THE EFFECT OF TERROR INCIDENTS ON THE YIELD OF INDEX MARKETS FOR DEVELOPING AND DEVELOPED MARKETS

Tchai Tavor

Department of Economics and Management, Yizrael Valley College,
Yizrael Valley, 19300 Israel

Abstract
The proliferation of terror threats in the last decades, and the increasing number of terrorist incidents at different locations around the world, engendered a counter-reaction from the members of the international community. This study examined how terrorist incidents which took place over the last decade affected the capital markets of the targeted countries, and whether the effect was permanent or transitory. Using the Terror Index, terrorist incidents were analyzed in four main tests. The study results point at the following conclusions: 1. There is a correlation between the yield index on the day of the terrorist incident and the two following work days, 2. There is a negative correlation between the severity of the event and the yield indices, 3. On the day of the terror incident, there is no difference in yield indices between large and small countries and between democratic and authoritarian countries, developing countries, however, show a steeper decline than developed countries. 4. In larger and developed countries terror incidents are permanent, while in democratic countries they are transitory.

Key words: *Terror Index, Terror Incidents, Market Efficiency, Permanent*

1. INTRODUCTION

Terrorism is a global threat, becoming over the last decades a problem which almost every society has to face from time to time. Terrorism is a common weapon used by terrorist groups, carrying out terror attacks of different measures in different places in the world and against various populations, from soldiers to women and children. Many studies of terrorism were carried out in the fields of sociology, political science and history. However, since the terror attacks of September 11th and the terrorist incidents in Madrid in 2004 and London in 2005, many articles were published dealing with the effect of terrorist incidents on economy and the capital market. These incidents revealed that terrorism is a new catastrophic risk that has to be faced by financial investors and institutions (Chesney and Karaman, 2011).

The measure of financial effect is partly influenced by the severity of the terror attack and partly influenced by the economic, political, and social characteristics of the targeted countries. Terror will not have the same effect on all financial activities since the severity of the financial effect of terror depends on the composition of financial activities and on the market structure. Different market sectors can be ranked according to their potential vulnerability to terrorism. Studies show that the aggregate financial loss will be greater in countries where foreign trade, tourism and foreign investments hold a relatively higher place than other financial sectors. In addition, the effect of terrorism also differs between urban and rural areas, since the growth of expenses which result from terrorism is higher for urban businesses than for rural ones (Harrigan and Martin, 2002). Moreover, the capital market will react more strongly in non-confrontational areas and in central areas (Tavor, 2011).

Another characteristic of countries that allows us to examine financial loss in general and the effect on stock markets in particular, is the different levels of development between countries. It is generally believed that in developed countries with government institutions that have a short reaction time, the negative effect of terrorism on economy will be generally smaller than in developing countries

(Sandler and Enders, 2004). In contrast, Bilson et. al (2012) discovered that large terrorist incidents cause significant "infection", especially in markets of developed countries compared with markets of developing countries, finding also that the average effect lasts for a short span of time. In their study they collected data about 45 countries, including 21 developed countries and 24 developing countries, and examined correlations between the countries' markets around the time of major terrorism incidents, emphasizing later terrorist incidents taking place during the period of 1996 – 2006 and limiting the sample to significant terrorism incidents (more than 10 fatalities or injuries and a damage of more than 10,000$).

My work will study the effect of terrorism on the stock markets of different countries, with relation to the country's size, type of regime and level of development (developed or developing country). The work is based on a unique sample of terror attacks ranging from 3/2000 until 2/2013 and includes 108 terrorism incidents which took place in different countries. I offer a quantitative index to measure the level of pessimism (Terror Index) which contains different components of the incident, such as: the location of the incident, the type of terrorism used, the target of the attack and the number of fatalities and injured people in the attack. I will examine the effect of every one of the incidents on the main index of the targeted country, comparing the characteristics of the different countries. Afterwards, I will ascertain whether the incident's effect is permanent or is an excessive reaction which is later corrected.

