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The Impact of Islamist Terror Attacks on Global Financial Markets: A Holistic Assessment of Selected Terroristic Incidents

DOCTORAL DISSERTATION

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Abstract

Key words: Financial market impact, equity investment, Islamic equity, terror attacks

Terrorism can be regarded as one of the most evident issues of this century, with a majority of countries and societies being affected by the global phenomenon. It does not just lead to loss of life and injuries of the victims, but also triggers political and economic consequences. The afore noted quickly spills over to financial markets and causes negative investor sentiment.

This work explores how five selected terror attacks have impacted equity markets and additionally, how the reaction of market participants in the aftermath of five selected Islamic terror attacks has changed throughout time. The main goal of the dissertation is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity.

In order to investigate the equity market dynamics following terroristic incidents, a multiple-criteria decision analysis is employed. The results are achieved by using 22 different risk and performance ratios in addition to other criteria. The ratios include risk, return and volatility assessments as well a combination of the afore noted. The criteria are employed with regards to the main equity index of the country affected by the terror attack as well as the Tadawul as a proxy for the reaction of Islamic equity.

The results indicate that even though the impact might deviate from incident to incident based on economic and social circumstances, the overall trend reveals a decrease in magnitude of the impact throughout time. The comparison between conventional and Islamic equity shows that there are strong contagion effects between the two markets as a response to exogenous shocks. However, the Islamic equity has reacted more sensitively than its conventional counterparts in the aftermath of a terror attack.

The work contributes to the overall understanding of the linkage between conventional and Islamic equity and it attributes to the overall understanding of the economic consequences of terror attacks.

Extended abstract

Terrorism can be regarded as one of the most evident issues of this century. It does not just lead to loss of life and injuries of the victims, but causes also political instability and unrest, curtailing a country's GDP while triggering damage and loss of property. Terrorism causes an atmosphere of fear through ruthless violence, it harms international peace, the securities of cities and governments as well as nations and markets worldwide. It vanishes the businesses of entire industries including tourism, airline and gastronomy, which are the most affected by terroristic incidents. The total number of deaths being attributed to terrorism account for about 16,000 deaths as of 2018 with 71 countries being affected by terrorism globally. The global economic impact of terrorism has amounted to $33 billion in constant purchasing power parity terms. The overall global cost of violence amounts to 14.1 trillion USD as of 2018 (Global Terrorism Database, 2020).

Radicalization, which ultimately leads to brutal ferocity has spread globally. While terrorism roots in countries which struggle with economic, cultural and political issues in addition to a lack of education and cultural change, terrorism has not stopped at their borders. The afore noted conditions pose a fertile soil for the radical interpretation of religious texts and the resulting cruelties. In recent years religious-themed terror attacks have been conducted worldwide. With terroristic incidents expanding rapidly and occurring with increased frequency across the globe the reasons for their conduction is manifold. Even though global terror uses religious discourses and arguments for justification purposes, the main motives for the conduction of terror attacks include political, cultural and social causes. The non-Islamic aetiologies of terrorism include political issues and encounters such as the Isareli-Arab conflict, as well as cultural and social causes. The cultural dissatisfaction is caused by rebellion against Western cultural colonialism, while the social causes are triggered by economic hardship such as alienation and poverty. The afore noted reasons give ground to terroristic organizations to indoctrinate, radicalize and recruit mercenaries joining the jihad.

News associated with terrorism are quickly spilling over to financial markets all across the globe. This leads to contagion effects as well as co-movement and synchronization of stock markets due to the loss in investor's confidence. Terror attacks manifest extensive apprehensions about the short-term and long-term impact on the economy and especially on an impending destabilization of financial markets due to decelerated growth rates and reluctant investments. It triggers the desire for a wish premium among investors in order to be

compensated for enhanced risk due to the terror attacks. Unexpected events cause such as terror attacks cause fear, shock and negative investor sentiment, resulting in panic-selling responses and consequent sharp stock market declines accompanies by enhanced volatility. With the stock market being the economic barometer of a country, the reaction of market participants to the conduction of terror attacks provides a suggestion of the perceived economic damage.

While the reaction of investors to terror attacks has been studied extensively in literature with regards to Western equity markets, the reaction of Islamic equity to terror attacks has received less attention. Islamic equity is subject to several rules established by the Sharia, excluding various industries such as the gambling, alcohol or pork industry due to religious prohibition. Also, companies with high leverage or high interest-bearing debt ratios are prohibited for investment. This leads to a bias in the equity selection, and hence, Islamic equity might react differently to market shocks stemming from terror attacks. With the Islamic financial industry delivering 40% in growth from 2012 until 2017, comprising assets worth 2.7 trillion USD as of 2017, its international importance among equity investors is on the rise. The new emergence of important financial centers might lead to an accumulation of capital outside of Western states and it is widely acknowledged that global integration and inclusion of financial markets is closely linked to the rebalancing of geopolitical power and influence. From equity portfolio perspective, the exploration of potential co-movements between the Islamic equity and its conventional counterparts can be regarded as important, since contagion effects might lead to biased portfolios due to lacking diversification effects. Also, Islamic equity poses an alternative investment for market participants, especially, since it shares many aspects and fundamentals with sustainable investing, which has received great attention just recently.

This work investigates the impact of terror attacks on equity markets, and especially how the impact has changed throughout time. The main goal of the dissertation is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity. The focus of the analysis will measure the return and volatility impact of the chosen terror attacks. In order to assess the aforenoted, two research hypotheses have been formulated. The first research question aims to evaluate whether the overall impact of terror attacks decreases throughout time. The second research question targets whether the impact of terror attacks on Islamic equity indices are as hard as on Western indices. By comparing the

effects on both Islamic and Western equity, it is also tested for contagion effects between the afore noted. This comparison can additionally be regarded as the assessment of the impact between developed and emerging market countries.

In order to explore the relationship between the changes in investor sentiment following terroristic incidents, a multiple-criteria decision analysis is employed. The aim is to obtain a holistic analysis of the impact of selected terror attacks on global financial markets while capturing the change in the investor sentiment following a terroristic incident. The results are achieved by using 22 different risk and performance ratios in addition to qualitative criteria. An amplified number of criteria is introducing aiming to measure specifically the impact on return and volatility and its short-term (5 to 15 days) and long-term (from 2001 until 2016) change. Additionally, the enhanced number of criteria intentions to avoid an estimate bias triggered by a narrow focus on only a limited number of parameters and benchmarks. The criteria under investigation are employed with regards to the main equity index of the country affected by the terror attack. After the estimation of the parameters and their consecutive calculation, a scoring system is derived. The obtained results for each of the five terror attacks are compared against one another and ranked according to the severity of the impact on the respective equity market. The highest impact is assigned with rank number 5, while the lowest impact is assigned rank number 1. The scores are summed up in order to allow for the assessment of the total impact. For the comparison between conventional and Islamic equity, the scores of either 1 or 0 are assigned, depending on which equity index showed the higher impact. 1 is assigned to the index with the higher effect.

In order to identify the terroristic incidents which have happened all across the globe The Global Terrorism Database (GTD) has been used. It is the most comprehensive database for terrorist attacks and terroristic activities in the world. The GTD comprises terroristic events from 1970 until now and the database includes more than 190,000 events. By using the extensive collection of the GTD, five terror attacks were chosen. The criteria for the choice of the terror attacks include that the motive for the conduction is Islamist-inspired, the target of the terror attack has to ben European or American soil and the combined number of people dead and injured has to exceed 500. The five terroristic events corresponding to the criteria are the 11 September 2001, the Madrid bombing of 2004, the London bombing of 2005, the Paris attacks of 2015 as well as the Nice truck attack of 2016.

The underlying data for the calculations comprises a time frame of 250 trading days before the terror attack until 15 trading days after the terror attack for all 5 attacks and all indices and rates included. The time horizon of 250 trading days before the terror attack has been chosen in order to ensure the statistical robustness of the results. In order to achieve meaningful statistical results, the sample size needs to be sufficiently high. As previous studies have shown that the impact of terror attacks on equity markets are only short-lasting, shorter time spans preceding and succeeding the terror event have been included. The calculation for the 15 trading days' time frame before the terror attack allows to judge, whether the figures under investigation have already shown abnormal behavior from the long run (250 days) shortly before the conduction of the terror attack. Additionally, the 15 days before the attack were chosen in order to determine whether enhanced volatility has already prevailed before the conduction of the attack. The 5 days' time span succeeding the terror attack allows to judge the immediate impact of the terror attack on the respective index, while the 15 days allow to assess if and how fast an equity index has recovered from the attack or if the impact of the terror attack prevails for a longer time horizon and at which intensity.

The data needed in order to conduct a holistic analysis include the daily end of day prices of the following equity. The indices used are the DJIA for the US, the IBEX for Spain, the FTSE100 for the UK and the CAC40 for France. With regards to the risk-free rate, the effective fed funds rate has been used as a proxy for the US, the EONIA for Spain and France and the LIBOR for the UK. The risk-free rate has been in accordance with the investment horizon, which is considered to be one day. The MSCI World Index has been chosen as a reference index against which the afore noted country equity indices are compared. It can be regarded as the representation of global equity as it includes 1,600 stock across 23 industrialized nations. In order to obtain a proxy for the reaction of equity to Islamic-inspired terror attacks the Saudi Arabian equity index (Tadawul) has been chosen. This choice can be justified as Saudi Arabia shows the strongest economic performance in terms of GDP in the GCC region as of 2018. As of 2018 Statistics of the International Monetary Fund show that Saudi Arabia had a GDP of approximately 800,000 million USD and a GDP per capita of 24,000 USD (IMF, 2020). While the data needed for the calculations was highly available for the Western world, this was not the case for Saudi Arabia. The overnight rates, which are considered as a proxy for the risk-free rate for the US, Europe and UK were accessible. However, for the Saudi Arabian market the overnight tenor was not available before November 2016. The Saudi Arabian Interbank Offered Rate (SAIBOR) can be regarded as a

daily reference rate, which is issued by the Saudi Arabian Monetary Authority based on the average interest rate Saudi banks offer to lend unsecured funds to one another. The shortest tenor available in the Saudi market posed the 1-month interbank offered rate. Hence, it has been chosen as a proxy for the risk-free rate.

The first criteria under investigation was the number of fatalities. In the 9/11 terror attacks the highest number of people died, while in London the least number of people died. The second criteria under investigation was the number of people injured. Also, for this criterion the 9/11 terror attacks showed the highest number of people injured, followed by the Madrid bombing. The least number of people were injured during the Paris attacks.

The consecutive criteria were the average return for both 5 days and 15 days after the attack. For both of the afore noted the 11 September 2001 terror attacks showed the worst average return. With regards to the comparison between Islamic and conventional equity, the results show that based on the average return, both the Western and the Islamic equity showed the same impact. However, it is worth mentioning that the impact of the market shock on the Islamic equity was mostly only seen after a longer time horizon than on the Western equity market. This indicates an overall lower market efficiency of the Islamic equity.

Subsequently, the cumulative returns for both 5 days and 15 days after the terroristic incident have been calculated and compared. A similar picture as with the average returns is observable, for both time horizons the 9/11 terror attacks showed the most severe impact, followed by the Madrid bombing. Ranked third with regards to this criterion is the Nice truck attack. When comparing Western equity against Islamic equity the results indicate that the overall impact was quite similar across all terror attacks.

The following criteria under investigation poses the abnormal return due to exogenous shocks, which is determined by employing an event study. Typically, the event study is used to determine the abnormal returns (AR) of an individual company's stock price with regards to the stock market index. As within this study the reaction of the entire stock market is assessed, an equity index comprising a sample of the entire world's equity is used. By using the MSCI world as a proxy for the global stock market performance, the expected return of a specific countries' equity index is modeled. The implementation was done by setting up a linear regression in order to determine the expected returns of the respective countries' equity

index. Consequently, the cumulative abnormal return is calculated, and the ranks are assigned. The results show that after the 9/11 attacks the worst cumulative abnormal return was observable for the 5-day time horizon while for the 15-day time-horizon the Madrid bombing showed worse results. When comparing the Islamic equity against Western equity it is visible, that for four out of five terror attacks assessed the Islamic equity has incurred a higher MDD in the aftermath.

Successively, the Maximum Drawdown is the next criterion to be assessed. The maximum cumulative loss measured from a high to a consequent low is commonly denoted as the maximum drawdown (MDD). It measures the worst loss (largest drawdown) of a financial market within a pre-specified time interval. It also captures the worst possible market timing and the maximum occurring loss resulting from the bad market timing. The lowest MDD was realized after the London bombing. What is worth noting is that the Nice truck attack showed an extremely high Maximum Drawdown. Nonetheless, the highest MDD was realized after the 11 September 2001 terror attacks.

The consequent criterion under investigation was the time to recovery of the index. For this criterion, again, the 9/11 terror attacks showed the longest time to recovery. The shortest time to recovery was needed after the Paris attacks. Except for the 9/11 terror attacks it took the Islamic equity after all terror attacks longer than the Western equity to recover from the market shock.

A related criterion to the afore noted poses the time to normalization of returns. The normalization of returns is defined as the number of days until the abnormal returns do not show any statistical significance for 3 consecutive days. While the New York terror attacks again scored the highest, it is worth noting that the time to recovery was the same for the Madrid and London bombing as well as the Paris attacks. Both the Islamic and Western equity showed even reactions after a terror attack in terms of normalization of returns.

The standard deviation for 5 days and 15 days after the terror attack poses the consequent criteria. For both times under investigation the highest effect was noticeable in the 9/11 terror attacks, followed by the Madrid bombing. Ranked third was the London bombing. The Islamic equity and the Western equity showed similar reactions in terms of standard deviation of returns.

Investors associate risk with outcomes, which fail to meet their respective expectation. An investor's risk is not associated with large positive returns. The (target) downside deviation can be defined as root-mean-square of the deviations of the realized returns underperformance from a pre-defined target return. All returns exceeding the target return are considered to be 0. The afore noted justifies the introduction of the downside deviation for 5 days and 15 days as the next criteria. The downside deviation denotes the deviance of the returns of the respective countries' equity index from the global equity index MSCI world. Again, after 9/11 the downside deviation was the most inflated, followed by the Madrid bombing. The results show that the impact on Western equity was higher than on Islamic equity measured by downside deviation.

Another important factor when assessing the impact of an event on the equity market poses the impact on volatility. Hence the next criteria under investigation assesses the abnormal volatility of the equity indices. A GARCH (1,1) is employed and consecutively, a volatility forecast is derived in order to assess the event impact. The GARCH model was chosen as it is able to capture the volatility clustering effect, which is extremely visible in times of market turmoil's following market shocks. The predicted volatility of the GARCH (1,1) is consequently compared against the realized volatility of the equity index on a daily basis. In terms of volatility, the New York attacks had the biggest impact on the equity market. The second-biggest impact in terms of volatility was observable in the aftermath of the London bombing. The least volatility was realized after the Nice truck attack. Upon the comparison between Islamic and Western equity the results show that the terror attack has triggered higher volatility in the Islamic equity markets than in the Western equity markets.

Risk adjusted performance measures (RAPM) set the expected reward into relation with a risk measure. Within this study, the RAPMs are used for setting the realized return into relation with the realized volatility, both before and after the terror attack. This is done in order to provide a holistic overview over the impact.

The first risk adjusted performance measure and the next criterion on the list poses the Sharpe ratio, which was again assessed by using the 5-day and 15-day time horizon after the terror attack. The Sharpe ratio was first introduced by Sharpe in 1966 in order to compare the performance of various mutual funds. The Sharpe ratio denotes the risk premium over the standard deviation, i.e. the difference between the realized return and the return of the risk-

free asset over the standard deviation. 15 days after the terror attack, the Madrid bombing showed the lowest Sharpe ratio, while 5 days after the terroristic incident, the 9/11 terror attacks showed the lowest Sharpe ratio. The Islamic equity showed slightly worse Sharpe ratios than the conventional equity when comparing for both time spans.

The Sortino ratio was introduced in the 1980s and was supposed to provide a better choice when measuring and comparing different performances within different skews of return distribution. The Sortino ratio can be expressed as the risk premium over downside deviation. The results obtained are similar to the ones of the Sharpe ratio, with the Madrid bombing showing the lowest Sortino ratio 15 days after the attacks, while New York scored the lowed Sortino ratio for the 5-day time horizon. The best Sortino ratios were achieved after the London bombing. When comparing Western against Islamic equity, the impact on both equity indices are very similar and no striking differences in reaction or obtained results can be denoted.

The last criterion under analysis was the information ratio, which is often referred to as a more generalized version of the Sharpe ratio. The information ratio provides similar content like the Sharpe ratio, with the main difference being that the information ratio compares the portfolio or index return against a benchmark, while the Sharpe ratio compares the portfolio or index return against the risk-free rate. The information ratio is therefore beneficial for measuring the relative returns of a portfolio. The information ratio is given by the difference between the portfolio and benchmark return, divided by the tracking error. Within the assessment of terror attacks, the tracking error is used in order to determine if and to what extent the returns of the affected countries equity index deviate from a pre-selected global equity index. The 9/11 terror attacks showed the worst information ratio 5 days after attacks, followed by the Nice truck attack. When assessing the 15-day time horizon after the conduction of the attack, the Information ratio revealed the worst results, i.e. the biggest impact for the Nice truck attack and the best for the 9/11 terror attacks. Upon the comparison of Western vs. Islamic equity, the results show that impact measured by the information ratio was far worse on the Islamic equity than on the Western equity.

Summing it up, the overall scores reveal that the 9/11 terror attacks have triggered the biggest impact on the equity market. This was followed by the Madrid bombing. Ranked third was the Nice truck attack, followed by the Paris attacks and lastly the London bombing. Out of

110 maximally achievable points, the New York attacks realized 103 points, the Madrid bombings 88, the Nice truck attack 60, followed by the Paris attacks with 46 points and the London bombings with 38 points.

The results show that even though the impact might deviate from incident to incident, the overall trend reveals a decrease in magnitude of the impact. Literature proposes that the reasons for this might be related to the overall investor sentiment, which is subject to change within different market regimes. Another reason for the differences might stem from the nature of the attacks. While for the case of suicide attacks, the threat of another incident happening is abolished, while this is not the case for other types of attacks. Also, the weekday and daytime of the incident influences the overall impact of a terror attack on the equity market. Closed markets give investors time to assess the economic impact in more depth, while observing the governmental reaction and the development of the terror attacks. When terror attacks happen within trading hours or shortly before market start, market participants are incapable of making a proper economic assessment and hence, have base their investment decision on other criteria. Lastly, the differences in the magnitude can also be explained by the overall economic situation of the country affected by the terror attack. Within stable economies, the impact is less severe compared to economies which have gone through vicious economic boom and bust cycles.

When comparing the Islamic equity with the conventional equity, the results are mixed. For 3 out of 5 terror attacks, the magnitude of the impact on the Islamic equity was bigger than on the conventional equity. For the remaining two terror attacks the impact on the Islamic equity was balanced to non-existent. Overall, a lag in the reaction of the Saudi Arabian stock market was observed, which can be attributed to the difference in trading hours and trading days of the week. Additionally, the effect of the terror attack appears to be longer lasting than in developed markets. This is linked to the macroeconomic development of emerging market economies, the political stability and investor sentiment. The sensitive reaction of Islamic equity on terror attacks conducted in the Western world provide empirical evidence for the contagion effects between the two markets. Short term co-movement between conventional and Islamic equity can be observed, even though the magnitude of the impact might differ.

The work contributes to the overall understanding of the linkage between conventional and Islamic equity, arguing that there are strong contagion effects between the two markets as a

response to exogenous shocks. The work provides a holistic overview over the impact of terror attacks through the introduction of about 20 different decision criteria, including quantitative and qualitative ones. The methodology and the inclusion of a wide-ranging set of parameters was chosen with the intention to avoid a bias of the results through the focus on only one criterion. The work might help market participants by raising awareness that there are spillover effects between conventional and Islamic equity based on the increasing global market integration. This might lead to the production of superior investment decisions with regards to market behavior in the aftermath of a terror attack.

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ABBREVIATIONS

AAOIFI:	Accounting and Auditing Organization for Islamic Financial Institutions
CAPM:	Capital Asset Pricing Model
CML:	Capital Market Line
CSR:	Corporate Social Responsibility
EONIA:	Euro Overnight Index Average
FX:	Foreign Exchange
GARCH:	Generalized AutoRegressive Conditional Heteroscedasticity
GCC:	Gulf Cooperation Council
GDP:	Gross Domestic Product
GTD:	Global Terrorism Database
IR:	Information Ratio
ISIL:	Islamic State of Iraq and the Levant
ISIS:	Islamic State of Iraq and Syria
LIBOR:	London Interbank Offered Rate
MDD:	Maximum Drawdown
MENA:	Middle East and North Africa
OECD:	Organization of Economic Cooperation and Development
RAPM:	Risk Adjusted Performance Measure
SAIBOR:	Saudi Arabian Interbank Offered Rate
VIX:	Volatility Index
WTC:	World Trade Center

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Introduction

Terrorism can be regarded as one of the most evident issues of this century. It does not just lead to loss of life and injuries of the victims, but causes also political instability and unrest, curtailing a country's GDP while triggering damage and loss of property. Terrorism causes an atmosphere of fear through brutal violence, it harms international peace, the securities of cities and governments as well as nations and markets worldwide. It vanishes the businesses of entire industries including tourism, airline and gastronomy, which are the most affected by terroristic incidents. The total number of deaths being attributed to terrorism account for about 16,000 deaths as of 2018 with 71 countries being affected by terrorism globally. The global economic impact of terrorism has amounted to $33 billion in constant purchasing power parity terms. The overall global cost of violence amounts to 14.1 trillion USD as of 2018 (Global Terrorism Database, 2020).

While terror attacks were mainly driven by political aspirations after the Second World War, the nature of terror attacks has changed and is now driven by religious conviction. The non-Islamic aetiologies of terrorism include political causes such as the Isareli-Arab conflict, as well as cultural and social causes. The cultural dissatisfaction is caused by rebellion against Western cultural colonialism, while the social causes are triggered by economic hardship such as alienation and poverty. The afore noted reasons give ground to terroristic organizations to indoctrinate, radicalize and recruit mercenaries joining the jihad.

Terror attacks manifest widespread concerns about the short-term and long-term impact on the economy and especially on a potential destabilization of financial markets due to decelerated growth rates and reluctant investments. It triggers the desire for a wish premium among investors and in order to be compensated for enhanced risk due to the terror attacks. Unexpected events cause such as terror attacks cause fear shock and negative investor sentiment, resulting in panic-selling responses and consequent sharp stock market declines accompanies by enhanced volatility. With the stock market being the economic barometer of a country, the reaction of market participants to the conduction of terror attacks provides a suggestion of the perceived economic damage.

Analysis of the financial economic consequences of terror attacks have been conducted by Bevilacqua, et al (2020), Javaid and Kousar (2018), Aslam, et al (2018), Rompotis (2017) and Amri and Hamza (2017) among others. Nikkinen, et al. (2010) explored the development of the

stock returns in the aftermath of the 11 September 2001 terror attacks across various regions of the world. Arif and Suleman (2014) assessed the impact of terroristic activities on various industries affected by the terror attack. Ramiah, et al (2010) showed that the impact of terror attacks is short-term by nature and trigger negative abnormal returns. Chauhdry, et al. (2018) added to the discussion by showing that also the countries of the SAARC region experience negative returns in the aftermath of terror attacks. Chesney, et al. (2011) explored how investors can protect their portfolios from diminishing losses triggered by terror attacks. Eldor and Melnick (2004) analyzed how stock and foreign exchange markets reacted to terror attacks by using 639 terror attacks and showed, that the type of attack influences the market impact tremendously. Bas and van Teen (2017) point out that the magnitude and duration of the impact of terroristic activities are moderate and short lived. Bouoiyour and Selmi (2019) evaluate the financial price of terror attacks using the example of terror attacks in Berlin and Munich and stress that the high competitiveness of the German economy allowed for quick recovery of the stock market. Papakyriakou, et al. (2019) adds to the discussing by proposing that stock markets with positive investor sentiment return to pre-attack levels in a shorter period, compared to countries where negative sentiment prevails.

This work adds to the discussion by exploring how the reaction of market participants in the aftermath of terror attacks has changed throughout time. In order to explore the relationship between the changes in investor sentiment following terroristic incidents, a multiple-criteria decision analysis is employed within this work.

