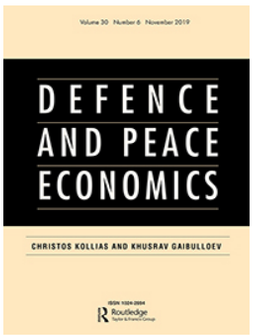

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The Effects of Terrorism on Turkish Financial Markets

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ABSTRACT

In this research, we analyzed how Turkish financial markets and foreign investors in the stock market reacted to the terror attacks in Turkey. Our analysis, which was performed using the terror index for the stock market and the foreign exchange market, revealed that returns, abnormal returns, and cumulative abnormal returns were not affected by the terror attacks; however, foreign investors in the stock market were affected. When the geographic regions of the terror attacks were analyzed, the findings showed that foreign investors were negatively affected mainly by the terror attacks that occurred in southeast Anatolia. Attack type and target type were important only for foreign investors. An evaluation of the interaction between the terror attacks and the markets with the involvement of the terrorist organizations indicated that only the foreign investors in the stock market were affected by Al-Qaeda and PKK-linked terror attacks. An evaluation of the effect of terror attacks in foreign countries on Turkish financial markets revealed no effect on the domestic stock market and foreign exchange markets. We also examined the volatility spillovers from the terror index to the stock market and found that terrorist attacks increased the volatility of the stock market.

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Stock market; foreign exchange market; foreign investors; volatility; terrorism

Introduction

Terrorism is accepted worldwide as a range of crimes that aim to disrupt social order and harm innocent people. According to Sandler (2014) 'Terrorism is the premeditated use or threat to use violence by individuals or subnational groups to obtain a political or social objective through the intimidation of a large audience beyond that of the immediate victims.' Terrorism has direct and indirect financial/economic costs. The direct costs are financial losses associated with damage to public or private property and infrastructure. The indirect costs are the loss of investor confidence in financial markets. Turkey has encountered terrorist acts for many years by different terrorist organizations from the ethnic separatist terrorism of the PKK[1] and the leftist DHKP-C to religiously motivated terrorist groups, such as Al Qaeda.

This study explores the ways in which the Turkish stock market, foreign exchange market and foreign investors in the stock market reacted to the terror attacks. Daily data were used in the analysis to find out how the terror affected stock market prices, exchange rates, and the portfolio value of foreign investors for free float shares in the stock market. Terror data were drawn from the Global Terrorism Database.

In the literature on terrorism, relevant published studies are mainly conducted to find answers to the following three questions: why terrorism occurs, how terrorism occurs, and what the social, political, and economic effects of the terrorism are (Crenshaw 1981). Here, our aim is to analyze the effect

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of terrorism on Turkish financial markets and foreign investors in the stock market. We devised five research questions as follows:

(1) Did the terror in any way affect the stock market, currency market and the portfolio value of foreign investors for free float shares in the stock market?
(2) Is the effect of a terror attack permanent or transitory? Does market sensitivity to terror diminish over time?
(3) Are the consequences of all terror attacks similar? Does the effect of terror attacks on financial markets and on foreign investors differ according to the region, terrorist organization, attack type, and target type?
(4) Did the terror that took place in the United States of America (US), the United Kingdom (UK), Italy (IT), and Spain (SP) affect Turkish financial markets?
(5) Did the terror affect stock market volatility in any way?

Nowadays, far from being a local problem, terrorism has become international in character. Terrorist organizations carry out attacks in many countries, targeting citizens of many different nations, and operating from offices, bases and training camps scattered across different countries. They receive direct and indirect support from various countries and comprise militants from different ethnic groups.

Current published research on terrorism has focused on two forms of terrorism: domestic and transnational terrorism (Sandler 2008). Domestic terrorism is homegrown with consequences only for the home country, its institutions, citizens, property, and policies, whereas transnational terrorism involves more than one country. Transnational terrorism is significant from three perspectives. First, transnational terrorism forms of terrorist events have a low probability. Second, they have potentially large losses. Third, since terrorists are demanding greater world recognition, domestic terrorism has a tendency to spillover into transnational terrorism. The 9/11 attack was an example of a transnational terrorist event, as the victims were from many different countries, the attack was financed and planned from abroad, the terrorists were foreign nationals, and the repercussions of the event were global.

The existing literature on the impact of terrorism on financial markets shows that most of the research has been focused on the impact of very limited terrorist events (see Hon, Strauss, and Yong 2004; Glaser and Weber 2005; Barry Johnston and Nedelescu 2006; Nikkinen et al. 2008; Chuliá et al. 2009; Drakos 2010; Apergis and Apergis 2016; Kolaric and Schiereck 2016) while there are also some studies that have addressed the impact of a series of events (see Eldor and Melnick 2004; Arin, Ciferri, and Spagnolo 2008; Chesney, Reshetar, and Karaman 2011; Balcilar et al. 2016). Studies that have investigated the impact of series of events have generally concentrated on regions frequently hit by terrorist events like Israel, Pakistan, or Spain. Eldor and Melnick (2004) reported on attacks in Israel, Barros and Gil-Alana (2009) in Spain and Aslam and Kang (2015) investigated attacks in Pakistan, while some studies explored specific sectors, whose core business was affected by terrorist attacks, such as insurance, tourism, defense, and transportation. Apergis and Apergis (2016); Berrebi and Klor (2010) investigated the companies from the defense sector, and Kolaric and Schiereck (2016) explored airlines. Analysis results in these studies showed that stocks in defense industry were affected positively while airlines were affected negatively by terrorist attacks.

In a previous study on the Turkish stock market, Aksoy (2014) used two different methods to analyze the effects on the Turkish stock market of the terror attacks in Turkey between 1996 and 2007 and the 11 September 2011, terror attack in the U.S. In this study, using event study methodology and time series analysis, Aksoy reported that the stock market continued to fall in the days following most terror incidents. Their study also concluded that the Turkish Stock Market is sensitive to terror attacks and that terror incidents increased the volatility of the BIST 100 index. Eruygur and Omay (2014) analyzed the effects of terrorist activities on the stock market in Turkey. They found a negative influence and non-linear relationship. Christofis et al. (2013) investigated three major terrorist incidents and their influence on the Istanbul Stock Exchange and its sub-sector indices. Their empirical findings show that the effects are only short-lived effects since the market rebound was fairly quick. The tourism index is found to be more adversely affected.

The aim of the present study is to analyze the effect on Turkish financial markets of terror attacks that occurred in Turkey and other countries. Among the different financial markets, this study specifically examined the stock market and the foreign exchange market. In this study, the Borsa Istanbul 100 (BIST 100) price index was the indicator of the stock market. The foreign exchange rate for U.S. dollar announced to the market by the Central Bank was considered as the indicator of the foreign exchange market.

Using data from the most recent terrorist attacks the present research is the first study, to our knowledge, that has jointly examined both the stock market and the foreign exchange market in Turkey in terms of returns and volatility, which is under-researched. The main contribution of the present study is that we examined an aspect that has not been addressed in previous studies, given that we addressed whether the terror attacks had any effect on the portfolio value of foreign investors for free float shares in the stock market. To distinguish the effects of domestic vs. transnational terrorism on the Turkish financial markets, we also analyzed the impact of terrorist attacks that took place in the U.S., U.K., IT and SP.

Data and Methodology

The daily data used in this study were obtained from Borsa Istanbul and CBRT. The actual period investigated ranged from 1988 to 2015. For the purposes of our analysis, we first defined 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, following Eckstein and Tsiddon (2004), Arin, Ciferri, and Spagnolo (2008); Balcilar et al. (2016), we constructed a daily terror index for our sample within the period specified from the Global Terrorism Database.[2] The Global Terrorism Database (GTD) is an open-source database including information on terrorist events around the world from 1970 through to 2015. The GTD includes systematic data on domestic as well as transnational and international terrorist incidents. For each GTD incident, information is available on the date and location of the incident, the weapons used and nature of the target, the number of casualties, and when identifiable–the group or individual(s) responsible (http://www.start.umd.edu/gtd/about, 2015). The final sample was obtained by adding the additional filters according to the following criteria. First, we focused on the most recent attacks, which occurred during the January 1988–December 2015 period. Second, we restricted our sample to consider prominent terrorist attacks (If there was at least one victim who died, was injured or kidnapped as a direct result of the incident, this incident is included in the terror index).

