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## The impact of terrorism attacks on stock market performance

*Evidence from Israel*

Rawy Hellou  
Nova SBE Student number: 26277

A Project carried out on the International Master in Finance Brazil-Europe course,  
under the supervision of:

Professor Duarte Pitta Ferraz (Nova SBE, Lisbon, Portugal)

Co-Supervisor, Professor Ilídio Tomás Lopes - ISCTE - University Institute of Lisbon

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## **Abstract**

This is a study on the impact of terrorism attacks on stock market performance, evidence from Israel. The study deals with the question “*Which effect(s) do terrorism attacks have on stock market performance in the short run?*” The examines the short term impact of suicide boom terror attacks on the Israeli stock market, Palestinian stock market, Financial sector and armament manufactures, performed with an event study methodology to estimate the abnormal returns of the stock prices of the acquired induces and firms after the dates when the terror attack happened. The terror attacks include in this study occurred between 2003 until 2008. The results overwhelmingly show signs of underperformance. However, there are indications that this underperformance does not continue in the long run. Furthermore, the results indicate that this underperformance is different for different sub-groups.

**KEYWORDS:** Terrorism, Israeli stock market, Israel, Palestine.

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# 1. Introduction

Although terrorism is a commonly used term in everyday life, it is not as simple to give a clear definition of it. Is it a 'mere' criminal act, or does it have to concise some political or religious goal? Who or what decides if a murder is a terrorist attack? Where has the line been drawn? And is there any grey area? A short thought about this issue already underlines the complexity of the topic.

The definition of "Terrorism" as it's written in the United States Department of defines as following: *"the calculated use of unlawful violence or threat of unlawful violence to inculcate fear; intended to coerce or to intimidate governments or societies in the pursuit of goals that are generally political, religious, or ideological"*. This long definition highlights many of the key characteristics of terrorism. Firstly, terrorism consists of an act. It is the use or (threat of) unlawful violence. Secondly, this definition clearly outlines a short-term goal, and one or multiple long-term goals. In the short-term, it is used to inculcate fear. In the longer term, it is used to coerce or intimidate governments or societies in the pursuit of goal. Lastly, it becomes clear from this definition that motivations of terrorism are generally either political, religious or ideological.

Although the (ideological) motivations of terrorism are interesting, I will focus mostly on one specific part of this definition. Its intended short-term goal: fear. Much research has been done about the human emotion and the relation to both conflict and terrorism. It is clear that it has an (negative) effect on the general sentiment in society, and specifically in Israel (Bar-Tal, 2001).

Although the direct (or indirect) goal is not necessarily to affect financial markets. The general sentiment of fear, distrust of uncertainty does have an effect on financial markets. For this purpose, data from the country of Israel will be used.

The country of Israel can be seen as a specific case which in recent history has seen many terrorist attacks. According to the Israeli ministry of foreign affairs, Since January 2000 until December 2015, 1,552 people were killed and 7,182 people were injured during the last 16 years as a result of terror attacks that took place in Israel, an average of 8.08 Israelis killed and 37.40 injured per month. Terror attacks that took place between 1948 and 2015 resulted the deaths of 3,549 Israelis and injured 14,227 during the last 67 years. Sadly, the wave of terrorism between 2001-2006 in Israel has been the worst period on record. This can be observed from Figure 1 below. Which shows the number fatalities in different years over a longer period of time.

