

Doğuş Üniversitesi Dergisi, 14 (2) 2013, 153-164

## ISTANBUL STOCK MARKET'S REACTION TO TERRORIST ATTACKS

### İSTANBUL BORSASININ TERÖRİST SALDIRILARA REAKSİYONU

Nikos CHRISTOFIS<sup>(1)</sup>, Christos KOLLIAS<sup>(2)</sup>,  
Stefanos PAPANAMOU<sup>(3)</sup>, Apostolos STAGIANNIS<sup>(4)</sup>

<sup>(1)</sup>Leiden University, <sup>(2,3,4)</sup> University of Thessaly,  
<sup>(1)</sup> n.christofis@gmail.com, <sup>(2)</sup> kollias@uth.gr, <sup>(2)</sup> stpapada@uth.gr,  
<sup>(4)</sup> astagiannis@uth.gr

**ABSTRACT:** Terrorist attacks can have a multitude of economic consequences that may adversely affect a number of economic sectors and activities including capital markets. This paper examines the impact of three major terrorist incidents on the Istanbul Stock Exchange, one of the major emerging markets internationally. The reaction of both the general index as well as sectorial indices is investigated. The findings reported herein indicate that the impact, although significant in certain cases, had only short-lived effects since the market rebound was fairly quick. Of the sectorial indices, the tourist industry is found to be more adversely affected by these events.

**Keywords:** Event Study; Terrorism; Volatility; Istanbul Stock Market

**JEL Classification:** G14; G21; C22

**ÖZET:** Terörist saldırıların sermaye piyasalarını da kapsayan birçok sektör ve faaliyet üzerinde olumsuz etki yaratabilecek çeşitli ekonomik yansıması olabilmektedir. Bu makale, üç ana terörist saldırısının önemli yükselen uluslararası borsalardan biri olan İstanbul Borsası üzerindeki etkilerini incelemektedir. Hem genel endeksin hem de sektörel endekslerin verdiği tepkiler araştırılmaktadır. Burada sunulan sonuçlara göre bazı durumlarda anlamlı tepkiler verilmiş olsa da bu tepkiler kısa süreli olmuş ve endeks çabuk toparlanmıştır. Sektörel endekslerden en olumsuz etkilenen turizm sektörü olmuştur.

**Anahtar Kelimeler:** Vaka Çalışması; Terörizm; Volatilité, İstanbul Borsası

### 1. Introduction

With the predominance over the past decade or so of terrorism as the main international security threat, the number of papers that take up the issue of the economic effects of terrorist actions, has steadily grown (*inter alia*: Enders and Sandler, 2006; Abadie and Gardeazabal, 2008; Sandler, 2003). A part of this growing body of literature has focused its attention to the possible effects terrorist attacks can have on stock markets both in terms of returns as well as volatility (*inter alia*: Barros and Gil-Alana, 2009; Chesney *et al.*, 2011; Kollias *et al.* 2011a, 2013; Nikkinen *et al.*, 2008; Fernandez, 2008). As a plethora of studies have shown, markets and market agents react to unexpected events such as, for example, natural catastrophes, anthropogenic disasters, political instability, conflict and war (*inter alia*: Kaplanski and Levy, 2010; Kollias *et al.* 2010; Bolak and Suer, 2008; Herbst *et al.* 1996). Major terrorist attacks are unforeseen events that act as external shocks.

Thus, they have the potential to affect market risk premium, highly increasing volatility and exert an adverse impact on asset valuation, investment decisions and portfolio allocation (*inter alia*: Drakos, 2004, 2010; Chen and Siems, 2004; Kollias *et al.* 2013).

For instance, Abadie and Gardeazabal (2008) find that through increased uncertainty, terrorism reduces the expected return to investment and thus changes in the intensity of terrorist incidents may cause significant movements of capital across countries. Using event study methodology, Chen and Siems (2004) examine the magnitude of the effects the 9/11 New York terrorist attacks had on global and US capital markets. They report an overall significant impact but a relatively speedy recovery for US markets compared to other global capital markets. Nikkinen *et al.*, (2008) also examine the effects 9/11 had on 53 markets across the world. Their results indicate increased volatility as well as short-run negative effects that vary across regions depending on the degree of their integration into the global economy. From a different angle, Hon *et al.* (2004) focus on how the cross-country correlation of assets was affected from the same terrorist mega-event (i.e. 9/11). Compared to the time before 9/11, their results, especially for European markets, indicate that international stock markets responded more closely to US stock market shocks in the three to six months that followed 9/11. The 9/11 effects on markets are also addressed by Drakos (2004) who focuses on the shares of the airline industry. His findings indicate that the stock market valuation of such shares was adversely and significantly affected due to changed risk perceptions by consumers that led to lower demand for air travel and higher insurance premia due to the reassessment by insurance companies of the risks. Two other major terrorist attacks, the March 2004 Madrid and July 2005 London bombings, and the reaction of the Spanish and London markets respectively, is the theme of Kollias *et al.* (2011a). Eldor and Melnick (2004) examine the impact of terror on Israel's foreign exchange market and the Tel Aviv Stock Exchange (TASE) given the frequent and continuous terrorist incidents Israel faces. Their findings indicate that the foreign exchange market was affected but the opposite was the case for TASE. Two European Union stock markets – the London and Athens stock exchanges and their comparative reaction to terrorist incidents depending on their attributes is the theme of Kollias *et al.* (2011b). Other studies, such as that of Barros and Gil-Alana (2008), instead of focusing on the consequences of a single major terrorist incident, look at how ongoing terrorist activity has affected financial markets while Kollias *et al.* (2013) examine how the stock-bond correlation is affected by terrorist activity, reporting findings that suggest a flight-to-safety effect.