The main goal of the dissertation is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity. The results are achieved by using 22 different risk and performance ratios in addition to qualitative criteria. An amplified number of criteria is introducing aiming to measure specifically the impact on return and volatility and its short-term (5 to 15 days) and long-term (from 2001 until 2016) change. Additionally, the enhanced number of criteria intentions to avoid an estimate bias triggered by a narrow focus on only a limited number of parameters and benchmarks.

The criteria are employed with regards to the main equity index of the country affected by the terror attack. Five terror attacks are extensively analyzed within this work: the 9/11 terror attacks, the Madrid and London bombing as well as the Paris and Nice attack. All of the terror

attacks had religiously inspired perpetrators, were conducted on European or American grounds and the combined number of fatalities and people injured exceeded 500.

Within this work, it is tested whether the impact of Islamic terror attacks on equity markets decreases with an increasing number of frequencies. In particular, the research question explores whether terror attacks which have happened in the beginning of the century (i.e. the 9/11 terror attacks of 2001) have had a more severe impact on the financial market than recent terror attacks (the Nice truck attack of 2016). Additionally, the magnitude of the impact on Western equity is compared against the impact of terror attacks on Islamic equity. Islamic equity is subject to several rules established by the Sharia, excluding various industries such as the gambling, alcohol or pork industry due to religious prohibition. Also, companies with high leverage or high interest-bearing debt ratios are prohibited for investment. This leads to a bias in the equity selection, and hence, Islamic equity might react differently to market shocks stemming from terror attacks. By comparing the effects on both Islamic and Western equity, it is also tested for contagion effects between the afore noted.

With the Islamic financial industry delivering 40% in growth from 2012 until 2017, comprising assets worth 2.7 trillion USD as of 2017, its international importance among equity investors is on the rise. The new emergence of important financial centers might lead to an accumulation of capital outside of Western states and it is widely acknowledged that global integration and inclusion of financial markets is closely linked to the rebalancing of geopolitical power and influence. From equity portfolio perspective, the exploration of potential co-movements between the Islamic equity and its conventional counterparts can be regarded as important, since contagion effects might lead to biased portfolios due to lacking diversification effects. Also, Islamic equity poses an alternative investment for market participants, especially, since it shares many aspects and fundamentals with sustainable investing, which has received great attention just recently.

The effects of the terror attacks are explored both on domestic level, analyzing the stock market of the country affected but also on international level through the comparison against the impact on Islamic equity. Additionally, this comparison can be regarded as the assessment of the impact between developed and emerging market countries. Since terrorism poses the greatest safety threat to the world, while it has increased significantly during the last decade attributes to the overall understanding of its economic consequences.

1. Literature Review

1.1. Overview of previous studies

Bevilacqua, et al. (2020) analyze the impact of terrorist attacks on the U.S. financial market by employing an event study methodology. The volatility index VIX is therefore decomposed into positive and negative components, which are extracted from the implied volatilities in call and put option prices. This allows the determination of the main channel through which terroristic activities impact the volatility index. The impact of 17 significant terrorist attacks occurring throughout several developed countries during the past 18 years was analyzed. Even though, the Nice driver attack in 2016 was the first attack of this kind in Europe, it did not have significant impact on the VIX. While similar attacks carried out in Berlin and London did not produce significant abnormal behaviors in the VIX, the Barcelona driver attacks in Las ramblas in August 2017 exhibited strong positive abnormal returns, implying an increase in volatility. This suggests that terroristic activities in Spain triggers global market uncertainty, which can be justified by the country's dramatic booms and busts (Bevilacqua, et al., 2020).

Bouoiyour and Selmi (2019) evaluate the financial price of terror attacks using the example of terror attacks in Berlin and Munich. Further, they reflect on the reaction of the German stock market regarding the terroristic incidents. The attack in Berlin caused substantial German stock prices moves, heavily affecting the airline, hotels, leisure and communication industry. The high competitiveness of the German economy as well as high quality of response in the aftermath of the incidents allowed German stocks to recover quickly.

Papakyriakou, et al. (2019) proposes that stock markets with positive investor sentiment return to pre-attack levels in a shorter period, compared to countries where negative sentiment prevails. Further, stock markets sustain significant economic losses with the biggest impact on the event day and the consequent trading day. After this time period, the markets continue to decline more gradually and without reversal of the indicated trend for up to 10 trading days after the occurrence of a terroristic activity. Further, they conclude that indices of countries that are associated with higher declines in post-event sentiment show higher declines in equity returns. Papakyriakou, et al. (2019) considered terroristic activities in the G7 countries between the period of 1988 – 2017 and assessed the impact of those attacks of stock market indices of 66 countries by employing an event-study approach. The sample data used for employing the model has been retrieved from the Global Terrorism Database and terroristic activities that have been carried out on territories of the G7. In order to account for the country-level sentiment and for the development of the newly introduced surprise measure, the Thomson Reuters

Marketpsych Indices have been used. Consequently, the Capital Asset Pricing is deployed, and the abnormal returns are calculated.

Ramiah, et al. (2019) adopted an event study approach in order to evaluate the effect of terrorist attacks on risk and returns in commodity markets. The technique was used in order to evaluate the effect include the non-parametric ranking test and kernel regression. The terrorist attacks considered comprise 20 attacks in different cities. In order to fit the asset prices various GARCH models are used in order to determine the changes in systematic risk. The results indicate that commodities reveal abnormal returns up to 120 days after an incident, which challenges the efficient market hypothesis.

Aslam, et al. (2018) point out to the fact that terrorism is the greatest safety threat to the world, and it has increased significantly during the last decade. In their study, they contribute by analyzing high frequency daily data in order to assess the impact of terroristic activities on five Asian stock markets. They consider a time period of 15 years, starting from 1997. The analysis includes 410 major terrorist attacks, and the event-window was chosen with 5 days. In addition, the type of attack including armed assault, assassination, bombing, facility and suicide are considered. Further, it is distinguished whether businesses, government, citizens, religious sites or security forces were attacked. For the analysis, also the number of injuries and deaths were included. A regression model approach under the usage of Dummy variables was used by Aslam, et al. (2018) in order to determine the impact of terror attacks on the financial market. Each Dummy variable corresponds to a consecutive day after terroristic activity in order to measure the investor's change of behavior after the occurrence of a terror attack. Further, the results show that terroristic activities targeting the business sector and security forces as well as the usage explosive weapons also imply bigger losses on the Asian stock markets. In addition, the more severe the terroristic incident is in terms of people dead and injured, the bigger the impact on the stock market.

Chauhdry, et al. (2018) analyzed the impact of terrorism on stock markets in the South Asian Association for Regional Cooperation region. Its member states include Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan as well as Sri Lanka. Further, they investigate whether human loss causes a difference in stock market returns. Their results suggest that the day of the terror attack is significant in less affected as well as in highly affected countries of the SAARC region. Further, they suggest that the negative impact continues into the next day in less affected countries. Chauhdhry, et al. (2018) run a multiple regression model

in order to determine the impact of terror attacks on the SAARC region. The event study methodology was used in order to review long-term and short-term horizons. They were used in order to determine the economic influence of the terror attacks by using security prices over a certain time period. The introduced dummy variables help to divide the entire observation period into three-time windows: prior to the specified event, day of event and post-event (Chauhdhry et al., 2018). They define terrorist attacks as well as the occurrence of earthquake as the dependent variable. The returns of the respective country's main equity index are considered as the independent variable. Further, they introduce the usage of dummy variables, which are dependent on the type of terrorist attack: bombing or explosion, assassination, armed assaults or kidnapping. The analysis was used for analyzing the impact of human loss. For their study, Chauhdry, et al. (2018) use daily stock market prices over a time period of 15 years (from 2000 to 2014) and 400 terrorist attacks are considered through random sampling.

Strother and Pagano (2018) analyzed the impact of the information provided by the U.S. Department of Homeland Security regarding terrorist attacks on 7 equity indexes. They employ an AR (1), EGARCH-M (1,1) model via the maximum likelihood method for the period from March 2002 to December 2006. Their results suggest that the investor's perceived risk increases, measured by conditional and implied volatility on the Standard&Poors 500 Index options. The study also provides evidence that traders are more active and precautious when there is information about an increased threat of an attack, nonetheless, equity market responses to this sort of information has declined monotonically during the course of time.

Bas and van Teen (2017) investigate in their study the magnitude and duration of the effect of a terror attack on stock market indices. The impact of 8 terroristic activities on 7 stock market indices all across the globe is measured by using a graphical analysis as well as an event study methodology. The results show that the magnitude and duration of terroristic activities are rather moderate and diminish during the course of time.

Also, Arif and Suleman (2014) assessed the impact of terroristic activities on stock prices among differences sectors in India. They defined terrorism as an action which focuses on explicit targets across various geographic locations with the goal to set in oppressiveness and fear. Further, they pointed out to the fact that there is very little possibility of predicting terrorism. This abruptness may initiate social reaction in the form of market shocks. Arif and Suleman (2014) used monthly stock price data from 2002 to 2011, which comprises 120 observations from 13 industries. They measured the effect of terrorist attacks on the Karachi

Stock Exchange market by using the Terrorism Impact Factor with lingering effect on stock prices. Their analysis points out to the fact that intensity as well as severity of the terrorist events triggered different reaction of the stock price. Their results indicate that the market is efficient in integrating the news regarding terroristic attacks. This rejects the assumption that investors get used to social and economic insecurity, which means that when terroristic acts become frequent, investors' confidence and therefore their investment decisions might not be affected. The study showed that while the financial, tobacco as well as health care industry denoted rising prices after terrorist attacks, the oil, gas as well as automotive industry experienced falling equity prices. Additionally, within the study it is stressed that the fear of terroristic acts can hinder investors from making neutral investment decisions since insecurity prevails and confidence in the market and the economy is weakened (Arif and Suleman, 2014)

Previous studies have shown that US and Islamic equity markets are weakly correlated throughout time and there is no evidence supporting the theory that the sentiment and volatility of US markets spills over to Islamic equity markets. This can be explained through the weak integration of Islamic equity markets in global financial markets, as well as through the peculiar conditions of the Islamic finance industry as a whole (Majdoub and Mansour, 2014). The authors have employed a multivariate GARCH BEKK, CCC and DCC models in order to analyze the conditional correlations between five Islamic emerging markets, namely Turkey, Indonesia, Pakistan, Qatar and Malaysia and the US market. Their results suggest low correlation between the afore mentioned markets.

After the Bali bombings of 2002, when a suicide bomber killed 202 tourists and injured another 240, the Indonesian stock market dropped on the first trading day by approximately 25%. A sector analysis showed that on the first trading day the investors' capital reduced between 5% - 8%. The returns remained negative for five days. In contrast to Bali and New York, the London Stock Exchange remained open after the bombings of 2005. Trading was not interrupted and the FTSE100 closed at about -1.6%. The bombings happened in the early morning, killing 52 civilians and injuring over 700 people. The London bombings in 2005 posed the first suicide attack in the country and posed the worst terroristic incident since the 1988 bombing in Lockerbie. (Ramiah and Graham, 2013).

Hayat and Kraeussl (2012) used weekly observations for a continuous period of 10 weeks in order to assess the performance of Islamic equity indices compared to their conventional counterpart. By employing a CAPM performance analysis on 145 Islamic equity funds, the

results show that Islamic Equity indices underperformed both their respective as well as conventional benchmarks from 2000 – 2009. The afore mentioned does not include management fees. In addition, it should be denoted, that Islamic Equity funds which invested in stocks all around the globe had worse performance than those funds, which only invested into local stock markets. Further, when testing for market timing the study shows that Islamic equity funds are poor in timing market, as supported by numerous robustness tests. Hayat and Kraeussl (2012) conclude that Islamic equity funds have a long way to go before being promoted as a real alternative to conventional funds. Further, they stress that before investing in an Islamic equity fund, an investor has to consider the enhanced risks. Muslims looking for investment opportunities might therefore rather invest into Islamic index trackers or Islamic exchange traded funds rather than Islamic mutual funds.

Sukamana and Kholid (2012) state the risk comparison between conventional and Islamic stocks has only been performed by Zoubi and Maghyereh (2007). In their study, they analyze the performance of Islamic equity against conventional equity by employing an ARCH and GARCH methodology, using daily data from the Indonesian stock exchange. They examine the risk performance of the Jakarta Islamic Index vs. its conventional counterpart, the Jakarta Composite Index. This analysis is performed in order to evaluate the effect of a financial crisis on both indices' respective volatility. Their results suggest, that even though both indices show increased volatility in times of market turmoil, the volatility of Jakarta Composite Index is greater than the volatility of its Islamic counterpart. From this finding it can be derived, that the Islamic equity index in Indonesia shows greater resilience against crisis than its Western counterpart and therefore, is less risky.

Chesney, et al. (2011) provided an empirical study which investigated the impact of terrorism on the behavior of stock bond and commodity markets. Various methods were used in order to analyze the market including non-parametric approaches and a filtered GARCH-EVT. Further, the study compares the impact of terror attacks with the impact of other extreme events including financial crashes and natural catastrophes. The results suggest that the parametric approach is the most appropriate method in order to assess the impact of terrorism on financial markets. They demonstrate how the results of this approach can be used for investors in order to diversify their portfolio.

Merdad et al., (2010) compare the performance between Islamic and conventional mutual funds using the example of Saudi Arabia. The study comprises data from 2003 to 2010 and the risk-

return behavior is examined through employing performance measures, including Sharpe and Treynor ratio, Jensen's Alpha and their variants. The results suggest that Islamic funds underperform conventional funds throughout the whole period. Nonetheless, the Islamic funds provide a good hedge for conventional funds during economic downturns due to the restriction Islamic law enforces on the selected portfolio stocks.

According to Nikkinen, et al. (2010) stock returns experienced significant negative development after the September 11 terror attacks in the short run but recovered quickly afterwards. They also showed that the impact on financial markets varied across regions. Those regions who are less involved in international economy were less exposed to the market shock triggered by the terror attack. Through their study they contribute to existing literature which already showed that changes in stock returns and volatility differ when it comes to dramatic events in various regions of the world. Nikkinen, et al. (2010) followed the methodology of calculating the log-returns and conditional volatility on daily basis. The volatility was calculated by employing a GARCH (1,1). The changes in the returns and the volatility of each region have been calculated by using $CR_{i,T} = R_{i,t-pos} - R_{i,t-pre}$ where $CR_{i,T}$ denoted the change in the index return. The study is based on the assumption that the effect of the September 11 attacks on global markets is ubiquitous due to globalization. They also showed that the impact on financial markets varied across regions. Those regions who are less involved in international economy were less exposed to the market shock triggered by the terror attack. Through their study they contribute to existing literature which already showed that changes in stock returns and volatility differ when it comes to dramatic events in various regions of the world. Nikkinen, et al. (2010) point out to the fact that the September 11 terror attacks were less severe than previous shocks in financial markets. In particular the 1987 crash as well as the 1997 Asian crisis had a bigger impact in terms of return and volatility on the financial market. The quick rebound implies either that financial markets have become more resilient in recent years or that terrorist shocks need to be treated differently compared to economic shocks.

Ramiah, Cam, Calabro, Maher, and Ghafouri (2010) analyzed the impact of terror attacks on the Australian Stock Exchange. They used five terrorist attacks to assess the reaction and found that on short term, there were negative abnormal returns for the case of the Madrid and London Bombings as well as 9/11. The market had positive equity returns after the Bali bombing.

Johnston and Nedelescu (2005) evaluated in their study the response of financial markets to the terror attacks and the respective authorities' responses. Johnston and Nedelescu (2005) stressed,

that the effects on the financial markets after the March 2004 terrorist attack in Spain did not have such a big impact on equity markets. The S&P500 as well as the EURO STOXX fell initially but recovered almost completely until the end of the month. The authors claimed that this because the Federal Reserve's fast and effective reaction to the terror attack calmed and stabilized the economy immediately. The more developed and efficient financial markets were efficient in absorbing the shocks triggered by terrorist attacks since relevant authorities reacted effective and fast to counter the effects of the terrorist attacks. Further, the paper evaluates the regulatory responses to terror attacks and focuses on aspects that should be reinforced in the future in order to enhance the resilience of financial markets. Between 1998-2003 the number of facilities struck by terror attacks were mainly civilian targets including individuals and businesses activities. The effects of those terror attacks can be divided into short-term, medium-term and long-term effects. The direct economic costs of terrorism include the destruction of life and property, restoration of systems and infrastructure. These direct costs appear immediately after the attacks, they can be regarded as short-term effects. Further, the direct costs are proportionate to the size and intensity of the incident. (Johnston and Nedelescu, 2005). However, the indirect costs of terrorism can be significant and influence the economy as well as investor confidence in the medium-term. This loss of confidence influences financial markets heavily since the weakening of the economy associated with the terror attack reduce the incentive of an investor to invest into assets of the specific market. Further, it can reduce the overall incentive to spend the money since the deterioration of one economy might affect the economies globally. The distribution of the effects varies significantly throughout industries and sectors and is based on the terroristic attack as well as the respective authorities' response. (Johnston and Nedelescu, 2005).

Hassan and Antoniou (2006) show that the impact of Islamic equity is closely related to the global stock market performance. The goal of the study was to examine the impact of Islamic screenings on investment performance through the comparison of a diversified portfolio of Islamic screened stocks with a conventional benchmark and further, to elaborate on the degree of correlation in price movement and volatility of the afore mentioned. The study was performed by comparing performance measures like Jensen's Alpha, Sharpe Ratio among others. The indices used for the comparison are the Dow Jones Islamic Market Index and the Datastream Global Index using the time horizon from 1996 until 2003. Their results suggest that the bias of Islamic equity towards stocks of the technology industry has provided major benefits before March 2000. Upon bursting of the Dot-com bubble, Islamic stocks suffered

tremendously from crashing equity markets. Nonetheless, Islamic equity indices did not show any shortcomings compared to conventional equity funds. This statement was supported by the results, which revealed great differences between Sharpe and Treynor ratio and significant positive Alpha when the Dow Jones Islamic Market Index outperformed the Datastream Global Index. Islamic equity funds face greater difficulties than conventional equity funds, since screening criteria with regards to the investable stock universe imply either a positive or negative bias on the stock selection. This bias is determined by market phase and selected industry. Further, Islamic equity is heavily dependent on the development of different investment strategies and risk assessment tools, which have to be compliant with Sharia (Hassan and Antoniou, 2006).

Eldor and Melnick (2004) analyzed how stock and foreign exchange markets reacted to terror attacks by using 639 terror attacks that happened in Israel between 1990 – 2003. The fatalities during that time period amount up to 1212 with 5726 people injured. Their study showed that the type of attack had a tremendous influence on the stock as well as the foreign exchange market, as did the number of victims. The location of the terror attack did not trigger any reaction of the financial market.

In the following chapter the terror attack which have happened between 2000 and 2020 are listed and criteria for the selection of the five terror attacks which are analyzed within the thesis are introduced. The five terror attacks are consequently presented.

1.2. Selection of terror attacks

In order to identify the terroristic incidents which have happened all across the globe The Global Terrorism Database (GTD) has been used. It is the most comprehensive database for terrorist attacks and terroristic activities in the world. The research from GTD is administered by the University of Maryland. GTD has collected information about terrorist events from 1970 until now and the database includes more than 190,000 events. For each respective happening, a wide range of information is available. This information includes the type of event, the target, weapons used, number of fatalities, the group or individual responsible among others (Global Terrorism Database, 2020).

The following list gives an extensive, however, not complete overview over the Islamist terror attacks between 2000 and 2020 which have happened on European or American soil (Global Terrorism Database, 2020):

Table 1. Overview of terror attacks.

Islamic terror attacks in Europe and the US from 2000 - 2020					
Year	**City**	**Happening**	**Fatalities**	**Injuries**	**Combined Ratio**
2001	New York	Airplane hijacking and crash into the twin towers	2.814	21.000+	23.814
2004	Madrid	Train bombings	191	1800	1.991
2005	London	Underground bombing	52	784	836
2012	Toulouse and Montauban	Attack of French soldiers and a Jewish school	7	5	12
2013	Boston	Marathon bombing	3	183	186
2014	Tours	Police station stabbing	1	3	4
2015	Paris	Charlie Hebdo attack	12	11	23
2015	Lyon	Beheading in a factory	1	11	12
2015	Paris	Mass shooting and suicide bombing	137	368	505
2015	San Bernardino	Mass shooting and attempted bombing	14	22	36
2016	Belgium	Airport and metro bombing	35	300+	335
2016	Orlando	Mass shooting in a nightclub	49	53	102
2016	Nice	Cargo truck attack	87	433	520
2016	Würzburg	Stabbing attack on a train	1	5	6
2016	Ansbach	Suicide bombing outside a wine bar	1	15	16
2016	Berlin	Truck attack on a Christmas market	12	56	68
2017	London	Car attack on Westminster Bridge	6	49	55
2017	Stockholm	Truck attack in pedestrian area	5	15	20
2017	Paris	Shooting of police officers	2	3	5
2017	Manchester	Manchester Arena bombing at the Ariana Grande concert	22	129	151
2017	London	Van attack on London Bridge	11	48	59
2017	Barcelona	Van attack on Las Ramblas	15	120	135
2017	Turku	Stabbing attack on Market Square	2	8	10
2017	London	Bombing attack in the underground	0	29	29

2017	New York	Truck attack in Lower Manhattan	8	12	20
2018	Carcassonne and Trébes	Hostage-taking, car-hijacking and shooting	5	15	20
2018	Paris	Stabbing near Palais Garnier	2	4	6
2018	Liége	Stabbing of police officers	4	4	8
2019	London	Stabbing on London Bridge	2	3	5

The terror attacks under consideration within this work were chosen according to the following criteria:

- the motive for the terror attack was Islamist-inspired
- the targeted location has to be either on European or American grounds
- the combined number of people dead and injured has to exceed 500

Hence, the terror attacks under consideration were chosen to be 11 September 2001, the Madrid bombing of 2004, the London bombing of 2005, the Paris attacks of 2015 as well as the Nice truck attack of 2016.

11 September 2001

The September 11 attacks were a series of terroristic activities performed by members of the Islamist terrorist group al-Qaeda. It can be regarded as the single deadliest terrorist attack in human history. All of the attacks happened on soil of the United States in the morning of Tuesday the 11 September 2001. The attacks resulted in about 3.000 fatalities, more than 25.000 injuries and billions of dollars of costs.

Four passenger air jets were hijacked by the terroristic and two of the planes were crashed into the North and the south tower of the World Trade Center in Lower Manhattan. As a consequence, both towers collapsed within two hours after the airplane hit the towers. The South Tower collapsed at 9:59 after the fire caused by the crash of the plane and the consequent explosion of its fuel caused a fire-induced structural failure. The Norther Tower collapsed at 10:28 after burning for 102 minutes (Miller, 2002). The other plane crashed into the Pentagon, which sustained from substantial damage. The fourth plane crashed into a field. (Congressional Record, 2006).

In the morning of 11 September, 19 hijackers took control of four passenger airliners, which took off from Boston, Newark, Washington and New Jersey. The four airplanes were selected

for the conduction of the attack since all of them were en-route to long-distance destinations (Los Angeles and California) and hence, the tanks of the airplanes were fully fueled.

Consequently, five of the hijackers crashed American Airlines Flight 11 into the Northern tower of the World Trade Center (1 WTC) at 8:46. Less than 20 minutes later, the terrorists crashed United Airlines Flight 175 into the South tower of the WTC (2 WTC). At 9:37 the American Airlines Flight 77 crashed into the Pentagon. United Airlines Flight 93 crashed into a field in Pennsylvania, after the passengers aboard the flight have managed to fight the hijackers. National Transportation Safety Board, 2002). The target of the fourth flight is believed to be the Capitol or the White House, but the passengers managed to thwart the attack after learning from phone calls that three other planes have crashed into buildings (Commission Report, 2011).

Passengers and crew members were able to conduct phone calls, which provided details about the process of hijacking. The terrorists have used mace, tear gas and pepper spray in order to take control. Some members of the air crew as well as some passengers were stabbed (Goo and Eggen, 2004).

The attacks killed about 3,000 people and injured about 6,000 others. These figures include the 265 people who died in the airplanes, 125 people at the Pentagon as well as the 19 terrorists. Most of the fatalities were civilians, except for about 350 firefighters, 72 law enforcement officers, 55 military personnel as well as the terrorists. (Frieden and Kokenes, 2009). In the Twin Towers in New York City, more than 90% of people who died in the towers have either been at or above the point of the airplane impact. Within the North Tower about 1,500 people have been above the point of impact. There was no escape for those people, since the staircases were destructed and hence, an escape was impossible. They died of smoke inhalation and fell or jumped from the tower in order to escape the fire and the flames. Many people also died because of the collapse of the building (Commission Report, 2004).