The daily return for the BIST 100 price index series was calculated as the logarithmic change in the value of the index compared with the previous day's closing value. We also used daily Turkish foreign exchange data obtained from the CBRT for the period from 1988 to 2015. Daily returns for the selling rates of the U.S. Dollar (USD) on day *t* are calculated as the logarithmic change in the USD selling price compared with the previous day's selling price. The daily data of portfolio value of foreign investors for free float shares in the stock market were taken from Central Registry Agency[3] (CRA) of Turkey. Figure 1 shows this data, which has been available since December 2005. When we look at the graph, we can see that foreign investors' share in the Turkish stock market was notably high. To our knowledge, this study is the first attempt to answer the question of whether the portfolio value of foreign investors for free float shares in the stock market is affected by terrorist attacks.

Table 1 shows that a total of 1666 relatively major events (i.e. if there was at least one victim who died, was injured or kidnapped as a direct result of the terrorist attack, this event is included in the analysis) took place from the years 1988 to 2015. The number of attacks was increasing, with the worst year being 2015 with 237 major attacks, since the year 1992 when there were 309 attacks. In Table 1, we show a summary of the 1666 terrorist attacks between 1988 and 2015 that resulted in 5989 major injuries and 4992 fatalities.

The proportion of victims attacked, injured, and killed, by category is provided in Table 2 and for the summary of terror attacks by terrorist organizations, Table 3 is presented below.

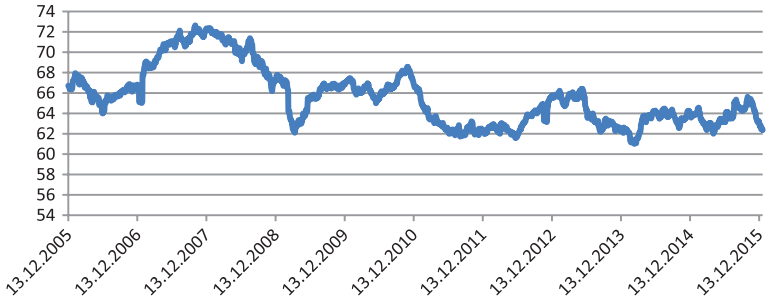

Figure 1. The stock market share of foreign investors in BIST (2005–2015).

Table 1. Summary of terror attacks by years (1988–2015).

	Number of attacks	Victims killed	Victims wounded	Hostages
1988	25	102	12	7
1989	71	232	53	101
1990	130	483	210	7
1991	126	307	296	45
1992	309	1226	529	90
1993	2	9	4	0
1994	172	954	433	29
1995	76	186	211	38
1996	37	112	92	205
1997	26	60	108	7
1998	18	36	102	40
1999	55	127	266	0
2000	12	12	27	0
2001	12	17	30	278
2002	1	0	0	13
2003	14	67	778	7
2004	19	25	92	0
2005	25	35	140	3
2006	27	45	315	0
2007	21	25	122	18
2008	22	42	274	6
2009	7	18	43	0
2010	5	13	7	0
2011	33	25	108	67
2012	112	235	394	59
2013	25	83	192	19
2014	47	37	81	71
2015	237	479	1070	142
Total	1666	4992	5989	1252

In the past, the Kurdistan Workers' Party (PKK) committed most of the attacks (see Table 3). In terms of attack frequency, following the PKK, the Dev Sol, and the Revolutionary People's Liberation Party/Front (DHKP/C) terrorist organizations were present.

As a first approach for our analysis, we wondered what immediate effects could be expected as a consequence of a terrorist attack. To answer this question, we followed the approach that Chen and Siems (2004) proposed for day-event-study analysis. Daily excess returns were measured by the mean-adjusted returns approach. The date of the event is $t = 0$, the mean adjusted returns model was estimated over 20 days, from $t = -30$ to $t = -11$ relative to the event date. The main event window under this study was the event date itself ($t = 0$). Abnormal returns were computed for each sample, for the statistical significance of the event period, using the test statistics described by Brown and Warner (1985). We used a standardized abnormal return (SAR) where each abnormal security return was normalized by its estimation period standard deviation.

Table 2. Summary of terror attacks by category (1988–2015).

		Number of attacks	Victims killed	Victims wounded	Hostages
Type of attack					
	Armed Assault	734	2944	1990	200
	Bombing/Explosion	493	1276	3529	247
	Assassination	218	433	257	14
	Hostage Taking (Kidnapping)	133	159	57	376
	Unknown	60	158	117	20
	Facility/Infrastructure Attack	16	16	15	4
	Hijacking	5	5	0	241
	Hostage Taking (Barricade Incident)	4	1	1	150
	Unarmed Assault	3	0	23	0
Type of target					
	Military	476	1923	1427	106
	Police	382	1026	1108	322
	Private Citizens & Property	300	836	1064	212
	Government (General)	143	350	569	49
	Business	128	228	986	177
	Transportation	78	246	348	68
	Educational Institution	52	68	31	38
	Journalists & Media	27	63	32	17
	Religious Figures/Institutions	13	61	306	7
	Tourists	12	15	56	34
	Unknown	11	23	12	0
	Violent Political Party	10	14	15	0
	Utilities	9	89	18	6
	Telecommunication	8	21	5	0
	Terrorists/Non-State Militia	5	13	2	0
	Government (Diplomatic)	4	3	5	0
	Airports & Aircraft	3	4	0	216
	NGO	3	3	5	0
	Food or Water Supply	1	2	0	0
	Maritime	1	4	0	0

There could be two situations following a terrorist attack that brings about social uncertainty and fear (Chen and Siems 2004, 352). In the first situation, uncertainties and fear arose from the terrorist attack may continue the ensuing days, which gives rise to a decline in stock prices and an increase in volatility. In the second situation, the declarations and policy actions of authorities could stabilize the markets. In order to study how well and how quickly the market absorbed the news, five longer event windows, from the date of the event to 1 day following the event ($t = +1$) and from the event date to 2 days following the event ($t = +2$) and from the event date to 3 days following the event ($t = +3$) and from the event date to 5 days following the event ($t = +5$) and from the event date to 10 days following the event ($t = +10$) were defined in accordance with Chen and Siems (2004). For these longer event windows, we also computed the cumulative abnormal returns (hereafter CARs). The statistical significance of the event period abnormal returns were computed for each sample using the test statistics described by Brown and Warner (1985) (see also Chen and Siems 2004, 352). By cumulating the periodic abnormal return over i days, we obtained the i day cumulative abnormal return, $\mathrm{CAR}_{i,t}$.

To detect an abnormality on the portfolio value of foreign investors for free float shares in the stock market, we followed the approach Bajo (2010) proposed for analysis. AV_t is the abnormal stock market portfolio value for foreign investors at time t. TV_t is the stock market portfolio value for foreign investors on day t; μ is the mean of stock market portfolio value for foreign investors on day t calculated on a window of the previous 66 days.

$$\mathrm{AV}_t = \mathrm{TV}_t - \mu_t^{\mathrm{TV}}$$

$$\mu_t^{\mathrm{TV}} = \frac{1}{66}\sum_{j=0}^{65} \mathrm{TV}_{t-j}$$

Table 3. Summary of terror attacks by terrorist organizations (1988–2015).

Terrorist Organization	Number of attacks	Victims killed	Victims wounded	Host kid
Kurdistan Workers' Party (PKK)	1086	3784	3227	875
Unknown	389	800	1362	39
Dev Sol	70	161	79	4
Revolutionary People's Liberation Party (DHKP/C)	20	23	71	1
Islamic State of Iraq and the Levant (ISIL)	16	71	266	2
Turkish Communist Party/Marxist (TKP-ML)	13	21	25	4
Unaffiliated Individual(s)	10	5	21	2
Great Eastern Islamic Raiders Front (IBDA-C)	8	25	306	0
Kurdistan Freedom Hawks (TAK)	8	7	102	0
Islamist Extremists	6	1	26	0
Turkish Hezbollah	5	9	4	0
Other	4	3	6	0
Al-Qaida	4	38	450	3
Chechen Rebels	3	3	0	291
Turkish Communist Workers Party	3	2	1	0
Islamic Revenge Organization	3	1	5	0
Islamic Movement Organization	2	2	0	0
Soskan Tribe	2	11	1	0
Pro-State Militiamen	1	0	2	0
Turkish People's Liberation Front (TPLF)(THKP-C)	1	0	1	0
Turkish Islamic Commandos	1	2	0	0
East Turkistan Liberation Organization	1	1	0	0
People's Defence Unit (Turkey)	1	1	3	0
Grey Wolves	1	0	1	0
Hezbollah	1	1	0	0
Kurds	1	9	0	0
Maoist Communist Party (MKP)	1	0	2	0
Revolutionary Headquarters (Turkey)	1	3	8	0
Kurdish Guerrillas	1	1	0	0
Left-Wing Demonstrators	1	1	1	31
The Unit of the Chemical Weapons Martyrs	1	6	11	0
Gunmen	1	0	8	0