In line with such previous studies and hoping to contribute to this particular body of literature, this paper sets out to examine the impact major terrorist attacks had on the Istanbul Stock Exchange (henceforth ISE). To this effect, an event study methodology to assess ISE's reaction is used. The impact of these events on conditional volatility is also addressed. We begin by briefly presenting in the next section the main issues associated with terrorist activity in Turkey. Then, in section three the methodology employed is presented and the empirical findings analyzed and discussed. Finally, section four concludes the paper.

## 2. Terrorist Activity in Turkey: An Overview

Turkey is by no means a stranger to terrorism. Especially since the mid 1980's she has experienced an almost steady increase in terrorist activity (Rodoplu, 2003; Aras and Toktaş, 2007; Feridun and Sezgin, 2008; Yaya, 2009; Feridun, 2011). Several terrorist groups operate or have in the past operated in Turkey. The vast majority are domestic terrorist organisations but some of them apparently have strong international connections or loose ties with infamous transnational terrorist organisations such as Al-Qaeda. The most prominent among the groups that operate in Turkey is PKK, a left-wing guerrilla army established in 1978 with a nationalist separatist agenda. Other terrorist organisations include both left wing revolutionary groups such as the leftist group Dev-Sol of the 1970s, DHKP/C and TIKKO; as well as Islamic fundamentalist groups such as the Turkish Islamic Jihad and IBDA/C with close ties to Al-Qaeda that reportedly also has shells operating in Turkey.

As Yaya (2009) observes, a distinct characteristic of terrorist activity in Turkey is that it has not concentrated only on attacks in metropolitan areas. It has hit targets across the whole country both in cities as well as rural areas. Not surprisingly, a number of studies have addressed the issues associated with terrorist activity in Turkey, trying to assess its economic effects. A number of them concentrated on the effects terrorism has on the tourist industry since it is an important income generator for the Turkish economy (Feridun, 2011; Ozsoy and Sahin, 2006; Yaya, 2009; Araz-Takay *et al.*, 2010).

This paper departs from previous studies on the economic effects of terrorism in the case of Turkey. It does not concentrate on the aggregate level of the economy or a specific sector, such as tourism. It turns its attention to the reaction of ISE to major terrorist incidents that took place in 1999, 2003 and 2008. All three are selected because they are generally considered to be the most severe and serious attacks that have taken place in a major metropolitan area, given that Istanbul - the venue of the three events - is the financial centre of Turkey. The attacks were also particularly violent in terms of fatalities and were aimed at civilian targets (Table 1). Noteworthy are the 2003 bombings that targeted important, in terms of symbolism, targets: the British Consulate in Istanbul, Jewish synagogues and HSBC's headquarters. They were also the severest of the three attacks in terms of the sheer number of victims.

**Table 1. Summary of the Terrorist Events in Istanbul**

	Target	Fatalities	Injuries
13 March 1999	Shopping mall	13	23
15 November 2003	Jewish synagogues	27	>300
20 November 2003	British Consulate & HSBC bank headquarters	30	>400
27 July 2008	Shopping street	17	>150

The terrorist attack of 13<sup>th</sup> March 1999 took place in the *Mavi Çarşı* shopping mall in the Göztepe suburb in the Asian side of Istanbul. The shopping mall was taken over and set ablaze by the terrorists leaving thirteen people dead and twenty-three injured (Rodoplu *et al.* 2003). Although there was no official claim of responsibility by any organization or group, the attack was associated with PKK. The 2003 terrorist events took place with a five-day interval between them. The first, on

November 15, targeted the Jewish synagogues *Bet Israel*, in Şişli, and *Neve Shalom*, in the Galata district. They were attacked with bomb carrying cars that crashed into the synagogues. Five days later, on November 20, the British Consulate in Istanbul and HSBC's headquarters were the targets of two trucks loaded with explosives. Both attacks cost the lives of around sixty people and left more than seven hundred injured. A radical Turkish Islamic group, apparently with strong ties with Al-Qaeda, the *Great Eastern Islamic Raiders' Front* (İBDA/C), claimed responsibility. This probably explains not only the severity of the attack but the strong symbolism embedded in the choice of the targets. Finally, the 2008 bombings of July 27 had as a target a shopping street in the Güngören neighborhood of Istanbul. The bomb explosions claimed the lives of seventeen people (five of them children) and injured more than one hundred and fifty. Again, no responsibility was claimed. However, security forces attributed the bombing to PKK. In the next section we turn to examine ISE's reaction to these three major terrorist events.