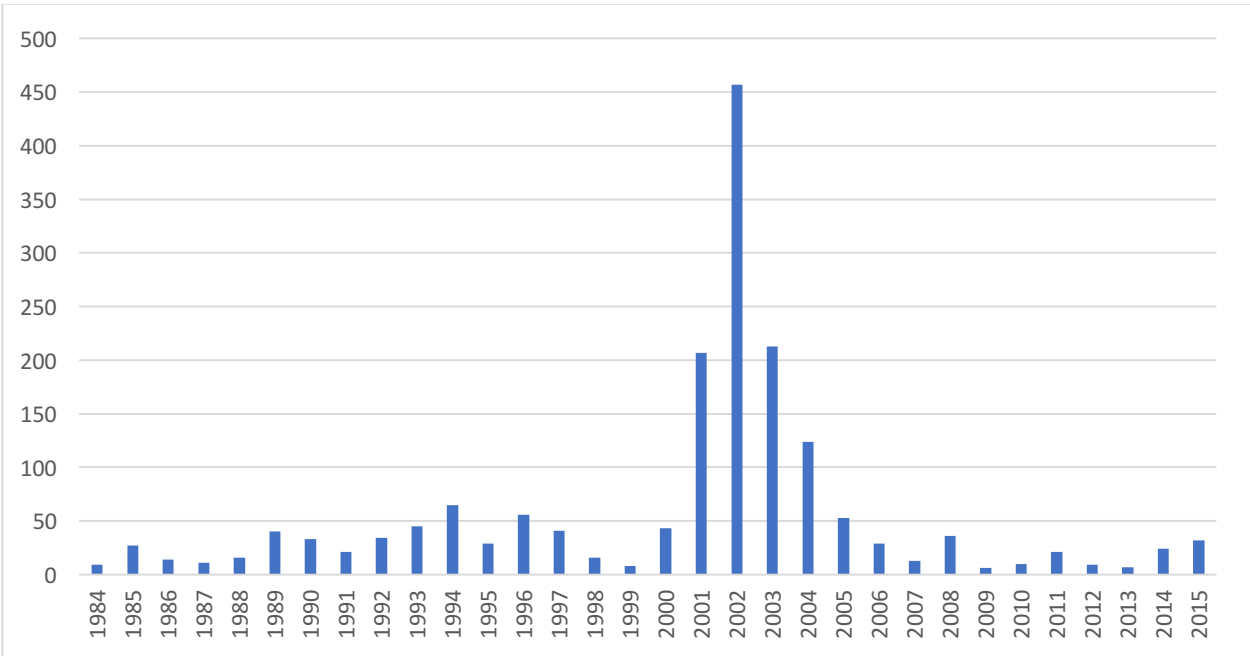


Figure 1: Fatalities from terrorism in Israel by year

This has clearly had large effects on the country as a whole, but also negative relations on the stock market (Eldor et al., 2012). However, the reason of this research is thus twofold. Firstly, it will try to shed new light on previous findings. This will be done by trying replicate and (re-test) some of the most important previous findings against new data of a later period. By doing so, I hope to confirm or re-establish previously find relationship. Furthermore, I hope to that this will deepen our knowledge about the relationship between terrorism and stock-market performance. Secondly, I will try to develop multiple new hypotheses and test these against my (relatively new) dataset. In this sense, I hope to broaden scientific knowledge about the relationship between terrorism and stock market performance.

Previous research has greatly focused on the period 2001 – 2006. However, this period is indeed very special due the large number of casualties. Although this is very interesting, it is important to focus on the large period. Using a larger dataset from a longer (and later) period. I hope to gain new insights.

Using both these methods, I hope to give an extensive answer on my research question:  
*Which effect(s) do terrorism attacks have on stock market performance in the short run?*

## 2. Literature review & Hypotheses

In recent years, much research has been undertaken concerning the impact of terror activity on the economy, especially the impact of the mega terror attacks of the 21st century, i.e. the attack of 9/11 on the World Trade Center, the 2004 Madrid and 2005 London bomb attacks.

Hassan, S.A., Mahmood, A., Ahmed, A. and Abbas, S.F. (2014) argued that the world has witnessed much deadlier attacks during this century. For example, an armed attack in Uganda in 2004 killed almost 250 refugees; car bombings in Iraq in 2006 killed nearly 550 people with additional 1,500 people injured; militant attacks in Nigeria, Syria, and Lebanon. However, researchers have focused their attention on the impact on stock market returns in major and developed markets.

Chen and Siems (2004) studied the impact of 77 terrorist attacks that occurred in 25 countries over a period of 11 years from January 1994 to August 2005. They report that almost 66 percent of the terrorist attacks have negative effects on the corresponding stock markets. The negative impact is more significant on the day of the attack and its intensity then tends to decline. Chen and Siems (2004) investigated the Dow Jones Industrial Average's reaction to 14 terrorist and military events. Out of the 14 events analyzed, 12 had a statistically significant abnormal return and the September 11th attack was the event with the largest abnormal return (-7.14%). They also applied the same methodology to assess the effect of the 9/11 event on 33 stock market indexes from 28 countries, 31 of which exhibited negative and statistically significant abnormal returns.

The impact of Palestinian terror attacks on different capital market has been studied before. However, I find it reasonable to assume that there might be difference between different countries in the type and size of the effects (possibly caused by cultural reasons). For this reason, I will only refer to specific studies, which focus on the Israeli market.

