

The Effects of Terrorism on Turkish Stock Market

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ABSTRACT

This paper uses daily data to analyze how Turkish stock market reacted to terror attacks that took place between 1996 and 2007 in Turkey and September 11, 2001 in the United States. Two different methodologies are used. The first one is abnormal returns methodology, and the second one is time series analysis. Although, some of the events in our sample experienced high negative returns, most events do not have statistically significant abnormal returns (ARs) for the event day ($t=0$). For longer event windows, from the event date to 5 days following the event ($t=+5$) and from the event date to 10 days following the event ($t=+10$) the cumulative abnormal returns (CARs) are calculated. CARs are higher than the event day ARs for most of the events. This implies that the stock market continued to decline the following days. On the other hand, the volatility models used for the analysis revealed that Turkish stock market is sensitive to terrorist attacks.

Keywords: Stock market, volatility, abnormal returns, terrorism

ÖZET

Bu çalışmada 1996 ile 2007 tarihleri arasında Türkiye'de ve 11 Eylül 2001 tarihinde Amerika Birleşik Devletleri'nde gerçekleşen terörist saldırıların Türk Hisse Senedi Piyasası üzerindeki etkileri analiz edilmiştir. İki farklı analiz yöntemi kullanılmıştır. Bu yöntemlerden ilki olay etüdü yöntemi diğeri ise zaman serisi analizidir. Örneklem üzerinde bazı terör olayları yüksek negatif getiriye sebep olurken, çoğu terör olayı, terör olayının gerçekleştiği gün için ($t=0$) istatistiksel olarak anlamlı anormal getiri (ARs) oluşturmamıştır. Daha uzun olay pencereleri için, olay gününden 5 gün sonrasına ($t=+5$) ve olay gününden 10 gün sonrasına ($t=+10$) kadar kümülatif anormal getiriler (CARs) hesaplanmıştır. Çoğu terör olayı için kümülatif anormal getiriler olay günü için hesaplanmış olan anormal getirilerden daha yüksek çıkmıştır. Bu sonuç hisse senedi piyasasının terör olayını takip eden günlerde düşmeye devam ettiğini göstermiştir. Zaman serisi analizlerinde kullanılan oynaklık (volatilité) modelleri ise Türk Hisse Senedi Piyasasının terör saldırılarına duyarlı olduğunu göstermiştir.

Anahtar Kelimeler: Hisse senedi piyasası, oynaklık, anormal getiri, terörizm

1. INTRODUCTION

The definition of terrorism is controversial. There is no universally agreed definition for it. Different legal systems and government agencies use different definitions. According to a definition taken from Republic of Turkey Ministry of Foreign Affairs: "Terrorism is the use or the threat of the use of violence, a method of combat or a strategy to achieve certain targets, that it aims to induce a state of fear in the victim, that it is ruthless and does not conform with humanitarian rules, and publicity is an essential factor in the terrorist strategy" (Republic of Turkey Ministry of Foreign Affairs, http://www.mfa.gov.tr/what-is-terrorism_---the-problem-of-definition.en.mfa, 24.04.2013).

There are different organizations carrying out terrorist acts in Turkey. The PKK¹ is one of them. Since 1984, there have been a series of attacks carried out by PKK which resulted in the death of many

Turkish citizens. Al-Qaeda and DHKP/C are other terrorist organizations in Turkey. Suicide attacks are trends in terrorism that deserves special attention. In the history, different terrorist organizations employed suicide-bombing methods in Turkey. In 2003, a total of 58 people lost their lives and 753 others were injured in 4 different suicide attacks in Istanbul. Al-Qaeda claimed responsibility for these bombings. Before this period, the PKK KONGRA/GEL and DHKP/C terrorist organizations carried out lots of suicide attacks in different locations of Turkey in the 1990's. This paper explores the ways in which Turkish stock market reacted to the terror attacks. Table 1 shows the suicide bombing chronology in Turkey between 1996 and 2001.

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Table 1: Suicide Bombing Chronology in Turkey between 1996 and 2001