Bin-Laden, the head of al-Qaeda claimed responsibility for the attacks. The 19 hijackers were members of the Salafist organization of al-Qaeda. Bin Laden issued a fatwa which declared a holy war against the United States in 1998, which can be seen as the basis motivation for the conduction of the terror attack. In 2002, Osama Bin Laden wrote a letter to the United States, in which he explicitly stated the motives for the attacks, stating that the aggression against

Muslims in many countries including Somalia, Bosnia and Herzegovina as well as Lebanon were the drivers for the attack (Lawrence, 2005). Other motives which were stated in his letter to the United States were the American immorality, the support for Israel by the United States, the sanctions imposed on Iraq, as well as the presence of US military in Saudi Arabia (The Guardian, 2002).

A military campaign was launched by the United States as a response to the 11 September terror attacks. This military campaign is known as the Global War on Terror (Schmitt and Shanker, 2005). The target of the military operation were Islamist fundamentalists, mainly advocates of Sunni Islam. The targets of the campaign were located throughout various locations in Muslim world. The targeted terroristic groups include al-Qeada, the Islamic State as well as the Taliban among others. U.S. president George W. Bush declared the War on Terror in a formal speech to the Congress. He used the term for the very first time on 16 September 2001 (Bazinet, 2001).

As a consequence of the terrorist attack of 9/11 on the World Trade Center, the New York Stock Exchange remained closed for more than a week. Upon reopening the Dow Jones fell by 14% (Lenain, Bonturi & Koen, 2002). Since 9/11 affected only a concentrated area in New York, some critical market functions including the clearing and settlement of funds as well as securities and financial contracts relied only on a small number of institutions. Therefore, the lessons learned from the aftermath of September 11 included the setup of detailed business continuity plan with the goal of rapid recovery and timely resumption of critical operations in one major operating location. This plan is supposed to be subject to testing in order to achieve critical internal and external continuity arrangements. Summing it up, it can be said that those contingency plans have to be integral part of good business practice throughout the whole financial sector, with a special focus on systemically important financial institutions.

Johnston and Nedelescu (2005) pointed out that the September 11 terror attack aimed to undermine the stability of the U.S. economy as well as their financial markets. The incident led to a major disruption of the market activity as well as massive damage to property and communication systems which in turn led to soaring volatility levels in the financial markets. Nonetheless, trading never opened on the New York Stock Exchange as well as NASDAQ on 11 September 2001, due to the timing of the terror attacks. After reopening, which was only done after it was ensured that viability of the damaged infrastructure was restored. The trading session started with a drop In US equity, bringing it down approximately 18% in the consecutive days until 21 September.

But the terror attack did not just damage equity markets, it also affected the government's security market heavily as well as the repo market. As a response, the Federal Reserve build up their account balance to a back-then record amount of approximately $120 billion in order to provide liquidity to the market. In addition to the financial markets, also the insurance industry was heavily damaged by the 9/11 terror attacks. The claims summed up to more than $50 billion, which large insurers tried to compensate by demanding higher risk premiums due to increased uncertainty (Johnston and Nedelescu, 2005).

The costs of the terror attacks exceed the 100 billion USD mark when accounting for lives lost as well as property damage and loss of production and services. The loss of four civilian aircrafts can be valued at about $385 million USD, the destruction of major buildings in the World Trade Center can be valued with replacement costs between $3 billion to $4.5 billion USD. The damage of a part of the Pentagon amounts to $1 billion. The clean-up costs in New York are about $1.3 billion, while property and infrastructure damage cost about "10 billion USD to $13 billion. The FED emergency funds, which include the costs for increased airport and governmental security, costs of anti-terrorism measures and the operations in Afghanistan amount up to $40 billion. About 83.000 people lost their job directly, that amounts for $17 billion in lost wages. Damaged and unrecoverable property is valued at around $22 billion dollars. The city of New York lost about $95 billion, the insurance industry $40 billion and the loss of air traffic revenue is about $10 billion. Another big damage – fall of global markets – is incalculable (Institute for Analysis of Global Security, 2004).

Madrid bombing of 2004

The Madrid bombings were a series of terror attacks, which are also known as 11-M, conducted by the Islamic terror group al-Qaeda in the morning of 11 March 2004. The target of the coordinated bombings was the Cercanía commuter train system of Madrid and the happening took place 3 days before Spain's general election. The terror attack killed 193 people and injured around 2,0000. (El Mundo, 2006). The bombings can be regarded as the deadliest terroristic activity in Europe since 1988. Hamilos and Tran, 2007). Spanish judiciary found that al-Qaeda was responsible for the conduction of the attack, even though no direct al-Qaeda participation has been established (O'Neill, 2007).

During the rush hour in the morning of Thursday, 11 March 2004, ten almost simultaneous explosions occurred on four commuter trains, which are known as Cercanías. All of the attacked

trains were traveling in the direction of Madrid, between the Alcalá de Henares and the Atocha station in Madrid. 13 improvised explosive devises have been placed on the trains (El Mundo, 2006). All of the explosive devices were hidden inside backpacks. Investigation showed that three people in masks were getting on and off the trains several times in the afore-noted stations. Further, a car was found parking outside of one of the targeted stations, containing detonators, audio tapes with verses of the Koran as well as cell phones (Richburg, 2004).

Judicial investigation had shown later that all four trains had departed the afore-noted station between 07:01 and 07:14. The explosions took place between 07:37 and 07:40, with three bombs exploding at 07:37 at the Atocha Station, followed by two further explosions at 07:38. The happenings were followed by another two explosions in different carriages in the train station El Pozo del Tío Raimundo. At 07:38 another bomb exploded and ultimately, four bombs detonated at 07:39 (El Mundo, 2006). Around 08:00 emergency relief workers arrived at the place of the train bombing.

A spokesman of al-Qaeda in Europe claimed responsibility for the attacks in a videotape on 14 March 2004 (BBC News, 2004). Spanish judiciary state that a group of Moroccans, Syrian and Algerian Muslims as well as two Guardia Civil and Spanish informants were accused of conducting the attacks. In April 2006, 29 suspects were charged for the involvement in the bombings (El Mundo, 2006).

In the aftermath, authorities found out that in the south of Madrid, an apartment was used as the base of operations for the Madrid bombings. The accused terrorists (two Tunisians, and a Chinese) were inside the apartment when the police appeared to arrest them on 3 April. When the police were about to enter the apartment, the terrorists committed suicide by blasting a bomb, which killed themselves and one of the police officers. The explosives they used in order to commit suicide were found to be of the same type as those under the train bombings. (Goodman, 2004). Further investigation showed, that the 200kg of explosives were obtained from a retired miner, who still had access to the bombs (BBC News, 2004). Even though the three main suspects committed suicide in the apartment, five to eight suspects which had been involved in the bombings are believed to have escaped.

London bombing of 2005

On 7 July 2005, a series of Islamic terrorist attacks happened in London. The series were coordinated suicide attacks which targeted London's public transport system during the rush hour in the morning. Four Islamic terrorists ignited self-made bombs in the London Underground trains all over the city, as well as one bomb in a double-decker bus. The bombings occurred on the Circle and Piccadilly line, near Edgar Road and Russell square (The Newsroom, 2015). The London bombings can be regarded as the country's first Islamist suicide attack and it left 52 UK residents dead and more than 700 were injured.

On Thursday, 7 July 2005 three bombs exploded in the London Underground within 50 seconds from one another. The first bomb exploded on a train close to Liverpool Street. At the time of explosion, the train was approximately 90m along the tunnel at Liverpool street. This was followed by the detonation of the second bomb traveling towards Paddington. During that detonation also other trains passing by were damaged. A third bomb detonated on Piccadilly line, damaging the first, second and third car as well as the tunnel. About one hour after the attacks on the London Underground a fourth bomb exploded on the top deck of double-decker bus at Tavistock Square (BBC News, 2005).

Originally it was believed that there were more than 3 bombs because the wounded were exiting the tunnel on two different stations. Further, it was believed that the explosions were caused by power surges. (BBC News, 2005).

The suicide attacks were carried out by 4 men, aged between 18 and 30. Three of the four terrorists were British-born sons of immigrants from Pakistan. The police described the four man as unknown to the authorities until the conduction of the attacks (Lewis, 2007). Two of the bombers recorded videotapes in which they explained the reasons and motivations for their actions. They justified their behavior with the argument that the British supported the attacks against "their people". The governments which is democratically elected perpetuate atrocities against them including bombing, gassing and imprisonment. They claimed affiliation to al-Qaeda and the videotapes were mentioned by Osama Bin Laden and other high-ranking al-Qaeda members during various speeches, referring to them as "heroes" (BBC News, 2005).

As a consequence of the terror attacks, the British pound decreased by about 0.9 cents against the US-dollar. The FTSE 100 Index increased the most since the invasion of Iraq. This in turn triggered special measures imposed by the London Stock Exchange, restricting panic selling in

order to ensure market stability. Also, the equity markets in France, Germany, Spain and the Netherlands closed about 1% down from the previous day. The US markets, namely the Dow Jones and the NASDAQ increased slightly (Dune, 2005).

Paris attacks of 2015

The Paris attacks of 2015 were a coordinated series of Islamic inspired terror attacks. The terroristic incidents happened on 13 November 2015, beginning at around 21:16 Central European Time in the Norther suburbs of Paris, in Saint-Denis. Three groups of men launched six different attacks. Three suicide bombings, another suicide bombing in another location and shootings at four locations. 130 people lost their lives, and about 400 were severely injured (Chow and Kostov, 2015). The attacks can be regarded as the deadliest within the European Union since the Madrid train bombings and the deadliest in France since the Second World War (Nafeesa, 2015).

Three suicide bombers blew themselves up In Stade de France during a football match, which was watched by the then-president Hollande and the German foreign minister. The incident was followed by various mass shootings and suicide bombings throughout various cafés and restaurants. One of the deadliest ones, accounting for 90 of the 130 fatalities was the shooting in the Bataclan theatre during a concert. When the police entered the Bataclan, the attackers were shot or committed suicide through explosive belts (De la Hamaide, 2015).

In Bataclan, the gunmen opened fire, however, the audience did not recognize the gunfire as such, but thought it is part of the concert pyrotechnics. Survivors were able to escape via emergency exits or hid in toilets and offices. Many of them were laying on the floor, pretending that they were dead. The terrorists walked among the dead corpses and shot everyone who showed a sign of life. They had time to reload their weapons various times and French parliamentary repots contained a detailed description of how the victim's bodies had been mutilated (Randolph and Valmary, 2015).

The Islamic State of Iraq and the Levant claimed responsibility for the attacks and called it revenge for the French airstrikes on ISIL objects in Syria and Iraq (Elgot et al, 2015). The attacks were initiated in Syria and organized by a terrorist cell in Belgium. Most of the attackers had the French or Belgian citizenship. Some of them had fought in Syria. Some of them had entered Europe with the flow of migrants and refugees (Parlapiano et al, 2015). The lead

operative of the attacks was killed a few days later on 18 November in a police shooting. As a response to the terror attacks, France has launched its biggest air strike against targets of the Islamic State in Raqqa (Griffin, 2015). Within the French borders, the country declared the state of emergency for three months. Consequently, public demonstrations as well as police searches without warrants and house arrests in order to fight terrorisms were imposed (Breeden and de Freytas-Tamura, 2015).

Nice truck attack of 2016

The truck attack of Nice happened in the evening of 14 July 2016, when a 19-ton cargo truck was driven into the crowd on the Promenade des Anglais in Nice. At that time, the street was fully crowded and resulted in the death of 86 people, while wounding 458. The perpetrator was Tunisian, with permanent residence in France. The police were able to end the attack by shooting the terrorist (Howell et al, 2016).

The terror attack can be regarded as jihadist terrorism and the Islamic State claimed responsibility for the attack. The IS denoted that the attacker has targeted the citizens of coalition nations which fight the Islamic State and hence, acted in the best interest of the caliphate. As a reaction, president Hollande declared a state of emergency and announced that France will intensify the airstrikes on the Islamic State (Moore, 2016).

At around 22:30 after the end of the Bastille Day fireworks, the truck entered the Promenade des Anglais. The truck travelled at a speed of about 90 kilometers per hour and eyewitnesses had the impression that the truck lost control. It hit and killed numerous people on the premade, before it was first reported by the police. It broke through police barriers which marked the beginning of the pedestrianized zone and started to drive in a zigzag manner in order to knock out as many people in the streets as possible. The driver had fired several shots before he came to halt and was killed by police offers. The attack lasted about five minutes since its initial start, with the entire attack stretching over a distance of about 1.7 kilometers. The attack was classified as jihadist terrorism by Europol. However, before the conduction of the attack the terrorist was not known to French or Tunisian intelligence authority.
(Moore, 2016).

The perpetrator was a 31-year-old Tunisian who became radicalized shortly before the Nice attack. Upon the investigation of his phone, it showed that he had distinct interest in radical

jihadist movement and was in contact with Islamic radicals. However, he was said to be completely uninvolved in religious issues, and hence, was not a practicing Muslim. He ate pork, drank alcohol and took drugs, while having an unrestrained sex life. Even though he was sending money to his family in Tunisia regularly, the amounts were rather small. Before the conduction of the attack he smuggled cash to Tunisia worth about 100.000 €. (The Local, 2016).

Research revealed that he had searched on the Internet about topics like "terrible fatal accidents" and shocking videos, which were not meant to be for sensitive people. He began attending a mosque in 2016 and friends denoted, that he had expressed fascination for the Islamic State. On his computer, pictures of ISIL fighters and beheadings as well as dead bodies and images linked to radical Islamism were found (Berton and Hjelmgaard, 2016). Shortly before the attack, he was researching on the Internet websites with Surahs, as well as sites with Islamic religious chants and ISIL propaganda. His friends reported to the police that he had expressed extremist views shortly before the attack and one of his family members said that he was indoctrinated about 10 days before the Nice truck attack by an Algerian ISIL member (Tribune News Services, 2016).

His mobile phone, which was found in the truck revealed information about his preparations for the attack. Before conducting the attack, the perpetrator has visited the promenade various times in order to surveil the area. He also used the truck in order to drive up and down the promenade (Tribune News Services, 2016). It was believed that the terrorist planned the attacks months in advance while receiving help from accomplices. Six suspects were arrested by the French police for charges on criminal terrorist conspiracy. The suspects had sent messages via social media to the terrorist and stated their support. Some of them proposed instructions on how to cause more fatalities during the terror attack. These advices stated that the terrorist should load the truck with 2,000 tons of iron while releasing the brakes. Fingerprints of the suspected allies as well as videos of the terrorists in the truck were found. Further three suspects were also arrested because they supplied the attacker with weapons. (BBC, 2016).

The following chapter poses an introduction to the Islamic financial industry especially with regards to principles, prohibitions and usances.

1.3. Islamic finance

The Islamic financial industry held approximately 2.7 trillion USD in asset value as of 2017, which implies an increase by over 40% as of 2012. International organizations including the International Monetary Fund and the World Bank have welcomed this growth, since it comprised a wide range of countries and economic sectors. All of the afore mentioned institutions welcomed Islamic finance since it promotes the reduction of global inequality, tackling poverty and improves financial inclusion. The new emergence of important financial centers might lead to an accumulation of capital outside of Western states and it is widely acknowledged that global integration and inclusion of financial markets is closely linked to the rebalancing of geopolitical power and influence. At the core, the Islamic financial sector of the six Gulf Cooperation Council (GCC) countries has gained international attention and influence. The six states comprise: Saudi Arabia, the United Arab Emirate, Bahrain, Oman, Qatar and Kuwait (Hanieh, 2020).

Islamic banking institutions currently operate in more than 60 countries worldwide and can were regarded as systemically important by the IMF in Asia and the Middle East (Hanieh, 2020). Further, Islamic finance has a growth rate of approximately 15% - 20% annually and has reached a share of 1.4% of all assets in global financial market (Rethel, 2017). It is a mean for Muslims to convert illiquid assets to liquid ones. Nonetheless also non-Muslims use the Islamic financial markets to make investment in Islamic Financial Institutions. It is worth nothing, that Muslim world produces no more than 15% of global GDP, which did not slow down during the financial crisis of 2008. Only the Muslim countries in the Gulf Region enjoy plentiful resources in terms of energy, which makes them a respectable destination for international investments, while most other Muslim countries are highly indebted. In order to diminish wealth disparity among Muslim countries is by the application of Islamic finance Nakip, et. al (2017).

Muslim investors, but also socially responsible investors have been the key growth drivers of the Islamic financial industry. Within the Islamic financial universe, equity funds represent approximately one third of Islamic funds worldwide. Islamic funds have profited from enhanced standardization of Sharia-screening processes as well the growing number of Sharia-compliant securities globally. Nonetheless, the Islamic equity universe is way smaller than the investable universe of their conventional counterparts. This fact fueled the investment into commodities, since they provide a natural supplement to Islamic investing. It should be

denoted, that while investment in spot and tangible commodities is prohibited in Islamic finance, options and futures fall into the category of gharar and therefore prohibited (Nagayey et al., 2016).

Islamic investing denotes the nowadays-practice of trading assets in accordance with the ideologies of Islam. Even though various restrictions are applied on Muslim investors by Sharia, the Islamic asset industry has grown throughout the past decades. This is mainly due to the fact that Sharia scholars have accepted common stock investments. After this agreement between Sharia scholars, that buying and selling corporate stocks does not violate Islamic law, fund managers interests have been fueled. The agreement was made, since stocks and shares represent real assets. Further, dividend payments are in compliance with Sharia, while interest payments are not. After the establishment of Islamic equity indices, the development of new, innovative and liquid Islamic financial products has been fueled (Hassan and Antoniou, 2006).

Since Islam should direct all aspects of a Muslim's life, Islamic Banking seeks to bring pious Muslim's closer to their belief by aligning their financial practices with their religion. The emergence of Islamic finance was triggered by the Gulf States in 1973 during the oil embargo. Through tremendous capital surpluses, Saudi Arabia was looking for alternative investment channels. Also, other Gulf States were interest in the creation and consequent establishment of a Sharia compliant financial system. Dubai was the first one to create a purely Islamic Bank in 1975 and Kuwait followed shortly thereafter, in 1977. Islamic finance was also adopted in Bahrain in 1979 and by Qatar in 1982 (Ewers et al, 2016).

The states of the GCC have taken an active part and contributed to the development of the financial market, instead of opposing it. Various policies have been enforced in order to fuel financial markets through state intervention and policy innovation. The actions taken include the promotion of the private housing market (while still being Sharia-compliant), the governance of Islamic banks has been arranged and new Islamic products including the sukuk have been encouraged. The measures taken by the respective governments can be regarded as a form of financial market diversification, which are complementary to conventional finance. However, the class-fraction of financial capital has been strengthened by the measures (Hanieh, 2019).

Global political cooperation supported by economic factors gave surge to the emergence of the contemporary Islamic financial industry. The Organization of Islamic Countries supported the unity and monetary, economic and fiscal cooperation among Islamic States. In countries like Saudi Arabia, Kuwait, Turkey and Jordan among others, Islamic banks became utterly important in recent years, promoting openness and globalization (Khan and Bhatti, 2018). In order to fully capture the currently ongoing world affairs, it is necessary to incorporate the opinions of the people within Muslim-majority countries. Approximately one fourth of the world population are Muslims, with Islam spreading from South America to the west of Africa and Asia. Research on international relations suggests, that the incorporation of non-western norms and practices is inalienable for the global development. However, Western policies and practices still dominant the world and global happenings, however, in those practices the role of religion is not acknowledged.

Khan and Bhatti (2018) investigate the role of the Islamic banking and finance industry as a new regime within international relations. The results suggest that the Islamic financial industry can be used as a tool to convert religious conviction into political force through the creation of political alliances, establishing new cooperation as well as the implementation of an educational center for the Islamic banking and finance industry. These efforts could be coordinated by the Organization of Islamic Countries, such as granting Sharia scholars for higher studies among the Muslim worlds, or the promotion of Muslim students in minority countries. Further, the delegation of government officials and/or Sharia scholars to International institutions could be promoted.

Yordanova (2018) highlights that Islamic Finance represents a unique geo-economic code, which has been influenced tremendously by the following factors:

- the political and religious leadership vacuum in the Middle East and North Africa and the geo-economic and geo-political penalties such as the Arab spring and other violent acts triggered by the leadership crisis
- the endorsement of Islam and the resulting spiritual, religious and moral values and principles in order to encounter Western ideologies as well as military and economic infliction
- the growth of the political ideology of Islamism and extreme fundamentalism, as well as its transition to the West through the expansion of the Islamic cultural and spiritual identity as a dogmatic perception

Islamic finance principles

Islam underscores the moral value for human existence and every individual is regarded as a trustee of God's resources, which are to be used for the greater good and welfare of the whole society. Contrarily, conventional economics deal with how things are, not necessarily about how they should ideally be. The Islamic economic thought builds the fundament for the theory and practice of Islamic finance, which relies on the Islamic ideas of moral. These should be used as the fundament of an Islamic economic system. Islamic lessons reject excessive waste production, disproportionate consumption and unfair trade practices. Unjust profits and unjustified losses are considered as an unfair transaction. Sustainable developments and the Islamic economic thought share common grounds in terms of protecting people' prosperity, intellect and ensuing ages. Hence, the individual prosperity always has to be in balance with the greater good of the society. Distinct self-centeredness, profit maximization, market contest and private liberty are permitted, as long as they do not pose a threat to the broader society. Within the Islamic framework, the ultimate owner of all goods is God. While private ownership is permitted, the right to ownership is not absolute. The Islamic approach is seeking for a balance between the accumulation vs the distribution of wealth, private vs. communal incentives, spirituality vs materialism. (Hayat and Malik, 2014).

Capitalism focuses on the maximization of profit, private property rights, market rivalry and competition, as well as the free market. None of the afore mentioned are rejected in Islam, however, the moral fundament of Islam creates a different social and economic order compared to capitalism. The Islamic economic though relies on the divine revelation as the core source of knowledge and moral compass (Hayat and Malik, 2014).

Maulidizen (2017) points out that Islam openly legitimizes the wealth of an individual and companies. If the involved individuals fulfill their religious duties, they are rewarded spiritually and materially. Additionally, the connection between trade and religion in Islam is illustrated by Islam's spreading across the world. While conventional economics do not add an ethical and social dimension, Islam does. Islamic laws also include economic morality: justice, equality, inclusion, accountability and freedom. These five attributes are the basics principle of Sharia economics. The main differences between Islam and conventional economics can be summed up as follows: while Western world is selfish, with materialism and absolute private ownership as a principle, Islamic economics state that humans can be selfish, but also selfless, while

materialism should be controlled, and personal ownership has to remain within the framework of morality.

Summing it up, Islamic finance comprises seven key principles (Maulidizen, 2017):

- the elimination of pure debt securities from the financial system through replacement of interest rate payments
- bank deposits must be collected on a profit and loss sharing basis
- promotion of trade financing and the exchange of goods in order to ensure a tight link between the financial sector and the real economy
- upholding property rights for an individual and the whole society in order to avoid conflicts
- fulfillment and inviolability of contracts dealing with the trade of goods and services
- underscore the principles of morality and business ethics, the code of conduct while banning activities that are considered haram in the Sharia
- promote sharing reward and risk equally between the rich and the poor through instruments of re-distribution

Sharia boards

For an Islamic investment product to be approved, a council of Islamic scholars, also referred to as Sharia board or Sharia committees needs to give its consent. The Sharia board must act in accordance with religious decrees, incompliance is haram. These executives are responsible for the protection and preservation of client deposits. Further, they must protect the client's investments against corruption, negligence and illicit issues. The board also needs to harmonize their policies with the practices established by the Accounting and Auditing Organization for Islamic Financial Institutions in 1991.

Sharia guidelines on Islamic investing incorporate profit sharing partnership, leasing as well as socially responsible investments, along with the prohibition of fixed interest. Consequently, financial investments into corporate bonds, treasury bonds and treasury bills, certificates of deposits and preferred stocks are banned. Further, the Sharia disallows investments into conventional insurance products. At the operational level, Islamic principles state that mandate trading must be free of ambiguity, banning options futures and other speculative financial investments (Merdad et al., 2010).

