0000
D17	2.22E-05	0.091363	0.9272
*The second of the second s	-1 - 1 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 -	1	

\*These coefficients are significant at the 5% level

D1=Benazir Bhutto attack; D2=Benazir Bhutto killed; D3= Peshawar market; D4=Army school; D5=Shiite neighborhood; D6=Shiite pilgrims; D7=Shiite muslims; D8=Ahmadis attacked; D17=Lal Masjid

In the above table coefficient indicates percentage change in return if the event occurred. Z-value relates return to the mean return of the exchange. It indicates whether it is below or above the mean and by how many standard deviations. If it's far away from the mean it means that the return is said to be significantly different than the mean. The p-value is the smallest level of significance at which the null hypothesis can be rejected. Hence, if pvalues are less than 0.05 we can reject the null hypothesis of no significant change in return in favor of alternative hypothesis of significant change in return.

Analysis of the mean equation reveals that the killing of former Prime Minister Benazir Bhutto caused the Karachi Stock Exchange to fall by almost 1.7% which is the largest decline relative to all other events. The decline is also significant at the 5% level. In addition, the Peshawar market attack also decreased the index by almost 1.6% and is significant at the 5% level. All the other coefficients are not significant depicting the importance and impact of these two events. In the analysis of the variance equation several coefficients are significant showing negative effects on the volatility of market returns. As Enomoto and Nguyen (2009) explained that due to uncertainty following a terrorist event some investors opt to stay out of the market which results in reduced trading activity and hence reduced volatility.

M D					
Mean Equation					
Variable	Coefficient	Z-statistic	P-value		
Intercept	0.000934*	2.285789	0.0223		
D9	0.005967*	2.542595	0.0110		
D10	0.000750	0.122695	0.9023		
D11	0.003545	0.909699	0.3630		
D12	0.002110	0.235035	0.8142		
D13	-0.004550	-0.991832	0.3213		
D14	0.000300	0.014777	0.9882		
D15	-0.011933	-0.488862	0.6249		
D16	-0.015400	-1.296706	0.1947		
D18	0.001483	0.386080	0.6994		
Variance Equation					
Intercept	0.000113*	5.346322	0.0000		
$\mathcal{E}_{t-1}^2$	0 126859*	5 364695	0.0000		
_2	0.120037	5.501075	0.0000		
$\sigma_{t-1}$	0.448755*	4.849588	0.0000		
D9	-0.000124	-0.875963	0.3811		
D10	-8.37E-05	-0.642149	0.5208		
D11	-0.000117	-1.037729	0.2994		
D12	-0.000125*	-4.900657	0.0000		
D13	-0.000126*	-7.510729	0.0000		
D14	-0.000126	-1.183378	0.2367		
D15	9.18E-05	0.136523	0.8914		
D16	-0.000147	-0.917101	0.3591		
D18	-0.000126*	-2.267227	0.0234		
*These coefficients are significant at the 5% level					
D9=Wagah border; D10=Army HQ; D11=Air Force base; D12=Navy base; D13=Karachi					
violence; D14=Karachi shutdown; D15=Lahore clashes; D16=Islamabad protests;					
D18=Osama bin Lader	1		-		

#### Table 4 - Eq. 2: GARCH model with Dummy Variables (for 3 days after attack)\*

The results from the second equation are summarized in the above table. In the mean equation only the coefficient of Wagah border attack is significant and shows a positive increase in return of the Karachi Stock Exchange of about 0.60%. It could be due to signing of mega investment deals with China which took place few days back. In the variance equation some coefficients are significant depicting the same phenomenon of investors pulling out of the market and hence reducing the volatility.

Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model has also been estimated when the dummy variable took a value of 1 for 10 days following the act of terrorism and 0 for all other days. Due to less efficient stock market it could take more time for the market to reflect the reality in prices after a terrorist event (Enomoto and Nguyen, 2009). The new estimates are presented in Table 5 and Table 6 below.

<b>Fable 5 - Eq. 1: GARCH model with Dum</b>	my Variables (for 10 days after attack)*
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Mean Equation			
Variable	Coefficient	Z-statistic	P-value
Intercept	0.001594*	8.363151	0.0000
D1	-0.006504	-1.238973	0.2154
D2	-0.011040	-1.629211	0.1033
D3	-0.005533	-1.010344	0.3123
D4	0.006176*	2.185453	0.0289
D5	0.000639	0.079331	0.9368
D6	-0.003427	-1.395076	0.1630
D7	0.000121	0.066028	0.9474
D8	-0.005072	-1.325399	0.1850
D17	-0.003206	-1.000743	0.3170
Variance Equation			
Intercept	7.15e <sup>-06</sup> *	14.89743	0.0000
$\mathcal{E}_{t-1}^2$	0.188312*	13.45076	0.0000
$\sigma_{t-1}^2$	0.771221*	63.23807	0.0000
D1	3.76e <sup>-05</sup>	0.987414	0.3234
D2	0.000136	1.599130	0.1098
D3	$1.92e^{-05}$	0.364184	0.7157
D4	-1.08e <sup>-05</sup>	-1.215632	0.2241
D5	9.11e <sup>-06</sup>	0.353188	0.7239
D6	-1.09e <sup>-06</sup>	-0.140021	0.8886
D7	-5.59e <sup>-06</sup>	-0.687492	0.4918
D8	$1.80e^{-05}$	0.992830	0.3208
D17	6.44e <sup>-08</sup>	0.008041	0.9936
	· · · · · · · · · · · · · · · · · · ·	1	