	Date	Place of Incident	Organization	Dead	Wounded
1*	30.06.1996	TUNCELI	PKK KONGRA/ GEL	8	29
2*	04.08.1996	HAKKARI	PKK KONGRA/ GEL	1	3
3	25.10.1996	ADANA	PKK KONGRA/ GEL	4	12
4*	29.10.1996	SIVAS	PKK KONGRA/ GEL	4	10
5	17.11.1998	HAKKARI	PKK KONGRA/ GEL		5
6	01.12.1998	DIYARBAKIR	PKK KONGRA/ GEL		10
7	24.12.1998	VAN	PKK KONGRA/ GEL		24
8	04.03.1999	BATMAN	PKK KONGRA/ GEL		1
9*	20.03.1999	VAN-BASKALE	PKK KONGRA/ GEL		3
10*	27.03.1999	ISTANBUL	PKK KONGRA/ GEL		11
11	05.04.1999	BINGOL-GOVERNOR	PKK KONGRA/ GEL		12
12	08.04.1999	HAKKARI- GOVERNOR	PKK KONGRA/ GEL		8
13	02.06.1999	SIRNAK	PKK KONGRA/ GEL		1
14	05.07.1999	ADANA	PKK KONGRA/ GEL		14
15*	03.03.2001	ISTANBUL	DHKP/C		7
16	10.09.2001	ISTANBUL	DHKP/C		21
17*	15.11.2003	ISTANBUL(NEVE SHALOM)	Al-Qaeda	13	186
18*	15.11.2003	ISTANBUL(BETH ISRAEL)	Al-Qaeda	13	117
19	20.11.2003	ISTANBUL(HSBC BANK)	Al-Qaeda	14	192
20	20.11.2003	ISTANBUL(BRITISH CONSULATE)	Al-Qaeda	18	258
21	22.05.2007	ANKARA(ANAFARTALAR SHOPPING MALL)	PKK KONGRA/GEL (Under Inspection)	6	91

(Resource: Center Of Excellence Defense Against Terrorism, "Special Report No: 9, 4th June 2007, Ankara Suicide Bombing Overview", <http://www.tmmm.tsk.tr/anasayfa.htm> (24.04.2013). "*" Shows the terror events that took place during the weekends.)

Terrorism affects the global economy and financial markets by reducing confidence and increasing the risk aversion of consumers and firms, by lowering consumption and real investment activity, by triggering economic slowdown, and by spilling over to other stock markets, bond markets, currency and even other commodity markets. For investors, corporations and government policymakers, it is critical to understand the magnitude of the effects of terrorist acts. Economists and others have tried to calculate the economic impact of terrorism for years but there is still little known about the financial consequences of terrorism.

The effect of the impact of the September 11 terrorist attacks on stock markets has revealed that terrorism risk is a new type of catastrophic risk that investors may be facing. Since, the prices of stocks reflect investors' hopes and fears about the future, terrorist attacks and other unforeseen disastrous occurrences can have serious implications for stocks. So, it seems logical to investigate the response of stock market to terrorist attacks. The intention of this paper is to provide a deeper understanding of the impact of this

risk on the behavior of Turkish stock market.

In this paper we focus on the effects of terrorism on Turkish stock market returns and volatilities. Two different methodologies are used. The first one is abnormal returns methodology, and the second one is time series analysis. Although, some of the events in our sample experienced high negative returns, most events do not have statistically significant abnormal returns (ARs) for the event day ($t=0$). For longer event windows, from the event date to 5 days following the event ($t= + 5$) and from the event date to 10 days following the event ($t= + 10$) the cumulative abnormal returns (CARs) are calculated. CARs are higher than the event day ARs for most of the events. This implies that the stock market continued to decline the following days. On the other hand, the volatility models used for the analysis revealed that Turkish stock market is sensitive to terrorist attacks. The remainder of this paper continues as follows. After an overview of relevant literature in Section 2, Section 3 provides data and discusses methodological issues. We finish by summarizing our main findings.

2. LITERATURE

We can classify the studies about the the impact of terrorism on the economy in two groups. The first group of studies concentrate on a specific type of economic activity and the second group concentrate on the economy of a specific country. Abadie and Gardeazabal (2005) study the impact of terrorism on the economy. They find that terrorism increases the perception of risk and decrease the expected returns which as a result affects the allocation of investment capital. In their study, they show that when terrorism risk in a country increases, foreign direct investment significantly decreases. Enders and Sandler (1996) find losses in foreign direct investment for Greece and Spain because of negative effects of terrorism. Similarly, Enders, Sandler and Parise (1992) study the effects of terrorism on tourism sector and report that terrorism significantly reduces tourism in Greece, Italy, and Austria. Abadie and Gardeazabal (2003) study the economic impact of ETA terrorism in Spain. Eckstein and Tsiddon (2004) study the effects of terrorist attacks on the Israeli economy. They all present evidence of negative economic impact of the terrorism.

Chen and Siems (2004) measure the impact of terrorism on equity indices around the world using an event study methodology. They select 14 terrorist and military attacks that dated back to 1915, from the Significant Terrorist Incidents list published by the US Department of State (2001) and a list from the Constitutional Rights Foundation (2001). The impact of terrorist events which occurred on September 11, 2001 is widely studied in finance literature. Chen and Siems (2004) also study the effects of September 11th terrorist attacks for 33 capital markets located around the world. They show that though the effect of terrorist events varies from country to country, it generally yields negative and significant abnormal returns. The influence of terrorist events on major stock exchanges is also transitory, lasting just one to three days for most major events. Interestingly, they find evidence that US capital markets seem to recover sooner from the terrorist attacks than other global capital markets.

A study conducted by Eldor and Melnick (2004) examine how stock and foreign exchange markets react to terrorism in Israel. They study 639 terror attacks during the period from 1990 to 2003 and classify the data by location, target, type of attack and number of casualties. They show that suicide attacks has a permanent effect on both the stock and foreign exchange market, as do the numbers of people injured and killed but the location of a terror attack has no effect on either market.