Results

In our analysis, our first question is whether terror affected in any way the stock market, currency markets, and the portfolio value of foreign investors for free float shares in the stock market. Following the example of Eckstein and Tsiddon (2004), the daily terror index[4] was defined as the natural logarithm of (e + number of people killed + number of people wounded + number of people taken as hostages) that occurred each day. As in Arin, Ciferri, and Spagnolo (2008), terror attacks, which occurred during a weekend, were summed up to the previous Friday's figure. R_t is the daily return for the stock market and daily return for the currency market (U.S. Dollar). AV_t is the abnormal stock market portfolio value for foreign investors at time t.

$$\mathrm{PR}_t = \beta_0 + \beta_{\mathrm{TerrorIndex}} D_{\mathrm{TerrorIndex}} + \varepsilon_t$$

$$\mathrm{AR}_t = \beta_0 + \beta_{\mathrm{TerrorIndex}} D_{\mathrm{TerrorIndex}} + \varepsilon_t$$

$$\mathrm{AV}_t = \beta_0 + \beta_{\mathrm{TerrorIndex}} D_{\mathrm{TerrorIndex}} + \varepsilon_t$$

Our second question was whether the effect of a terror attack is permanent or transitory and that market sensitivity to terror diminishes over time? In order to observe this, we calculated five longer event windows and calculated cumulative abnormal returns (CARs) for them. In the regressions against the terror index, we used CARs ($t = +1$, $t = +2$, $t = +3$, $t = +5$, $t = +10$) over event window as dependent variables.

$$CAR_{i,t} = \beta_0 + \beta_{TerrorIndex} D_{TerrorIndex} + \varepsilon_t$$

The results of the estimation for the Turkish Stock Market, Foreign Exchange Market and Foreign Investors were displayed in Tables 4–6. According to Tables 4 and 5, the analysis conducted on the stock market and the foreign exchange market using the terror index revealed that returns (R), abnormal returns (AR) and cumulative abnormal returns (CAR) were not affected by terror attacks. On the other hand, foreign investors in the stock market (see Table 6) were negatively affected by terror attacks (−0.0010 with *t*-value -2.4740). The findings for the stock market are consistent with the empirical results of Christofis et al. (2013) that provided evidence of transitory and insignificant effects of the terror events. They linked the findings to the efficiency of the stock market; the market is fairly efficient and able to react instantaneously in absorbing and incorporating any new information when it becomes available. Therefore, the market may quickly rebound after an unexpected terror shock. In another study by Eruygur and Omay (2014), it is founded that terror events have an insignificant negative effect on the Turkish stock market during the low regime of terrorist activity. This shows that terror events do not always cause a decline in stock returns, supporting our results.

For the foreign exchange market, all regressions were insignificant for the full sample, indicating that there was not a valid relationship between the variables and the foreign exchange market return, abnormal return, and cumulated abnormal returns.

Our third question is whether the consequences of all terror attacks are comparable? Does the effect of terror attacks on financial markets and foreign investors differ according to the region, terrorist organization, attack type, and target type? The location of the attacks was divided into three categories. The first category is Istanbul. Istanbul, considered by many as the country's financial center, is the largest city in Turkey. The second category is Ankara, which is the capital of the Republic of Turkey and after Istanbul the second largest city in Turkey. The third category is Diyarbakir.

$$R_t = \beta_0 + \beta_{Ankara} D_{Ankara} + \beta_{Istanbul} D_{Istanbul} + \beta_{Diyarbakir} D_{Diyarbakir} + \varepsilon_t$$

$$AR_t = \beta_0 + \beta_{Ankara} D_{Ankara} + \beta_{Istanbul} D_{Istanbul} + \beta_{Diyarbakir} D_{Diyarbakir} + \varepsilon_t$$

$$CAR_{i,t} = \beta_0 + \beta_{Ankara} D_{Ankara} + \beta_{Istanbul} D_{Istanbul} + \beta_{Diyarbakir} D_{Diyarbakir} + \varepsilon_t$$

Table 4. Regression results for Turkish stock market (Terror Index).

Dependent variable window	β_0	$\beta_{TerrorIndex}$	Adj. R^2 *F*-value
R_t	0.0013 (1.7273)	0.0000 (−0.0128)	−0.0001 (0.0002)
AR_t	−0.0006 (−0.7329)	0.0005 (0.7998)	−0.0001 (0.6397)
CAR_t [0,1]	0.0001 (0.1112)	−0.0001 (−0.1218)	−0.0001 (0.0148)
CAR_t [0,2]	0.0002 (0.1608)	−0.0002 (−0.1694)	−0.0001 (0.0287)
CAR_t [0,3]	−0.0008 (−0.4544)	0.0007 (0.5140)	−0.0001 (0.2642)
CAR_t [0,10]	−0.0020 (−0.5816)	0.0018 (0.6919)	−0.0001 (0.4787)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 5. Regression results for Turkish foreign exchange market (Terror index).

Dependent variable window	β_0	$\beta_{TerrorIndex}$	Adj. R^2 *F*-value
R_t	−0.0026 (−0.5441)	0.0014 (0.4028)	−0.0001 (0.6870)
AR_t	0.0001 (0.0168)	0.0001 (−0.0205)	−0.0001 (0.0004)
CAR_t [0,1]	−0.0006 (−0.0886)	0.0005 (0.0941)	−0.0001 (0.0088)
CAR_t [0,2]	−0.0017 (−0.1932)	0.0014 (0.2082)	−0.0001 (0.0433)
CAR_t [0,3]	−0.0018 (−0.1747)	0.0015 (0.1876)	−0.0001 (0.0352)
CAR_t [0,10]	−0.0032 (−0.1692)	0.0026 (0.1801)	−0.0001 (0.0324)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 6. Regression results for foreign investors (Terror index).

Dependent variable window	β_0	$\beta_{TerrorIndex}$	Adj. R^2 *F*-value
AV_t	0.0086*** (15.5821)	−0.0010** (−2.4740)	0.0020** (6.120791)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 7. Regression results for Turkish stock market (Major Cities).

Window	β_0	β_{Ankara}	$\beta_{Diyarbakır}$	$\beta_{Istanbul}$	Adj. R^2 *F*-value
R_t	0.0012*** (3.9418)	−0.0085** (−1.9638)	0.0006 (0.2683)	0.0026 (1.4333)	0.0004 (2.0161)
AR_t	−0.0001 (−0.2389)	−0.0105** (−2.3594)	0.0019 (0.8071)	0.0032* (1.7160)	0.0008** (3.0803)
CAR_t [0,1]	−0.0001 (−0.1832)	−0.0152** (−2.2493)	0.0019 (0.5271)	0.0045 (1.5987)	0.0007** (2.6568)
CAR_t [0,2]	0.0000 (−0.0605)	−0.0245*** (−2.8460)	−0.0002 (−0.0543)	0.0059* (1.6498)	0.0011** (3.6494)
CAR_t [0,3]	−0.0001 (−0.1304)	−0.0241** (−2.3669)	−0.0021 (−0.3877)	0.0095** (2.2315)	0.0011** (3.6309)
CAR_t [0,10]	−0.0001 (−0.0958)	−0.0400** (−2.0813)	−0.0021 (−0.2049)	0.0182 (2.2634)	0.0009** (3.2112)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 8. Regression results for Turkish foreign exchange market (major cities).