\*These coefficients are significant at the 5% level

D1=Benazir Bhutto attack; D2=Benazir Bhutto killed; D3= Peshawar market; D4=Army school; D5=Shiite neighborhood; D6=Shiite pilgrims; D7=Shiite muslims; D8=Ahmadis attacked; D17=Lal Masjid

Mean Equation				
Variable	Coefficient	Z-statistic	P-value	
Intercept	0.001614*	8.517557	0.0000	
D9	-5.91e <sup>-05</sup>	-0.034743	0.9723	
D10	-0.008919	-1.241681	0.2144	
D11	7.16e <sup>-05</sup>	0.044377	0.9646	
D12	0.000140	0.084390	0.9327	
D13	0.002888	1.136039	0.2559	
D14	-0.001469	-0.386042	0.6995	
D15	-0.008725	-0.677659	0.4980	
D16	0.003615*	7.380850	0.0000	
D18	-0.001415	-0.471536	0.6373	
Variance Equation				
Intercept	$1.71e^{-05*}$	15.44242	0.0000	
$\mathcal{E}_{t-1}^2$	0.274944*	12.51027	0.0000	
$\sigma_{t-1}^2$	0.674051*	41.00533	0.0000	
D9	-1.45e <sup>-05</sup> *	-3.941712	0.0001	
D10	$7.44e^{-05}$	0.707769	0.4791	
D11	-1.05e <sup>-05</sup>	-1.336283	0.1815	
D12	-8.39e <sup>-06</sup>	-1.182086	0.2372	
D13	$-1.31e^{-05}$	-1.054612	0.2916	
D14	$2.44e^{-05}$	0.786270	0.4317	
D15	$7.22e^{-05}$	0.541069	0.5885	
D16	$-2.23e^{-05*}$	-3.055711	0.0022	
D18	$7.09e^{-06}$	0.361951	0.7174	
*These coefficients are significant at the 5% level				

#### Table 6 - Eq. 2: GARCH model with Dummy Variables (for 10 days after attack)\*

D9=Wagah border; D10=Army HQ; D11=Air Force base; D12=Navy base; D13=Karachi violence; D14=Karachi shutdown; D15=Lahore clashes; D16=Islamabad protests; D18=Osama bin Laden

As expected the killing of the former Prime Minister still reduced returns on the Karachi Stock Exchange. However, the effect is not as big as the effect with 3 days regression. Similarly, fewer coefficients in the variance equation are significant. This is because investors had already incorporated the information and revised their expectations. In the next section I would conclude my study with measures the government would be able to take in the future in order to mitigate adverse impact of such violence and terrorist events.

## **5.** Conclusions

As expected the category of Al Qaeda attacks had the greatest impact on the Karachi Stock Exchange. Within Al Qaeda attacks category the killing of former Prime Minister Benazir Bhutto and Peshawar market attack caused the index to decline by 1.7% and 1.6% respectively. In addition, events in other categories did not significantly impact the index. Although, it was expected that political violence category would significantly impact the index. Plausibly, the explanation could be that these events were confined to a single city and also when these events took place it overlapped with some other events which impacted the index positively. From these results it is clear that the index is only impacted significantly by events which create a national impact and cause significant disruption in the business activity. The killing of Benazir Bhutto resulted in shutting down of several major cities for around five consecutive days. During this time business activity was completely halted and therefore it adversely impacted the index. Similarly, the attack on Peshawar market was also devastating although it is not considered to have as far reaching impacts as Benazir Bhutto killing.

As detailed by Johnston and Nedelescu (2005) in response to such attacks associated with Al Qaeda the government needs to undertake coordinated monetary, financial and fiscal measures in order to restore confidence within and outside financial markets. Two other important aspects which they highlighted in case of such events are operational risk mitigation and countering terrorist financing.