Johnston and Nedelescu (2005) examine cases where financial markets are directly or indirectly affected by terrorist acts. They review the reaction of the markets to the September 11, 2001 attacks in the US and attacks in Madrid in March 11, 2004. They conclude that terrorist attacks in US and Madrid created uncertainty and volatility in the financial markets. However, there are some differences in the stock market reaction to these two terrorist events. While attacks in Madrid were perceived as mostly having a regional effect, those in New York were seen as having global effect.

Arin, Ciferri, and Spagnolo (2008) shows interesting results in relation to the effect of terrorist events on the markets' behavior based on the evidence from six different financial markets (Indonesia, Israel, Spain, Thailand, Turkey and UK). In their work, the authors investigate the effects of terrorism on both stock markets and the stock market volatility. They found that the magnitude of terrorist effects is larger in emerging markets.

A very recent paper by Berrebi and Klor (2010) analyses whether or not terrorism affects companies in the defense and security-related industries differently than it does companies in other economic sectors. Their findings show that terrorism has a positive effect on the stock-market valuation of companies involved with defense, security or anti-terrorism products or clients, and a significantly negative effect on that of other companies.

Hon, Strauss, Yong (2004) and Mun (2005) analyze whether the terrorist attack resulted in a change in correlation across global financial markets. Glaser and Weber (2006) focus on how the terrorist attack influenced expected returns and volatility forecasts of individual investors by using questionnaire data. They find that the stock return forecasts of individual investors are higher and the differences of opinion lower after the terrorist attacks. They also report an increase in investors' volatility expectations. Chuliáa, Climent, Soriano, and Torrób (2009) analyze the volatility transmission between the US and Eurozone stock markets considering the financial market responses to the September 11, March 11 and July 7 terrorist attacks. They find bidirectional and asymmetric volatility transmission between the markets.

3. DATA AND METHODOLOGY

The daily data used in this study was obtained from Borsa Istanbul BIST 100 Index (XU100). The actual time period under study ranges from 1996 to 2007. We use two methodologies to evaluate the impact of terrorist attacks on stock market returns. The first one is abnormal returns methodology, and the second one is time series analysis. For this study, a total of 13 events were selected. The events are listed in Table 1. We also include September 11th terrorist attacks in the United States in our analysis. The terror events that took place during the weekend are not included in the analysis.

September 11th terrorist attacks were a series of four coordinated terrorist attacks launched by the terrorist group Al-Qaeda upon the United States in New York City and the Washington, D.C. areas on September 11, 2001. Major economic effects arose from the September 11 attacks, with initial shock causing global stock markets to drop sharply. The New York Stock exchange, The London Stock Exchange and other stock exchanges around the world were closed after these terrorist attacks. Turkish stock market (Istanbul Stock Exchange) was also closed following the event day September 12, 2001.

For our analysis, we first define attack as a dummy variable that is either 0 or 1 (if a terrorist attack takes place on day t, attack = 1, if there is no a terrorist attack on day t, attack = 0). Based on this, we construct a terror index for our sample within the period specified. Our terrorist attack series is then matched with the stock market series, and the days that meet both conditions – significant abnormal return and a terrorist attack on the same day – are analyzed.

Daily return is calculated as the percentage logarithmic change in the value of index compared to previous day's closing value as in the following:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) * 100$$

Skewness is a measure of asymmetry of the distribution of the series around its mean. The skewness of a symmetric distribution, such as the normal distribution, is zero. A positive (/negative)

skewness suggests a higher (/lower) than normal distribution chance of higher (/lower) than mean return. Kurtosis measures the peakedness or flatness of the distribution of the return series. A normal distribution has a kurtosis value equal to three. If it exceeds three, the distribution is peaked relative to the normal; on the other hand, if it is less than three, the distribution is flat relative to the normal. Hence, it captures the excess probability of abnormal returns, regardless of the sign of the returns. Jarque-Bera is a statistic for testing whether the series are normally distributed and measures the difference of the skewness and kurtosis of the series with those from the normal distribution.

Table 2: Descriptive Statistics for Daily Stock Market Returns and Stock Market Abnormal Returns

	Stock Market Abnormal Return	Stock Market Return
Mean	-0.002813	0.152206
Median	-0.006111	0.1554
Maximum	18.28693	17.77358
Minimum	-19.65826	-19.97851
Std. Dev.	2.934468	2.858201
Skewness	0.003339	-0.063022
Kurtosis	7.737881	7.911366
Jarque-Bera	2715.22	2919.62
Probability	0	0
Sum	-8.166095	441.8533
Sum Sq. Dev.	24989.42	23707.35
Observations	2903	2903

Table 2 gives the descriptive statistics for daily stock market returns and stock market abnormal returns for the entire period. As it can be noticed from Table 2, the kurtosis exceeds three. High Jarque-Bera test statistics strongly suggests a rejection of normality. The volatility of the returns in terms of standard deviation is high. Figure 1 shows the graph of XU100 daily closing prices. Figure 2 shows XU100 daily returns. A visual perspective on the volatility of returns can also be gained from the plots of daily returns in Figure 2. It should be noted that returns are time varying with volatility clusters. Figure 3 shows the stock market abnormal returns.