2. DATA AND METHODOLOGY

In the course of this study, data was collected regarding terrorism incidents which took place at different countries around the world. The data collected included the description of the incident, the number of people injured and killed, the location of the incident, and the target of the incident. Data was collected from the following sites: Wikipedia.co.il, Ynet.co.il, News.nana10.co.il, Haaretz.co.il. The sample includes data from 108 terrorism incidents which took place in 22 countries, among which are Iraq, Sri-Lanka, Turkey, Indonesia, USA, Israel and others. Data about the central index of the countries was gathered on the following sites: Investing.Com, YahooFinance.com and Bloomberg.com. These sites are an information source for the central indices of stock markets around the world.

In order to find out if the terrorism incident is permanent or transitory, the study is based on the hypothesis that if the stock prices show no excessive reaction after the terrorism incident, but a negative continuous effect in the period following the incident, then the effect will be called permanent. To test this hypothesis, the study will examine the closing prices of the central index in the targeted country on the day of the incident (Yt), on the day before the incident (Yt-1) and on the two days following the incident (Yt+1) and (Yt+2). If the terrorism incident took place on the morning of the trading day or during the trading day, then the trading day will be considered as the day of the incident. If the incident took place at the end of the trading day or on a day in which trading does not take place, the first trading day after the terror incident will be considered as the day of the incident.

In order to examine the incident's effect, the study will use the TI index - a measure of pessimism with values ranging from 5 to 16 - during the four days around the terrorism incident. This test will be based on a variant of the regression model of Eldor and Melnick (2004). While their model refers to the TI index on the day of the incident, this study will refer to the yields around the day of the incident and to the TI index on the day of the incident. The econometric model in this test is expressed through the following equation (1):

$$Y_t = \alpha + \beta_1 \cdot Y_{t-1} + \beta_2 \cdot Y_{t+1} + \beta_3 \cdot Y_{t+2} + \gamma \cdot TI_t + \sum_{i=1}^{3} \delta_i \cdot X_i + \varepsilon_t \quad (1)$$

Where Y_{t-1} is the yield of the central index on the day before the incident, Y_{t+1} is the yield of the central index on the day after the incident, and Y_{t+2} is the yield of the central index two days after the incident. If the result of this regression will show that $\beta_2 + \beta_3 \neq 0$ then we can conclude that the effect of the

terror incident is permanent.

TI is a variable which signifies the terror index. Using this index this study can reflect the investors' level of pessimism resulting from the intensity of the terrorism incident. Five parameters that have a major influence on the incident's severity have been used in order to construct the index. The first parameter is the number of fatalities in the incident (D_1). This parameter was divided to four categories. The value 1 is assigned to an incident with 20 fatalities or less, 2 to an incident with 20 to 40 fatalities, 3 to an incident with 40 to 70 fatalities and 4 to an incident with more than 70 fatalities. The second parameter is the number of injured people (D_2), this parameter is divided to four as well, based on the same criteria of division used in the first parameter of fatalities. A third parameter is the type of incident (D_3). This parameter was divided to three categories, the value 1 is assigned to a suicide attack, 2 to an attack using an explosive device and 3 to an incident of massacre shooting. The numbers of the categories were arranged according to the severity of the incident. The fourth parameter is the incident's target (D_4), and is divided to 3 levels. The value 1 is assigned to an attack against the army, 2 to an attack against the government and 3 to an attack against civilians. The fifth and last parameter (D_5) is the location of the incident, where the value 1 is assigned to an attack in a non-central area, and the value 2 is assigned to an attack in a central area. The categories of all the selected incidents were determined according to the data and description of each one of the incidents.

The index of incident severity TI will be based on these components.

$$TI = D_1 + D_2 + D_3 + D_4 + D_5 \quad (2)$$

The index values range from 5 to 16. A high index value will indicate that the incident was severe and targeted to incur complete destruction in a central place, while an index value of 5 will indicate a light, insignificant incident.