In the aftermath of the killing of Benazir Bhutto unknown groups of people started to loot banks, set fire on cars and caused other disruptions in several cities of the country. This brought the whole system to a halt. All these incidents resulted in the loss of investor confidence which in turn caused decline in the index. On a high level, financial institutions should have proper business continuity plans in place and should be in a position to restore operations from back up sites. The State Bank of Pakistan has very strict business continuity planning guidelines for financial institutions which should be followed strictly by institutions. Concentration of critical functions such as clearing and settlement of funds should be avoided at all costs. There should be multiple layers of redundancy corresponding to different emergency levels (Johnston and Nedelescu, 2005). In addition, there should be triggers built into the stock market which triggers in case of extraordinary circumstances. In the aftermath of 9/11 Federal Reserve provided instruments in order to maintain sufficient liquidity and ensured payment systems were operational (Ferguson, 2003). According to Securities and Exchange Commission of Pakistan report on stock market crisis 2008 it was decided to take several steps like circuit breakers (the trading in the shares would be halted for the day if it declined by more than 1% or increase by more than 10%) and prohibition of short selling in order to ensure stability of the stock exchange. I believe there are more efforts needed in order to keep intact the confidence of investors. In the same report there was a proposal to set up a market stability fund of PKR 30 Billion which would be triggered and provide liquidity under extreme cases which was never set up. Hence, under volatile circumstances the policy makers should deploy such instruments to provide liquidity. Due to lack of such instruments investors are not confident to keep their investments in the market which in turn results in flight of capital from the market some of which never returns. In addition, the Government of Pakistan, the State Bank of Pakistan and the Securities and Exchange Commission of Pakistan should come up with a coordinated response. Generally, under such scenarios expansionary monetary and fiscal policies are recommended along with provision of liquidity to the financial markets participants.

The Government of Pakistan should focus more on countering Al-Qaeda attacks as they cause the exchange to decline the most. The government and law enforcement agencies of the country failed to counter such attacks. In Bhutto's killing the government and armed forces were caught off guard. In particular, post event armed forces were nonexistent while angry mobs were destroying public and private assets. Therefore, coordinated effort is needed to mitigate the effect on the exchange. Post 9/11 government agencies bailed out industries affected by the attacks. Direct government assistance was provided to insurance and airline industries (Johnston and Nedelescu, 2005). After the killing of Bhutto banking, transportation, insurance industries and some multinational companies suffered huge losses. To restore confidence and stability the Government of Pakistan could have provided some sort of financial assistance to these industries.

While working on this study I faced several challenges. Firstly, the number of studies done in the past on this subject is limited. Secondly, it was not easy to divide violence and terrorist events into categories as several events overlapped in terms of categories. In addition, selecting appropriate violence and terrorist events for the regression was also a challenge. Thirdly, it was difficult to decide which variables to study and finally I decided to study the return of the Karachi Stock Exchange. Future researchers can use my research as a basis and can do the same research with more narrowly or broadly defined categories. The events which I analyzed could be replaced with other significant events which took place. Event study methodology could also be applied instead of using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to analyze the impact; it would be interesting to compare the results of the two. Last but not the least, other economic variables could be used rather than the return of the Karachi Stock Exchange such as FDI or exports.

# Appendix

Categories of Violence and Terrorist events

#### • Al-Qaeda/Taliban attacks

October 18 2007: Former Prime Minister Benazir Bhutto was returning from a 9 years exile from Dubai. The convoy was bombed leaving hundreds dead and injured. Most of the dead belonged to Pakistan Peoples Party.

December 27 2007: She was later killed in another gun and twin suicide bomb attack.

October 28 2009: A car bomb destroyed a Peshawar (North Western city of Pakistan) market, 125 people were killed.

December 16 2014: Taliban insurgents storm an army-run school in Peshawar, killing at least 141 people, almost all of them children.

### • Sectarian Violence

January 10 2013: A double suicide attack on snooker club happened in the city of Quetta in a predominantly Hazara neighborhood killing almost hundred people.

January 21 2014: A bomb planted in a bus carrying Shiite pilgrims exploded in South West of the province of Baluchistan leaving two dozen dead.

August 16 2012: Around two dozen Shiite Muslims were killed, this time in the North Western city of Mansehra in Pakistan.

May 28 2010: Extremists stormed the mosque of Ahmadi Muslims in the city of Lahore leaving around hundred dead.

### • Attacks on Armed Forces

2 November 2014: Wagah border is the border between India and Pakistan. Close to the city of Lahore in Pakistan and Amritsar in India. It left more than fifty dead.

10–11 October 2009: This attack followed a series of bombing by Pakistan Army in the North West of Pakistan. It left approximately two dozen dead.

16 August: Minhas base at Kamra, Pakistanwas attacked at night. Militants armed with rockets and weapons carried out the attack.

23 May 2011: In the city of Karachi Pakistan's Navy Mehran base was attacked. Later on after 17 hours they were able to counter the attack from militants carrying guns, bombs and rockets.

#### • Political Violence

12 May 2007: This day was one of the worst days in the history of Karachi. Several people were killed as Muttahida Qaumi Movement (MQM) tried to stop former Chief Justice of the Supreme Court to come to Karachi.

11 September 2013: Following the arrest of prominent politician violence erupted in the city of Karachi.

9 August 2014: Clashes took place in several cities after clashes between the Police and Qadri's supporters in the city of Lahore.

30 August 2014: Later on in the month of August Qadri joined forces with Politician Imran Khan and they were both demanding the resignation of the Prime Minister.

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