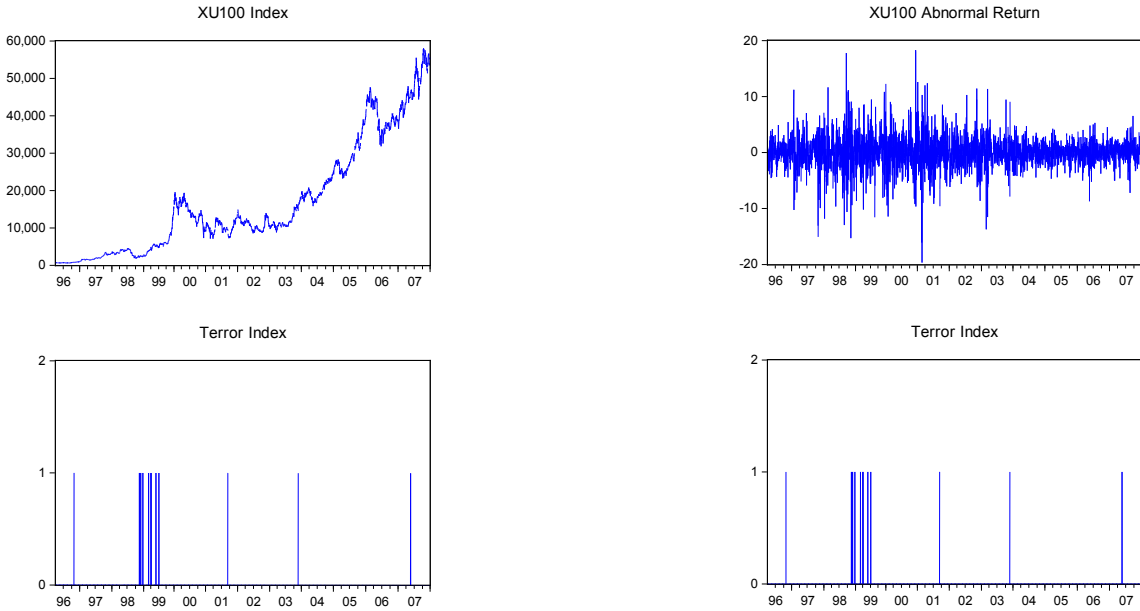


Figure 3: Stock Market Abnormal Returns and Terror Index

Figure 1: Time Series Plots of Daily Close and Terror Index

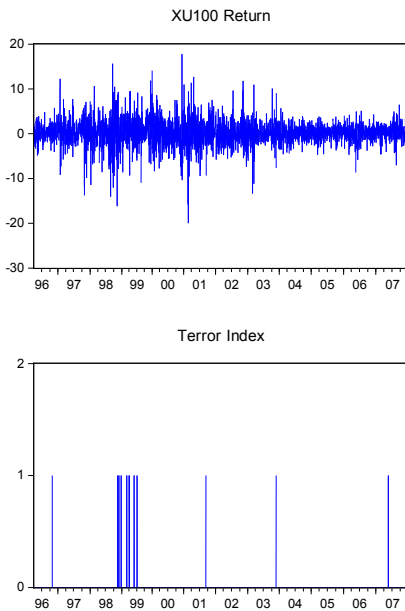


Figure 2: Stock Market Returns And Terror Index

3.1. The Abnormal Returns Analysis

As a first approach for our analysis, we wonder what immediate effects can be expected as a consequence of a terrorist attack. To answer this question, we follow the approach that Chen and Siems (2004) propose for day-event-study analysis. Daily excess returns were measured by the mean-adjusted returns approach; that is, for each day t , and following, the event, we computed

$$AR_t = R_t - \bar{R}$$

Where \bar{R} the simple average of XU100's daily returns in the $(-30, -11)$ estimation period. AR_t is the abnormal return for XU100 at time t . \bar{R} is computed as follows:

$$\bar{R} = \frac{1}{20} \sum_{t=-30}^{-11} R_t$$

The date of the event is $t=0$, the mean adjusted returns model is estimated over 20 days, from $t = -30$ to $t = -11$ relative to the event date. The main event window under study is the event date itself ($t = 0$).