The first one was done by Rafi Eldor and Rafi Melnick in 2004. They used a dataset covering 14 years, between 1990 and 2003. They clearly found that although there was a large number of terrorist attacks, markets were still clearly affected. They find that suicide effects have had a clear negative effect on the market in the long run. Furthermore, they find that terror attacks which are more severe (having a larger number of injured and/or killed) has a clear effect as well.

This latest finding has been found in another study as well. In Eldor et al. (2012), the researchers find that more “successful” terrorist attacks lead to a stronger negative performance in both the Israeli as well as the Palestine stock market. They find that a terrorist attack leads to a significant decline of 0.43% in the in the TASE and a statistically significant decline of 0.23% in the PSE.

As before mentioned, economic damage is not (necessarily) a goal of terrorism. However, it is clear that terrorist attacks lead to real economic damage. In this paper, we will focus on the short-term relationship between terrorist attacks and stock market performance. The decision to focus on short-term performance is one which has to do with multiple reasons, albeit being methodological issues being an important one (which will be explained later). In the rest of this chapter: I will develop the theories & hypothesis which will be tested in my work project.



Firstly, it is important to establish why terrorism attacks (might) have an effect on the financial performance. Firstly, terrorist attacks have direct costs. Examples of these costs might be human losses or financial losses in the case of destruction of a company's assets. Even when assets which are not owned by a company are destroyed, this can negatively impact a company's performance. For instance, in the case of the destruction of infrastructure.

More important however might be the indirect costs associated with terrorism. For instance, it has been shown that terrorism can negatively affect both investor confidence as well as consumer behavior (Kumar & Liu, 2013). Although the second effect is possibly strong, both relationships lead to lower stock-market performance. It is thus on this basis that I will formulate the first hypothesis:

*Hypothesis 1: Terrorism attacks have a negative effect on local stock market performance in the short run*

It must also be noted that there have been formulated reasons why there should be no relationship between terrorism attacks and stock market performance. The most relevant one is in the case of Israel the desensitization hypothesis. In countries where multiple terrorist attacks occur, investors and markets might become desensitized or used to them. Thus leading to no direct short-term relationship (Eldor & Melnick, 2004).

In the second hypothesis. We will differentiate between the two sides of the conflict as was done in the 2012 research by Eldor et al. It is reasonable to assume that both stock markets can be negatively impacted by both the direct and indirect costs associated with terrorism. However; a previous research concludes (Eldor et al., 2012) that although both

local stock exchanges were negatively impacted, the size of the effect was different. This might happen for multiple reasons. Possibly, Palestinian investors are less sensitive to news about terrorism attacks. Another possibility may be that Israeli companies suffer more indirect and direct costs related to terrorism attacks. This leads to the following hypothesis

*Hypothesis II: The Israeli local stock market is more negatively affected by terrorism attacks than Palestinian local stock market.*

Although the market as a whole can be influenced. It is reasonable to assume that different subsectors respond differently to the information about the terror attack. More information about this topic will lead to a better understanding about the financial consequences of terrorism. Thus, I will formulate multiple hypothesis about the relationship between terrorism and stock market performance for different subsectors.

As stated before, one specific goal of terrorism is to inculcate fear. Assuming, terrorism attacks are at least somewhat effective in that, we can further hypothesize that the financial shock which is caused by terrorism is thus especially strong in markets which are strongly dependent on fear (or, opposite, trust). One such sector is the financial sector. Specific research has studied the relationship between trust and the performance in the financial sector in periods of increased fear and distrust (Sapienza & Zingales, 2012). The fact that the financial sector is more affected by fear (caused by terrorism) brings me to the following hypothesis:

*Hypothesis III: The negative effect which terrorism attacks have on stock markets is stronger for the financial sector than the market as a whole.*

Another sector which might respond significantly different from the market are defense-related companies or armament manufacturers. This hypothesis was developed by Zussman & Zussman (2005) and later used by Berrebi & Klor (2005). They find that terrorism attacks have a significant positive effect on the stock market valuations of defense-companies. In this paper, we will focus on armament manufacturers specifically. Rationalizing that these companies thrive in periods of conflict since this might increase demand for their products. This leads to the fourth hypothesis:

*Hypothesis IV: Terrorism attacks have a positive effect on the short-term stock market performance of local armament manufacturers.*

### 3. Data

For the research conducted in my dissertation. Data from multiple sources was used.