### 3. The Impact on the Istanbul Stock Exchange

The Istanbul Stock Exchange is a major emerging stock market. It has a market capitalization of more than \$120bn and more than 300 listed companies. For the purposes of the analysis that follows, daily prices of the ISE are used. Six major indices are selected as the most representative sample through which the market's reaction to the aforementioned terrorist events can be investigated: the National-100, the Bank Index, the Industrial Index, the Services Index, the Tourism Index and the Trade Index. All of them are drawn from the *Reuters DataStream* database. The sample covers the period from January 1997 to December 2009 and includes 3391 trading days (Figures 1a, 1b, 1c)<sup>1</sup>. The dates of interest for the purposes of the paper are 15/03/1999, 20/11/2003 and 27/07/2008 when the attacks mentioned above took place<sup>2</sup>. Event studies as well as volatility analysis are the instruments widely used to assess and quantify markets' reaction to specific incidents and events (*inter alia*: Chen and Siems, 2004; Kollias *et al.* 2011a, 2011b).

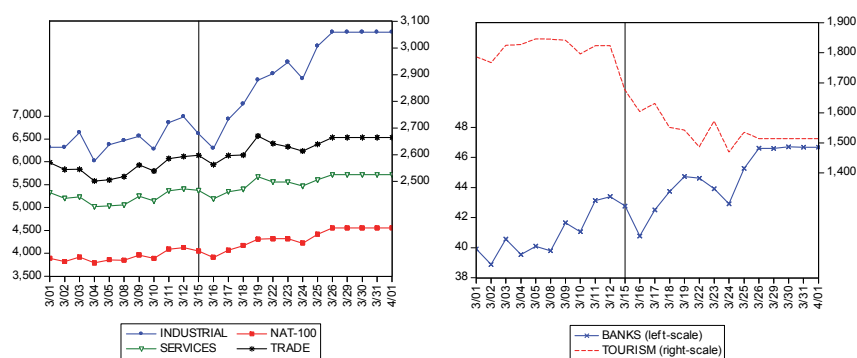


Figure 1a: Price Indices 15/03/1999

<sup>1</sup> The sample period is selected based on data availability.

<sup>2</sup> Given that 13/3/1999 was a Saturday in the tests that follow 15/3/1999 is taken as the event day to investigate the market's reaction. Similarly, the 15/11/2003 was also a Saturday and given that it was immediately followed by a second major hit on 20/11/2003 it was decided to use the 20/11/2003 as the event day for the relevant tests.