The last variable in the equation is a vector of dummy variables defined as X_i which aim is to represent an interaction between the characteristics of the countries in relation to the existing independent variables.

The first characteristic the study will examine is the size of the population (X_1) and its assigned value will be “70M”. If the population exceeds 70 million residents, the country will be considered large. Of the participating countries, the ones whose population exceeds 70 million residents are: Pakistan, Indonesia, India, Turkey, Russia, Egypt and the US.

The second characteristic is the country's level of development (X_2). We will examine if the country is considered a developing or a developed country using the Human Development Index (HDI), which is used to compare the development level of different countries, with a range of values that extends from 0 to 1. The grade given to every country is a composite statistic of that country's average life span, education level and GDP. This index is a standard means to measure the level of welfare and is used by the United Nations Development Programme in its annual report, and is used in order to divide world countries to developed countries and developing countries.

If this index value is above 0.7, then the country is considered a developed country, otherwise it is developing. To describe this qualitative trait we will use an additional dummy variable, HDI, assigning the value 1 for a developed country. The developed countries in the sample are: England, Israel, France, Italy, Belgium, Sweden, USA, Denmark, Spain, Russia, Turkey and Tunisia. The consideration for choosing this variable is that a developed country has more resources to withstand this type of incident.

The third characteristic is the type of regime (X_3). This characteristic will indicate if the incident took place in a democratic or authoritarian country, determined by the democracy index, which examines the democracy level of 167 countries around the world. This index focuses on five main categories on which the countries are compared: the election process, civil rights, government functioning, political involvement and political culture. This category is ranked through a series of 60 multiple choice questions that are answered each year by experts. Every country receives a grade on a scale range of 0 to 10, while 10 signifying a high democracy level. A country with a grade higher than 7 is considered a democratic country and a country with a grade lower than 7 is considered a dictatorship. This

characteristic will be given the name "DEMOCRACY", and is a dummy variable. The value 1 will be assigned to democratic countries. The countries which have the value 1 are: Spain, Israel, France, Italy, USA, Thailand, India, England, Holland, Belgium and Sweden.

The aforementioned division to groups is used to test if a terrorism incident has a different effect on each one of the separate groups, running a regression analysis on each one of the groups, including all variables and the group characteristics.

3. RESULT AND DISCUSSION

My expectation is that a terror incident will negatively influence expected profitability of companies, and their risk premiums as well as a result of the increase of uncertainty, which causes the stock rates to decline. Therefore, the main study hypothesis is the existence of a negative correlation between terrorism incidents and the capital market, with a higher negative correlation the more severe the incident is. It is also safe to assume that most of the effect will be permanent and not transitory.

3.1 Descriptive Statistics

In this part I will present a general review of the data gathered for this study, in respect to terrorist incidents and their effect on the capital market (see Table 1 below). This study tested the effect on the central index of the targeted country.

Table 1: a statistical review of the sample variables

	N	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Yt-1	108	-6.11%	5.89%	0.24%	1.52%
Yt	108	-10.36%	6.98%	-0.38%	1.96%
Yt+1	108	-6.11%	3.36%.	-0.15%	1.75%
Yt+2	108	-7.56%	4.44%	-0.02%	0.72%
TI	108	5	16	10.12	2.437
Democracy	108	0	1	0.49	0.502
70m	108	0	1	0.54	0.501
HDI	108	0	1	0.44	0.499

The table shows that the movement of the yield indices on the day of the incident ranges between -10.36% to 6.98%, with an average negative yield of -0.38% and a standard deviation of 1.96%. In the course of the two days following the incident there is an average decline of 0.17% in the yield indices. Observing the severity of the incident, it was found that the terror index ranges between 5 to 16. The average grade of the index for all incidents is 10.12, that is, the sampled incidents are defined by a medium to high severity level, with a standard deviation of 2.43. It was found that about half of the participating countries are democratic ($mean_{Democracy} = 0.49$) and large ($mean_{70m} = 0.54$) and a little less than half of them are developed ($mean_{HDI} = 0.44$).