The statistical significance of the event period abnormal returns was computed for each sample using the test statistics described by Brown and Warner (1985). We use a standardized abnormal return (SAR) where each abnormal security return is normalized by its estimation period standard deviation:

$$SAR_t = \frac{AR_t}{SD(AR_t)}$$

The standard deviation $SD(AR_t)$ of each abnormal return is given by:

$$SD(AR_t) = \sqrt{\frac{1}{T_0 - 1} \sum_{t=1}^{T_0} AR_t^2}$$

Where T_0 is the number of days in the estimation period. The standard deviation for calculating t statistics to assess significance is also defined within a (-30, -11) days window.

$$SD(AR_t) = \sqrt{\frac{1}{19} \sum_{t=-30}^{-11} AR_t^2}$$

Of the 13 terrorist/military attacks listed in Table 3, 9 events experienced negative abnormal returns (ARs) on the day of the event (t=0). Four events with positive event-day ARs were the bombing in Van on December 24, 1998, Bingöl Governor on April 5, 1999, Adana on July 5, 1999, and Ankara on May 22, 2007. Only one event had negative AR that was significantly different from zero at the 0.05 level, which was in Istanbul on November 20, 2003.

There may be two situations after a terrorist attack which causes social uncertainty and fear (Chen and Siems, 2004: 352). In the first situation, uncertainties and fear caused by the terrorist attack may continue the

following days which causes the decline of stock prices and the increase of volatility. In the second situation, declarations and policy actions of authorities can make the markets stable. In order to study how well and how quickly the market absorbed the news, two longer event windows, from the event date to 5 days following the event (t= + 5) and from the event date to 10 days following the event (t= + 10) are defined by following Chen and Siems (2004). For these longer event windows we also compute the cumulative abnormal returns (CARs). The statistical significance of the event period abnormal returns was computed for each sample using the test statistics described by Brown and Warner (1985) (see Chen and Siems, 2004, pg. 352). By cumulating the periodic abnormal return over six days, we obtain the six day cumulative abnormal return, $CAR6_t$. The t-statistic for the six day cumulative abnormal return ($CAR6$) is obtained by dividing $CAR6_t$ by the standard deviation of the six day cumulative abnormal return, $SD(CAR6_t)$. In the same way, we calculate $CAR11_t$ and t-statistics t_{CAR11_t} .

$$CAR6 = \sum_{t=0}^5 AR_t \quad t_{CAR6_t} = \frac{CAR6_t}{SD(CAR6_t)}$$

$$CAR11 = \sum_{t=0}^{10} AR_t \quad t_{CAR11_t} = \frac{CAR11_t}{SD(CAR11_t)}$$

Table 3: Abnormal Returns, Cumulative Abnormal Returns and t-Statistics

Date Place of Incident Organization	AR	SAR	CAR6		CAR11	
25.10.1996 ADANA PKK KONGRA/ GEL	-1.9246	-1.0304	-6.4262	-4.2438*	-8.1771	-5.7403*
17.11.1998 HAKKARI PKK KONGRA/ GEL	-3.8178	-0.8084	-3.5291	-0.5886	-0.5571	-0.1197
01.12.1998 DIYARBAKIR PKK KONGRA/ GEL	-2.86425	-0.6422	-6.8494	-2.7928*	-11.8486	-5.3228*
24.12.1998 VAN PKK KONGRA/ GEL	0.3527	0.0824	2.1801	0.9419	6.9995	2.2982*
04.03.1999 BATMAN PKK KONGRA/ GEL	-5.3007	-1.4920	-7.1266	-2.2276	-14.9643	-4.9868*
05.04.1999 BINGOL-GOVERNOR PKK KONGRA/ GEL	1.8384	0.5472	-9.5288	-2.7045*	-9.5406	-1.8439
08.04.1999 HAKKARI- GOVERNOR PKK KONGRA/ GEL	-4.4953	-1.5349	-17.0329	-2.7162*	-5.0094	-0.8514

02.06.1999 SIRNAK PKK KONGRA/ GEL	-4.1743	-1.3316	0.0625	0.0171	-2.8202	-0.8357
05.07.1999 ADANA PKK KONGRA/ GEL	3.5951	1.0915	14.9602	3.0670*	21.4242	5.3982*
10.09.2001 ISTANBUL DHKP/C	-1.1680	-0.5505	-22.6480	-6.4141*	-23.9251	-6.3465*
11.09.2001 NEW YORK Al-Qaeda	-2.5036	-1.1670	-18.7226	-4.2808*	-22.7571	-5.7495*
20.11.2003 ISTANBUL (HSBC BANK) ISTANBUL (BRITISH CONSULATE) Al-Qaeda	-7.8678	-2.8146*	3.7067	0.6865	5.5586	1.3998
22.05.2007 ANKARA (ANAFARTALAR SHOPPING MALL) PKK KONGRA/GEL (Under Inspection)	0.4746	0.2476	2.2855	3.3148*	1.5425	1.4492

(Note: The symbol "*" denotes the statistical significance at the 0.05 level. (for SAR, $t_{19,0.025} = 2.093$, for CAR6, $t_{5,0.025} = 2.571$, for CAR11, $t_{10,0.025} = 2.228$)

When we look at the Table 3, eight events have negative CAR6s. The t-statistics reveal that six of the events (having negative CAR6s) are significant. It is also noticeable from Table 3 that the CAR6 is higher than the event day AR for most of the events. This implies that the market continued to decline the following five days. The reaction of Turkish authorities or the public in any way to the terror attack may introduce new information that will affect market prices. This may explain the negative significant CARs after terrorist attacks especially sourced by PKK KONGRA/GEL.