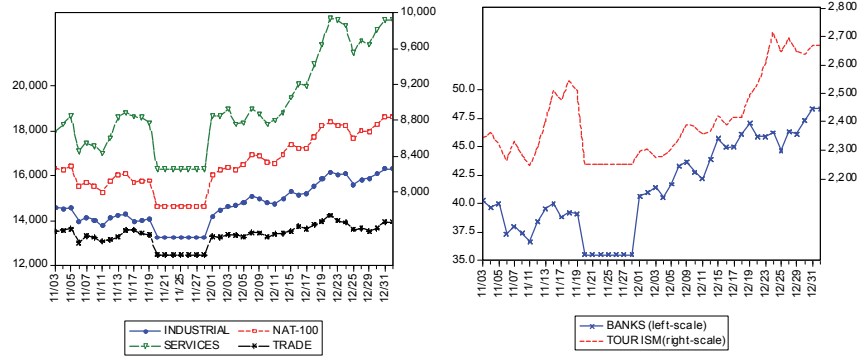


Figure 1b: Price Indices 20/11/2003

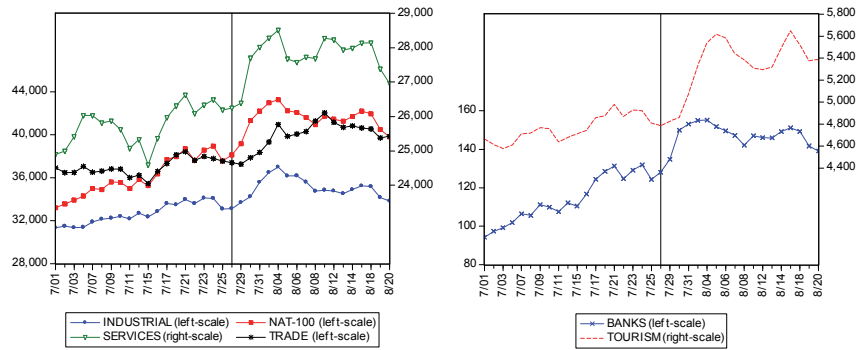


Figure 1c: Price Indices 27/07/2008

#### Event Study Methodology

In line with Craig-MacKinley (1997), an event study is employed in sequential steps. Firstly, the event window is selected, i.e. the number of days before and after the event day. Secondly, for a specific period of time an asset pricing model is estimated describing the evolution of equity returns. Then, based on the difference between actual and estimated returns abnormal returns are calculated. More specifically, by adopting an asset pricing model the expected returns of an equity can be modelled conditional on a number of factors (e.g. factors concerning global financial environment, currency risk etc)  $E(R | X_1, X_2, \dots, X_n)$ .

In order to assess the impact of these incidents on the market indices that were selected, i.e. ISE's general index, as well as the five sectoral indices, an asset pricing model is estimated. Thus the general formula of the arbitrage pricing model for expected index return in our case is as follows:

$$E(R_t) = b_0 + b_1 E(R_t^M) + b_2 E(R_t^{US}) + b_3 E(FX_t) \quad (1)$$

Where the daily return of the national 100 index is used as a proxy for the local market ( $R_t^M$ ); the daily return of the Dow Jones index ( $R_t^{US}$ ) is used for capturing the effect from world financial interactions, and, in order to allow for the presence of

exchange rate risk, the daily rate of the US dollar versus the Turkish Lira ( $FX_t$ ) is added in order to reflect the covariance of the asset with the US dollar exchange rate. Rational expectations are assumed in order to estimate (1). Hence, from the expected return we can get actual returns. Solving the following two equations and then substituting in (1) we get (2) that can be estimated empirically.

$$\begin{aligned} E(R_t) &= (R_t) + e_1, \quad E(R_t^M) = (R_t^M) + e_2, \quad E(R_t^{US}) = (R_t^{US}) + e_3 \\ E(FX_t) &= (FX_t) + e_4 \quad R_t = b_0 + b_1 R_t^M + b_2 R_t^{US} + b_3 FX_t + e_t \end{aligned} \quad (2)$$

Then, the parameters of the regression equation (1)<sup>3</sup> are calculated, using 3191 trading days from February 1997 to December 2009 and thus we obtain the estimated returns.

$$\hat{R}_t = \hat{b}_0 + \hat{b}_1 R_t^M + \hat{b}_2 R_t^{US} + \hat{b}_3 FX_t$$

Then, daily excess or abnormal returns are calculated through the difference of the actual return and the estimated return:

$$AR_t = R_t - (\hat{R}_t) \quad (3)$$

Initially, the event-day abnormal returns are calculated. The date of the event is set at  $t=0$ , and two longer event windows are examined by computing the cumulative average abnormal returns (CARs) 3 ( $t=3$ ) and 6 days following the event ( $t=6$ ). The cumulative abnormal returns (CARs) were estimated using the following equation:

$$CAR_t = \sum_{t=T_1}^{T_2} AR_t \quad (4)$$

where  $T_1$  is the event day and  $T_2$  is consequently 3 and 6 days after the event.

The findings of the event study methodology for each one of the three key dates are presented in Table 2 where the abnormal returns and statistical significance levels for the 0, 3, and 6-day event windows are shown. Furthermore, a column was included that shows the number of trading days that elapsed before each of the indices returned to the initial pre-attack level. The results indicate that the 1999 attack had, broadly speaking, a negative effect on the event day on both the general as well as the sectoral indices. The only exception to this general reaction was the Trade index (Table 2). Worth noticing is that the largest negative and statistically significant abnormal return is recorded in the case of the Tourism Industry (-8.86%) followed by that of the Industrial Index (-2.69%). The Tourism Index also displays significant negative 3 and 11-day cumulative abnormal returns. This finding accords with that of other studies. It shows that this sector is particularly sensitive and vulnerable to terrorist attacks irrespective of whether the culprits are domestic or transnational terrorist organizations. This is true not only in the case of Turkey but elsewhere given its importance as an income generator for a number of countries

<sup>3</sup> When the National-100 index is considered as dependent variable the model includes only the Dow Jones index and the currency risk factor.