Window	β_0	β_{Ankara}	$\beta_{Diyarbakır}$	$\beta_{Istanbul}$	Adj. R^2 *F*-value
R_t	−0.0009 (−0.4846)	0.0025 (0.0922)	0.0033 (0.2175)	0.0020 (0.1770)	−0.0004 (0.0282)
AR_t	0.0000 (−0.0060)	0.0001 (0.0061)	0.0012 (0.0787)	−0.0006 (−0.0529)	−0.0004 (0.0030)
CAR_t [0,1]	0.0000 (0.0013)	−0.0007 (−0.0183)	0.0015 (0.0668)	−0.0015 (−0.0884)	−0.0004 (0.0042)
CAR_t [0,2]	0.0000 (−0.0130)	0.0003 (0.0068)	0.0025 (0.0900)	−0.0008 (−0.0390)	−0.0004 (0.0032)
CAR_t [0,3]	−0.0001 (−0.0209)	0.0007 (0.0123)	0.0036 (0.1111)	−0.0004 (−0.0162)	−0.0004 (0.0042)
CAR_t [0,10]	−0.0001 (−0.0069)	0.0066 (0.0603)	−0.0014 (−0.0240)	−0.0015 (−0.0326)	−0.0004 (0.0017)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

$$AV_t = \beta_0 + \beta_{Ankara}D_{Ankara} + \beta_{Istanbul}D_{Istanbul} + \beta_{Diyarbakir}D_{Diyarbakir} + \varepsilon_t$$

The terror attacks in Ankara had a statistically significant negative effect on the AR and all CARs of the stock market (Table 7). The city where the terrorist attacks happened did not make a statistically significant difference on the foreign exchange market (see Table 8). When we examine Table 9, we see that the foreign investors were negatively influenced by the terror incidents that happened in Diyarbakir.

The following regression equations were estimated to analyze whether the location of terrorist attacks would make a difference for financial markets. There are seven geographical regions in Turkey. For each geographic region, a dummy variable was created. When Tables 10 and 11 are examined, it does not make a meaningful difference, for the stock market and the foreign exchange market, in which geographical region the terror attacks took place. Nonetheless, the foreign investors are negatively affected by the terror incidents that occur mainly in southeast Anatolia (Table 12).

$$R_t = \beta_0 + \beta_{Mediterranean}D_{Mediterranean} + \beta_{EasternAnatolia}D_{EasternAnatolia} + \beta_{Aegean}D_{Aegean} + \beta_{Southeast\ Anatolia}D_{Southeast\ Anatolia} + \beta_{CentralAnatolia}D_{CentralAnatolia} + \beta_{BlackSea}D_{BlackSea} + \beta_{Marmara}D_{Marmara} + \varepsilon_t.$$

$$AR_t = \beta_0 + \beta_{Mediterranean}D_{Mediterranean} + \beta_{EasternAnatolia}D_{EasternAnatolia} + \beta_{Aegean}D_{Aegean} + \beta_{Southeast\ Anatolia}D_{Southeast\ Anatolia} + \beta_{CentralAnatolia}D_{CentralAnatolia} + \beta_{BlackSea}D_{BlackSea} + \beta_{Marmara}D_{Marmara} + \varepsilon_t.$$

$$CAR_{i,t} = \beta_0 + \beta_{Mediterranean}D_{Mediterranean} + \beta_{EasternAnatolia}D_{EasternAnatolia} + \beta_{Aegean}D_{Aegean} + \beta_{Southeast\ Anatolia}D_{Southeast\ Anatolia} + \beta_{CentralAnatolia}D_{CentralAnatolia} + \beta_{BlackSea}D_{BlackSea} + \beta_{Marmara}D_{Marmara} + \varepsilon_t.$$

Table 9. Regression results for foreign investors (Major Cities).

Window	β_0	β_{Ankara}	$\beta_{\text{Diyarbakır}}$	$\beta_{\text{İstanbul}}$	Adj. R^2 F-value
AV_t	0.0075*** (33.4198)	0.0013 (0.3377)	−0.0038*** (−2.6817)	−0.0019 (−1.0335)	0.0021** (2.7643)

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

$$AV_t = \beta_0 + \beta_{\text{Mediterranean}}D_{\text{Mediterranean}} + \beta_{\text{EasternAnatolia}}D_{\text{EasternAnatolia}} + \beta_{\text{Aegean}}D_{\text{Aegean}} + \beta_{\text{Southeast Anatolia}}D_{\text{Southeast Anatolia}} + \beta_{\text{CentralAnatolia}}D_{\text{CentralAnatolia}} + \beta_{\text{BlackSea}}D_{\text{BlackSea}} + \beta_{\text{Marmara}}D_{\text{Marmara}} + \varepsilon_t.$$

Terror attacks are sponsored by many diverse terrorist groups with varying political, social, and religious goals. The following regression equations were estimated to analyze whether the terrorist group made a difference in the response of financial markets to terror attacks.

$$R_t = \beta_0 + \beta_{\text{AlQaida}}D_{\text{AlQaida}} + \beta_{\text{DevSol}}D_{\text{DevSol}} + \beta_{\text{DHKPC}}D_{\text{DHKPC}} + \beta_{\text{IBDAC}}D_{\text{IBDAC}} + \beta_{\text{PKK}}D_{\text{PKK}} + \varepsilon_t$$

$$AR_t = \beta_0 + \beta_{\text{AlQaida}}D_{\text{AlQaida}} + \beta_{\text{DevSol}}D_{\text{DevSol}} + \beta_{\text{DHKPC}}D_{\text{DHKPC}} + \beta_{\text{IBDAC}}D_{\text{IBDAC}} + \beta_{\text{PKK}}D_{\text{PKK}} + \varepsilon_t$$

$$CAR_{i,t} = \beta_0 + \beta_{\text{AlQaida}}D_{\text{AlQaida}} + \beta_{\text{DevSol}}D_{\text{DevSol}} + \beta_{\text{DHKPC}}D_{\text{DHKPC}} + \beta_{\text{IBDAC}}D_{\text{IBDAC}} + \beta_{\text{PKK}}D_{\text{PKK}} + \varepsilon_t$$

As indicated in Table 13, an evaluation of the 'terror attack-markets' interaction with respect to the terrorist organizations involved revealed that only the stock market's CARs were affected by DHKPC, DevSol, and IBDAC linked terror attacks. When we look at Table 14, we can see that terrorist groups did not affect foreign exchange market. The foreign investor is affected by the terror incidents by AlQaida and PKK (see Table 15).

The following regression equations were estimated to analyze whether the form of terrorist attack affected financial markets. When determining the types of attacks, the classification in the Global Terrorism Database was taken into consideration. For each attack type, A1: Assassination, A2: Armed Assault, A3: Bombing Explosion, A4: Hijacking, A5: Hostage taking barricade, A6: Hostage taking kidnapping, A7: Facility infrastructure, A8: Unarmed assault dummy variables were created.

$$R_t = \beta_0 + \beta_{A1}D_{A1} + \beta_{A2}D_{A2} + \beta_{A3}D_{A3} + \beta_{A4}D_{A4} + \beta_{A5}D_{A5} + \beta_{A6}D_{A6} + \beta_{A7}D_{A7} + \beta_{A8}D_{A8} + \varepsilon_t$$

$$AR_t = \beta_0 + \beta_{A1}D_{A1} + \beta_{A2}D_{A2} + \beta_{A3}D_{A3} + \beta_{A4}D_{A4} + \beta_{A5}D_{A5} + \beta_{A6}D_{A6} + \beta_{A7}D_{A7} + \beta_{A8}D_{A8} + \varepsilon_t$$

$$AV_t = \beta_0 + \beta_{A1}D_{A1} + \beta_{A2}D_{A2} + \beta_{A3}D_{A3} + \beta_{A4}D_{A4} + \beta_{A5}D_{A5} + \beta_{A6}D_{A6} + \beta_{A7}D_{A7} + \beta_{A8}D_{A8} + \varepsilon_t$$

Table 16 shows that the stock market was not affected by the attack type. On the other hand, foreign investors were negatively affected by 'assassinations;''armed assault;' and 'facility infrastructure' attacks (see Table 17).

To analyze the effect of terror attacks on different targets on financial markets, the target types were determined considering the classification in the Global Terrorism Database. For each target type, T1: Business, T2: Police, T3: Military, T4: Government diplomatic, T5: Journalists media, T6: Religious figures, T7: Tourists, T8: Transportation, T9: Utilities, T10: Violent political parties, T11: Government general, dummy variables were created.

$$R_t = \beta_0 + \beta_{T1}D_{T1} + \beta_{T2}D_{T2} + \beta_{T3}D_{T3} + \beta_{T4}D_{T4} + \beta_{T5}D_{T5} + \beta_{T6}D_{T6} + \beta_{T7}D_{T7} + \beta_{T8}D_{T8} + \beta_{T9}D_{T9} + \beta_{T10}D_{T10} + \beta_{T11}D_{T11} + \varepsilon_t$$

Table 10. Regression results for Turkish stock market (Region).