Sharia committees play an essential part in the Islamic financial structure since they ensure the efficient functioning of the system besides safeguarding Islamic financial standards. Sharia committees ensure that financial contracts, transactions, services and products are in accordance with Sharia law (Syahiru and Engku, 2018).

Islamic investors are only willing to invest into an asset if it does not cause religious conflict. This means that Islamic investments need to be compliant with the Sharia. The Sharia comprises rules and laws, stemming from three sources: the Quran, Hadith and Ijtihad. In Islam it is essential that there is no unique higher institution when it comes to official religious opinions. The existence of such an institution would resultingly ease the process of decision making with regards to financial products. Since the establishment of such an institution is not desired by the Muslim community, Islamic investment providers need to engage Sharia scholars. Sharia scholars interpret the different Sharia sources and ultimately, take a decision on whether an investment is considered halal or haram. Consequently, different Sharia scholars might lead to different decisions regarding the Sharia compliance of financial investments. Resultingly, current Sharia screening procedures which are applied in practice are inconsistent with respect to discriminating between what is prohibited and what is permitted. (Derigs and Marzban, 2008).

The three primary goals of every Sharia committee can be defined as: directing, reviewing and supervising. The main task of the Sharia committee members is to take decisions on Sharia matters, which are usually referred to as ijtihad. Further, they can be regarded as a traditional practice of Muslim scholars. The committee member who is taking the decision is referred to as Mujtahid. However, certain requirements need to be fulfilled in order to be entitled to be or become a Mujtahid. (Dima, et al., 2014).
The AAOIFI has not issued concrete rules within their governance standards with regards to Sharia committees. Yet, within the governance standards a specific ruleset can be derived (Dima, et al., 2014):

- Independence of the Sharia committee needs to be ensured
- all business activities requiring the acknowledgement of the Sharia commitment need to be brought in consistently without gaps
- a Sharia committee must comprise a minimum of three members
- reports are provided by the Sharia committee for any fatwa which follows the AAOIFI standards of reporting

From the above it follows that objectivity and independence are mental attitudes every member of the Sharia committee must fulfil. Hence, the member must not neither be an employee of the institution nor involved in any operational or management business activities. Any conflicts of interest such as the engagement with an employee of the firm is prohibited if the engagement has been going on within the past three years since the beginning of his or her contract. A conflict of interest and resultingly, a lack of independence would also involve financial involvement in the financial institution, personal or family relationship as well performance-related payments among others. By insulting one of the afore mentioned principles, risks will be brought to the Islamic financial community and the establishment or re-establishment of trust will be undermined (Dima, et al. 2014).

However, upon the investigation of the governance standards issued by the AAOIFI no specific methodological standard with regards to the decision-making process can be found. Further, there is no definition about how a regulation or fatwa is agreed on within the Sharia committee. The governance standards do not denote whether a leader or chairman is appointed within the Sharia committee. Indirectly, the guidelines propose to consult professionals who are familiar with business matters, economics law, accounting or other fields of economics. I independence must also be maintained when consulting external professionals. However, these professionals must not necessarily be specialized in Islamic ruling but have expertise in Islamic finance. (Dima, et al. 2014)

Hassan, et al. (2018) analyzed how the educational composition of the Sharia board influences the risk-return profile of Islamic equity indices. The study was conducted for the FTSE, S&P and the Dow Jones and analyzes how screening criteria imposed by the board members on the total market portfolio influence the risk vs return ratio of the chosen Sharia compliant asset universe. The results suggest, that the FTSE underperforms the S&P and the Dow Jones in terms of Sharpe ratio. When comparing the Islamic equity indices against the benchmark, the analysis shows that Islamic indices represent a defensive investment strategy, with the investment criteria driving the Islamic indices' sensitivity. Also, the study shows that if a Sharia board consists of many members, the higher the risk for Islamic equity indices becomes. Members who share a similar background lead to enhanced standardization of the screening criteria and contribute by flattening out the differences in performance. However, this comes at the price of higher systematic risk.

Official reasoning, statements and legal opinions about specific issues which are disclosed by national-level Sharia councils are referred to as fatwas. These play an important role in the governance of Islamic capital markets in many countries. Usually these fatwas are issued by muftis, which are experts in Islamic law and finance. However, the process of producing those fatwas involves a two-fold translation: translating a financial market issue into a language which can be understood by Sharia experts and further, translating the Sharia principles back into the market practices. The aforementioned fatwas co-exist with the financial regulations in a mutual dependence (Rethel, 2017). In Southeast Asian countries, new governance practices regarding the capital market have emerged. A centralized model of Sharia governance has been established at the national level, with both apparatuses being closely tied to the state government. Fatwas are meant to provide the fundament for regulatory guidelines; however, fatwa bodies are dependent on the government for their status. Further, the state regulates who is entitled to make those fatwas. The fatwas are not just a part of a social or ethical guideline, providing a framework for how pious Muslims should handle their economic affairs, but rather legally binding financial regulations (Rethel, 2017). With the lack of standardization and consistency across Sharia boards, both Malaysia and Indonesia have institutionalized Sharia boards at the national level. This poses a step towards the harmonization and convergence of Sharia board decisions, both in terms of permissible market activities and financial instruments. Further, it is a step towards a common understanding of knowledge practices. While this establishment brings advantages such as mainstreaming of Islamic financial principles and capital market governance, one of the major disadvantages poses the fact that Islamic financial principles of equity, mutuality and social justice might be subordinated in order to ensure national development (Rethel, 2017).

Prohibitions

Islamic finance follows the basic principles that any business can be conducted unless it violates Sharia ruling. Munawar (2020) states the following prohibitions within the Sharia:

- Islam prohibits all forms of riba, encompassing all possible returns achieved through the issuance of a loan. This prohibition is independent of the reason why a loan was taken out and what it was used for (business vs. consumption) and it does not make any difference whether the potential return achieved is big or small, fixed or variable, paid in advance or at maturity.

- Islam prohibits the gharar, which has various definitions in jurisprudential literature. It applies to cases of uncertainty with regards to the outcome. It further comprises the trading of unknown, prohibiting buying or selling things that either the buyer or the seller does not know. In addition, a combination of the afore mentioned, gharar also covers both the unknown and the uncertain. According to Munawar (2020), the following businesses (among others) would be assumed gharar:
    - Selling one kilogram of apples for five dollars, without specifying which type of apples are subject of sale
    - Selling a pet for 100 dollars without specifying which pet is meant
    - Selling a car for 5000 dollars without postulating which car
    - Selling a box of oranges for 20 dollars without stipulating the type of oranges and their respective weight
    - Buying a dress for a week's salary without specifying the exact amount

Gharar refers to acts, conditions and (missing) specifications of contracts, where the consequences for one or both parties are not clearly defined. This can be interpreted as an attempt of minimizing misunderstandings and conflicts.

- Further, Islam forbids gambling. This includes any transfer of wealth without adding any value, also referred to as zero-sum games. Risks involved in conventional business activities are not included in the prohibition of gambling.
- Islam prohibits combination of contracts. If more than option is offered, the buyer must specify his choice before the closing of the deal, otherwise the contract is considered to be gharar.
- Any circumstances, which give one of the parties an assured benefit without taking over the risk is not allowed. This prohibition ensures that both parties share the profits and losses.

Various financial instruments and regulations have been introduced in order to comply with the rulings of Islam and the Sharia. Sharia involves the principles of Al-Quran, Sunnah and Hadith. Sharia does not just influence the way Muslims interact with financial markets, but also dictates the way of life of pious Muslims. Since Islamic finance does not involve the instruments and services of western financial regimes, it makes Islamic financial institutions more dependable than others. This is mainly since there is no interest in Islamic Finance, making it the center of the paradigm Nakip, et. al (2017).

According to Nakip, et. al (2017) Islamic Finance is embossed by peculiar traits, which include:

- being exempt of interest (riba)
- being free of speculating (maisir)
- evading situations and issues which are not permissible (haram)

In this regard, it is strictly forbidden to receive or give interest in any business transaction or payment. This implies that conventional financial dealings which are popular in Western finance are not applicable in Islamic Finance. In addition, financial instruments including funds, stocks, loan contracts and bonds are also not permissible, since they are not compliant with Sharia. These investments involve uncertainty, interest and they are not in the best interest of the entire society.

The predominant regimes and policies that have been established follow the consequent rules (Hunter, 2014; Zulfiqar et al., 2016; Marimuthu et al., 2017; Mansour et al., 2015; Siddiqi, 2012; Widana et al., 2015; Quttainah et al., 2013):

- favoring supportive merits, while achieving financial, economic and spiritual results
- acting within legal limits during business operations, i.e. the source of wealth must be legitimate
- price gouging is illicit, and income should be equal
- the poor must be supported through zakat (alms)
- land and capital must only be used in combination with the employment of people in order to preserve equality and justice
- individuals own assets only temporarily and they must be passed over to the next generation intact
- induvial enjoyment of assets must be in the interest of the whole society
- hoarding, monopolies as well as cognizant market disruptions are prohibited
- transactions must be free of riba
- investments as well as business activities must be permitted (halal)
- investment transactions must be without irrational uncertainty
- financial applications are subject of approval of the Sharia board and must be implemented within the framework of Sharia
- economic and financial actions and operations must contribute to the wellbeing of a society and must fight for the elimination of injustice.

The question, whether trading stocks is allowed or prohibited within the Islamic finance framework and principles, was raised by many authors, including Hassan and Lewis (2007). By arguing, that stock market poses pure speculation, it would be considered haram within the Islamic finance framework.

One of the arguments which support the theory that trading on stock markets is pure gambling is the efficient market hypothesis. The hypothesis states, if it is true, that no market participant should ever be able to capitalize on a special informed position in order to achieve a profit, since information is already absorbed by the market. On the other hand, there are also hedgers participating in the stock markets which are seeking to reduce their exposure to uncertain future price movements.

According to newer interpretations, gambling and trading can strictly be distinguished. While trade is a means to raise the welfare and status of all parties involved, gambling can be regarded as a strict win-or-lose game. The general rule is that gharar is only tolerable if its benefits outweigh its damages (Hassan and Lewis, 2007). This argumentation was also welcomed by many countries to the fact that it enabled them to join the World Trade Organization. Upon joining the World Trade Organization, a country is obliged to open its financial market to foreign funds. In many countries this has led to great concerns, since forces from international stock markets might lead to the destabilization of a financial market, which has been pointed out by many Islamic countries including Saudi Arabia (Hassan and Lewis, 2007).

Stabilizing a country's exchange rate is one of the main concerns to ensure that stock markets are not subject of excessive speculation. At the global level, enormous outflows of foreign funds can lead to excessive domestic inflation. On national level, drainage of foreign funds might lead to collapsing financial markets, while destabilizing the financial system. Therefore, the middle course policy involves the maintenance of a liquid capital market through appropriate regulations against extreme speculation. (Hassan and Lewis, 2007).

Until the late 1990s, stock markets were not popular among Muslim investors, since heavy manipulation and speculation across stock exchanges caused the public belief that stocks involve gharar, making it an intolerable Islamic pursuit. Comprehensive supervision of the stock markets and stronger regulation with regards to corrupt market practices eliminated the doubts about equity markets. Islamic scholars provided security, that the afore mentioned deceptive behaviors of manipulation and corrupt practices were not tolerated. In addition, only

few companies traded in the stock exchange provided Sharia compliant services and products. Back then, there were no comprehensive mechanisms to audit, monitor and collect a dynamic assortment of the Sharia compliant stocks (Saraç and Ülev, 2017).

The five main principles which are to be obeyed including riba, gharar, maysir, sharing of risk and return and prohibition of an investment into unethical companies, implies that Muslims are not allowed to invest in futures, options or other speculation and expectation based financial instruments. Further, it does not allow Muslims to take out conventional loans. Nonetheless, taking entrepreneurial risk and making money from it is permitted. From this it follows, that unless the five afore mentioned principles are not insulted, investing into equity and mutual funds is allowed (Hayat and Kraeussl, 2012).

Sharia screening

Different evaluation procedures and guidelines are proposed by financial institutions and Sharia scholars involved in the evaluation of the Sharia compliance of an investment. These differences stem from the high complexity of financial markets and the wide variety of multifaceted financial products. Since conventional financial products including bonds, options, futures and swaps are not permitted under Sharia, they need to be restructured in a Sharia compliant manner. An example for a successful restructuring would be Sukuks. These Sukuks are asset-backed securities where the sukuk holders lease a specified asset and receive halal returns. Through this structure, interest payments are avoided and compliance with Sharia is given. (Derigs and Marzban, 2008).

Rosly (2005) introduced three approaches in order to detect Sharia compliant socks:

- the activity method, also referred to as production method
  The activity method declares stocks as Sharia compliant when the company does not deliver products or services including the prohibited activities.
- the income method,
  Income generated from investment in financial assets must be free from interest, riba and gharar under the income method. The most conservative Islamic index is the Dow Jones Islamic Index. Companies, in which interest-bearing securities exceed 33 percent of total assets cannot be encompassed or must be excluded from the index.
- and the capital structure method

The capital structure method measures the Sharia compliance of a company by evaluating its debt-to-equity ratio. Islamic legitimacy is given if the leverage factor does not surpass 45%.

Sharia scholars who manage the Sharia compliance of an Islamic fund or index apply a set of qualitative (e.g. sector) and quantitative (e.g. leverage ratio) screens in order to identify halal equity investments. In a first step, the investable universe is reduced by applying qualitative screens. Consequently, financial screens are performed, and the investable universe is further reduced. Within these two phases, pertinent differences exist between different Islamic investment providers.

Special processes determine whether a stock can be regarded as Sharia compliant and whether they might resultingly be added to an Islamic equity index. A stock or company is Sharia compliant if it fulfills the following criteria (Sukmana and Kholid, 2012):

- it has to be free from riba (interest)
- it must be free from gharar (uncertainty)
- it must not contain maysir (gambling) elements
- it must not be involved in producing, distributing or providing services which are against Islamic teachings (i.e. producing or distributing alcohol, running a casino, buying or selling pork, distribution of pornographically contents and others.

Qualitative screening

The general rules of Islamic funds can be divided into quantitative and qualitative criteria. The qualitative screening process involves the inclusion and exclusion of stocks, which are permissible or not permissible in Islam. Stocks of companies, whose core business activity includes the following are excluded (Hassan and Antoniou, 2006, Yordanova, 2018:

- banking and other interest-rate related business
- insurance
- narcotics including alcohol and tobacco,
- contraceptives including condoms and the anti-baby-pill
- gambling and gaming
- porn industry
- pork production, consumption and sale of food containing pork, or any other activity related to pork

- fast food and junk food (referred to as food for unbelievers including restaurant chains such as McDonald's, KFC, Burger King, etc.)
- weapons
- activities offending the basic principles and rules of Islam
- sectors or industries which are heavily dependent on one of the afore mentioned.

Upon the issuance of a fatwa, which bans a specific sector or industry, automatically all business activities including investing money and trading financial instruments is prohibited. Following this logic, fatwas can inhibit a potential market shock for Islamic financial instruments and hence, posing a specific risk factor for Islamic finance. In 2007, one of the most influential experts in global Islamic finance issued a fatwa, which prohibited the investment into sukuks, since they were perceived as incompliant with Islamic principles. The issuance affected the growing market for Islamic debt securities, which comprised over 50 billion USD at that time (Yordanova, 2018).

Stocks, with business activities involved in the above are excluded from the Islamic fund investment universe. Further, companies which have a material ownership or income streams of another business involved in the prohibited activities are also excluded from the investment universe. Besides the qualitative screening and exclusion of certain stocks from the business universe, the remaining stocks' financial ratios are evaluated. and if necessary, the investment universe if further trimmed (Hassan and Antoniou, 2006).

Quantitative screening

The quantitative screening is necessary insofar as it is necessary to determine the percentage of a company's involvement in riba and the trading of money against money. In this case, the riba is measured based on how much interest-based money a company receives and how much interest a company pays for its liabilities. This ratio needs to stay below a certain threshold in order to be Sharia compliant. The threshold application poses a relaxation of the strict riba ban. Further, it can be regarded as an adjustment to nowadays world, since it is impossible to find a company which is not indebted and repaying a loan with interest to a conventional financial institution. If Islamic scholars were extremely inflexible, it would be almost impossible to invest into a company's equity. Upon setting the threshold, the definition is based on the interpretations derived from Ijtihad and Shariah statements, which delivers a certain degree of freedom when specifying the quantitative criteria. (Derigs and Marzban, 2008).

In order to determine the quantitative compliance of a company with Sharia rules, the Sharia screening process involves the in-depth analysis of the annual report. Resultingly, the Sharia screening process is highly dependent on the frequency of a company's statement publishing. Quantitative Sharia screens are performed through analyzing a company's financial ratios, including liquidity, interest, debt and income and consequently comparing the ratios against a maximum allowable threshold. Shariah boards typically use various ratios to assess the Sharia compliance. Further, a company is only considered Sharia-compliant if it fulfills all of the criteria, i.e. stays below the maximum allowable thresholds for each ratio.

The Sharia screens include the following (Derigs and Marzban, 2008):

- liquidity screens

  From Sharia perspective, returns must only be achieved on illiquid assets. While conventional investors appreciate high liquidity ratios since it implies that a company is able to cover all of its short-term financial obligations, the assets of a Sharia-compliant company should mainly be illiquid.
- interest screens

  Generally, earnings from interest are not permissible under Sharia law. Since nowadays companies are leveraged and have close relationships with banks, which might lead to receiving or paying interest, thresholds for permissible interest have been defined.
- debt screens

  Similarly, to interest screens, also thresholds for interest rate payments are defined by Sharia scholars. Both Islamic and conventional investors prefer lower interest rate payments over high ones.
- non-permissible income screens

  Less frequently used criteria in order to assess Sharia compliance use the income achieved through non-Sharia-compliant business activities. The screen for business activity is considered important under Sharia-law. This is due to the fact that qualitative screens only exclude companies whose main business is not Sharia-compliant.

The criteria set up by the Dow Jones Sharia Supervisory Board deploy the standards for the entire Islamic investment industry. In order for an equity investment to be permitted, the following criteria must be fulfilled in accordance with Islamic law:

- a company's total debt divided by its 12-month average market capitalization must not exceed more than 33%
- a company's total of cash and interest-bearing securities divided by its 12-month average market capitalization must not exceed more than 33%
- a company's accounts receivables divided by its 12-month average market capitalization must not exceed 33%.

While the 33% look arbitrary at first glance, Hayat and Kraeussl (2012) suggest that the one-third rule is very likely to have close connection to the hadith, where it states that one should not donate more than a third of his wealth to charity.

In 1998 the first index was established which only included stocks of Sharia compliant firms. This establishment was triggered through a collaboration of the Kuwait Finance House and FTSE. In 1999, the Dow Jones Islamic Index followed, and it encompassed only companies whose core activity was Sharia compliant and in addition, whose interest-bearing debt within liabilities did not exceed 33%. After the launch of the Dow Jones Islamic Index, many others followed this trend (Saraç and Ülev, 2017).

The table below shows a summary of the pros and cons of Islamic finance and its applications.

Table 2. Pros and cons of Islamic finance

Pros and cons of Islamic finance	
Pros	**Cons**
• more stable in times of economic downturn and market disruptions (Mohieldin, 2012)	• insufficient risk management
• Islamic finance establishes close links between financial markets and real economy and hence, is less prone to crises (Mohielding, 2012)	• lack of liquidity in the financial markets
• no skew towards debt investment and hence no involvement in subprime toxic assets during the financial crisis of 2008 (Mohieldin, 2012)	• low diversification potential due to limited investment horizon (Hayat and Kraeussl, 2012)
• equity finance confines extreme leveraging (Mohieldin, 2012)	• lack of benchmark for evaluating the equity performance

• more careful evaluation of business ideas due to sharing of risks and profits (Mohieldin, 2012)	• no official agreement about financial criteria used for screening halal stocks
	• development of an own accounting system can be regarded as necessary, as accounting methodologies applied by modern Western world does not capture their specific risks properly (Ballack, 2019)
	• many aspects of Islamic finance can be regarded as an imitation of conventional equity, leading to higher transaction costs and inefficiencies for Islamic investments
	• low awareness of potential clients
	• slow innovation process
	• Compulsory compliance with the Basel III framework leads to inefficicient use of liquidity
	• standardization is needed in many business areas including the tax treatment and insolvency framework
	• many aspects of Islamic finance can be regarded as an imitation of conventional equity, leading to higher transaction costs and inefficiencies for Islamic investments
	• low awareness of potential clients
	• slow innovation process
	• Compulsory compliance with the Basel III framework leads to inefficicient use of liquidity

In addition to the drawbacks mentioned, Islamic Equity funds are not permitted to invest in companies which exceed the 33% debt-to-total assets ratios. From this it follows, that Islamic equity investments are biased towards sub-optimally leveraged companies. These companies include start-ups, which might have difficulties in obtaining external debt finance. This bias creates high exposure to small growth stocks within Islamic mutual funds. (Hayat and Kraeussl, 2012). During market turmoil and financial shocks, some companies might have to increase their debt ratios, far beyond what is permissible by Islamic finance. This forces Islamic equity

funds to sell stocks (with a loss) in times of crisis at low prices due to the excess of the 33% debt ratio. Consequently, the conventional buy-and-hold strategy applied by Western market players is practically not implementable for Islamic equity funds.

In addition to the potential issue of the increased debt-to-total assets ratio in times of market turmoil, the 33% limit on accounts receivables might also be problematic. These criteria might lead to biased investment into companies facing liquidity issues since low receivables might be an indicator for unsatisfactory working capital.

When Islamic finance was initially developed, the idea of bringing economic progress, distribution equality and social welfare for the society was at focus. Several factors have contributed to falling short of those goals (Sabirzyanov and Hashim 2015):

- the present economic and monetary system
  Even though Islamic financial institutions operate within the Sharia framework, they are still influenced and affected by the natural economic business cycle. Further, Islamic finance is also exposed to the existing monetary system. Hence, within the neo-classical framework it is not possible to fully ban interest-rates. In order to stay competitive, Islamic banks need interest rate benchmarks to measure mark-up values or the time value of money when evaluating projects. Evidence for the return to interest-rate based finance provides the high correlation between the saving deposit rate in both conventional and Islamic banking system. The systems correlate at approximately 70% in terms of average financing rate using the example of the Malaysian market.
- global focus on the financial industry and contentious financial products
  New Islamic finance products have been introduced, which mostly pose copies of the financial instruments used under the conventional banking system. The new products were developed by Islamic financial engineers, who compromised on the Islamic principles and values in order to introduce instruments, which serve the investor's needs. This compromise has made the Islamic banking system also vulnerable to outside shocks from global financial markets – just as their conventional counterparts. Previous studies also indicate that there is a direct link between the performance of conventional banks and Islamic banks.
- subordination of equity financing vs debt financing

Due to its long-run nature, equity supports the development of economic growth more than debt-based financing, which is usually done for shorter maturities. Nonetheless, Islamic financial institutions have employed and incorporated debt financing in their business activities, since it is less risky due to its shorter maturity. Even though Islamic law does not allow for interest rate payments or reception of interest rate, the analysis of Islamic financial institution shows that the prevailing financing mode is debt financing. The inconsistency with Islamic economics comes at the advantage of lower risk and fewer implementation issues (like e.g. the agency problem).

- shortage in development financing

  Due to the importance of the financial industry to economic growth, Islamic economics can be regarded as a development-driving sector. Under Islamic principles, this influenced is deemed to fuel economic and especially social well-being. Even though Islamic Finance has a history of approximately 40 years and has surely contributed to economic growth, there is still room for improvement with regards to the contribution to social welfare and economic development.

- lack of social responsibility

  Since Islamic finance is based on the principles of economic development and social welfare, the Islamic banking and finance industry is deemed not just to be Sharia compliant, but also CSR compliant. Nonetheless, previous studies have shown that CSR activities performed by Islamic banks are rather limited.

- undersized corporate governance

  Conventional banks do not just focus on being profitable, but also on thorough means of corporate governance, ethical actions and ecological consciousness. Previous crises have shown that poor corporate governance practices have contributed tremendously to the outbreak and worsening of a crisis. Resultingly, in the aftermath of the financial crisis many conventional banks have employed best practices and a high level of corporate governance. In this regard, Islamic financial institutions have just adopted the corporate governance model of conventional banks, without accounting for the Islamic principles and values. Further, the proposals and initiatives of the IFSB and AAOIFI are not commonly acknowledged by Islamic financial institutions.