(*inter alia*: Feridun, 2011; Enders *et al.* 1992; Drakos and Kutan, 2003; Yaya, 2009). As among others these studies have shown, persistent terrorist activity or headlines capturing terrorist events, as the ones examined here, impact destination choices by international tourists, since they raise country risk perceptions. As, among others, the findings reported by Sönmez and Graefe (1998), Sönmez (1998) and Llorca-Vivero (2008) indicate, terrorist activity constitutes negative advertising for the country that may cause tourists or indeed other type of visitors such as business persons to reconsider their decision to visit. This of course is particularly true when the target is tourist venues or transportation networks. Since Istanbul is one of the prime tourist destinations for visitors in Turkey, the negative impact on the tourist industry is augmented. A reduction in tourist arrivals affects foreign exchange earnings and tourist revenues for the plethora of economic activities associated with this industry. In this context, the negative response of this index reflects a fall in investors' expectations for the tourist industry's turn-over and hence profitability. In contrast to the tourist industry index, all the other indices exhibit a quick recovery within two days or so and positive CARs. This transitory and broadly insignificant effect accords with the findings reported by previous studies (*inter alia*: Chen and Siems, 2004; Drakos, 2010; Kollias *et al.* 2011b, 2013). A tentative explanation is that there was ample time for the impact of the attack to be absorbed and discounted by the time markets opened given that the incident took place on a Sunday. But it may also be indicating that markets are fairly efficient when it comes to absorbing and incorporating events. As a result, they quickly rebound, following the initial exogenous shock that rattles them. In fact, as noted above, this is a common finding and conclusion among a number of studies (*inter alia*: Eldor and Melnick, 2004; Chen and Siems, 2004; Kollias *et al.* 2011a, 2013).

Quite the opposite is observed in the case of the next attack examined here. The 15<sup>th</sup> and 20<sup>th</sup> November 2003 bombings appear to have rattled ISE (Table 2). The significance (symbolic or otherwise) of the targets – Jewish Synagogues, the British Consulate, HSBC's headquarters - may explain this reaction. Indeed, as the results of other studies suggest, markets' reaction to terrorist events can significantly vary with the magnitude of the response depending on a number of factors that include the severity of the attack in terms of victims and damages and the significance of the target(s) hit (Kollias *et al.* 2011b). Clearly the targets chosen by the terrorist on this occasion were of high symbolism both in terms of a diplomatic and international relations perspective as well as in terms of economic significance. To this, one must also add the sheer number of victims in terms of fatalities and injuries. In other words, the attacks in question had all the attributes that trigger and cause a major reaction by markets. Generally, the findings of the event study suggest that the attacks left an identifiable imprint on ISE. On the event day the actual reaction of the main index was a fall of -7.59%. In fact, as a result of these attacks, the havoc that they created and perhaps most importantly the significance of the targets hit, trading was suspended. The stock exchange was closed and reopened<sup>4</sup> on December 1<sup>st</sup> with Turkey's Central Bank prepared to intervene to support the falling of Turkish Lira. With no exception, all the indices record a fall with the two largest reactions being those of the Bank and Tourism Indices that fall by almost 11% and display negative and statistically significant ARs. Just as in the case of the first attack, the Tourism Index continued to record losses and rebounded only after fifteen trading days have elapsed. With this exception, the days ISE remained closed appear to have proved

<sup>4</sup> Cumulative abnormal returns are estimated since the opening of the stock exchange on December 1st.

enough for the market to recover in a single trading day once trading resumed. Hence, it is possible to argue that the decision of the supervisory authorities to suspend trading was vindicated since it helped the market and market agents to absorb the repercussions of the episode avoiding an unjustified overreaction to the initial shock waves. In a sense it contributed to curtailing and abating the negative spill-overs of the attacks. Overall, in view of these findings, one may tentatively point to implications for portfolio management strategies. In particular, given that all ISE sectors do not exhibit a similar reaction to violent and unexpected events, such as the terrorist attacks examined here, diversification benefits may exist for investors and portfolio managers. Since the tourist and to a lesser extent the banking sectors seem to exhibit a greater sensitivity and vulnerability to such events, portfolios that are mainly based on these two sectors would probably be better off with greater diversification in order to hedge against such eventualities.