Window	β_0	$\beta_{Mediterranean}$	$\beta_{EasternAnatolia}$	β_{Aegean}	$\beta_{Southeast\ Anatolia}$	$\beta_{CentralAnatolia}$	$\beta_{BlackSea}$	$\beta_{Marmara}$	Adj. R^2 F-value
R_t	0.0012 (3.8251)	−0.0052	0.0012 (0.7537)	0.0039 (0.7361)	−0.0011	−0.0038	0.0009 (0.1838)	0.0026 (1.4981)	0.0010 (1.0919)
		(−1.5006)			(−0.8221)	(−1.0710)			
AR_t	−0.0001	−0.0041	0.0019 (1.1546)	0.0047 (0.8720)	0.0001 (0.0811)	−0.0051	0.0038 (0.7362)	0.0034* (1.8794)	0.0003 (1.3568)
	(−0.4332)	(−1.1585)				(−1.4024)			
CAR_t [0,1]	−0.0000	−0.0006	−0.0001	0.0004 (0.0566)	0.0005 (0.2726)	−0.0071	−0.0113	0.0042 (1.5342)	−0.0001 (0.8821)
	(−0.1148)	(−0.1262)	(−0.0524)			(−1.2679)	(−1.4208)		
CAR_t [0,2]	−0.0001	0.0002 (0.0344)	−0.0000	0.0040 (0.3839)	0.0016 (0.5904)	−0.0118*	−0.0125	0.0063* (1.7767)	0.0001 (1.1453)
	(−0.2298)		(−0.0039)			(−1.6560)	(−1.2337)		
CAR_t [0,3]	−0.0003	−0.0011	0.0009 (0.2555)	−0.0049	0.0037 (1.1242)	−0.0119	−0.0193	0.0098** (2.3456)	0.0006 (1.6698)
	(−0.4112)	(−0.1470)		(−0.3918)		(−1.4210)	(−1.6069)		
CAR_t [0,10]	−0.0003	−0.0076	0.0006 (0.0849)	0.0173 (0.7355)	0.0046 (0.7441)	−0.0322**	0.0014 (0.0629)	0.0169** (2.1447)	0.0004 (1.4499)
	(−0.2605)	(−0.5001)				(−2.0279)			

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 11. Regression results for Turkish foreign exchange market (Region).

Window	β_0	$\beta_{Mediterranean}$	$\beta_{EasternAnatolia}$	β_{Aegean}	$\beta_{Southeast\ Anatolia}$	$\beta_{CentralAnatolia}$	$\beta_{BlackSea}$	$\beta_{Marmara}$	Adj. R^2 *F*-value
R_t	−0.0012	0.0025 (0.1168)	0.0027 (0.2711)	0.0054 (0.1620)	0.0026 (0.2953)	0.0030 (0.1352)	0.0019 (0.0609)	0.0023 (0.2069)	−0.0009 (0.0339)
	(−0.5811)								
AR_t	−0.0001	0.0000 (−0.0020)	−0.0001	0.0035 (0.1031)	0.0019 (0.2185)	0.0004 (0.0209)	−0.0002	−0.0004	−0.0009 (0.0087)
	(−0.0485)		(−0.0182)				(−0.0075)	(−0.0390)	
CAR_t [0,1]	−0.0002	0.0014 (0.0454)	0.0004 (0.0303)	0.0064 (0.1296)	0.0049 (0.3744)	0.0001 (0.0053)	0.0004 (0.0096)	−0.0011	−0.0009 (0.0235)
	(−0.0935)							(−0.0677)	
CARt [0,2]	−0.0005	−0.0010	0.0027 (0.1463)	0.0026 (0.0428)	0.0076 (0.4633)	0.0012 (0.0293)	0.0008 (0.0144)	−0.0003	−0.0009 (0.0335)
	(−0.1359)	(−0.0256)						(−0.0169)	
CAR_t [0,3]	−0.0006	−0.0024	0.0028 (0.1308)	0.0051 (0.0696)	0.0098 (0.5099)	0.0014 (0.0295)	0.0001 (0.0018)	0.0001 (0.0072)	−0.0009 (0.0399)
	(−0.1466)	(−0.0506)							
CAR_t [0,10]	−0.0015	0.0123 (0.1408)	0.0004 (0.0107)	0.0171 (0.1270)	0.0229 (0.6470)	0.0058 (0.0647)	−0.0024	0.0007 (0.0161)	(−0.0009)
	(−0.1789)						(−0.0191)		(0.0646)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 12. Regression results for foreign investors (Region).

Window	β_0	$\beta_{Mediterranean}$	$\beta_{EasternAnatolia}$	β_{Aegean}	$\beta_{Southeast Anatolia}$	$\beta_{CentralAnatolia}$	$\beta_{BlackSea}$	$\beta_{Marmara}$	Adj. R^2 *F*-value
AV_t	0.0077***	−0.0028	0.0005	0.0058	−0.0044***	−0.0004	−0.0068	−0.0019	0.0087***
	(32.5296)	(−1.0912)	(0.5594)	(1.2034)	(−4.8016)	(−0.1165)	(−1.2570)	(−1.1085)	(4.1045)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 13. Regression results for Turkish stock market (Terrorist Organization).

Window	β_0	$\beta_{AlQaida}$	β_{DevSol}	β_{DHKPC}	β_{IBDAC}	β_{PKK}	Adj. R^2 *F*-value
R_t	0.0013	−0.0295	−0.0056	−0.0033	0.0085	0.0003	0.0001
	(4.0243)	(−1.6014)	(−1.4888)	(−0.5668)	(0.8712)	(0.2925)	(1.1944)
AR_t	−0.0001	−0.0276	−0.0034	0.0004	0.0100	0.0012	0.0000
	(−0.2958)	(−1.4572)	(−0.8778)	(0.0760)	(0.9898)	(1.1435)	(1.0476)
CAR_t [0,1]	−0.0001	−0.0274	0.0076	0.0140	0.0212	0.0009	0.0002
	(−0.3695)	(−0.9542)	(1.2916)	(1.4999)	(1.3817)	(0.5536)	(1.3891)
CAR_t [0,2]	−0.0003	−0.0350	0.0141*	0.0244**	0.0373*	0.0015	0.0010**
	(−0.4988)	(−0.9577)	(1.8880)	(2.0567)	(1.9086)	(0.7300)	(2.5388)
CAR_t [0,3]	−0.0005	−0.0207	0.0131	0.0308 **	0.0424 *	0.0034	0.0010**
	(−0.6551)	(−0.4787)	(1.4838)	(2.1965)	(1.8341)	(1.3714)	(2.4405)
CAR_t [0,10]	−0.0004	0.1084	0.0145	0.0270	0.0463	0.0036	0.0000
	(−0.2901)	(1.3319)	(0.8703)	(1.0240)	(1.0654)	(0.7664)	(1.0383)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 14. Regression results for Turkish foreign exchange market (Terrorist Organization).

Window	β_0	$\beta_{AlQaida}$	β_{DevSol}	β_{DHKPC}	β_{IBDAC}	β_{PKK}	Adj. R^2 *F*-value
R_t	−0.0011	0.0005	0.0049	0.0016	0.0015	0.0029	−0.0006
	(−0.5591)	(0.0050)	(0.2058)	(0.0423)	(0.0249)	(0.4336)	(0.0454)
AR_t	−0.0001	−0.0018	0.0017	−0.0003	−0.0010	0.0013	−0.0007
	(−0.0698)	(−0.0154)	(0.0717)	(−0.0089)	(−0.0158)	(0.2005)	(0.0090)
CAR_t [0,1]	−0.0003	−0.0009	0.0007	−0.0005	−0.0041	0.0033	−0.0006
	(−0.1085)	(−0.0056)	(0.0201)	(−0.0091)	(−0.0449)	(0.3377)	(0.0233)
CAR_t [0,2]	−0.0005	−0.0056	−0.0026	−0.0010	−0.0067	0.0054	−0.0006
	(−0.1322)	(−0.0260)	(−0.0602)	(−0.0147)	(−0.0147)	(0.4357)	(0.0400)
CAR_t [0,3]	−0.0006	−0.0064	−0.0032	0.0006	−0.0086	0.0070	−0.0006
	(−0.1461)	(−0.0251)	(−0.0614)	(0.0080)	(−0.0637)	(0.4754)	(0.0473)
CAR_t [0,10]	−0.0013	−0.0346	−0.0022	0.0065	−0.0173	0.0132	−0.0006
	(−0.1569)	(−0.0742)	(−0.0231)	(0.0433)	(−0.0695)	(0.4894)	(0.0507)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 15. Regression results for foreign investors (Terrorist Organization).