Mohieldin (2012) suggests that for Islamic finance to develop and nourish to its full extent, imitations of conventional investment instruments need to be abandoned. This emulation needs to be paired with investment in human capital, research and innovation in order to achieve the

desired results. In addition, Islamic finance investments need to be tailored to the specific economic needs and financial requirements and therefore, meeting the predilections of local cultures, boost financial inclusion and intermediation. This would lead to mobilization of financing for SMEs, long-term project funding, which in turn could trigger sustainable growth. Also, increased demand for Islamic products stemming from sovereign companies could trigger the innovation and implementation of Islamic financial products. Many Islamic financial products were implemented in theory, but due to a lack of demand never put into practice. Also, firms could demand more Islamic financing and resultingly, fuel and boost the market for Islamic financial products.

2. Objectives and methodology

2.1. Aim and research question

The main goal of the dissertation is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity. Two research questions are formulated and tested within the dissertation:

1. has the overall impact of terror attacks decreased throughout time (i.e. has 9/11 had a bigger impact on the equity market than the Nice truck attack in 2016)?
2. was the impact of terror attacks on Islamic equity indices as hard as on Western indices (i.e. was the impact of e.g. 9/11 on the DJIA more severe than on the Tadawul)?

In order to so, various time frames as well as various risk as well as risk- and return measures are introduced which aim at measuring the afore noted. Since various variables not directly observable in the market, estimation procedures need to be derived. The estimates are subject to a bias caused by the choice of estimation procedure, parameters involved as well as the time horizon chosen. In order to overcome this bias and provide an objective and universal assessment of the impact of Islamic terror attacks on equity indices, various measures, ratios and time horizons are introduced in order to conduct the analysis.

After the estimation of the parameters and their consecutive calculation, the obtained results for each of the five terror attacks are compared with one another and ranked according to the severity of the impact on the equity market. The highest impact is assigned with rank number 5, while the lowest impact is assigned rank number 1. Through this method, a scoring system is derived which allows to compare the terror attacks with one another based on different parameters and the ranks, i.e. scores assigned. For the comparison between conventional and Islamic equity, the scores of either 1 or 0 are assigned. Rank 1 is assigned to the index which reveals the higher effect in the aftermath of a terror attack.

In order to assess the impact of a terror attack on both the return and the volatility, the respective ratios and figures have been calculated for different time spans. The parameters needed in order to conduct the risk adjusted performance analysis were calculated for the following timeframes:

- 250 trading days before the attack
- 15 trading days before the attack
- 5 trading days after the attack

- 15 trading days after the attack

The time horizon of 250 trading days before the terror attack has been chosen in order to ensure the statistical robustness of the results. In order to achieve meaningful statistical results, the sample size needs to be sufficiently high. Within literature, various studies, tests and argumentations have been performed in order to determine the word "sufficient". However, among empirical research no agreement has been achieved. While Pett and Salkind (2004) propose a sample size of n>30, Warner (2008) considered n>20 as convenient and denoted, that n>10 per sample group can be considered as an absolute minimum.

However, since previous studies have shown that the impact of terror attacks on the equity markets is only short-lasting, shorter time spans preceding and succeeding the terror event have been included. The calculations for the 15 trading days' time frame before the terror attack allows to judge, whether the figures under investigation have already shown abnormal behavior from the long run (250 days) shortly before the conduction of the terror attack. Additionally, the 15 days before the attack were chosen in order to determine whether enhanced volatility has already prevailed before the conduction of the attack. The 5 days' time span succeeding the terror attack allows to judge the immediate impact of the terror attack on the respective index, while the 15 days allow to assess if and how fast an equity index has recovered from the attack or if the impact of the terror attack prevails for a longer time horizon and at which intensity.

While the event study as well as the GARCH (1,1) volatility forecast uses daily data in order to employ both models, the risk measures as well as risk-adjusted performance measures focus on time spans between 5 and 250 trading days before and after the terror attack.

The following sub-chapter gives an overview over the data used in order to employ the multiple criteria decision analysis.

2.2. Data

In order to determine the impact of a terror attack on equity markets holistically, various measurements and calculations are introduced. For each of the terror attacks, the required and chosen data is presented below. It comprises a time frame of 250 trading days before the terror attack until 15 trading days after the terror attack for all 5 attacks and all indices and rates included. The data needed in order to conduct a holistic analysis include:

Table 3. Employed data per country

Country	Equity index	Risk-free rate
United States	DJIA	Effective fed funds rate
Spain	IBEX	EONIA
UK	FSTE100	LIBOR
France	CAC40	EONIA
Saudi Arabia	TADAWUL	SAIBOR
Global Equity	MSCI World	-

The reference index that was chosen for all terror attacks and all markets was the MSCI World. The MSCI World comprises data of 1,600 stocks across 23 industrialized countries. It can be regarded as one of the most important equity indices globally and is calculated by the US financial institution MSCI. The companies involved are weighted according to their free-float market capitalization.

For the Western world, i.e. the US, Spain, UK and France the choice of the equity index was very explicit, since all the main indices of the respective countries were chosen. However, in order to obtain a proxy for the reaction of equity to Islamic-inspired terror attacks in the Middle East the equity indices of the GCC countries were considered. However, research on the data availability (the main source being Bloomberg) showed that historical equity prices for indices across the Middle East are rather scarce. Most of the respective countries' equity indices as well as MSCI index, created as a mixture of the various all-share indices were only available after 2005. The table below shows the historical equity data availability on Bloomberg sorted by country.

Table 4. Data of GCC countries

Country	Index	Data availability as of
Kingdom of Bahrain	Bahrain Bourse All Share Index (BHSEASI)	5 July 2004
United Arab Emirates	Abu Dhabi General Index (ADSMI)	30 September 2001
Kingdom of Saudi Arabia	Tadawul All Share Index (SASEIDX)	26 January 1994

Sultanate of Oman	Muscat Securities Market 30 Index (MSM30)	1 January 1992
State of Qatar	Qatar Exchange Index (DSM)	10 August 1998
State of Kuwait	Boursa Kuwait All Share Index (KWSEAS)	1 January 2016

Since data availability varies, the Saudi Arabian stock market has been chosen as a proxy for the analysis of the reaction of Middle Eastern equity to terrorist attacks. Saudi Arabia has been chosen, since it showed the strongest economic performance in terms of GDP. As of 2018 Statistics of the International Monetary Fund show that Saudi Arabia had a GDP of approximately 800,000 million USD and a GDP per capita of 24,000 USD. This is followed by the United Arab Emirates with a GDP of about 450,000 million USD (equivalent to 41,476 USD per capita). Qatar and Kuwait are ranked on third and fourth place among the GCC countries (International Monetary Fund, 2020). Since GDP gives a proxy for economic development, Saudi Arabia's stock market was chosen for the analysis.

While the data needed for the calculations was highly available for the Western world, this was not the case for Saudi Arabia. The overnight rates, which are considered as a proxy for the risk-free rate for the US, Europe and UK were accessible. However, for the Saudi Arabian market the overnight tenor was not available before November 2016. The Saudi Arabian Interbank Offered Rate (SAIBOR) can be regarded as a daily reference rate, which is issued by the Saudi Arabian Monetary Authority based on the average interest rate Saudi banks offer to lend unsecured funds to one another. The shortest tenor available in the Saudi market posed the 1-month interbank offered rate. Hence, it has been chosen as a proxy for the risk-free rate.

Another important aspect when assessing the impact of terror attacks on financial markets is the respective (local) time of each terroristic incident in order to be able to include or exclude the happening day within the calculations. On 11 September 2001, the stock exchanges in New York have never opened for trading and remained closed for the consecutive week, reopening only on 17 September 2001. For Madrid and London, even though both attacks happened before the respective market open, trading hours remained unchanged and markets opened as scheduled in both cases. However, occasions happening outside of trading hours, as it was the case for the Paris and Nice attacks, give investors the chance to reconsider and analyze the damage of terroristic happenings in more detail before making an investment decision. This

argument does not just hold with regards to the trading hours, but also to the respective weekday. Further, overall insecurity with regards to the ongoing happenings prevails if terror attacks happen within the trading hours and might lead to panic reactions of market players. Summing it up, it should be denoted that extended or non-existent digestion time for investors might yield in a different in the market reaction.

Ramiah, et al. (2017) collected the following data of terror attacks as displayed in the table below.

Table 5. Overview of event, even time and date

Event	Event date	Event time	Day of attack
September 11 attacks	11 September 2001	08:46	Tuesday
Madrid train bombings	11 March 2004	07:36	Thursday
London bombings	7 July 2005	08:49	Thursday
Paris attacks	13 November 2015	21:16	Friday
Nice attack	14 July 2016	22:30	Thursday

In order to determine the impact of a terror attack on equity markets holistically, various measurements and calculations are introduced. For each of the terror attacks, the required and chosen data is presented below. It comprises a time frame of 250 trading days before the terror attack until 15 trading days after the terror attack for all 5 attacks and all indices and rates included. The data needed in order to conduct a holistic analysis include:

Table 6. Data for holistic analysis

Country	Equity index	Risk-free rate
United States	DJIA	Fed funds
Spain	IBEX	EONIA
UK	FSTE100	LIBOR
France	CAC40	EONIA
Saudi Arabia	TADAWUL	SAIBOR
Global Equity	MSCI World	-

The reference index that was chosen for all terror attacks and all markets was the MSCI World. The MSCI World comprises data of 1,600 stocks across 23 industrialized countries. It can be regarded as one of the most important equity indices globally and is calculated by the US financial institution MSCI. The companies involved are weighted according to their free-float market capitalization.

While the data availability for the Western world with regards to the overnight interbank rate was broadly given, for the Saudi Arabian market the overnight tenor was not available before November 2016. The Saudi Arabian Interbank Offered Rate (SAIBOR) can be regarded as a daily reference rate, which is issued by the Saudi Arabian Monetary Authority based on the average interest rate Saudi banks offer to lend unsecured funds to one another. The shortest tenor available in the Saudi market posed the 1-month interbank offered rate. Hence, it has been chosen as a proxy for the risk-free rate.

11 September 2001

In order to determine the impact of the 11 September 2001 terror attacks, the Dow Jones Industrial Average has been chosen for the calculations. The Dow Jones poses a good choice due to its long history and importance. Since the calculations require the data of 250 trading days prior to the terroristic event as well as 15 days after the event, the time frame chosen for the DJIA comprises the data from 12 September 2000 until 5 October 2001.

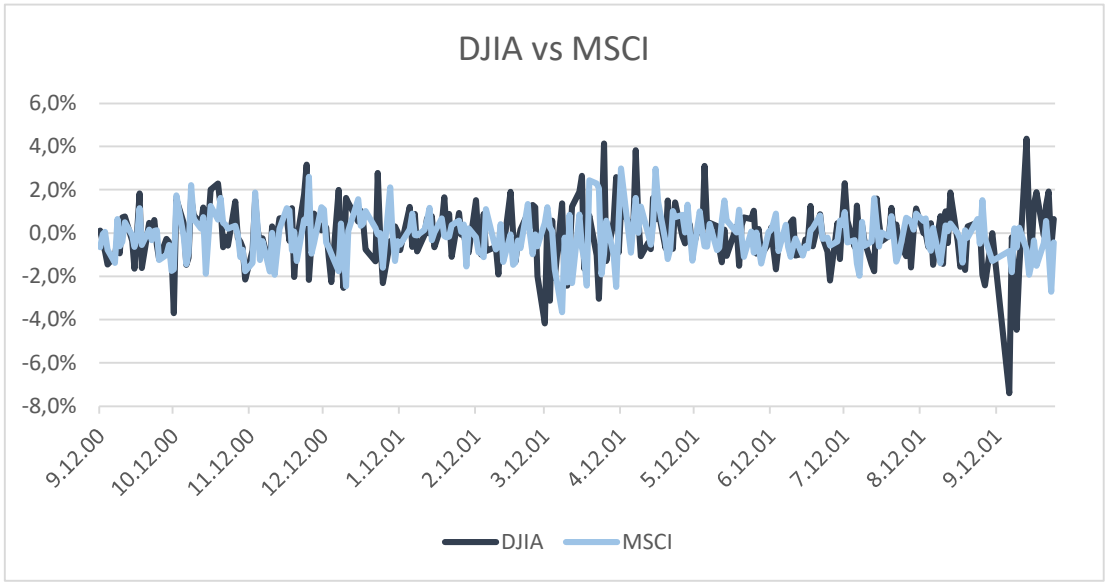

Illustration 1. DJIA vs MSCI returns (9/11)

From the graph above it is visible that the MSCI World and the DJIA were moving steadily uniformly throughout time. After the terror attacks on 11 September 2001, the DJIA plunged tremendously, which is also eye-catching upon analyzing the graph. The DJIA rebounded in the consecutive days after the terror attack.

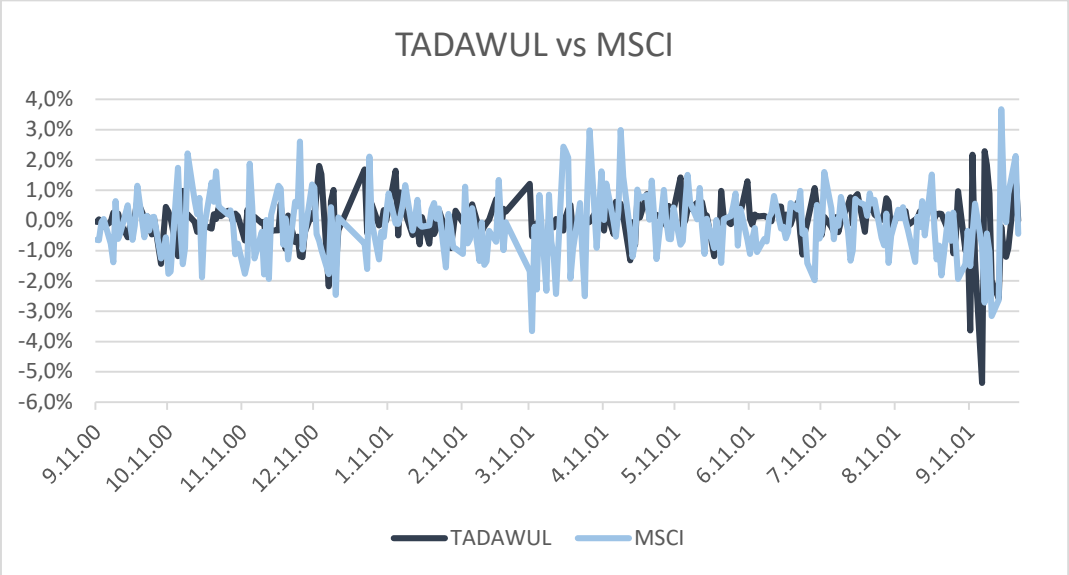

Illustration 2. Tadawul vs MSCI returns (9/11)

The above graph shows the development of the Tadawul and the MSCI from 11 September 2000 until 1 October 2001. From the graph it can be observed that the Tadawul reacted more extreme to the 9/11 terror attacks than the MSCI World.

As a proxy for the risk-free interest rate of the US, the effective federal funds rate has been chosen. The fed funds rate is an overnight unsecured borrowing rate of interest between financial institution in the United States (Hull, 2009). For the Saudi Arabian market, the Saudi Arabian Interbank Offered Rate (SAIBOR) with 1-month tenor has been chosen due to data availability. The development of the effective fed funds rate and the SAIBOR for the above stated time horizon can be seen below, with the left axis showing the Fed funds and the right axis showing the Saudi interbank rate:

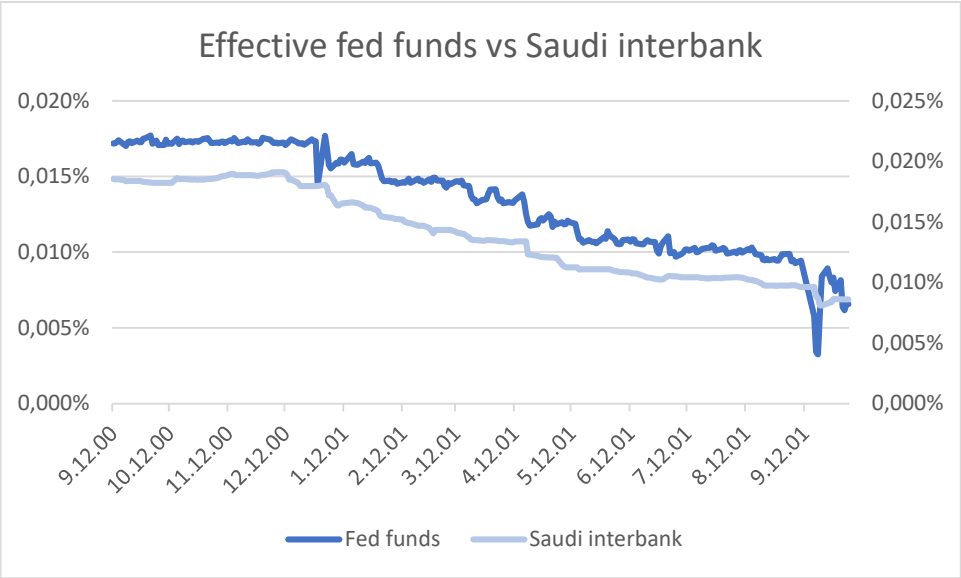

Illustration 3. Effective fed funds vs SAIBOR (9/11)

As afore noted, the investment horizon is considered to be less than a trading day and hence, the overnight interbank rate can be regarded as appropriate.

Madrid bombing of 2004

In order to determine the impact of the Madrid bombings which happened on 11 March 2004 on the equity market, the IBEX has been chosen. It comprises the 35 most important Spanish stocks. The below graph shows the development of the IBEX index from 11.3. 2003 – 1.4.2004 (250 trading days before until 15 days after the Madrid bombing on 11 March 2004.

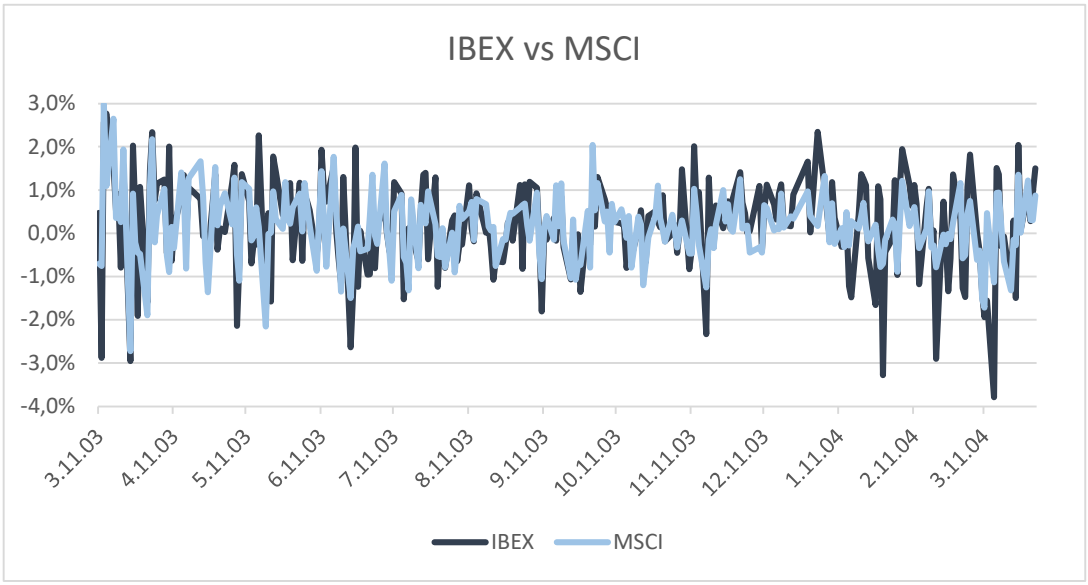

Illustration 4. IBEX vs MSCI returns (Madrid bombing)

As it visible from the graph, the Spanish main equity index turned strongly negative on the day of the terror attack. While global equity dropped as well, it did not drop as tremendously as the IBEX. The below graph depicts the index development of both the Tadawul and the MSCI World from 10.3.2003 – 1.4.2004.

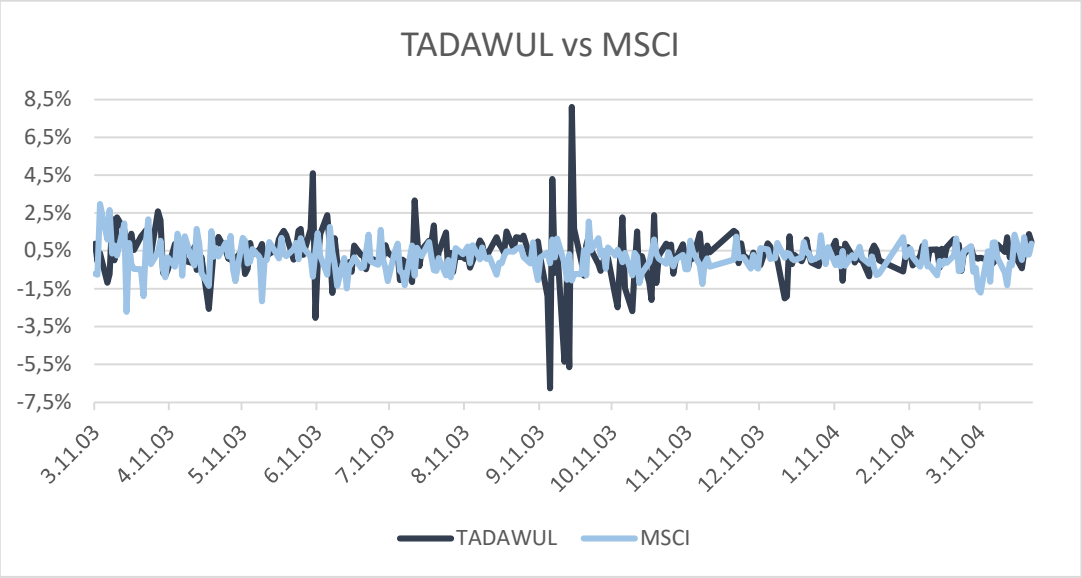

Illustration 5. Tadawul vs MSCI returns (Madrid bombing)

Overall, it is visible from the graph that the Tadawul moved grossly in line with the rest of the world, except for a more volatile period throughout September 2003. The time of increased volatility started on 15 September 2003, when a fire in the prison of Riyadh killed 94 detainees. In the subsequent period, various terror attacks were conducted on Saudi soil, including a shooting at a Riyadh hospital. However, with regards to the Madrid bombings of 2004, the Tadawul did not show any significant deviation from the global equity market.

As a proxy for the overnight risk-free rate the EONIA has been chosen for the European Union. The below graph depicts the development of both the EONIA and Saudi interbank offered rate (considered as the proxy for the risk-free rate of the Saudi Arabian market). The left axis shows the EONIA and right axis the Saudi Interbank Offered Rate.

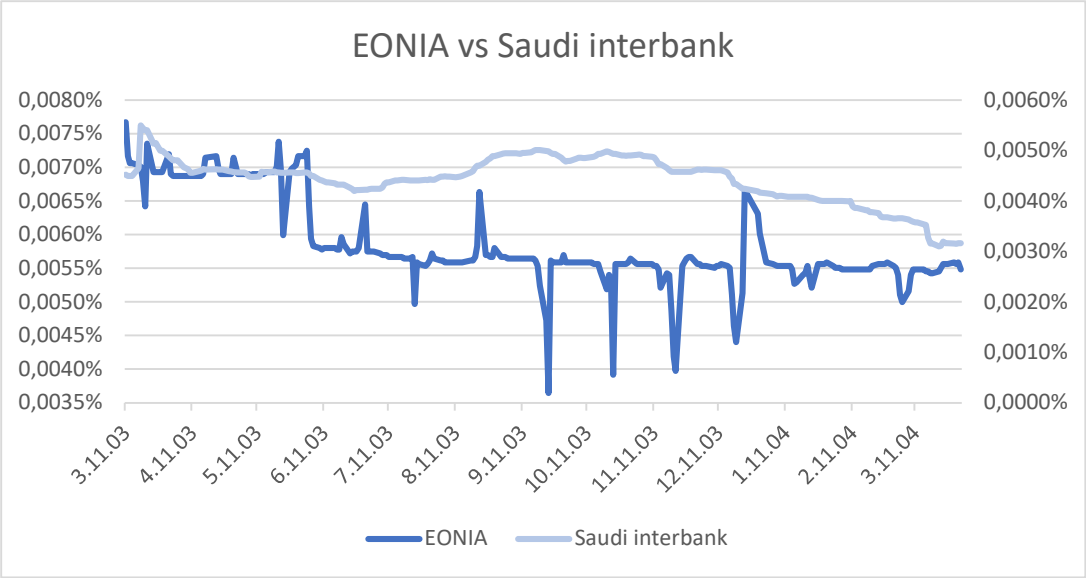

Illustration 6. EONIA vs SAIBOR (Madrid bombing)

London bombing of 2005

The below graph shows the stock price development of the FTSE100 in comparison with the global equity, represented by the MSCI World. The FTSE100 dropped more than the global equity as a response to the London underground bombings, which have happened on 7 July 2005. Overall, both indices moved almost uniformly throughout the previous year.