3.2. The Istanbul Attacks

The results of event study show that only one terrorist event 20.11.2003, which took place in Istanbul (Al-Qaeda, 32 dead, 450 wounded) has statistically significant abnormal return. In order to understand whether there is an investor sensitivity to the terrorist events that took place especially in Istanbul we study two more cases: 13.03.1999, Istanbul, Mavi Çarşı², (PKK, 13 people dead) and 27.07.2008, Istanbul, Güngören³ (18 people dead, 154 wounded). In these two cases, the terrorist attacks were not a suicide attack. Since both events took place at the weekends, we couldn't calculate abnormal return for the event day (t=0) but we calculate CAR6 and CAR11. Our

results show positive significant reaction of the ISE after the July 2008 attacks ($CAR6 = 15.05$, $CAR6_t = 8.94$, $CAR11 = 9.56$, $CAR11_t = 3.71$). The results also show negative significant CAR11 and negative insignificant CAR6 for ISE ($CAR6 = -6.68$, $CAR6_t = -1.87$, $CAR11 = -8.60$, $CAR11_t = -2.84$) after the March 1999 attack which is carried out by PKK. The results for these two cases do not give direct evidence for investor sensitivity to terrorist attacks especially for city Istanbul.

3.3. The Time Series Analysis

As a second approach for our analysis, we try to answer whether the effect of a terrorist attack has an impact on stock market volatility. In our study we apply generalized autoregressive conditional heteroscedasticity (GARCH) model proposed by Bollerslev (1986) which allows for the conditional variance to be linearly dependent on the past behavior of the squared residuals and a moving average of the past conditional variances. The lagged squared error terms imply that if past errors have been large in absolute value, they are likely to be large in the present, leading to volatility clustering. The model used here will follow the simple GARCH (1,1).

$$R_t = \beta_0 + \beta_1 R_{t-1} + m_1 D_{1,t} + \varepsilon_t$$

$$\varepsilon_t | \Omega_{t-1} \sim N(0, h_t)$$

$$h_t = \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^p \beta_j h_{t-j} + V_1 D_{(1,t)} + V_c$$

R_t is the XU100 index return on day t . $D_{1,t}$ is the attack dummies that is either 0 or 1. ε_t is the random error term for day t . If m_1 is negative and significant, this suggests that the average return on attack day is significantly lower than zero. We model the conditional variability of index returns by incorporating the attack effect into our volatility equation. The coefficient V_1 represents the volatility on attack day. If V_1 is positive and significant, this suggests that the volatility on attack day is significantly higher than zero. This specification requires $\alpha_i + \beta_j < 1$ in order satisfying the non-explosiveness of the conditional variance. This sum also indicates the level of persistence in the volatility shocks. A sum close to unity is favorable for providing evidence of a persistent volatility process (Bollerslev 1986). Each α_i, β_j, V_c has to be positive in order to satisfy the non-negativity of conditional variances for each given time t .

The results of GARCH (1,1) and modified GARCH (1,1) are reported on Table 4. Attack variable (m_1) is significant as well as negative (-0.924787) in GARCH (1,1) equation. When the modified GARCH (1,1) is estimated, the coefficient (3.269457) of attack variable (V_1) for volatility equation is also significant and positive. On the basis of the obtained results, the evidence indicates that terror attacks significantly affect stock market volatility and stock market returns.

Table 4:Regression Results for GARCH(1,1) and Modified GARCH(1,1)

GARCH(1,1)			Modified GARCH(1,1)		
Return Equation	Coefficient	p-value	Return Equation	Coefficient	p-value
β_0	0.161740	0.0001***	β_0	0.162199	0.0001***
β_1	0.044236	0.0218**	β_1	0.046017	0.0176**
m_1	-0.924787	0.0641*	m_1	-1.479547	0.1204
Variance Equation			Variance Equation		
V_c	0.093289	0.0000***	V_c	0.104929	0.0000***
α	0.102644	0.0000***	α	0.107268	0.0000***
β	0.890947	0.0000***	β	0.883087	0.0000***
			V_1	3.269457	0.0013***

(Note: The symbols "****", "***", "**", "*" denote the statistical significance at the 0.01, 0.05, 0.10 levels respectively.)

Figure 4 shows the GARCH variance series. In Figure 4, when we look at the volatility graph we can observe high volatility during the period between 1996 and 2001 in which most terrorist attacks take

place.