**Table 2. Abnormal Returns of indices 15/3/99, 20/11/03, 27/7/08**

Index	15/3/1999			20/11/2003			27/7/2008		
	Event day AR	3-day CAR	6-day CAR	Event day AR	3-day CAR	6-day CAR	Event day AR	3-day CAR	6-day CAR
<b>Nat-100</b>	-2,30%	0,22%	4,35%	-7,59%	-1,93%	-4,47%	1,99%	11,07%	10,19%
t-stat	(-0,74)	(0,07)	(1,40)	(-2,89)*	(-0,73)	(-1,70)	(0,89)	(4,98)*	(4,59)*
Days to Rebound	2			1			0		
<b>Bank Index</b>	-1,88%	-0,03%	-0,47%	-10,22%	4,53%	8,12%	4,19%	20,84%	18,53%
t-stat	(-0,43)	(-0,008)	(-0,49)	(-2,68)*	(1,19)	(2,13)	(1,12)	(5,57)*	(4,95)*
Days to Rebound	3			1			0		
<b>Industrial Index</b>	-2,69%	0,97%	6,93%	-6,07%	2,15%	4,86%	0,43%	6,68%	7,56%
t-stat	(-1,15)	(0,41)	(2,96)*	(-2,94)*	(1,04)	(2,36)*	(0,24)	(3,71)*	(4,20)*
Days to Rebound	2			1			0		
<b>Services Index</b>	-0,93%	-0,84%	2,49%	-6,06%	0,10%	-0,31%	0,54%	6,20%	4,22%
t-stat	(-0,37)	(-0,34)	(1,00)	(-3,09)*	(0,05)	(-0,16)	(0,32)	(3,66)*	(2,49)*
Days to Rebound	3			1			0		
<b>Tourism Index</b>	-8,86%	-16,84%	-14,63%	-10,84%	-11,15%	-6,36%	-0,44%	4,85%	14,31%
t-stat	(-2,38)*	(-4,53)*	(-3,94)*	(-4,37)*	(-4,52)*	(-2,58)*	(-0,02)	(2,49)*	(6,97)*
Days to Rebound	>100			15			1		
<b>Trade Index</b>	0,07%	-0,27%	3,02%	-6,91%	-1,95%	-1,50%	-0,11%	1,58%	4,66%
t-stat	(0,02)	(-0,09)	(1,06)	(-3,72)*	(-1,05)	(-0,81)	(-0,06)	(0,93)	(2,74)*
Days to Rebound	0			3			1		

Notes: T-statistics are in parentheses. <sup>a</sup>Number of trading days for the market index to return to pre-attack level. \*Statistically significant at the 0.05 level

Finally, in the case of the last of the three terrorist incidents examined here, the July 2008 attack, our results do not reveal a significant negative reaction by ISE. As it can be seen in Table 2, positive and statistically significant CARs appear to be the case for most of the indices. A tentative explanation that could be proposed is that this bombing was treated - in relative terms - as a *minor* and *insignificant* incident by the market and investors compared to the devastating 2003 attacks. In other words, this attack did not have any attributes that would warrant a noteworthy reaction by market agents. Hence trading continued unabated. Although it claimed the lives of seventeen people (five of them children) the significance and location of the venue were not comparable to those of 15<sup>th</sup> and 20<sup>th</sup> November 2003 bombings. This in itself would explain why no effect is statistically traceable in our dataset. Nevertheless, data of a higher frequency - i.e. intraday data - may reveal a slightly different picture in terms of short-term intraday reaction which apparently did not last. Furthermore, one may also add that the absence of any statistically traceable response could also reflect a growing resilience and stoutness of markets and investors to such incidents. In other words, increased market efficiency when it



comes to the reaction that markets and market agents exhibit to unanticipated external shocks such as terrorist episodes.

#### Time-varying Volatility

The next step in our analysis is to examine the effect of the three terrorist attacks on volatility. The Gauss-Markov assumption for linear regressions is usually violated because of the time dependency of the error in high frequency daily stock market and renders the estimation of ordinary least squares (OLS) models inefficient. Based on the relevant literature (Engle, 1983; Engle and Ng, 1993; Bollerslev, 1986), a GARCH modeling technique is more appropriate to solve this problem. The conditional variance of the sectoral indices is tested for insecurity effect by estimating the following equations:

$$R_t = c_0 + c_1 R_t^M + c_2 R_t^{US} + c_3 FX_t + \varepsilon_t, \varepsilon_t \sim N(0, h_t) \quad (5)$$

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} + \sum_{i=1}^3 \gamma_i d_{i,t} \quad (6)$$

where  $R_t$  is the daily return for the index,  $d_{i,t}$  is a dummy variable which takes the value of 1 for the event day (i), and  $\varepsilon_t$  is the error term with conditional mean zero and conditional variance  $h_t$ . Where there has been evidence of autocorrelation, an AR(1) model is estimated for the residuals (the relevant coefficient in Table 3 is  $c_4$ ). Volatility is modeled using a simple GARCH(1,1) model<sup>5</sup>. Since the innovations appear leptokurtic rather than normally distributed, quasi-maximum likelihood (QML) covariances and robust standard errors have been used (Bollerslev and Wooldridge, 1992).

From the results reported in Table 3, the Bank sector emerges as the most sensitive. It reacts more to the bad news of the terrorist attack as this is implied by the high value of  $\alpha$  in the volatility equation. Generally, all the sectors present significant volatility persistence as it can be deduced from the high values of  $\beta$ . Perhaps noteworthy is the significance of the dummies in the conditional volatility equation in the case of the 2003 bombings. A significant negative effect in the volatility across sectors is unearthed by our estimations suggesting herding behavior. At a first glance, this may be regarded as a strongly counterintuitive finding. However, this finding possibly reflects the effect that the suspension of trading for around a week had on the volatility of the market. As noted above, the significance of the targets as well as the severity of the attacks in terms of victims were such that trading was suspended. The stock exchange closed for about a week until December 1<sup>st</sup> when it was reopened and trading was allowed to be resumed. This probably explains the counterintuitive finding of our estimations. The days that elapsed until the reopening of the market offered ample time for the immediate shock to be absorbed and the financial turmoil to pass away.