Firstly, and most importantly, daily data about terrorism attacks is gained from the Israeli ministry of foreign affairs. This comprises daily data about the event of an attack, the number of people which have been reported injured and the number of casualties. One might argue that the Ministry of Israel is not an independent party, might have its own incentives and may thus not be a fully reliable source of data. However, this data has been used in previous researches and other sources for this information are not available to my knowledge. The data covers the period of 2003 until 2008. With a total of 280 attacks in this period.

Many attacks which occurred in this period caused a relatively low (<5) injured & killed people. Furthermore, in previous research it was found that only suicide attacks caused for significant underperformance (Eldor et al., 2012). I thus delete all observations which are non-suicide attacks. I assume these non-suicide attacks which have a low number of injured and killed people have too small of an impact to cause any noticeable change in performance. This leads me to a dataset which has 43 observations. Some attacks occurred on the same day. In this case, I will count them as one event. This leads me to a database with 40 events.

Variable	Killed people	Injured people	Killed & Injured People
N	40	40	40
Minimum	0	2	1
Maximum	25	133	157

Median	7	41	43
Average	4	34	28
Std. Dev.	7	35	41

*Table 1: Descriptives on the terrorists attacks after listwise deletion*

As can be observed from table 1 above. The standard deviation is very high, relatively to the average and the median. This means the data is not normally distributed. Both Jarque-Bera as well as Shapiro-Wilk tests confirm this observation. This goes for both the number of killed people as well as the sum of the number of killed & injured people.

On a side note, I would make the comment that the correlation between the amount of injured people and killed people is quite high (0.76)

Data covering the historical (daily) returns of different stocks and the market benchmarks will be downloaded using Bloomberg. I chose this source of data since it is both commonly used and reliable. Furthermore, all the data which is needed is available from this source.

For the Israeli stock exchange I use the Tel Aviv 25, comprised out of the largest 25 listed companies and the TA75, which is comprised about the largest companies ranked by the numbers 75-100. For the operationalization of the Israeli stock exchange, I use the Al Quds Palestinian stock exchange.

For the operationalization of the financial sector, I decide upon choosing the largest five banks in Israel. These are all listed. These banks are: Hapoalim Group, Bank Leumi Group, Discount Bank Group, Mizrahi-Tefahot Bank and First International Bank Group.

As the operation alization of weapon companies, I pick Elbit System Ltd. This is the largest, listed weapon company in Israel. It derives over 90% of its revenues directly from weapons. Furthermore, I have not found any other relevant companies on Bloomberg.

## 4. Methodology

To study the effect which terrorism attacks have on stock market performance, event study methodology will be used. This methodology was introduced by Fama in 1969. In their essence, this methodology calculates an expected return. This is done using a pre-event window where performance is estimated using one or multiple variables. Then, in the event window it calculates expected performance and compares these with the observed performance (Kothari & Warner, 2007).

There are multiple models to calculate the expected returns. In this case, the market model will be used. I will both apply this model with the S&P500 and the MSCI World.

Firstly, the S&P500 is one of the most commonly used indices for event studies. Furthermore, it is highly correlated to the Israeli indexes and companies. The MSCI World gives a broader overview of the world as a whole and it can be used in all the hypotheses. Although it is not as strongly correlated to the Israeli index companies.

In the market model, the expected returns of an asset are estimated as a linear function of a market index. This will be done by using formula 1.

$$R_{i,T} = \alpha_i + \beta_i R_{M,T} + \varepsilon_{i,T} \quad \text{Formula 1}$$

In this formula,  $R_{i,T}$  denotes the expected return of stock (or fund)  $i$  at time  $T$  as a function of constant  $\alpha_i$ , and the return on the  $R_{M,T}$  at this same moment  $T$  multiplied by an asset-specific risk factor  $\beta_i$ . Furthermore, there exists an uncorrelated error term  $\varepsilon_{i,T}$ .

For methodological reasons, I will only look at the short-term event windows. There are many difficulties associated with long-term performance measurement. One important one is when multiple events occur in the post-event window. This may lead to biased test-statistics and unreliable results (Kothari & Warner, 2007).

I will use multiple time windows for the estimation of the effect. I do not believe it makes sense to start the window early, since insider trading is quite unlikely to have a sizeable impact. All my windows will thus start on same the day of the event and testing different windows up to fourteen days after the event.

To test whether results are significant, the student's t-test will be used. This test was introduced by William Seally Gosset in 1909 (student, 1908). The null hypothesis in all cases is the Cumulative Average Abnormal Returns (CAAR) are not different from zero. The alternative hypothesis is that they are significantly different from zero.