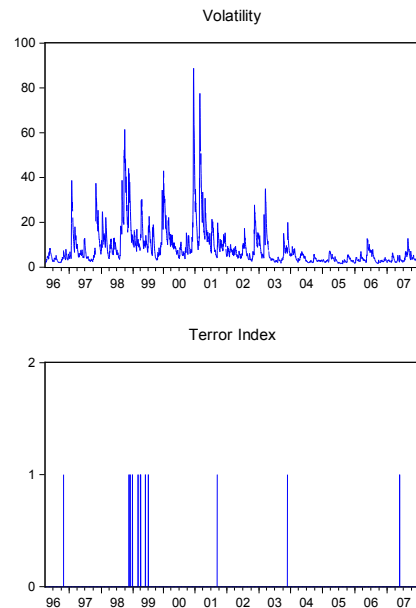


Figure 4:GARCH Variance Series

4. CONCLUSION

There is a growing body of literature that addresses the question of the effect of terrorist attacks on financial markets. This paper analyzes the impact of terrorist attacks on Turkish stock market by using two different methodologies. The first one is abnormal returns methodology (both daily and 5 and 10 days after the occurrence of a particular event), and the second one is time series analysis.

Although, some of the events in our sample experienced high negative returns, most events do not have statistically significant abnormal returns for the event day ($t=0$). Only one terrorist event which caused the death of 32 people and injury of 450 people has statistically significant abnormal return (20.11.2003, Istanbul, Al-Qaeda). This result may show that there is considerable sensitivity to the number of casualties as immediate investor reaction (the targets for the terrorist attacks by Al-Qaeda in Istanbul on 20.11.2003 was headquarters of HSBC Bank AS and the British Consulate).

While the event-day ARs show immediate investor reaction to terrorist attacks, the cumulative average abnormal returns (6-day CARs, 11-day CARs) provide a stronger indication of the stock market's ability (or inability) to recover from the attacks. In the analysis, negative significant CARs (stock market continues to decline) are observed after terrorist attacks especially

sourced by PKK KONGRA/GEL. Significant negative CARs may show that Turkish stock market is more sensitive to some type of attacks than to others. But it is certainly difficult to draw definitive conclusions when examining the abnormal returns from these events over time, there may be several reasons to explain these market reactions.

On the other hand, the volatility models estimated here revealed that Turkish stock market is sensitive to terrorist attacks. This finding is in line with results reported by studies such as Arin et al. (2008). Analysis results indicate that terrorist attacks have increased the volatility of the BIST 100 Index. These effects on stock returns have important implications for the

economies involved and provide information about investor reaction to terrorism. This study could be extended by including more news such as economic, politic, military and neighboring countries. Additionally, we could include more sectors in the data to analyze the impact on each sector. There is an ongoing fear of terrorist attacks in Turkey. The results of this study have broader implications for international investors because of Turkey's well-developed financial markets. And the findings of this study can be regarded as another contribution to the literature as at present there is no study that looks at the impact of terrorism on the Turkish stock market.

END NOTES

¹ Established in 1978, PKK (Kurdistan Workers Party) started its armed struggle in 1984 after a preparatory period of numerous murders and attacks, with the objective of the establishment, through armed struggle, of an independent Kurdistan within Turkey's borders." http://www.mfa.gov.tr/pkk_kongra-gel.en.mfa (24.04.2013).

² All papers, Hürriyet, Milliyet.

³ All papers, Hürriyet, Milliyet. Nobody has claimed responsibility for the bombing.

⁴The previous version of this study was presented in "11. Uluslararası Türk Dünyası Sosyal Bilimler Kongresi" Calalabat, Kırgızistan, June, 10-16, 2013. I thank Prof. Dr. Sacit Ertaş and two referees for helpful comments.