<sup>5</sup> For the estimation of GARCH models the E-views software was used.

**Table 3. Estimates of the Conditional Mean and Variance Equations  
for indices' returns**

<b>Indices</b>	<i>The conditional mean equation</i>					<i>The conditional variance equation</i>					
	$C_0$	$C_1$	$C_2$	$C_3$	$C_4$	$\omega$	$\alpha$	$\beta$	$\gamma_1$	$\gamma_2$	$\gamma_3$
<b>Nat-100</b>	0,001192*	0,303867*	0,000227	-	-	0,000011*	0,093534*	0,893169*	0,000338	0,000573	0,00011
<b>Bank</b>	-0,000383	0,084777*	-0,080567*	1,312021*	-	0,000006*	0,240162*	0,768925*	-0,000105	-0,0000065	0,000157
<b>Industrial</b>	0,000104	-0,02078*	0,011623	0,819313*	0,05988*	0,000003*	0,101278*	0,842771*	-0,000027	-0,000025*	0,000145
<b>Services</b>	0,000095	-0,037943	0,006877	0,80464*	-	0,000007*	0,145368*	0,81061*	0,000095*	-0,000095*	-0,000041
<b>Tourism</b>	-0,000395	0,053786	0,041487	0,852745*	0,04831*	0,000017*	0,074151*	0,902099*	0,000827	0,0000468	0,000177
<b>Trade</b>	0,000273	-0,031075	-0,046567	0,728723*	0,006623	0,000003*	0,069647*	0,917219*	0,00021	-0,000142*	0,000146

\*Statistically Significant at the 0.05 level.

#### 4. Concluding Remarks

A number of studies have addressed the issue of the economic effects of terrorist activity in Turkey. This paper set out to examine the impact that three major terrorist events had on ISE. Terrorist incidents are unforeseen, even in countries that are or have been the victims of systematic terror campaigns, such as Turkey in our case. From the markets' perspective terrorist attacks represent exogenous shocks that rattle and upset the daily social and economic routine and on occasions can also have serious political repercussions on the domestic as well as international level. In order to examine the impact on ISE, event study methodology and market volatility analysis were used. In broad terms, the findings reported herein do not seem to indicate any long lasting effects on the market's operation apart from the initial reaction that one would expect to be the case for such major and unforeseen events. The significance of the targets as well as the severity of the terrorist attacks seem to be the main determinants of the response magnitude. Given the reaction of the Tourist Industry index, the sensitivity of this sector to terrorist attacks also emerges as a noteworthy finding that accords with the evidence reported by previous studies that have examined the effects of terrorist activity on tourism. Nevertheless, the overall conclusion is that, although the terrorist attacks examined here had a negative impact on ISE, this effect was not particularly pronounced.

#### 5. References

- ABADIE, A., GARDEAZABAL, J. (2008). Terrorism and the world economy. *European Economic Review*, 52 (1), pp.1-27.
- ARAS, B., TOKTAŞ, S. (2007). Al-Qaida, 'War on Terror' and Turkey, *Third World Quarterly*, 28 (5), pp.1033-1050.
- ARAZ-TAKAY, B., ARIN, P., OMAI, T. (2009). The endogenous and non-linear relationship between terrorism and economic performance: Turkish evidence. *Defence and Peace Economics*, 20 (1), pp.1-10.
- BARROS, C., GIL-ALANA, L. (2008). Stock market returns and terrorist violence: evidence from the Basque Country. *Applied Economics Letters*, 16 (15), pp.1575-1579.
- BOLAK, M., SUER, O. (2008). The effect of Marmara earthquake on financial institutions. *Doğuş Üniversitesi Dergisi*, 9 (2), pp.135-145.
- BOLLERSLEV, T., WOOLDRIDGE, J.M. (1992). Quasi-maximum likelihood estimation and inference in dynamic models with time varying covariances. *Econometric Reviews*, 11 (2), pp.143-173.
- BOLLERSLEV, T. (1986). Generalised autoregressive conditional heteroskedasticity. *Journal of Econometrics*, 31 (3), pp.307-327.
- CHEN, A., SIEMS, T. (2004). The effects on terrorism on global capital markets. *European Journal of Political Economy*, 20 (2), pp.349-366.
- CHESNEY, M., RESHETAR, G., KARAMAN, M. (2011). The impact of terrorism on financial markets: an empirical study. *Journal of Banking and Finance*, 35 (2), pp.253-267.
- CRAIG MACKINLEY, A. (1997). Event studies in economics and finance. *Journal of Economic Literature*, 35 (1), pp.13-39.
- DRAKOS, K. (2004). Terrorism-induced structural shifts in financial risk: airline stocks in the aftermath of the September 11<sup>th</sup> terror attacks. *European Journal of Political Economy* 20 (2), pp.435-446.
- DRAKOS, K. (2010). Terrorism activity, investor sentiment and stock returns. *Review of Financial Economics*, 19 (3), pp.128-135.
- DRAKOS, K., KUTAN, A. (2003). Regional effects of terrorism on tourism in three Mediterranean countries. *Journal of Conflict Resolution*, 47 (5), pp.621-641.
- ELDOR, R., MELNICK, R. (2004). Financial markets and terrorism. *European Journal of Political Economy*, 20 (2), pp.367-386.