The time horizon shown in the graph below comprises the data from 6.7.2004 – 28.7.2005.

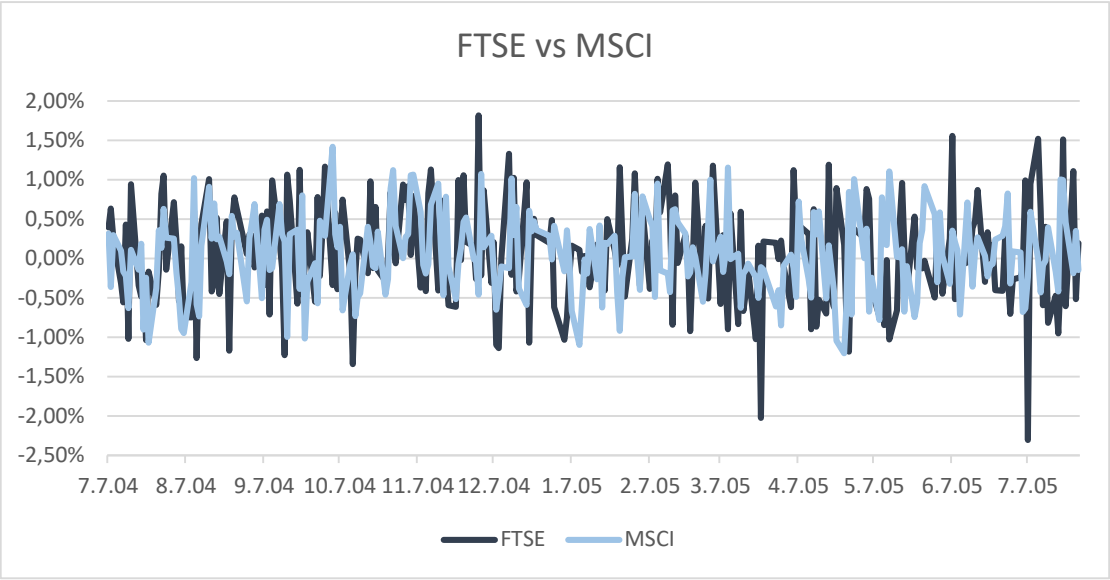

Illustration 7. FTSE vs MSCI returns (London bombing)

The graph shows the development of the Saudi Arabian stock market, represented by the Tadawul in comparison with the MSCI world. It is notable that throughout the whole trading year, the Tadawul showed with increased volatility compared to the MSCI.

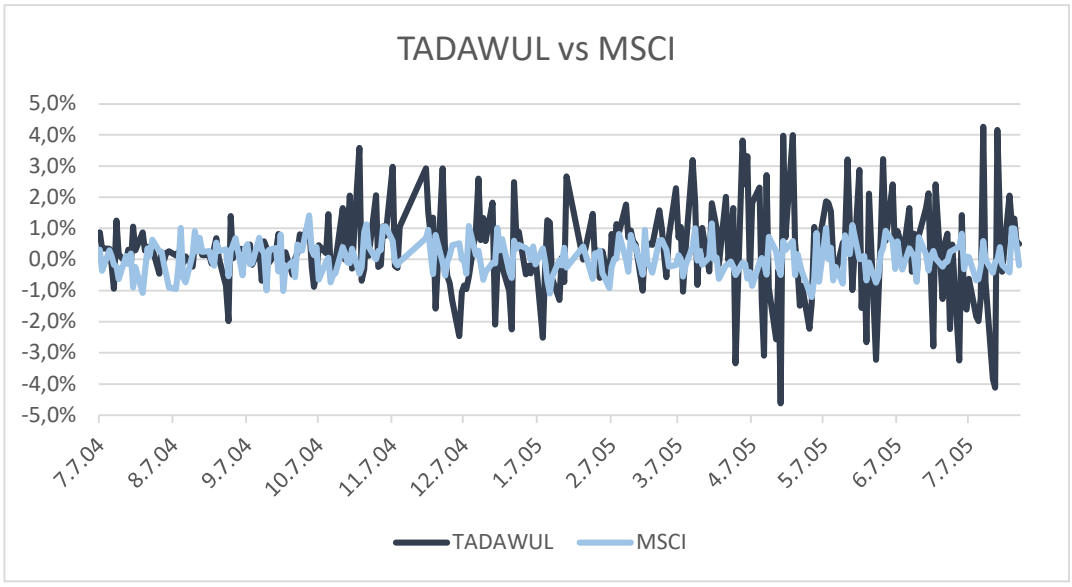

Illustration 8. Tadawul vs MSCI returns (London bombing)

The graph below shows the proxy for the risk-free rates of both the UK and Saudi Arabia. For the UK, the LIBOR with an overnight tenor has been chosen, while the for the Saudi Arabian market, the 1-month interbank offered rate has been considered. The left axis denotes the LIBOR overnight and the right axis the Saudi Interbank Offered Rate (SAIBOR).

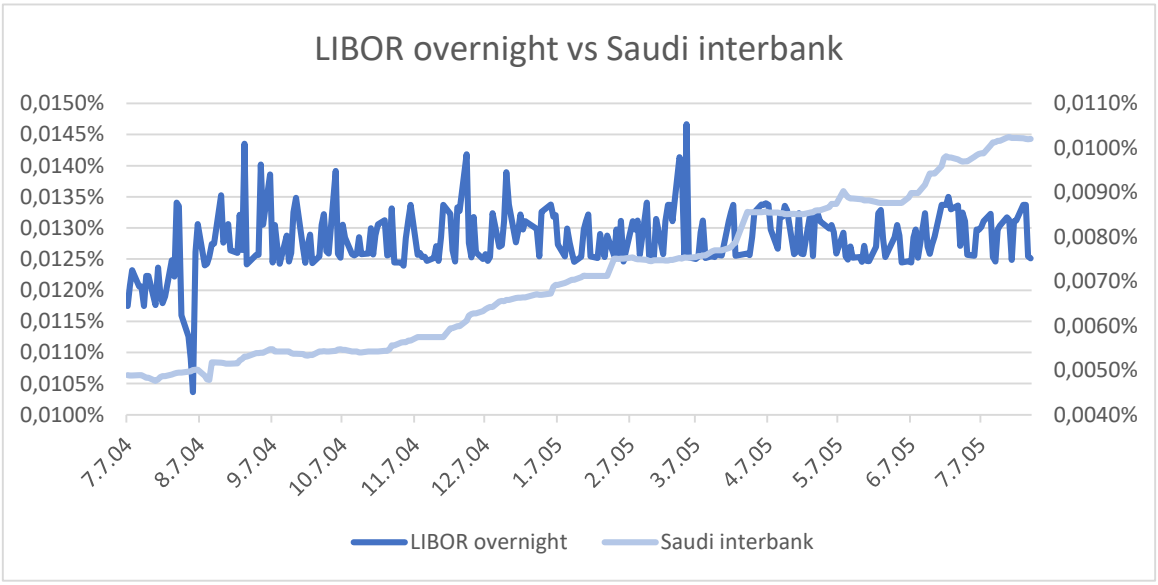

Illustration 9. LIBOR vs SAIBOR (London bombing)

Paris attacks of 2015

The graph below compares the stock market development of the CAC40 from 13.11.2004 – 3.12.2015 with the price development of global equity. Overall, the graph does not show any irregularities and proposes that both indices have used homogenously throughout the whole period. The Paris attacks have happened in the evening of Friday, 13 November 2015.

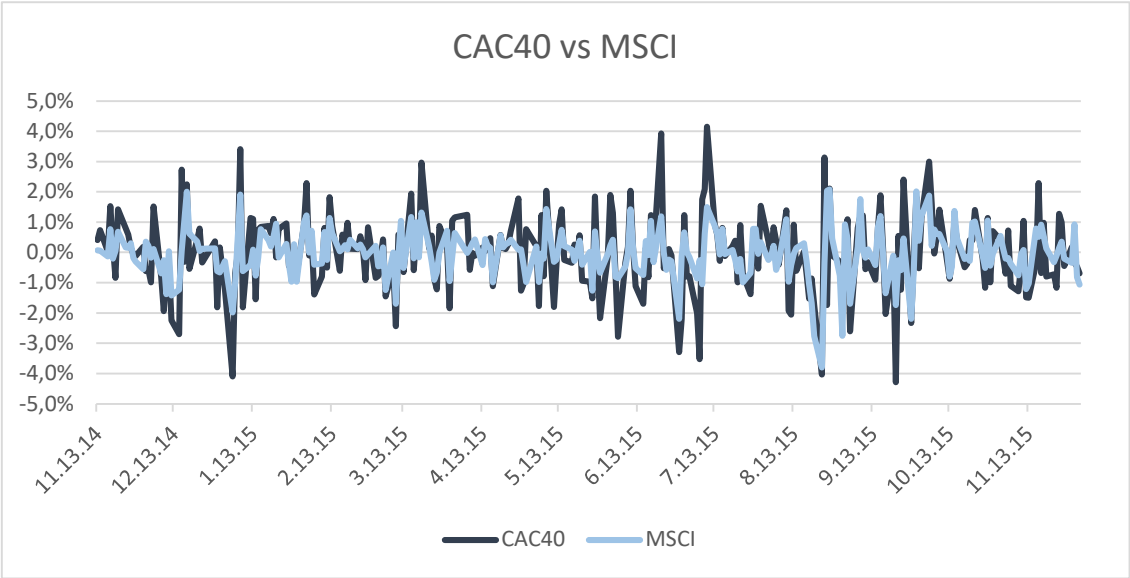

Illustration 10. CAC40 vs MSCI returns (Paris attacks)

The graph below shows that price development of both the Saudi Arabian Tadawul and the MSCI world from a time period of 13.11.2014 – 3.12.2015. The Tadawul appeared to be a bit more volatile than the MSCI, however, both indices were moving monotonously.

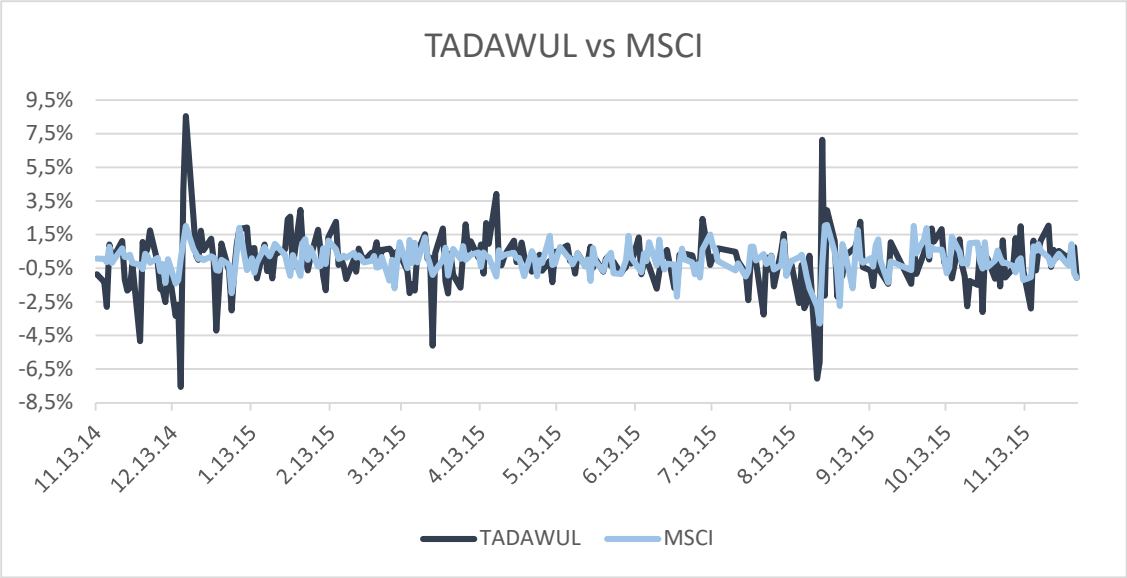

Illustration 11. Tadawul vs MSCI returns (Paris attacks)

The chart underneath shows that development of the risk-free rates for the EU (France) as well as Saudi Arabia. The EONIA and the SAIBOR are compared for the afore-noted time period. The left axis denotes the EONIA and right axis denotes the SAIBOR.

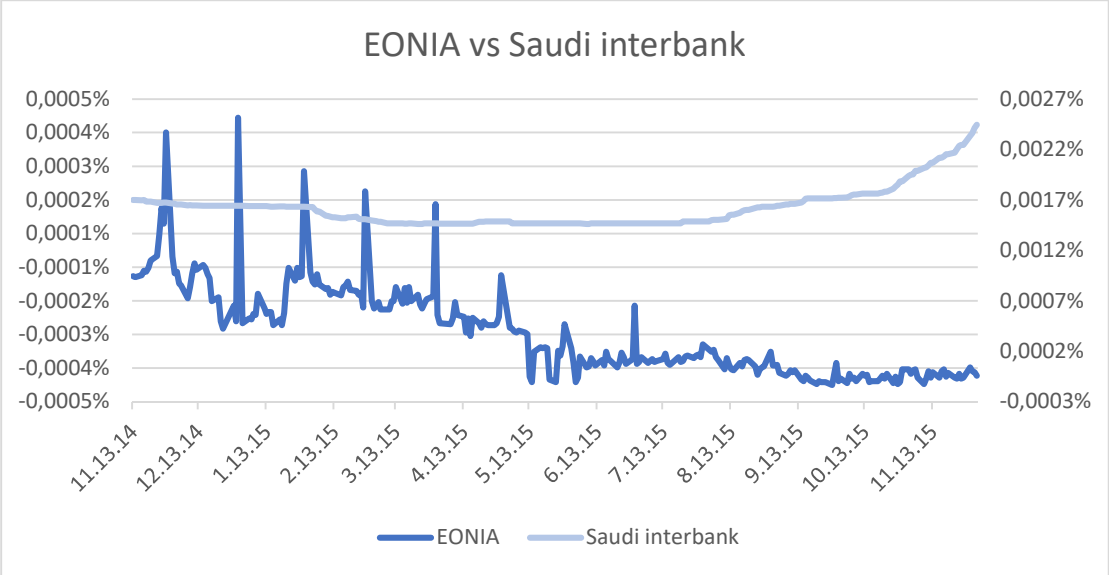

Illustration 12. EONIA vs SAIBOR (Paris attacks)

Nice truck attack of 2016

The below chart shows the CAC40 compared with the MSCI World from a time horizon of 14.7.2015 - 5.8.2016.

The terror attack happened in the evening of 14 July 2016. However, market did not show extraordinary reaction to the attacks. The dip of both the CAC40 and the MSCI World is attributed to the Brexit referendum on 24 June 2016.

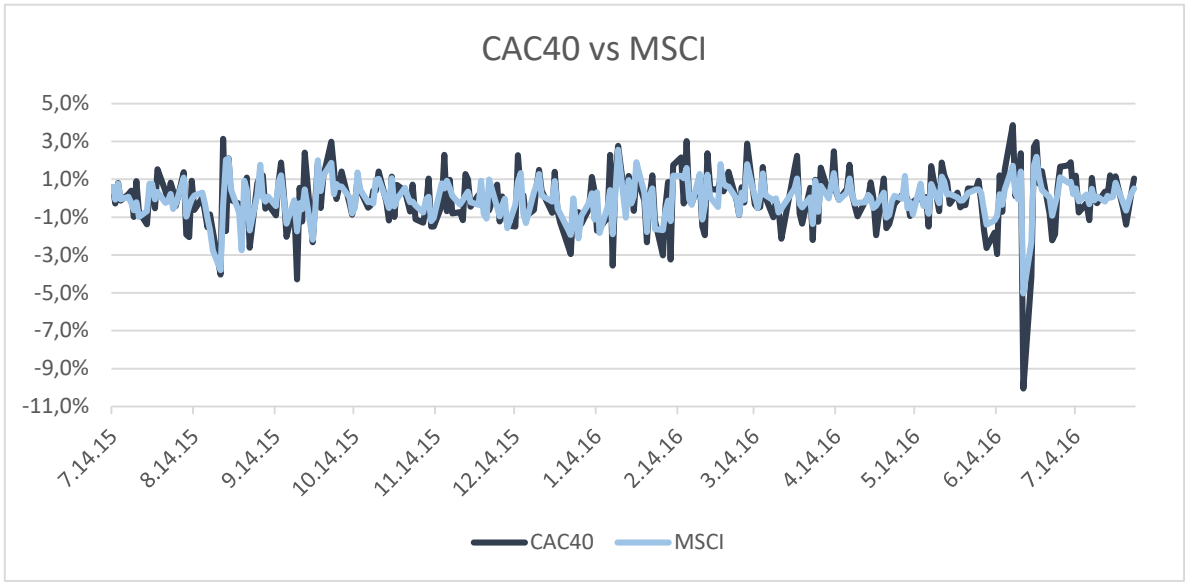

Illustration 13. CAC40 vs MSCI returns (Nice attack)

The diagram beneath shows the development of the Saudi Tadawul compared with the MSCI World for the 250 trading days preceding the Nice truck attack as well as the 15 trading days after the terroristic incident (14.7.2015 – 4.8.2016).

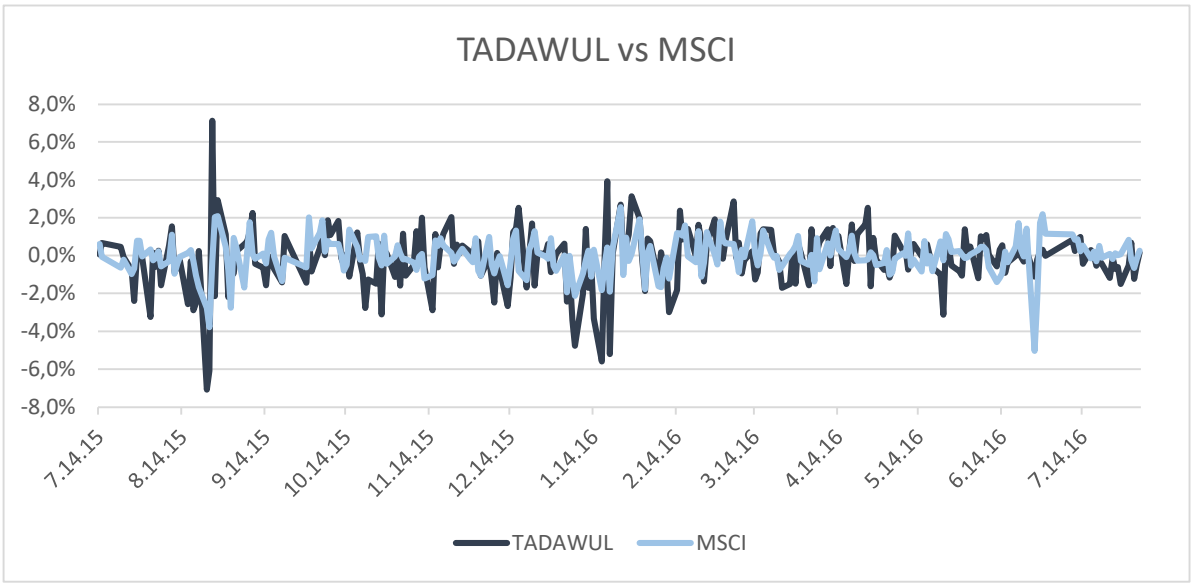

Illustration 14. Tadawul vs MSCI returns (Nice attack)

In order to compare the risk-free rates, the EONIA has been used as a proxy for the European Union, while the SAIBOR with tenor of 1 month has been used. In the graph, the left axis denotes the EONIA while the right axis denotes the SAIBOR.

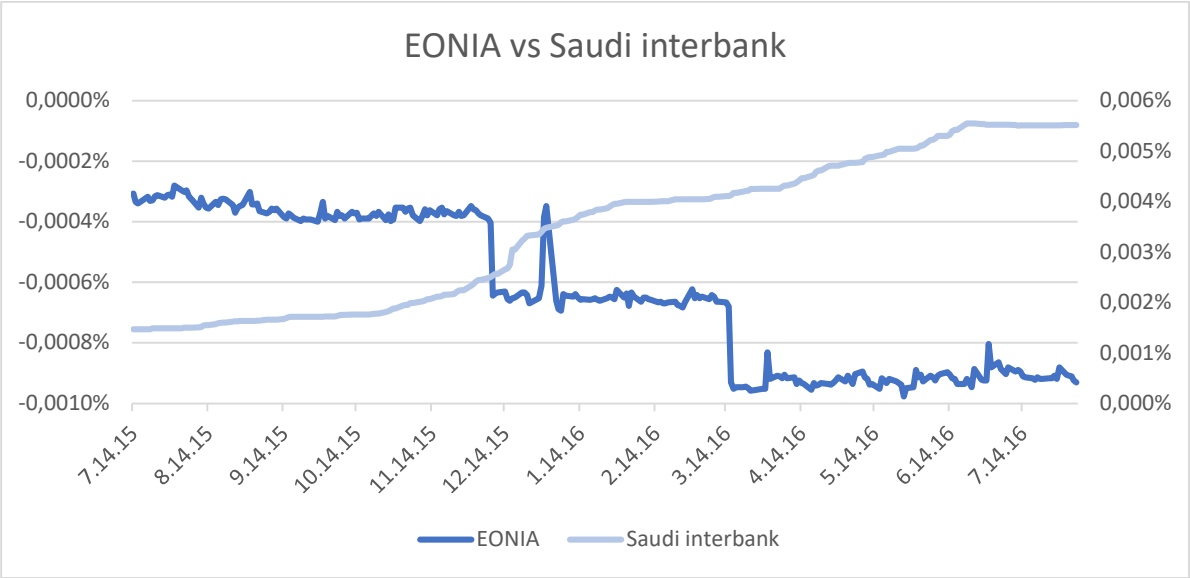

Illustration 15. EONIA vs SAIBOR (Nice attack)

The following chapters describe how the selected criteria were implemented with regards to the equity indices.

2.3. Event study

In order to understand how investors on the financial markets react to market shocks caused by terroristic activities, an event study is conducted. By using the event study methodology, the abnormal returns caused by exogenous shocks are determined. Event study poses a standard methodological approach to assess how rapidly markets respond to new information (Lauenstein and Simic Küster, 2016).

The event study methodology can be regarded as one of the most powerful and widely used application of the capital asset pricing model (CAPM). The aim of the event study is to determine whether a particular event in the financial market has contributed or influenced the stock market performance. The event study methodology can be regarded as an evidence for and against market efficiency (Benninga, 2008). Within this thesis, the event-study methodology aims to determine the abnormal return of the stock market to an exogenous shock in the form of a terror attack.

Typically, the event study is used to determine the abnormal returns (AR) of an individual company's stock price with regards to the stock market index. The expected return of the individual company is modelled by using the stock's market index. By using the market model, the co-movement between a company's stock return and the corresponding market return is determined. (Benninga, 2008). However, when measuring the entire stock market reaction to a terror attack, the abnormal returns must be determined on index-level. In order to determine the abnormal returns of an equity index of a specific country, an equity index comprising a sample of the entire world's equity is used. Thus, the expected returns of a specific countries' equity index are modeled by using an index which can be regarded as a proxy for the global stock market performance.

Following the event study methodology, the impact of terror attack on various equity markets can be determined by assessing the abnormal returns. These abnormal returns are also referred to as excess returns on or around specific dates. On event day τ around the terroristic activity n excess returns are defined as (Lauenstein and Simic Küster, 2016):

$$AR_{\tau n} = R_{\tau n} - E(R_{\tau n}) \quad (1)$$

where $R_{\tau n}$ denotes the realized log-return, observable in the market

$E(R_{\tau n})$ denotes the expected log-return. The returns of the price indices are calculated by using the log-returns, given by:

$$ln\left(\frac{p_t}{p_{t-1}}\right) * 100 \quad (2)$$

For conducting the event study three timeframes are introduced. the estimation window, the event window and the post-event window.