REFERENCES

- Abadie, A. ve Gardeazabal, J. (2003) "The Economic Costs of Conflict: A Case Study of the Basque Country" *American Economic Review*, 93(1):113-132.
- Abadie, A. ve Gardeazabal, J. (2005) "Terrorism and the World Economy" Harvard University and NBER Working Paper Series.
- Arin, K., Ciferri, D. ve Spagnolo, N. (2008) "The Price of Terror: The Effects of Terrorism on Stock Market Returns and Volatility" *Economics Letters*, 101(3):164-167.
- Berrebi, C. ve Klor, E. (2010) "The Impact of Terrorism on the Defence Industry" *Economica*, 77:518-543.
- Bollerslev, T. (1986) "Generalized Autoregressive Conditional Heteroskedasticity" *Journal of Econometrics*, 31:307-327.
- Brown, S. ve Warner, J. (1985) "Using Daily Stock Returns: The Case of Events Studies" *Journal of Financial Economics* 14:3-31.
- Center of Excellence Defense Against Terrorism (2007) "Special Report No: 9, 4th June 2007, Ankara Suicide Bombing Overview" <http://www.tmmm.tsk.tr/anasayfa.htm> (24.04.2013).
- Chen, A. ve Siems, T. (2004) "The Effects of Terrorism on Global Capital Markets" *European Journal of Political Economy*, 20:349-366.
- Chuliáa, H., Climent, F., Soriano, P. ve Torrób, H. (2009) "Volatility Transmission Patterns and Terrorist Attacks" *Quantitative Finance*, 9(5):607-619.
- Eckstein, Z. ve Tsiddon, D. (2004) "Macroeconomic Consequences of Terror: Theory and the Case of Israel" *Journal of Monetary Economics*, 51(5):971-1002.
- Eldor, R. ve Melnick, R. (2004) "Financial Markets and Terrorism" *European Journal of Political Economy*, 20:367-386.
- Enders, W., Sandler, T. ve Parise, G.F. (1992) "An Econometric Analysis of the Impact of Terrorism on Tourism" *Kyklos*, 45(4):531-554.
- Enders, W. ve Sandler, T. (1996) "Terrorism and Foreign Direct Investment in Spain and Greece" *Kyklos*, 49(3):3331-352.
- Glaser, M. ve Weber, M. (2005) "September 11 and Stock Return Expectations of Individual Investors" *Review of Finance*, 9(2):243-279.
- Hon, M.T., Strauss, J. ve Yong, S. (2004) "Contagion in financial markets after September 11: myth or reality?" *Journal of Financial Research*, 27(1):95-114.
- Johnston, R. ve Nedelescu, O. (2005) "The Impact of Terrorism on Financial Markets" International Monetary Fund Working Paper Series.
- Mun, C.K. (2005) "Contagion and Impulse Response of International Stock Markets around the 9-11 Terrorist Attacks" *Global Finance Journal*, 16(1):48-68.
- Türkiye Cumhuriyeti Dışişleri Bakanlığı (2013) http://www.mfa.gov.tr/pkk_kongra-gel.en.mfa, (24.04.2013).
- Türkiye Cumhuriyeti Dışişleri Bakanlığı (2013) http://www.mfa.gov.tr/what-is-terrorism_---the-problem-of-definition_.en.mfa, (24.04.2013).

APPENDIX

Table1: Abnormal Returns and Test Statistics Following The Event Days

Terror Attacks	Event Day AR (SAR)	Event Day + 1 AR (SAR)	Event Day + 2 AR (SAR)	Event Day + 3 AR (SAR)	Event Day + 4 AR (SAR)
25.10.1996	-1.92458 (-1.030362)	0.718887 (0.3821111)	-2.88632 (-1.553386)	-0.04459 (-0.024373)	-2.40433 (-1.299284)
17.11.1998	-3.84116 (-0.808401)	-2.50173 (-0.527225)	1.634349 (0.3267412)	2.666087 (0.5501375)	7.915398 (1.621827)
01.12.1998	-3.58743 (-0.642238)	3.107933 (0.5496197)	-0.2252 (-0.039673)	-3.24036 (-0.573138)	-1.99797 (-0.377497)
24.12.1998	0.352724 (0.082391)	3.855508 (0.9041115)	-1.54773 (-0.363251)	-0.51893 (-0.139332)	-2.20807 (-0.60729)
04.03.1999	-5.30072 (-1.492046)	0.053702 (0.0156684)	-2.29701 (-0.679196)	0.882049 (0.2624176)	-3.79459 (-1.117144)
05.04.1999	1.838351 (0.5472452)	2.628426 (0.9009328)	-0.14758 (-0.050609)	-4.49526 (-1.534922)	-3.46251 (-1.205776)
08.04.1999	-4.49526 (-1.534922)	-3.46251 (-1.205776)	-5.89024 (-2.071008)	-10.1814 (-3.562039)*	8.495566 (3.0297224)*
02.06.1999	-4.17433 (-1.331575)	-0.67138 (-0.212751)	6.763783 (2.7116585)*	-1.775 (-0.688608)	-0.30696 (-0.111451)
05.07.1999	3.595075 (1.0915464)	-4.29838 (-1.384128)	-1.47754 (-0.50185)	2.481874 (0.8417799)	5.198891 (1.7893112)
10.09.2001	-1.16796 (-0.550482)	-2.50359 (-1.167017)	-9.58282 (-4.461056)*	-6.60025 (-3.127563)*	-2.06761 (-1.040425)
11.09.2001	-2.50359 (-1.167017)	-9.58282 (-4.461056)*	-6.60025 (-3.127563)*	-2.06761 (-1.040425)	-0.72577 (-0.362563)
20.11.2003	-7.86782 (-2.814576)*	9.066705 (3.3484537)*	1.27214 (0.4754438)	0.700314 (0.2623699)	-0.6568 (-0.246286)
22.05.2007	0.474626 (0.2475815)	0.250044 (0.1303122)	-0.37879 (-0.198988)	0.022601 (0.0120397)	1.657932 (0.8884419)

(Note: The symbol "*" denotes the statistical significance at the 0.05 level. "AR" shows abnormal return, "SAR" shows standardized abnormal return. (for SAR, $t_{19,0.025}=2.093$))