## 5. Analysis

This chapter is dedicated to applying the before mentioned methodologies to the previously described data to test the hypothesis mentioned in chapter two. I will do this on an analysis-by-analysis basis.

Firstly, looking at the results in which the MSCI-World was used as an index. In some cases, there are (marginally) significant abnormal returns. For the TA25 this is not the case in any of the data. For the TA75, there are marginally significant results in the [0;3] window. For the weapons company, there exists significant underperformance in the [0;7] window and marginally significant underperformance in the [0;2] window. For the bank Leumi Group, there exists significant underperformance in the [0;5] and [0;7] window and marginally significant underperformance in the [0;2] window. The Mizrahi-Tefahot Bank Group shows significant underperformance in the [0;2] window and marginally significant underperformance in the [0;3] window. The clearest results exists for the Hapoalim group, which shows significant underperformance in the [0;3] and [0;4] windows and marginally significant underperformance in the [0;5] and [0;7] windows.

The results where the S&P was used in the model show more significant results. Firstly, the TA25 show significant underperformance in both the [0;4] and [0;5] models. The TA75 shows marginally significant underperformance in the [0;3] window. The Al Quds does not show any significance. Elbit Systems shows underperformance in the windows [0;1], [0;2], [0;3], [0;4], [0,5] and [0;7]. The Bank Leumi Group underperforms in the windows [0;3], [0;4]. [0;5] and [0;7] as well. Furthermore, there is marginally significant underperformance in the [0;2] window. The Discount Bank Group shows no underperformance. However, The First International Bank Group underperforms

marginally in the [0;4] window. The Mizrahi-Tefahot Bank Group shows significant underperformance in the [0;2] window. Hapoalim Group shows underperformance in the windows [0;3], [0;4], [0;5] [0;7], [0;10] and [0;14]

It is interesting to note a few things. Firstly, all the (marginally) significant results point to underperformance. There is no indication of overperformance in any of the data (as expected). Secondly, even though some stocks underperform for some periods. This does not happen for all of them. In the longer event windows, the underperformance is not significant anymore.

Event Window:	[0;14]	[0;10]	[0;7]	[0;5]	[0;4]	[0;3]	[0;2]	[0;1]
TA25	0.0026	0.0004	-0.0056	<b>-0.009***</b>	<b>-0.0108**</b>	-0.0061	-0.0003	-0.0009
TA75	0.0113	0.0046	-0.0024	-0.0016	-0.0074	<b>-0.0089***</b>	-0.0008	0.0008
AL QUDS	-0.0205	-0.0075	-0.004	0.0025	0.0073	0.0038	0.0008	-0.0051
Elbit System Ltd	-0.0154	-0.0156	<b>-0.0231*</b>	<b>-0.0161**</b>	<b>-0.0214*</b>	<b>-0.0223*</b>	<b>-0.014*</b>	<b>-0.0096**</b>
Bank Leumi Group	0.0003	-0.0098	<b>-0.0267*</b>	<b>-0.0242*</b>	<b>-0.025*</b>	<b>-0.0191*</b>	<b>-0.0093***</b>	-0.0047
Discount Bank Group	-0.0009	-0.0038	-0.0037	-0.0026	-0.0016	0.003	0.0042	-0.0016
First International Bank Group	0.0075	0.012	-0.0059	-0.0099	<b>-0.0144***</b>	-0.0099	-0.0045	-0.0014
Mizrahi-Tefahot Bank Group	0.0057	-0.0016	-0.0016	-0.0006	-0.0033	0.0057	<b>0.01**</b>	0.0052
Hapoalim Group	<b>-0.0216***</b>	<b>-0.019***</b>	<b>-0.0224*</b>	<b>-0.0194*</b>	<b>-0.0218*</b>	-0.0156*	-0.0049	-0.0031

\*\*\* 90% significance level, \*\*95% significance level, \*99% significance level