- ENDERS, W., SANDLER, T. (2006). *The Political Economy of Terrorism*, Cambridge, Cambridge University Press.
- ENDERS, W., SANDLER, T., PARISE, G. (1992). An econometric analysis of the impact of terrorism on tourism. *Kyklos*, 45 (4), pp.531-554.
- ENGLE, R., NG, V. (1993). Measuring and testing the impact of news on volatility. *Journal of Finance*, 48 (5), pp.1749-1778.
- ENGLE, R. (1982). Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation, *Econometrica*, 50 (4), 987-1006.
- FERIDUN, M. (2011). Impact of terrorism on tourism in Turkey: empirical evidence from Turkey. *Applied Economics*, 43 (24), pp.3349-3354
- FERIDUN, M., SEZGIN, S. (2008). Regional underdevelopment and terrorism: the case of south eastern Turkey. *Defence and Peace Economics*, 19 (3), pp.225-233
- FERNANDEZ, V. (2008). The war on terror and its impact on the long term volatility of financial markets. *International Review of Financial Analysis*, 17 (1), pp.1-26.
- HERBST, A., MARSHALL, J., WINGENDER, J. (1996). An analysis of the stock market's response to the Exxon Valdez disaster. *Global Finance Journal*, 7 (1), pp.101-114.
- HON, M., STRAUSS, J., YONG, S. (2004). Contagion in financial markets after September 11: myth or reality? *The Journal of Financial Research*, XXVII (1), pp.95-114.
- KAPLANSKI, G., LEVY, H. (2010). Sentiment and stock prices: The case of aviation disasters. *Journal of Financial Economics*, 95 (2), pp.174-201.
- KOLLIAS, C., PAPADAMOU, S., STAGIANNIS, A. (2010). Armed conflicts and capital markets: the case of the Israeli military offensive in the Gaza Strip. *Defence and Peace Economics*, 21 (4), pp.357-365.
- KOLLIAS, C., PAPADAMOU, S., STAGIANNIS, A. (2011a). Terrorism and capital markets: the effects of the Madrid and London bomb attacks. *International Review of Economics and Finance*, 20 (4), pp.532-541.
- KOLLIAS, C., PAPADAMOU, S., STAGIANNIS, A. (2011b). Stock markets and terrorist attacks: comparative evidence from a large and a small capitalization market. *European Journal of Political Economy*, 27 (S1), pp.S64-77.
- KOLLIAS, C., PAPADAMOU, S., ARVANITIS, V. (2013). Does terrorism affect the stock-bond covariance? Evidence from European countries. *Southern Economic Journal*, 79 (4), pp.832-548.
- LLORCA-VIVERO, R. (2008). Terrorism and international tourism: new evidence. *Defence and Peace Economics*, 19 (2), pp.169-188.
- NIKKINEN, J., OMRAN, M., SAHLSTROM, P., AIJO, J. (2008). Stock returns and volatility following the September 11 attacks: evidence from 53 equity markets. *International Review of Financial Analysis*, 17 (1), pp.27-46.
- OZSOY, O., SAHIN, H. (2006). Direct and indirect effects of terrorism on the Turkish economy. *International Journal of Business Management and Economics*, 2 (1), pp.59-74.
- RODOPLU, U., ARNOLD, J., ERSOY, G. (2003). Terrorism in Turkey: implications for emergency management. *Prehospital and Disaster Medicine*, 18 (2), pp.152-160.
- SANDLER, T. (2003). Collective action and transnational terrorism. *The World Economy*, 26 (6), pp.779-802.
- SÖNMEZ, S.F. (1998). Tourism, terrorism and political instability. *Annals of Tourism Research*, 25 (2), pp.416-456.
- SÖNMEZ, S.F., GRAEFE, A.R. (1998). Influence of terrorism risk on foreign tourism decisions. *Annals of Tourism Research* 25 (1), pp.112-144.
- YAYA, M. (2009). Terrorism and tourism: the case of Turkey. *Defence and Peace Economics*, 20 (6), pp.477-497.