Window	β_0	$\beta_{AlQaida}$	β_{DHKPC}	β_{PKK}	Adj. R^2 *F*-value
AV_t	0.0076*** (32.9784)	0.0365*** (3.3379)	−0.0015 (−0.4046)	−0.0025*** (−3.4458)	0.0081*** (7.7630)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

$$AR_t = \beta_0 + \beta_{T1}D_{T1} + \beta_{T2}D_{T2} + \beta_{T3}D_{T3} + \beta_{T4}D_{T4} + \beta_{T5}D_{T5} + \beta_{T6}D_{T6} + \beta_{T7}D_{T7} + \beta_{T8}D_{T8} + \beta_{T9}D_{T9} + \beta_{T10}D_{T10} + \beta_{T11}D_{T11} + \varepsilon_t$$

$$AV_t = \beta_0 + \beta_{T1}D_{T1} + \beta_{T2}D_{T2} + \beta_{T3}D_{T3} + \beta_{T4}D_{T4} + \beta_{T5}D_{T5} + \beta_{T6}D_{T6} + \beta_{T7}D_{T7} + \beta_{T8}D_{T8} + \beta_{T9}D_{T9} + \beta_{T10}D_{T10} + \beta_{T11}D_{T11} + \varepsilon_t$$

Table 16. Regression results for Turkish stock market (Attack type).

Window	β_0	β_{A1}	β_{A2}	β_{A3}	β_{A4}	β_{A5}	β_{A6}	β_{A7}	β_{A8}	Adj. R^2 F-value
R_t	0.0013***	−0.0011	−0.0004	0.0008 (0.5139)	0.0078 (0.6682)	0.0049 (0.3745)	0.0009 (0.3256)	−0.0014	0.0177 (1.1738)	−0.0007
	(3.8329)	(−0.5019)	(−0.3134)					(−0.1928)		(0.3439)
AR_t	−0.0001	−0.0002	0.0007 (0.5246)	0.0010 (0.6853)	0.0133 (1.1041)	0.0063 (0.4698)	0.0017 (0.6017)	0.0021 (0.2800)	0.0185 (1.1923)	−0.0005
	(−0.3949)	(−0.1012)								(0.4917)

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level. Because all coefficients are statistically insignificant for $CAR_{i,t}$, they are not reported.

Table 17. Regression results for foreign investors (Attack type).

Window	β_0	β_{A1}	β_{A2}	β_{A3}	β_{A4}	β_{A5}	β_{A6}	β_{A7}	β_{A8}	Adj. R^2 *F*-value
AV_t	0.0077***	−0.0049*	−0.0030***	−0.0014	−0.0085	−0.0090	−0.0001	−0.0090*	−0.0040	0.0040**
	(32.5062)	(−1.9096)	(−2.8806)	(−1.5235)	(−1.1019)	(−0.8274)	(−0.0439)	(−1.6483)	(−0.5225)	(2.2600)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level. Because all coefficients are statistically insignificant for $CAR_{i,t}$, they are not reported.

Table 18 suggests that the stock market was not affected by the target type. However, as we can see in Table 19, foreign investors were negatively affected by attacks on 'business' and 'police' targets.

Our fourth question is whether the terror that have taken place in the U.S., U.K., IT, and SP affected the stock market, currency markets and the portfolio value of foreign investors for free float shares in the stock market?

$$R_t = \beta_0 + \beta_{FR}D_{FR} + \beta_{IT}D_{IT} + \beta_{SP}D_{SP} + \beta_{TR}D_{TR} + \beta_{UK}D_{UK} + \beta_{US}D_{US} + \varepsilon_t$$

$$\mathrm{AR}_t = \beta_0 + \beta_{FR}D_{FR} + \beta_{IT}D_{IT} + \beta_{SP}D_{SP} + \beta_{TR}D_{TR} + \beta_{UK}D_{UK} + \beta_{US}D_{US} + \varepsilon_t$$

$$\mathrm{AV}_t = \beta_0 + \beta_{\mathrm{FR}}D_{\mathrm{FR}} + \beta_{\mathrm{IT}}D_{\mathrm{IT}} + \beta_{\mathrm{SP}}D_{\mathrm{SP}} + \beta_{\mathrm{TR}}D_{\mathrm{TR}} + \beta_{\mathrm{UK}}D_{\mathrm{UK}} + \beta_{\mathrm{US}}D_{\mathrm{US}} + \varepsilon_t$$

The regression results for the stock market can be seen in Tables 20 and 21 that reports the result for foreign investors. Evaluation of the effect of terror attacks in foreign countries on the financial markets in Turkey revealed no noticeable effects on the domestic stock market and foreign exchange markets. However, foreign investors in the Turkish stock market were affected by the terror attacks in Turkey.

The July 15 Failed Coup Attempt and Its Implications

On 15 July 2016, just before 23:00 EEST (UTC + 3), a coup was attempted in Turkey against state institutions, including, but not limited to the government. As reported, the attempt was carried out by a faction within the Turkish Armed Forces. The government accused the coup leaders of being linked to the Gülen organization. The organization was recently classified as a terrorist group, referred to as the 'Fethullah Gülen Terrorist Organization' (FETO), by formal state authorities such as the National Security.

When we look at Table 22, no statistically significant AR and CARs were observed in the stock market and the foreign exchange market in the first days following the 15 July Failed Coup. Positive statements made by the government following the coup attempt on 15 July, along with statements made by opposition parties and the measures taken by the Central Bank may have limited the expected negative impact on the markets. However, when the sum of the abnormal returns for 10 days after the coup was examined, we found out that the stock market continued to fall, and the Turkish lira depreciated against the U.S. dollar.

Volatility Spillover Analysis

We examined volatility spillovers between Turkish stock market returns and the terror index within the context of the BEKK-GARCH model introduced by Engle and Kroner (1995). The model enabled us to quantify the influence of one variable on another through spillover effects. The covariance matrices were directly generated from the model and hence the correlations can also be generated. Specifically, a fully parameterized BEKK-GARCH (1,1) model with n assets yields $(p + \mathrm{q})kn^2 + n(n + 1)/2$ parameter estimates. Thus, we assumed that the lags $p = k = q = 1$ leading to a BEKK-GARCH (1,1) model. First, we set up a bivariate VAR model to model the return-terror index dependency in the mean equation:

$$Y_t = \mu + \Phi Y_{t-1} + \eta_t$$

where Y_t is a 2×1 vector of returns and the terror index at time t, Φ is a 2×2 parameter matrix, and ε_t is a 2×1 vector of random errors.

The bilateral model BEKK-GARCH model could be mathematically expressed as:

$$H_t = C'C + A'\varepsilon_{t-1}\varepsilon'_{t-1}A + B'H_{t-1}B$$

where H_t, A and B are square matrices and C is an upper triangular matrix. H_t represents a conditional variance–covariance matrix at time t. The diagonal elements in the matrix H_t denote the return

Table 18. Regression results for Turkish stock market (Target type).

Window	β_0	β_{T1}	β_{T2}	β_{T3}	β_{T4}	β_{T5}	β_{T6}	β_{T7}	β_{T8}	β_{T9}	β_{T10}	β_{T11}	Adj. R^2 F-value
R_t	0.0012	−0.0017	0.0013	−0.0001	0.0048	−0.0076	0.0118	0.0109	0.0014	−0.0017	0.0110	0.0006	−0.0005
	(3.7699)	(−0.6551)	(0.7325)	(−0.0589)	(0.3695)	(−1.1928)	(1.2811)	(1.2521)	(0.4035)	(−0.1641)	(1.0329)	(0.2594)	(0.6426)
AR_t	−0.0002	−0.0016	0.0031	0.0005	0.0019	−0.0086	0.0154	0.0059	0.0027	0.0024	0.0136	0.0012	−0.0001
	(−0.4836)	(−0.5711)	(1.7430)	(0.3156)	(0.1430)	(−1.3109)	(1.6250)	(0.6536)	(0.7452)	(0.2165)	(1.2397)	(0.4877)	(0.9576)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.; Because all coefficients are statistically insignificant for $CAR_{i,t}$, they are not reported. T1: Business, T2: Police, T3: Military, T4: Government diplomatic, T5: Journalists media, T6: Religious figures, T7: Tourists T8: Transportation, T9: Utilities, T10: Violent political parties, T11: Government general.