Table [2] Results S&P500 Market Model

Event Window:	[0;14]	[0;10]	[0;7]	[0;5]	[0;4]	[0;3]	[0;2]	[0;1]
TA25	0.0091	0.0018	-0.0009	-0.0034	-0.0055	-0.0035	0.0007	- 0.0002
TA75	0.0138	0.0035	-0.001	-0.0007	-0.005	- <b>0.0077***</b>	-0.0008	0.0011
AL QUDS	-0.0155	-0.006	-0.0046	0.0029	0.006	0.0043	0.0007	- 0.0052
Elbit System Ltd	-0.0061	-0.0158	<b>-0.0166***</b>	-0.0071	<b>-0.0137**</b>	<b>-0.0174*</b>	<b>-0.0121**</b>	- <b>0.009*</b> *
Bank Leumi Group	0.0086	-0.0022	<b>-0.0199**</b>	<b>-0.0193**</b>	<b>-0.0218*</b>	<b>-0.0193*</b>	<b>-0.0101***</b>	- 0.0061
Discount Bank Group	0.006	-0.0005	0.0036	0.0074	0.0056	0.0057	0.0047	- 0.0018
First International Bank Group	0.0183	0.0162	-0.0017	-0.006	-0.0101	-0.0078	-0.005	- 0.0012
Mizrahi-Tefahot Bank Group	0.0082	0.0008	0.0056	0.0092	0.0041	<b>0.0088***</b>	<b>0.0109**</b>	0.0056
Hapoalim Group	-0.0173	-0.0158	<b>-0.0169***</b>	<b>-0.0135***</b>	<b>-0.0169**</b>	<b>-0.0146**</b>	-0.0055	-0.004

Table [3] Results MSCI- World Market Mode

## 6. Conclusions

Looking at the first hypothesis. It is clear that terrorism attacks have a negative effect on some stocks, in some cases. However, not in all windows were there significant results. I thus confirm the hypothesis with this small note.

- *Terrorism has a negative impact on local stock market performance in the short run*

When looking at the second hypothesis. The Palestinian stock exchange went mostly unaffected by these attacks of terrorism. Or at least, there was no underperformance. The Israeli stock exchange however suffered from underperformance in different windows. I thus partly confirm the second hypothesis,

- *In some cases, the Israeli stock exchange is more negatively affected by terrorism attacks than the Palestinian stock market.*

When looking at the financial sector. It is clear that some of the banks suffered from clear underperformance. These stocks underperformed in more (and longer) windows. However, this was not clear from all the cases. This thus partly confirms the third hypothesis

- *The impact on the financial performance of companies in financial sector is greater than on the stock market as a whole.*

The fourth hypothesis was only tested with one company. However, it is clear that this hypothesis was rejected. Not only did Elbit systems not excise any signs of overperformance, it even showed results of underperformance!

- *Terrorism does not have a positive effect on short-term stock market performance of weapon manufacturers.*

All in all, I believe the results raise answers as well as questions. Terrorism does seem to have an effect on stock-market performance. The results overwhelmingly show signs of underperformance. However, there are indications that this underperformance does not continue in the long run. Furthermore, the results indicate that this underperformance is different for different sub-groups.

## **7. Discussion**

This research is an important development in the international scientific knowledge on financial performance, economic damage and terrorism. However, it is important to know and understand the limitations of this work. Firstly, this paper only looks at short-term performance. Performance in the short-run is important, but in the long run, results may revert back. Short-term performance is thus not, in any case, a proxy for real economic damage. However, even when performance reverts back to the mean in the long run, short-term underperformance is still undesirable. At minimum, this will cause unnecessary volatility.

Secondly, event study methodology always encounters the joint-test problem. This means that when using this methodology both the predictive model as well as the hypothesis is tested. The results of these tests and the results of my work project thus always requires careful interpretation.

Lastly, the data of this research is specifically focused on Israel. These results can and may be different in other countries. As mentioned before, Israel has a unique history and a unique conflict. This is one reason why my research is important. Specific research in the effects within this country are important. However, we must be careful to not extrapolate these results to other countries. Large cross-country difference may exist.

Even though this research has its clear limitations, I still think it is an important extension to current knowledge about terrorism and financial performance in Israel. It uses new data to test old hypothesis. But also develops new hypotheses which are being tested.

Although this research has a scientific-focus, it also might be used in a more practical setting. For instance: in the wake of the 9/11 attack in The United States, there were (widespread) rumors which stated that terrorists had used the information about the crash to make money on the stock market. This research sheds light on the ways terrorist organizations might try to make money on stock exchanges. And using this information, security agencies might be able to counteract this.

Most interesting however are the possible options for further research. This project opens opportunities for new research questions as well. Future research could focus more on which specific factors cause certain stocks or industries to underperform after a terrorist attack. It could also be interesting to see which factors or companies are especially prone to terrorism in the stock-market performance. One of the companies which performed worst was the Hapoalim group. This company is especially known for financing settlements in the Palestinian territories. It could be, that this company suffered strongly from direct forms of damage. On the other hand, it could be that this company suffered more strongly from indirect damage.



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