The estimation window is used in order to determine the "normal" behavior of a stock (market). In order to determine the abnormal returns based on the estimation window, the expected returns need to be calculated. In order to do so, two estimation procedures can be distinguished, which are the mean-adjusted returns model and the market model. The mean-adjusted model assumes that the expected return during the event window can be denoted by using a constant rate of return $\bar{R}_{\tau n}$. This rate of return is calculated as follows (Lauenstein and Simic Küster, 2016):

$$E(R_{\tau n}) = \frac{1}{L_1} \sum_{t=1}^{L_1} R_{\tau n} \quad (3)$$

where L_1 denotes the number of days within the estimation period. While the mean model uses a constant rate of return, the market model uses linear regression and can be represented by:

$$r_{it} = \alpha_i + \beta_i r_{Mt} + \epsilon_{\tau n} \quad (4)$$

where r_{it} and r_{Mt}represent the stock and the market return on day t. α_i and β_i are determined by an ordinary least-square regression. Typically, the estimation window comprises 1 calendar year or 252 trading days in order to ensure the robustness of the obtained results.

However, Kothari and Warner (2006) highlight, that the estimation method for abnormal returns does not react sensitively when the event study is short-term by nature. Also, Brown and Warner (1980) point out that both methodologies in order to derive the expected returns produce similarly well estimates.

Nonetheless, Benninga (2008) proposed the use of the market model, which was consequently implemented. The implementation was done by setting up a linear regression in the form of equation 4 in order to determine the expected returns of the respective countries' equity index. R_t^m denotes the return of the index representing global equity and R_{tn} denotes the respective countries equity index. The set-up was also proposed by Jana and Das (2020). In order to produce statistically meaningful and robust results, the estimation window was chosen to comprise 250 trading days prior to a terror attack.

The event window is used to determine whether an event (announcement) how long it took the event information to be fully absorbed by the market. Further, it can be used in order to determine whether information was anticipated or leaked. as well as to determine. In order to fully incorporate the effect on the stock market, which was triggered by a terroristic activity on day $\tau = 0$, the event window was chosen to be 30 days. The afore noted event window chosen appears to be of sufficient length in order to capture the dynamics triggered in equity markets to measure the shocks (Lauenstein and Simic, 2016). The event window was chosen to start 15 days prior to the respective terror attack and lasts until 15 days after the terror attack. The terror attacks have happened throughout different weekdays and different trading days. If the terror attack has happened before or within market open, the event data is chosen to be congruent with the data of the respective terror attack. In the case of Nizza and Paris, the terror attacks have happened after the market close. Hence, for both events the event date was chosen to be the next respective trading day.

The post-event window can be used in order to assess the longer-term impact and performance following the event. However, since previous studies have shown that the impact of terror attacks on the equity market are short-term by nature, no post-event window is employed.

In order to determine the abnormal return, the equation 1 can be rewritten as $AR_{it} = r_{it} - (\alpha_i + \beta_i r_{Mt})$ where r_{it} denotes the actual stock return in the event window on day t and $(\alpha_i + \beta_i r_{Mt})$ denotes the return predicted by the regression (Benninga, 2008). The abnormal returns can be interpreted as measure of the impact the terror attack had on the market value of the security. Hypothesis testing with regards to the significance of the returns was done by performing a standard t-test as proposed by Binder (1998).

Consequently, the cumulative abnormal return (CAR) are determined. It is the sum of all abnormal returns from the beginning of the event window T_1until day t in the window $CAR_i = \sum_{j=1}^{t} AR_{T_1+j}$ (Benninga, 2008).

2.4. Volatility forecast using GARCH (1,1)

Another important factor when assessing the impact of an event on the equity market poses the impact on volatility. Return alone is insufficient to give a holistic and proper picture about the impact of exogenous shocks on the stock market. Hence, a GARCH (1,1) is employed and consecutively, a volatility forecast is derived in order to assess the event impact. This can be regarded as one of the most important models in order to calculate the value at risk under a model-building approach as well as for the valuation of derivatives. The current levels of volatility and their short-term change over time are assessed in order to determine the change in the value of a portfolio (Hull, 2009).

A stylized fact which can be observed in financial markets is volatility clustering. The empirical phenomenon of volatility clustering appears especially in times of crisis or exogenous shocks. The GARCH (1,1) model is capable of incorporating this stylized feature. The use of a GARCH-based approach was supported by Forbes and Rigobon (2002) as well as by Eldor and Melnick (2004). The authors point out that markets have an in-built mechanism which ensure the market efficiency. This supports the application of a GARCH model with order (1,1). Hence, only yesterday's market returns and standard deviation are considered.

Since adjustment for increased market volatility during a crisis period ensures that the changes in the relationship between two assets are not due to augmented market volatility. In this paper the issue will be addressed by modeling the error term via a GARCH process of order (1,1). In a GARCH (1,1) σ_n^2 is calculated from a long-run average variance $V_L$as well as from σ_{n-1}^2 and u_{n-1}. The equation for GARCH (1,1) is given by (Hull, 2009):

$$\sigma_n^2 = \gamma V_L + \alpha u_{n-1}^2 + \beta \sigma_{n-1}^2 \quad (5)$$

where γ denotes the weight assigned to V_L, α is the weight assigned to u_{n-1}^2 and β is the weight assigned to σ_{n-1}^2. All three weights must sum to unity. From this property it follows that $\gamma + \alpha + \beta = 1$. It should be denoted that the (1,1) in the GARCH (1,1) indicates that the estimation for σ_n^2 is based on the most recent observation of u^2 and the most recent variance. Often, the above equation can be rewritten, by setting $\omega = \gamma V_L$ (Hull, 2009).

Further, the parameter β can be interpreted as a decay rate. It gives relative importance of the observation on the u's in determining the current variance rate. If β is set to 0.9 u_{n-2}^2 will only be 90% as important as u_{n-1}^2. Generally, it should be denoted that the GARCH (1,1) works similarly to the exponential weighted moving average model. However, the GARCH assigns weights which decline exponentially to past u^2 while also assigning weight to the long-run average volatility denoted by V_L. When the parameter ω is set to zero, the GARCH (1,1) reduces to an exponential weighted moving average model. (Hull, 2009). Within the GARCH (1,1) framework, the variance gets pulled back to the long-run average level of V_L. The weight assigned to V_L. is given by $1-\alpha-\beta$. Hence, the GARCH (1,1) model incorporates mean reversion (Hull, 2009).

In order to estimate the values for the parameters a maximum likelihood method (MLE) is incorporated as proposed by Hull (2009). In order to apply the maximization, $\sigma_i^2 = v_i$ within the following formula:

$$\sum_{i=1}^{m} \left[-ln\,(v_{i)} - \frac{u_i^2}{v_i} \right] \quad (6)$$

Hull (2009) denotes, that if a GARCH model is working well, it is able to remove the autocorrelation. After the estimation of the parameters using MLE, in order to forecast future (daily volatility) the results were obtained by employing:

$$E[\sigma_{n+t}^2] = V_L + (\alpha + \beta)^t (\sigma_n^2 - V_L) \quad (7)$$

The equation forecasts the volatility on day n+t utilizing the information which is available at the end of day n-1. AS already denoted before, the variance rate exhibits the mean reversion property, with a reversion level of V_L and a reversion rate of $1-\alpha-\beta$ (Hull, 2009).

The volatility term structure, which is usually used to refer to the relationship between the implied volatility of an option and its respective maturity is determined. In order to estimate the volatility term structure based on a GARCH (1,1) for 25 trading days, the following formula can be employed (Hull, 2009):

$$\sigma(T)^2 = 252(V_L + \frac{1-e^{-aT}}{aT}[V(0) - V_L] \quad (8)$$

However, the formula was adjusted in order to be able to produce the volatility forecast for the consecutive trading day.

In order to determine the impact of the terroristic activity on the volatility level of the respective day, the obtained forecasts for the daily volatility are compared against the daily realized volatility. Andersen, Bollerslev, Christoffersen and Diebold (2006) point out that realized volatility provides the natural benchmark in order to evaluate volatility forecasts. Further, it should be denoted that realized volatility provides the fundamental feature of providing a consistent non-parametric estimate of the price variability within a discrete time interval. Realized volatility represents a model-free approach for the consistent estimation of the quadratic return variation under the general assumption that financial markets are arbitrage-free.

Hansen and Lunde (2005) propose that the formula for the realized variance (RV) is given by:

$$RV_t = \sum_{i=1}^{N} r_t^2 \quad (9)$$

where r_t^2 denotes the log-return of the equity index. The volatility estimate is based on the classical close to close volatility estimator.

2.5. Cumulative returns

In order to determine the stock market performance immediately after a terror attack has occurred, the cumulative returns for 2, 5, 10 and 15 trading days after the terroristic incident have been calculated. The measure should provide information about how long it takes the equity market to absorb a shock caused by terroristic events.

Within portfolio optimization, the maximization of long-term returns is widely ignored, since risk adjusted performance measures (see below) focus on mean-variance optimization. Tests with regards to the cumulative abnormal returns are usually conducted within the event study approach, however, these measures are highly dependent on the reference index and data chosen (Cowan, 1993). In order to introduce another measure, which allows for a more objective determination of the impact of terror attacks, the cumulative returns are introduced.

2.6. Standard deviation

The standard deviation measures all deviations of X_i from the average of all X_is (mean). For the standard deviation it is irrelevant whether X_i exceeds or undershoots the mean. Further, the standard deviation can be regarded as dispersion measure, assessing the dispersion of data both above and below its mean.
The standard deviation is given by

$$\sqrt{\frac{1}{N}\sum_{i=1}^{N}(X_i - u))^2} \qquad (10)$$

where X_i denotes the ith return, N the total number of returns and u the average of all X_i returns (Rollinger and Hoffman, 2013).

The standard deviation comprises the shortcoming that both positive and negative returns are considered alike, i.e. the fluctuations above and below the mean are the same. However, investors are usually only interested in the risk of falling short of an expected return. The standard deviation can be regarded as useless whenever the underlying return distribution is not symmetric. Skewed distributions, as they have been empirically found, exhibit different volatility patterns above or below the mean or a target return (Estrada, 2006). Following modern portfolio theory, the risk of an asset depends on the context in which it is considered. For the conduction of the calculations within this thesis, only equity indices of the respective country are considered in isolation (Estrada, 2006).

Even though the standard deviation incorporates various shortcomings, it is used within this thesis to give an overview over the volatility of the indices under investigation. This enables to compare the overall volatility in the market across various indices and further, it allows for the assessment of the impact of the terror attack on the standard deviation. Since statistically meaningful results can only be produced by using a sufficient sample size, in a first step, the standard deviation for 250 days is calculated. However, since previous studies have shown that

the impact of terror attacks is only noticeable within equity markets for a short period of time standard deviation has also been calculated for both 15 days before and after the date of the terror attack. Also, the standard deviation has been calculated for the 5 days succeeding the terroristic activity. This enables to assess the impact of the terror attack on the equity index under investigation.

2.7. Downside deviation

Investors associate risk with outcomes, which fail to meet their respective expectation. An investor's risk is not associated with large positive returns. Even though downside risk measures were developed simultaneously with traditional risk measures, they only gained popularity and acceptance among investors recently. Also, Markowitz (1959) denoted in his popular book Portfolio Selection that semi deviation is capable of producing efficient portfolios and are to be preferred over standard deviation.

The (target) downside deviation can be defined as root-mean-square of the deviations of the realized returns underperformance from a pre-defined target return. All returns exceeding the target return are considered to be 0. Mathematically, the downside deviation is defined as:

$$\sqrt{\frac{1}{N}\sum_{i=1}^{N}(Min(0, X_i - T))^2} \qquad (11)$$

where X_i denotes the ith return, N the total number of returns and T the pre-defined target return (Rollinger and Hoffman, 2013).

The downside deviation measured the deviation of X_i from a pre-defined target return. All X_i which are bigger than the target return is set to 0, however, in the summation they are still included. From this it follows, that the

downside deviation is measuring the data dispersion only below a selected target return, with all returns above the target return considered as 0. Consequently, the volatility below a benchmark or target return is measured (Estrada, 2006).

Empirical studies have shown that semi deviation is capable of explaining the cross-section of returns on U.S. stocks and emerging markets. Semi deviation among other downside risk measures had a strong appeal for portfolio managers and investors alike since it exhibits desirable features. It captures downside volatility which investors are trying to avoid, while excluding upside volatility which investors are seeking. The result of both the standard deviation as well as the downside deviation would be equally good, if the underlying return

distribution would be symmetric. The semi deviation performs better when the distribution exhibits a skew. The downside deviation unifies both the standard deviation as well as the skewness in one measure (Estrada, 2006).

Within this thesis, the downside deviation has been calculated by using the respective countries equity index and calculating the downside volatility when the returns are below the target return, denoted by a global equity index. Further, it has been calculated for various time spans: 250 days in order to ensure statistical robustness with regards to the sample size, for 15 days before and after the terror attack as well as 5 days after the attack. The time frame chosen enables to compare the long-run downside volatility with the downside volatility shortly before and after the terror attack. Further, the time frames chosen allows to assess whether the terror attack's preceding period showed any abnormal or enhanced downside volatility shortly before and after the attack.

2.8. Sharpe ratio

Risk adjusted performance measures (RAPM) set the expected reward into relation with a risk measure. Typically, RAPMs are used in portfolio management for various purposes including the assessment of the performance of portfolio manager, for investment decision basis as well as to rank possible investments. However, within this thesis the risk adjusted performance measures are used in order to set the return into relation with the respective volatility, before and after the terror attack. This is done in order to assess the impact on equity indices for both the return and the volatility separately (see the sections above), but also to create various combined ratios which allow to judge the impact of terror attacks not just from one angle, but instead give a holistic overview over the impact. Especially when measuring variables, which are not directly observable in the market or are subject to the choice of parameters, chances are high that biased results are achieved. In order to overcome the results bias, various measures have been introduced and calculated for different time spans in order to ensure the holistic and objective measurement of the impact assessment.

Various risk adjusted performance measures exist, which use different risk parameters in order to suit different risk types (including investments with e.g. symmetric, skewed or heavy tail distributions) as well as different contexts (e.g. systematic or specific risks). It should be denoted that RAPM are calculated based on past data. Within a stable environment this might provide a useful indication with regards to the future performance. However, in unreliable

situations, where the allocation of resources changes dramatically, the performance measures might be unreliable. (Alexander, 2008).

Within the portfolio management context, the ultimate goal is to achieve an asset allocation which yields the best reward to risk ratio. This is done in order judge the relative attractiveness of various risky assets and activities. RAPMs do not judge how much should be invested into an asset but rather to rank them. Within this framework, all results of an investment can be represented by the distribution of its return. Further, it is assumed that investors always prefer larger returns over smaller ones. This is referred to as principle of non-satiation (Alexander, 2008).

The risk adjusted performance measures are closely linked to the capital asset pricing model (CAPM). The CAPM is used in order to determine the risk premium of a security under the following assumptions (Ruppert and Matteson, 2015):

- there is an equilibrium of market prices (demand and supply are equal)
- everyone has the same forecast of expected return and expected risk
- all investors choose their respective portfolio in compliance with the principle of efficient diversification
- the market rewards investors for assuming unavoidable risk, however, there I no reward for needless risk based on inefficient portfolio selection

The validity of the CAPM can be guaranteed, assuming that the above-noted is true. However, some assumptions of the CAPM are contradicted by the behavior of investors. Even though the CAPM makes very restrictive assumptions which are incompliant with observations in the market, the concept is widely used in practice. Especially the concepts of the beta of an asset as well a systematic and diversifiable risk are of great importance (Ruppert and Matteson, 2015).

The capital market line (CML) relates the excess expected return of an efficient portfolio to its risk. The CML is given by: $\mu_R = \mu_f + \frac{\mu_M - \mu_f}{\sigma_M}\sigma_R$, where R denotes the return on a given efficient portfolio, μ_R denotes the expected return, μ_f the risk-free rate, R_M the return of the market portfolio, μ_M the expected return of the market portfolio, σ_M the standard deviation of R_M and σ_R the standard deviation of R. The slope of the CML is given by $\frac{\mu_M - \mu_f}{\sigma_M}$ which can be

interpreted as the ratio of the risk premium to standard deviation of the market portfolio. This slope denotes the Sharpe Ratio (Ruppert and Matteson, 2015). Consequently, other risk adjusted performance measures have been derived within the capital asset pricing model framework (Alexander, 2008).

The Sharpe ratio was first introduced by Sharpe in 1966 in order to compare the performance of various mutual funds. It rapidly gained popular acceptance and attention across the financial world (McLeod and Van Vuuren, 2004). The Sharpe ratio is a risk adjusted performance measure, which is linked to the capital asset pricing model (CAPM). It is defined as the expected return in excess of a risk-free rate over the standard deviation of the return distribution. When an investor relies on the Sharpe ratio, his preferences are entirely determined by the return and the standard deviation (Alexander, 2008).

Originally, the Sharpe ratio was motivated by the mean-variance analysis under the Sharpe-Lintner Capital Asset Pricing Model. The afore-noted assumes that the distribution of one-period portfolio returns are normal and that the mean as well as the standard deviation of the distribution provide sufficient statistics for evaluating the risk-reward performance of a portfolio (McLeod and Van Vuuren, 2004). However, within current portfolio management it is used within different contexts which range from performance attribution to market efficiency testing as well as for risk management purposes (Lo, 2002).

As already stated above, the slope of the capital market line is known as the Sharpe ratio and is given by $\frac{\mu_M - \mu_f}{\sigma_M}$ (Ruppert and Matteson, 2015). In other words, this means, that the Sharpe ratio denotes the risk premium over the standard deviation of the market returns and can be rewritten as (Brealey, Myers and Allen, 2011):

$$\text{Sharpe ratio} = \frac{Risk\ premium}{Standard\ deviation} = \frac{r - r_f}{\sigma} \qquad (12)$$

The Sharpe ratio can be thought of as a "reward-to-risk" ratio. It quantifies the excess expected return over the risk measured by the standard deviation. While Sharpe's original intention was that the ratio should be used ex ante, it has been widely implemented in practice as an ex post measure as well, in order to determine the past performance (McLeod and Van Vuuren, 2004). The Sharpe ratio determines, whether the expected return from an investment justifies the risk involved by setting the probability of a large loss against the likelihood of a profit in relation.

An investment providing better risk-return ratio results in a higher Sharpe ratio. Hence investments with higher Sharpe ratios are to be preferred over lower ones. Sharpe ratios can turn negative when the excess return, i.e. the individual or portfolio return is lower than the return of the risk-free rate. McLeod and Van Vuuren (2004) conducted an empirical investigation with regards to negative Sharpe ratios. The results indicated that superior investment decision can be realized under the aim of maximizing the Sharpe ratio. This holds regardless of whether the Sharpe ratios are positive or negative, i.e. the afore noted is valid for all values of excess returns.

The Sharpe ratio offers the advantage of being easily and simple to calculate. Due to the standardized relationship between risk and return it can also be used in order to compare investment opportunities among various asset classes, including equity, bonds, but also commodities. However, for the comparison of Sharpe ratios, it is important to convert the ratio estimates to the same frequency. This means that the Sharpe ratio based on monthly data cannot be directly compared to Sharpe ratio estimates based on yearly data. In order to obtain fair comparison values, the adjustment needs to be performed (Lo, 2002). Nonetheless, the ability to compare asset risk-return ratios poses a big advantage, especially since the Sharpe ratio can be applied to both individual securities as well as to portfolios, such as funds. Further, the Sharpe ratio can be regarded as a basis for investment decision-making.

Another drawback of the Sharpe ratio poses the fact that the risk estimate is biased by using the standard deviations. If returns were normally distributed, the standard deviation would quantify the risk involved in the investment properly. However, empirical studies have shown that asset return are not normally distributed and hence, using the standard deviation in order to quantify the risk might lead to biased results. Further, the Sharpe ratio does not differentiate between upside and downside volatility. While upside volatility provides benefits to an investor, downside volatility does not. In the Sharpe ratio framework, the downside volatility is not penalized within the formula or framework and both upside and downside volatility are treated equally. (Alexander, 2008). When using the Sharpe ratio in order to determine the performance of an investment ex-ante, it should be denoted that this is only suitable for stable market environments. Within those settings it is useful to consider the past stock price performance in order assess the future investment profitability. However, market dynamics are subject to change and hence, past performance might not provide a proper indication for future investments.

Lo (2002) conducted an empirical study in order to determine the accuracy of Sharpe ratios. Generally, it should be denoted that the performance of more volatile investment strategies is harder to capture than those of less volatile investment strategies. Hence, the Sharpe ratios for mutual funds are more accurate than those for hedge funds. However, the performance is not the only attribute which influences the Sharpe ratio. Also, specifications of the asset returns influence the results tremendously. These include mean reversion, serial correlation and momentum among others. Lo found, that even though the Sharpe ratio has become widely used within modern finance, it is subject to estimation errors, which can be substantial in some cases. The empirical analysis underscored that serial correlation is ignored within the Sharpe ratio framework and hence, Sharpe ratios can be overstated by more than 65 percent on an annualized basis. By adjusting and using the appropriate statistical distribution in order to quantify the performance of the return history, the Sharpe ratio could provide a better understanding with regards to risk and reward of investment opportunities (Lo, 2002).

The Sharpe ratio does not distinguish between upside and downside volatility. High outlier returns increase the value of the standard deviation more than the value of the numerator and hence, lower the value of the ratio. For positively skewed return distributions, the Sharpe ratio can be increased by removing the largest positive returns, which is undesirable for investors. Consequently, positively skewed strategies like trend following perform poorly compared to negatively skewed strategies like option selling. For positively skewed return distributions performance is achieved at less risk than the Sharpe ratio suggests. Standard deviation understates the risk for negatively skewed return distributions, i.e. the investment strategies comprises higher risk than the Sharpe ratio suggests (Rollinger and Hoffman, 2013). In order to overcome the drawbacks of the ordinary Sharpe ratio, especially with regards to the non-normal characteristics of financial return distributions, many RAPMs have been developed which focus only on downside risks (Alexander, 2008).

Another aspect, which needs to be considered when estimating the Sharpe ratio pose the prices and method used in order to determine the volatility. Since volatility cannot be directly observed in the market, various methods in order to determine the historical volatility have been introduced (Bennett and Gil, 2012). Various volatility estimators can be considered (Bennett and Gil, 2012):

- close-to-close (closing prices)

close-to-close volatility estimator poses the simples and most common type of calculation, using reliable prices from closing auctions

- exponentially weighted (closing prices)
  exponentially weighted volatilities are rarely used in practice since they are incapable of handling regular volatility driving events such as release of company data (earnings).
- Parkinson (high-low prices)
  the Parkinson volatility estimator denotes one of the first advanced volatility estimators and it was created by Parkinson in 1980. It does not rely on closing prices but uses the high and low price. However, the estimator assumes continuous trading and consequently, it underestimates the volatility since happenings and events which take place outside of trading hours are ignored. Nonetheless, empirical studies have shown that the Parkinson estimator delivers suitable results and can be regarded as the best measure for truly observed data
- Garman-Klass (open-high-low-closing prices)
  the Garman Klass volatility estimator was introduced in 1980 and proposes an extension of Parksion, which only includes the high and low prices. Overnight jumps are also ignored by Garman-Klass, since it uses only prices within trading hours in order to estimate the volatility
- Rogers-Satchell (open-high-low-closing prices)
  the model of Rogers and Satchell was proposed in the 1990s and it is measuring the volatility for securities with non-zero mean properly. However, as the other afore-noted models, it is incapable of incorporating jumping stock prices. Resultingly, it is deemed to underestimate volatility

Petneházi and Gáll (2019) conducted a study in order to explore the predictability of range-based volatility estimators. Their results indicate, that the accuracy of volatility improves dramatically when using a range-based estimator instead of the daily closing values. Within the thesis, the Rogers-Satchell volatility estimator has been chosen in order to provide a proxy for the realized intraday volatility. This is supported by Wadhawan and Singh (2019) who showed that the Rogers and Satchell volatility estimator provided 7.4 times more accuracy in comparison to the classical close-to-close model for the calculation of the standard deviation, while the exponentially-weighted volatility estimator, the Parkinson volatility as well as the Garman-Klass volatility estimator performed worse.