Table 19. Regression results for foreign investors (Target type).

Window	β_0	β_{T1}	β_{T2}	β_{T3}	β_{T4}	β_{T5}	β_{T6}	β_{T8}	β_{T9}	Adj. R^2 *F*-value
AV_t	0.0076***	−0.0035*	−0.0054***	−0.0010	0.0008 (0.0788)	−0.0066	0.0006 (0.0635)	0.0028 (0.8881)	−0.0009	0.0064
	(33.1537)	(−1.7742)	(−4.2921)	(−0.9166)		(−1.2074)			(−0.1653)	(3.0115)***

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level. Because all coefficients are statistically insignificant for $CAR_{i,t'}$ they are not reported.; T1: Business, T2: Police, T3: Military, T4: Government diplomatic, T5: Journalists media, T6: Religious figures, T7: Tourists T8: Transportation, T9: Utilities, T10: Violent political parties, T11: Government general.

Table 20. Regression results for Turkish stock market (other countries).

Window	β_0	β_{FR}	β_{IT}	β_{SP}	β_{TR}	β_{UK}	β_{US}	Adj. R^2 *F*-value
R*t*	0.0012***	0.0005	0.0011	0.0010	−0.0001	0.0009	−0.0003	−0.0006
	(3.2749)	(0.2064)	(0.3298)	(0.6769)	(−0.0950)	(0.8701)	(−0.1340)	(0.2556)
AR_t	−0.0003	0.0015	0.0033	0.0019	0.0007	0.0007	−0.0001	−0.0002
	(−0.8837)	(0.6715)	(0.9944)	(1.2308)	(0.8009)	(0.6065)	(−0.0606)	(0.7737)
CAR_t [0,1]	0.0000	0.0010	0.0048	0.0009	−0.0001	−0.0010	0.0000	−0.0007
	(−0.0196)	(0.2951)	(0.9467)	(0.3918)	(−0.0380)	(−0.5634)	(−0.0098)	(0.2376)
CAR_t [0,2]	0.0000	−0.0004	0.0083	0.0020	0.0004	−0.0020	−0.0011	−0.0004
	(−0.0291)	(−0.0823)	(1.2943)	(0.6882)	(0.2517)	(−0.9192)	(−0.2350)	(0.4985)
CAR_t [0,3]	−0.0001	0.0015	0.0053	0.0005	0.0019	−0.0023	−0.0039	−0.0005
	(−0.1078)	(0.2851)	(0.6965)	(0.1339)	(0.9327)	(−0.8909)	(−0.7033)	(0.4082)
CAR_t [0,10]	0.0002	−0.0001	0.0184	0.0011	0.0036	−0.0094	0.0054	0.0001
	(0.1068)	(−0.0095)	(1.2896)	(0.1689)	(0.9288)	(−1.9614)	(0.5175)	(1.0614)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 21. Regression results for foreign investors (other countries).

Window	β_0	β_{FR}	β_{IT}	β_{SP}	β_{TR}	β_{UK}	β_{US}	Adj. R^2 *F*-value
AV_t	0.0077***	−0.0019	−0.0026	−0.0006	−0.0020***	−0.0003	−0.0003	0.0029**
	(31.8249)	(−1.0628)	(−0.8851)	(−0.2571)	(−3.2648)	(−0.2847)	(−0.2028)	(2.2074)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets.
***Significant on the 1% level; **Significant at the 5% level; *Significant at the 10% level.

Table 22. Abnormal returns following 15 July failed coup.

	Stock market (BIST 100)	Foreign exchange market (USD)
Event-day R 15 July 2016	0.0028	−0.0011
Event-day AR 15 July 2016	0.0050 (0.3508)	−0.0009 (−0.1362)
1-day CAR	−0.0678 (−1.2312)	−0.0033 (-3.2527)
2-day CAR	−0.0778 (−1.8820)	0.0196 (1.3782)
3-day CAR	−0.0950 (−2.7922)	0.0300 (2.5473)
10-day CAR	−0.0970** (−3.3580)	0.0456** (4.2116)

Notes: Standard errors are in parentheses.***denotes the statistical significance at the 0.05 level. $t_{1,0.025} = 12.707$, $t_{2,0.025} = 4.303$, $t_{3,0.025} = 3.182$, $t_{10,0.025} = 2.228$, $t_{19,0.025} = 2.093$.

variances and the non-diagonal elements are the covariances between stock returns and the terror index. Coefficient A quantifies the effects of the unanticipated shocks while parameter B measures the volatility spillovers. Since we were interested in measuring the effect of terror events on stock returns, we only focused on the associated parameters, that is $A_{1,2}$ and $B_{1,2}$.

The empirical findings for the mean equation presented in Panel A show that the lagged own returns were highly significant in determining the future return levels. As for the cross-return effects, the non-diagonal parameters showed that the terror index was highly significant for stock returns (Φ (1,2)) while as expected stock returns did not have any impact on the terrorism index as shown by the parameter Φ (2,1). Therefore, in the Granger causality sense, terrorism Granger caused to the stock returns in Turkey while the opposite did not hold.

The results suggested that own shocks and volatility effects were present for the Turkish stock market returns. The own shock and volatility parameters were statistically significant and at a high magnitude; 0.342 for the market return shocks 0.934 for the market volatility, which indicated that the market return shocks and volatilities were most affected by their previous values.

As for the cross-market shock and volatility transmission, particularly the $A_{1,2}$ and $B_{1,2}$ coefficients that represent the propagation of terrorist events to the market returns, the empirical findings showed

Table 23. VAR- MGARCH-BEKK model results.

Panel A. Mean equation		
Φ (1,1)	0.09647***	0.011169
Φ (1,2)	−0.00174***	0.000386
Constant	0.002898***	0.000503
Φ (2,1)	0.033157	0.153776
Φ (2,2)	0.12678***	0.013352
Constant	0.93047***	0.014934
Panel B. Variance equation		
C(1,1)	0.003372***	0.00019
C(2,1)	−0.01164***	0.002622
C(2,2)	−0.04819***	0.002376
A(1,1)	0.342023***	0.008029
A(1,2)	0.25998***	0.084913
A(2,1)	−0.00073***	0.000254
A(2,2)	0.219113***	0.003221
B(1,1)	0.94887***	0.002863
B(1,2)	0.14801***	0.036329
B(2,1)	0.000133**	6.32E-05
B(2,2)	0.97139***	0.000823

Notes: Robust standard errors are presented in the Table.
**and ***denote statistical significance at the 1 and 5% significance levels.

Table 24. Model diagnostics.

	LB (50)		ARCH (50)	
Stock returns	65.42	(0.071)	1.294	(0.080)
Terror index	8.873	(0.999)	0.267	(0.985)

that the relevant model parameters were both statistically significant at the 1% significance level. The one-day lagged terrorist event substantially affected the current level of market return volatilities as shown by the $B_{1,2}$. Thus, our results provided evidence of statistically significant causality effects in the conditional variance. This suggests that the volatility of the terror index is highly likely to have a considerable influence on the volatility of Turkish stock market returns. The findings imply that financial market participants and policy-makers should be aware of the sensitivity of market volatility to terror as Turkish stock returns are not resilient to terror-related events.

We also analyzed the residual diagnostics of the VAR-BEKK-GARCH model to find out whether the model errors were suitable for the model validity. Table 24 shows us the results of Ljung-Box test for the serial correlation and ARCH test for the remaining heteroskedastic effects. As can be seen, none of the variables displayed significant autocorrelation and heteroskedasticity, which provided evidence that the VAR-BEKK-GARCH model is appropriate in terms of model desirability.

Conclusion

This study examined the impact of terrorist attacks on the financial markets of Turkey, using daily time series data from 1988 to 2015. Unlike Aksoy (2014), in this paper, we analyzed how, not only Turkish stock market but also foreign exchange market and foreign investors in stock market reacted to terror attacks. The events recorded in Global Terrorism Database were used as the data source. Instead of focusing on major suicide attacks, all types of terrorist events were included. This paper also attempted to answer the question of whether the effect of terror attacks on financial markets and on foreign investors differs according to the region, terrorist organization, attack type, and target type. An analysis was also made of the effect of terrorist events in the U.S., U.K., IT, and SP on the financial markets in Turkey.