3.2 Constructing a regression analysis model to examine the effect of terror incidents on capital market

Terror incidents bring a decrease of public financial assets resulting in a decrease of profitability for companies, which increases the level of market uncertainty. In this paragraph an econometric model will be used to test for a correlation between the incident's severity and the yield index of the incident day and to test the hypothesis that the effect of terrorism incidents on the capital market is permanent. Using this regression analysis, if $\beta_2 + \beta_3 \neq 0$, then we will conclude that the effect of the terror incidents is permanent.

Table 2: construction of a regression model to examine the effect of a terror incident on the capital market

This table examines the existence of a possible relation between the severity of the incident and the stock yield on the day of the incident, as well as the hypothesis that the effect of terrorist incidents on the capital market is permanent and not transitory, using of the following regression:

$$Y_t = \alpha + \beta_1 \cdot Y_{t-1} + \beta_2 \cdot Y_{t+1} + \beta_3 \cdot Y_{t+2} + \gamma \cdot TI_t + \sum_{i=1}^{3} \delta_i \cdot X_i + \varepsilon_t$$

Y_{t-1} is the yield of the central index a day before the incident, Y_{t+1} is the yield of the central index a day after the incident, and Y_{t+2} is the yield of the central index two days after the incident. If the result of this regression will show that $\beta_2 + \beta_3 \neq 0$ then the conclusion will be that the effect of the terror incident is permanent.

Variable	*Coefficient*	*Std. Error*	*Prob.*
C	-0.004	0.013	0.738
Yt-1	-0.558	0.286	0.054
Yt+1	0.032	0.012	0.021
Yt+2	0.115	0.058	0.048
TI	-6.740	2.132	0.008
70M	0.269	0.269	0.320
HDI	0.076	0.016	0.007
DEMOCRACY	0.001	0.017	0.931

The regression results indicate that there is a correlation between the yield index on the day of the incident and the two days following the incident. When the effect of the incident's severity on index performance is examined, a negative correlation is discovered. That is, the more severe is the incident (i.e. the higher the grade), the decline of the yield index will be more significant. In respect to the effect of the terrorist incident according to country characteristics, the results indicate that there is no difference in incident effect on yield indices between large and small countries or between democratic and authoritarian countries. However, the parameter of country development does have an effect – developing countries are more negatively affected by terrorist incidents.

4. CONCLUSIONS

The proliferation of terror threats in the last decades, and the increasing number of terrorist incidents at different locations around the world, engendered a counter-reaction from the members of the

international community. The war against terror includes many diverse means, such as: military and police prevention and enforcement operations; development of judicial mechanism in the national and international level and the presentation of a political front against the phenomenon and all its aspects. This study examined how terrorist incidents which took place over the last decade affected the capital markets of the targeted countries, and whether the effect was permanent or transitory, examining the incidents according to five main tests. The study used the Terror Index, which includes different components of the incident, such as: number of fatalities, number of injured people, type of incident, target of incident and location of incident.

The first analysis tested the relationship between the yield index and the characteristics of the incident. The results indicated that there is a correlation between the yield index on the incident day and the two trading days following the incident. The second analysis examined the effect of the incident's measure of severity on index performances on the day of the incident. The results showed a negative correlation, that is, the more severe a terrorist incident is (i.e. a higher grade), the yield index will go through a more significant decline. The third analysis tested the effect of the terrorist incident in relation to country characteristics. The results indicated that there was no difference in effect on yield indices between large and small countries or between democratic and authoritarian countries. However, when comparing between developed and developing countries, the result was different – developing countries are more negatively affected by a terrorist incident.

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