Our findings are in line with results reported by Aksoy (2014). Turkish stock market is sensitive to terrorist attacks. The analysis showed that the foreign exchange market was not affected in any way

by the terror attacks. This result is consistent with Eldor and Melnick (2004). The analysis performed using the terror index for the stock market revealed that returns, ARs and CARs were not affected by the terror attacks. This result may show that financial markets in Turkey are efficient and flexible, so they can absorb the impact of such terrorist attacks. It was also observed that foreign investors in the stock market were affected by the terror attacks. Consistent with the studies of Abadie and Gardeazabal (2003, 2008), Enders and Sandler (1996), Enders, Sachsida, and Sandler (2006), terrorism is one of the most important factors that affects investment decisions of foreign investors. Following these analyses, an investigation was made as to whether the terror attacks in three major cities, namely Ankara, Istanbul, and Diyarbakır led to any change in the stock market because these cities represent different social and economic backgrounds, with cultural and social diversity. The terror attacks in Ankara gave rise to statistically significant changes in the AR and all CARs of the stock market, while terror attacks in Diyarbakir led to statistically significant changes in the abnormal portfolio value of foreign investors for free float shares in the stock market. Foreign investors were negatively affected by the terror incidents that occur mainly in south-east Anatolia. Attack type and target type were important only for foreign investors. (Kollias et al. 2011; Aslam and Kang 2015). Evaluation of the interaction between the terror attacks and the markets with respect to the terrorist organizations involved indicated that only the foreign investors in the stock market were affected by Al-Qaeda and PKK linked terror attacks. Evaluation of the effect of terror attacks in foreign countries on the financial markets in Turkey revealed no effect on the domestic stock market and foreign exchange markets. However, foreign investors in the Turkish stock market were affected by the terror attacks in Turkey.

The number of attacks per year in Turkey has increased since 2011. Volatility analysis indicated that terrorist attacks increased the volatility of the Turkish stock market. This result is compatible with previous studies (Nikkinen et al. 2008; Barros and Gil-Alana 2009; Chuliá et al. 2009; Nguyen and Enomoto 2009; Balcilar et al. 2016). In addition to this result, consistent with the study of Arin, Ciferri, and Spagnolo (2008), terror index volatility also had an impact on the stock market returns in Turkey.

Terrorism in Turkey has become the most destructive phenomenon, causing not only injuries and fatalities but also real economic cost. By increasing risk, terrorism creates uncertainty when investing in Turkey. This indirect cost of terrorism may trigger a flight to quality and can lead to lower economic growth and increased costs for companies. The complete, timely, and flexible response of the authorities is crucial to make the financial markets efficient in absorbing terrorist shocks. The combined force among financial institutions, regulators, intelligence and prosecuting agencies, and the government is essential to make the financial systems more elastic against terrorism in Turkey.

One limitation of our study is that we used only one financial market, the stock market and foreign exchange market of Turkey. We also did not include other countries for comparison because Turkey has been countering terrorism in different forms and manifestations for decades, from the ethnic separatist terrorism of the PKK and the leftist DHKP-C to religiously motivated terrorist groups such as Al Qaeda.

Notes

1. "Established in 1978, the PKK (Kurdistan Workers Party) started its armed struggle in 1984 after a preparatory period of numerous murders and attacks, with the objective of establishing, through armed struggle, an independent Kurdistan within Turkey's borders." http://www.mfa.gov.tr/pkk_kongra-gel.en.mfa, 2013 (Accessed April 24).
2. National Consortium for the Study of Terrorism and Responses to Terrorism (START), Global Terrorism Database (http://www.start.umd.edu/gtd).
3. The Central Registry Agency Inc. is the central depository for all dematerialized capital market instruments in Turkey, which was established in 2001 as a private company, and the dematerialization process was completed in 2006, but for equities, it was completed in 2007. The handbook of the Turkish Capital Markets, https://www.tspb.org.tr/wp-content/uploads/2015/06/Handbook_2015_web.pdf, 2016, 55–56. (Accessed August 30).
4. Terror index calculation logic has been changed as natural logarithm of (e + 3*number of people killed + 2*number of people wounded + number of people taken as hostages + number of attacks) and calculations are done again with this new index. The index calculation logic does not change the results. The results are not reported in the Tables but will be given upon request.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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Appendix 1. Robustness check

Tables listed below reports a smaller estimation window of 20 days for calculation of abnormal stock market portfolio value for foreign investors.

Table A1. Regression results for foreign investors (Terror index).

Dependent variable window	β_0	$\beta_{\text{TerrorIndex}}$	Adj. R^2 F-value
AV_t	0.0055*** (12.6706)	−0.0008** (−2.4595)	0.0020** (6.0495)

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table A2. Regression results for foreign investors (Major cities).

Window	β_0	β_{Ankara}	$\beta_{\text{Diyarbakır}}$	$\beta_{\text{İstanbul}}$	Adj. R^2 F-value
AV_t	0.0045*** (26.1396)	0.0030 (0.9850)	−0.0029*** (−2.6583)	−0.0004 (−0.3547)	0.0020** (2.7270)

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table A3. Regression results for foreign investors (Terrorist Organization).

Window	β_0	β_{AlQaida}	β_{DHKPC}	β_{PKK}	Adj. R^2 F-value
AV_t	0.0047*** (26.3001)	0.0312*** (3.6402)	−0.0006 (-0.1997)	−0.0024*** (-4.1835)	0.0110*** (10.3236)

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table A4. Regression results for foreign investors (Other Countries).

Window	β_0	β_{FR}	β_{IT}	β_{SP}	β_{TR}	β_{UK}	β_{US}	Adj. R^2 F-value
AV_t	0.0048*** (25.4134)	−0.0015 (−1.0657)	−0.0019 (−0.8507)	−0.0014 (−0.7545)	−0.0017*** (−3.4191)	0.0000 (0.0876)	−0.0014 (−1.1613)	0.0043*** (2.8361)

Notes: Robust standard errors are presented in the Table. The t-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table A5. Regression results for foreign investors (Region).

Window	β_0	$\beta_{Mediterranean}$	$\beta_{EasternAnatolia}$	β_{Aegean}	$\beta_{Southeast\ Anatolia}$	$\beta_{CentralAnatolia}$	$\beta_{BlackSea}$	$\beta_{Marmara}$	Adj. R^2 *F*-value
AV_t	0.0047*** (25.8189)	−0.0022 (−1.1222)	−0.0002 (-0.2788)	0.0033 (0.8751)	−0.0035*** (−4.9065)	0.0016 (0.6054)	−0.0051 (−1.1949)	−0.0006 −0.4991)	0.0082*** (3.9795)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level.

Table A6. Regression results for foreign investors (Attack type).

Window	β_0	β_{A1}	β_{A2}	β_{A3}	β_{A4}	β_{A5}	β_{A6}	β_{A7}	β_{A8}	Adj. R^2 *F*-value
AV_t	0.0047*** (25.7858)	−0.0026 −1.2981)	−0.0024*** (−2.9496)	−0.0011 (−1.5074)	−0.0064 (−1.0640)	−0.0055 (−0.6461)	−0.0011 (−0.9604)	−0.0064 (−1.4979)	−0.0054 (−0.8997)	0.0035** (2.1097)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level. Because all coefficients are statistically insignificant for $CAR_{i,t'}$ they are not reported.

Table A7. Regression results for foreign investors (Target type).

Window	β_0	β_{T1}	β_{T2}	β_{T3}	β_{T4}	β_{T5}	β_{T6}	β_{T8}	β_{T9}	Adj. R^2 *F*-value
AV_t	0.0047*** (26.2148)	−0.0029** (−1.9821)	−0.0041*** (−4.1365)	−0.0009 (−1.0817)	0.0000 (0.0080)	−0.0042 (−0.9904)	−0.0012 (−0.1495)	0.0022 (0.9231)	−0.0023 (−0.5378)	0.0061*** (2.9543)

Notes: Robust standard errors are presented in the Table. The *t*-value of regression coefficients is shown in brackets. ***Significant on the 1% level. **Significant at the 5% level. *Significant at the 10% level. Because all coefficients are statistically insignificant for $CAR_{i,t'}$ they are not reported. T1: Business, T2: Police, T3: Military, T4: Government diplomatic, T5: Journalists media, T6: Religious figures, T7: Tourists T8: Transportation, T9: Utilities, T10: Violent political parties, T11: Government general