Even though the Sharpe ratio is traditionally being used in a portfolio management context, within this thesis it will be used in order to put the achieved return after a terror attack into relation with the realized intraday volatility. The Sharpe ratio gives an overview over the impact the terroristic events had on both return and volatility across various indices on various days. The calculation of the Sharpe ratio is performed for daily observations as well as throughout the time span of 250 and 15 days respectively before the attack, as well as for 5 days and 15 days after the terror attack.

2.9. Sortino ratio

The Sortino ratio was developed in the 1980s as an improvement with regards to risk adjusted returns. It measures the risk adjusted return of an asset, portfolio or strategy (Sortino, 1994).

It provides a better choice when measuring and comparing different performances within different skews of return distribution. The Sortino ratio can be regarded as a modified Sharpe ratio using downside deviation instead of the standard deviation for measuring the involved risk. Only returns falling below a target are considered risky. The Sortino ratio can be expressed as:

$$\text{Sortino ratio} = \frac{Risk\ premium}{Downside\ deviation} = \frac{r - r_f}{\sigma_{down}} \qquad (13)$$

The Sortino ratio penalizes only returns which fall below a specified target or required rate of return. Contrarily, the Sharpe ratio penalizes both upside and downside volatility equally. The Sharpe and the Sortino ratio both measure the risk adjusted return performance. Additionally, both ratios normalize the risk in order to assess which asset yields a higher return per unit of risk (Estrada, 2006).

Another way of perceiving the Sortino ratio is to consider it as the annualized standard deviation of returns which fall below a certain target. From this it follows, that below-target returns are penalized as failures at a quadratic rate. Empirical studies have shown that this perception is coherent with an investor's behavior in an unstable environment.

Even though both the Sharpe and the Sortino ratio show similarities, investments with different risk profiles might lead to extremely different results and hence, to different investment decisions. This is due to the fact that the Sharpe ratio assumes normal distribution, while the Sortino ratio does not. When asset return distributions are symmetrical, it follows that the target

return is close to the distribution mean. Consequently, the Sharpe and the Sortino ratio lead to similar results. Since return distributions are not symmetrical and skewness might increase dramatically within unstable market environments, the target return will differ widely from the median of the distribution. Hence, both ratios might lead to tremendously different results under extreme market conditions. The same holds for assets with different risk profiles, resulting in different asset return distribution (Estrada, 2006).

In order to be able to compare the obtained results across the different equity indices, the derived Sortino ratios for the respective time frame are consequently annualized. When assessing the impact of terror attacks on equity markets it is inalienable to recognize the difference and the delta in variables right before and immediately after the conduction of an attack.

2.10. Information ratio

The information ratio (IR) is often referred to as a variation or more generalized version of the Sharpe ratio. The information ratio was implemented in practice, since investors started to substitute the risk-free rate within the Sharpe ratio framework by using a benchmark return (Kidd, 2011). The information ratio provides similar content like the Sharpe ratio, with the main difference being that the information ratio compares the portfolio or index return against a benchmark, while the Sharpe ratio compares the portfolio or index return against the risk-free rate. While the Sharpe ratio is beneficial in order to determine the absolute returns of a portfolio, the information ratio is beneficial for measuring the relative returns of a portfolio (Clarke, De Silva and Thorley, 2015).

The information ratio compares the return of a portfolio or a security to the return of a pre-selected benchmark, relative to the standard deviation of the portfolio/security return. Formally, it is defined as the difference between the portfolio and benchmark return, divided by the tracking error. It denotes the amount of additional return an investor or portfolio manager achieves, per unit of increased risk (Clarke, De Silva and Thorley, 2015). In other words, the IR represents how much excess return is generated by taking and accepting excess risk relative to a benchmark. The information ratio is calculated by dividing the portfolio's excess return relative to its benchmark by the standard deviation of its excess return. The IR can be expressed as (Kidd, 2011):

$$\frac{r_i - r_b}{\sigma_{p-b}} \tag{14}$$

Within this framework, r_i denotes the return of the equity index of the respective country, which was targeted by the terror attack, r_b denotes the return of the benchmark representing a global equity index, and σ_{p-b} denotes the standard deviation of the difference in return between the global equity index and the country specific equity index. The numerator denotes the equity indices excess return and it is often also referred to as active return. (Kidd, 2011).

The denominator of the information ratio is also known as active risk or tracking error. Within the portfolio management framework, the tracking error measures the risk of an investment by tracking how closely a portfolio follows the index, against which it is benchmark. Within the assessment of terror attacks, the tracking error is used in order to determine if and to what extent the returns of the affected countries equity index deviate from a pre-selected global equity index. The tracking error can be measured historically (ex post), but also ex ante. When assessing terror attacks, it is important to recognize the change in the information ratio (and the tracking error) over time. It is especially important to assess, if and how both variables changed immediately before and after the terroristic activity. The standard deviation of the difference in the returns is calculated in order to analyze the impact of terror attacks on the equity market. Formally, the tracking error is given by (Cornuejols, and Tütüncü, 2007):

$$\text{Tracking Error} = \sqrt{Var\ (r_i\ -\ r_b)} \qquad (15)$$

Both the Sharpe ratio and the information ratio alike are based on the Markowitz mean-variance paradigm. This makes it applicable to portfolios with normally distributed asset returns. It provides information, whether an investment has outperformed its benchmark on a risk-adjusted basis. However, the information ratio is incapable of detecting how the performance was generated (Kidd, 2011).

The information ratio considers arithmetic returns instead of geometric returns. Further, the ratio ignores leverage effects. This might lead to biased results when calculating the performance of a fund managers, since it becomes negative even if the manager produces excess returns over the benchmark. An improvement which would be able to overcome this issue provides the usage of geometric returns instead of arithmetic ones (Grinold, and Kahn, 1999). Further, IR is heavily dependent on the time period chosen for the calculation as well as the selected benchmark index. IRs can be influenced by inclusion and exclusion of measurement periods. Additionally, market conditions of the entire time period under evaluation should be considered. In order to determine the impact of terror attacks as well as to avoid biased results, four different time periods have been chosen for the assessment (Kidd, 2011).

Despite its drawbacks, the information ratio is often used in practice in order to determine the performance of portfolio managers. A higher information ratio indicates that a higher active return was achieved for every unit of risk taken. A high information ratio indicates, that the fund manager performed well. The top-quartile portfolio managers typically yield an annualized information ratio of about 0.5. Grinold and Kahn (1995) stated that information ratios of 1.0 can be regarded as exceptional, 0.75 as very good and 0.5 as good. In the long run, it is extremely hard to sustain information ratios higher than 0.5 Information ratios can be observed and calculated both ex ante as well as ex post (Grinold, and Kahn, 1999).

It should be denoted, that neither the Sharpe nor the information ratio accounts for dynamic correlation between assets. In times of market turmoil, it should be considered that asset correlations tend to jump upwards. Very long time periods increase the Sharpe ratio, since long run volatilities tend to be lower than short run volatilities. While the Sharpe ratio becomes biased for longer periods of time due to the afore noted, the information ratio indicates the persistence of the equity indices outperformance with regards to the benchmark. However, both ratios are based on historical data, while the future might not bear a proper resemblance of the past performances (Kidd, 2011).

However, within the framework of measuring the impact of terror attacks on equity markets it is employed as an additional measure, which puts the return of an equity index before and after a terror attack into relation with the risk involved, measured by standard deviation. The information ratio should provide insights into how the return of the affected countries equity index deviates from the return of the rest of the world, put into relation with the standard deviation of the difference in return between the global equity index and the country specific equity index. Since the information ratio as highly dependent on the time period chosen for the calculation, it is calculated and compared for four different time periods in order to avoid the timespan bias.

2.11. Maximum drawdown

The maximum cumulative loss measured from a high to a consequent low is commonly denoted as the maximum drawdown (MDD). It measures the worst loss (largest drawdown) of a financial market within a pre-specified time interval. It also captures the worst possible market timing and the maximum occurring loss resulting from the bad market timing. Investors buying

assets at a local maximum and selling it a subsequent local minimum, realize a maximum loss, which can be determined by using the MDD (Vecer, 2007). Further, the MDD provides insights, into how sustained an investor's loss is (Magdon-Ismail and Atiya, 2004). Formally, the drawdown measures the decline of an asset from a historical peak. Drawdown can be referred to as a pain period, experienced by an investor between a recent peak and a consequent low and it is given by (Magdon-Ismail et al, 2004):

$$\text{MDD (T)} = \frac{bottom\ value - peak\ value}{peak\ value} \tag{16}$$

Another formulation of the MDD calculation shows, that the calculation is not available in a closed form solution but is rather calculated recursively. Upon the calculation of the MDD for the period $[0, T]$, V_t is the current observation of the time series and V_{max} the maximum observed value of the time series within the $[0, T-1]$ period:

$$MDD_{[0,T]} = min\ (\frac{V_t - V_{max}}{V_{max}}), MDD_{[0,T-1]} \tag{17}$$

A low MDD is required for any well-performing investment fund or portfolio and it can be regarded as one of the most important risk measures (Magdon-Ismail and Atiya, 2004). It was introduced in order to overcome some of the limitations within the mean-variance framework, which include the inconvenience to use an estimation for the correlation between two assets during calm and volatile market periods (Reveiz and León, 2010). The advantages of using the maximum drawdown as a risk metric include the fact that the MDD only comprises downward risk. This is desirable, since investors are mostly interested in downward risk and additionally, this poses a desirable property when considering the respective market phase (bear or bull market). Further, the MDD provides a well-grounded picture of how the market reacts to discontinuities and irrational behavior, since it can be regarded as a proxy for the magnitude and the length of the disaster. Another advantage poses the fact that the maximum drawdown strictly relies on historically returns, it does not consider any assumption about the return distribution and hence, is not subject to estimation errors. The properties of the MDD show that it fulfills the formal coherence criteria and hence, it can be regarded as a traditional risk measure (Reveiz and León, 2010).

Roy (1952) showed that the MDD measure provides insightful information for an investor, since the average loss within a period does not provide sufficient information for an investor. This is due to the fact that all his wealth might be eroded. Roy (1952) further showed that a rational agent, who has to make the choice between two different investments, will always prefer the investment with the lower maximum drawdown over the other. Also, Madon-Ismail

and Atiya (2004) supported this finding and stated, that trading desks and portfolio managers are interested in the performance and hence, in investment with superior returns and relatively small drawdowns. Vecer (2007) has shown within his study, that portfolio losses can be prevented by using the maximum drawdown for hedging purposes.

Traditionally, market drops are hedged by investors using put or lookback options. However, both hedging options perform poorly when a market drop is followed by a subsequent recovery. In these cases, the put option expires out of the money while lookback options provide small payoffs of the final value for the case that the asset is close to a running maximum. Vecer (2007) showed in his study that all three afore-mentioned hedging options provided proper hedges for the crash of 27 February 2007. From this it follows, that the maximum drawdown can also be utilized in order to derive hedging strategies in case of dropping markets.

The maximum drawdown poses a convenient measure in order to determine the impact of terror attacks on the equity markets. It is able to handle, what other risk measures are incapable of doing: the MDD takes extreme adverse events into account. This is due to the fact, that it does not incorporate any assumption about the probability distribution of future outcomes and provides a more convenient and sound estimation compared to traditional dispersion metrics, estimations of volatility or correlation analyses (Reveiz and León, 2010). Both of the afore noted can be regarded of importance when measuring the impact of terror attacks on equity markets, since terror attacks pose in severe cases and extremely adverse event. Previous studies have shown, that the impact of terror attacks is short by nature and hence, are followed by a subsequent incline in stock prices after hitting a low.

For the calculation of the maximum drawdown, the maximum index level of the respective countries' equity index has been calculated using the period of 250 trading days preceding the terror attack. The rolling window has been introduced for the succeeding 15 trading days after the terroristic incident.

2.12. Risk-free rate

Some of the ratios which were calculated in order to determine the impact of terror attacks holistically, included the usage of a risk-free rate, including the Sharpe and Sortino ratio. Generally, the risk-free interest rate denotes the rate of return on a hypothetical investment over a fixed period of time, assuming to meet all payment obligations. Further, it can be regarded as

the rate of return into an investment with zero risk. From this it follows that any other investment involving investment risk, is supposed to deliver a higher rate of return in order to compensate the investor for the incurred risk (Edwards and Sinzdak, 1997).

In the United States, the rate of Treasury bills, Treasury notes and Treasury bong can be regarded as risk-free interest rate. These instruments are issued by the US government and denominated in US dollars. It is commonly assumed, that it is very unlikely that the US government will ever default on the instruments since it has the possibility to increase the money supply in order to repay lenders (Hull, 2009). Within Europe the pendant to the US-government bonds poses the LIBOR. Pre-2008, market participants used LIBOR rates as a proxy for the risk-free rate. However, since LIBOR rates soared throughout the 2008 financial crisis, since banks were reluctant to lend money to one another. This experience shifted market participants from using the LIBOR to the usage of overnight indexed swaps. However, for non-collateralized transactions the LIBOR is still used as the proxy for the risk-free interest rate (Hull, 2009).

The yields on U.S. Treasury rates have been regarded as reasonable proxy for the risk-free interest rate, however, they are also subject to political factors such as the funding of the U.S. budget deficit. As a consequence, London Interbank Offered Rate has soon replaced the U.S. Treasury-bonds as a proxy for the risk-free rate. It can be considered as a better measure since it can be regarded as the price setting marginal dealer's cost of raising new money in the open market. (Chance and Brooks, 2016). Since the market participants have also used the overnight indexed swaps (OIS) historically as a measure for the risk-free rate, its usage can be considered appropriate (Hull, 2009).

Investors expect to achieve a return from an investment over a specific time period. This return can be decomposed into the expected return of a risk-free asset plus an expected risk premium (Damodaran, 1999) and the investment horizon has to match the investment duration of the risk-free asset. Since the impact of terror attacks are short by nature, the investment horizon is considered to be less than a trading day. From this it follows, that the risk-free rate is considered to have an overnight investment horizon. The overnight investment horizon restricted the choice of the data to interbank offer rates, since unlike government bonds also overnight data is provided.

3. Results

The main goal of the dissertation is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity. In the following sections the results for all the criteria employed are presented. The criteria chosen allow to provide answers for the formulated research questions:

1. has the overall impact of terror attacks decreased throughout time (i.e. has 9/11 had a bigger impact on the equity market than the Nice truck attack in 2016)?
2. was the impact of terror attacks on Islamic equity indices as hard as on Western indices (i.e. was the impact of e.g. 9/11 on the DJIA more severe than on the Tadawul)?

In the following section qualitative criteria are introduced, which allow to judge the severity of a terror attack beyond quantitative ratios and calculations. The calculation results for the introduced ratios and parameters are presented below. Additionally, the parameters are ranked according to their respective severity. The highest rank (5) is assigned to biggest impact, measured by the respective parameter under investigation.

3.1. Number of fatalities and people injured

In the graph and table underneath, the fatalities corresponding to each of the five attacks are listed and ranked, assigning the highest number to the most severe attack.

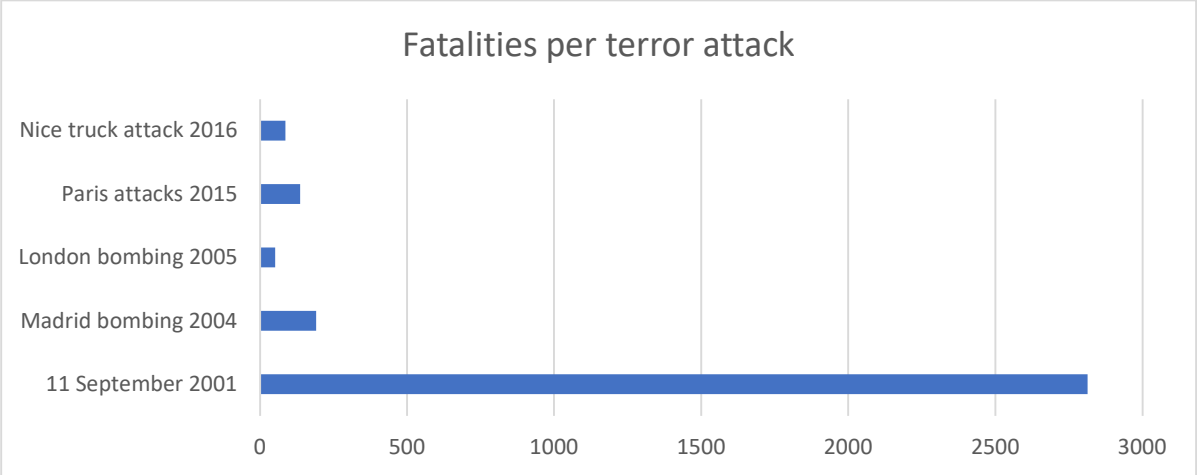

Illustration 16. Fatalities per terror attack

Table 7. Ranking of fatalities per terror attack

Attack	Fatalities	Rank
11 September 2011	2,814	5
Madrid bombing 2004	191	4
London bombing 2005	52	1
Paris attacks 2015	137	3
Nice truck attack 2016	87	2

Measured by the number of fatalities, the September 11 terror attacks had the most severe impact. Hence, it is assigned the rank/score of 5. Since in London 52 people died, which is less than compared to the other terror attacks, it is assigned the rank 1.

The below graph and table show the number of people who got injured during the five listed terror attacks. Additionally, a rank is assigned determined by the injuries.

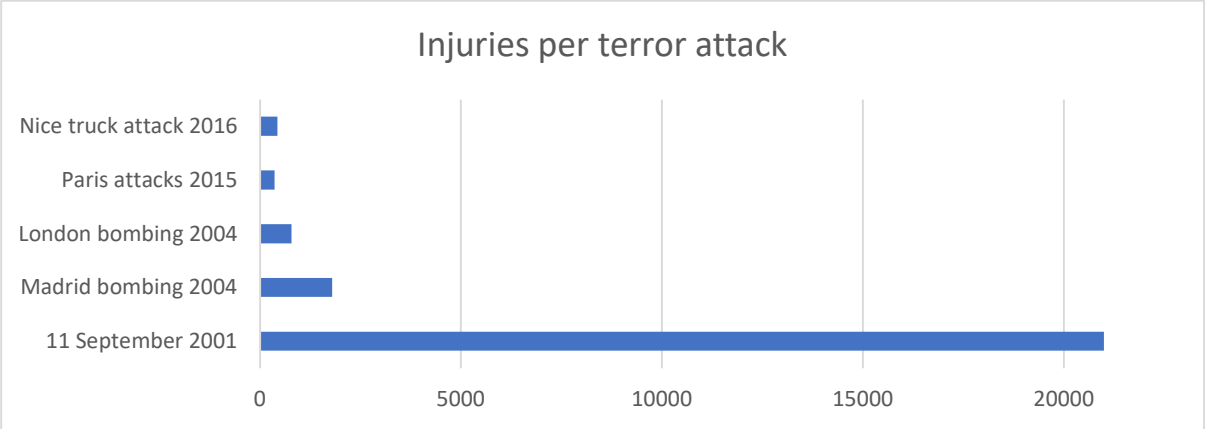

Illustration 17. Injuries per terror attack

Table 8. Ranking of people injured per terror attack

Attack	Injuries	Rank
11 September 2011	21,000+	5
Madrid bombing 2004	1,800	4
London bombing 2004	784	3
Paris attacks 2015	368	1
Nice truck attack 2016	433	2

The afore noted logic is also assigned to the number of injured people per terror attack. Since in New York more than 21,000 people got injured due to the terror attack it is assigned the rank

number 5. The least people got injured in Paris in 2015 compared to the other attacks, and hence, it is assigned the rank 1.

3.2. Average return

The below chart shows the comparison of the average return, calculated for 5 and 15 trading days after the terror attack.

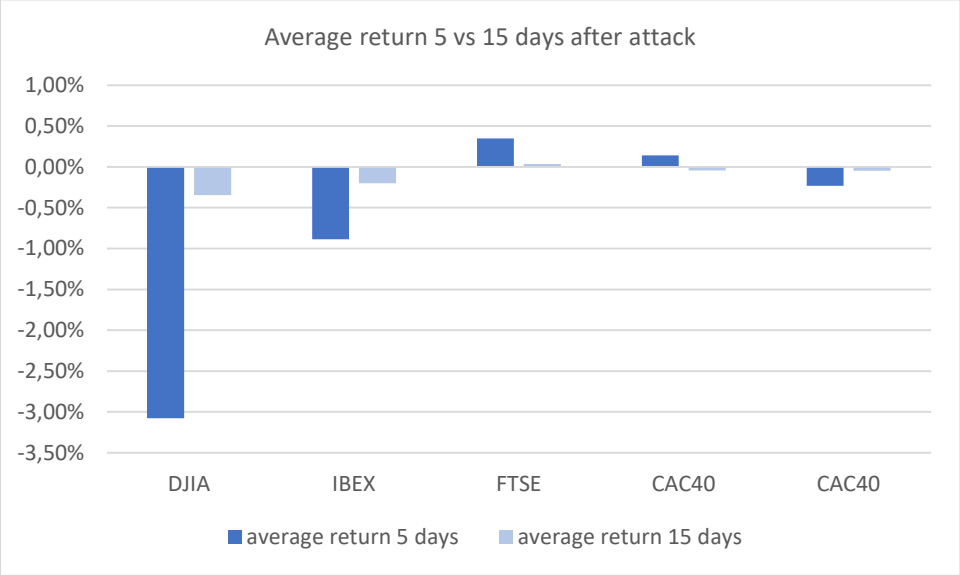

Illustration 18. Average return 5 vs 15 days after the attack

As it can be seen from the graph, the equity market reacted in the case of the 9/11 terror attack as well as the Madrid bombing. Also, after the terror attack of Nice, the stock market dropped. It can be seen, that in all the cases, the average return over a time horizon of 15 trading days normalized. The ranking can be found in the table below.

Table 9. Ranking average 5-day return

Attack	Index	Rank
11 September 2001	DJIA	5
Madrid bombing 2004	IBEX	4
London bombing 2004	FTSE	2
Paris attacks 2015	CAC40	1
Nice truck attack 2016	CAC40	3

The chart below shows the ranking of the average return for each terror attack, 15 trading days after the conduction of the attack.

Table 10. Ranking average 15-day return

Attack	Index	Rank
11 September 2001	DJIA	5
Madrid bombing 2004	IBEX	4
London bombing 2004	FTSE	1
Paris attacks 2015	CAC40	2
Nice truck attack 2016	CAC40	3

The exact average returns 15 trading days after the terror attack can be found in the afore section.

The graph below shows the average return of both the Western and Islamic equity 5 trading days after the conduction of the terror attack.

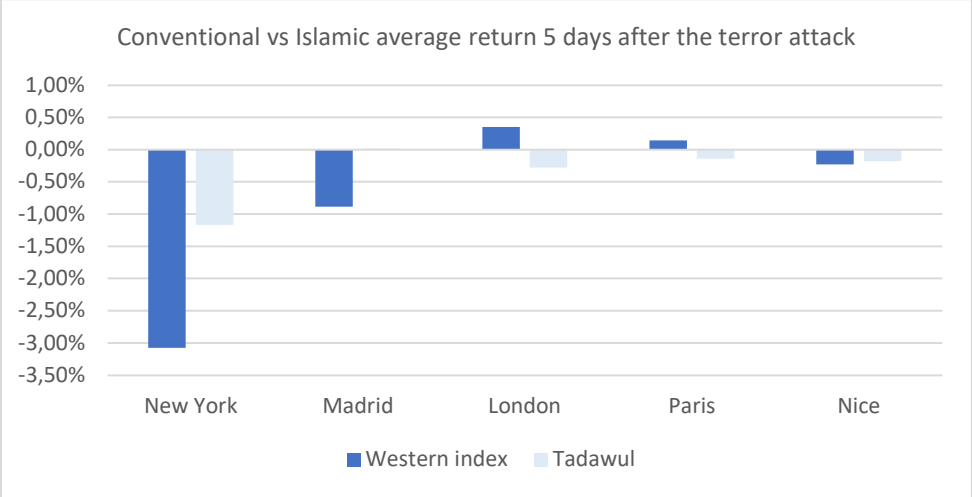

Illustration 19.Conventional vs Islamic average 5-day return

As it can be seen from the graph, the average impact on Western indices was higher in the case of the 9/11 terror attacks, the Madrid bombing as well as the Nice terror attack.

The graph below shows the average return of the respective Western index 15 trading days after the terror attack, compared against the Islamic equity represented by the Tadawul.

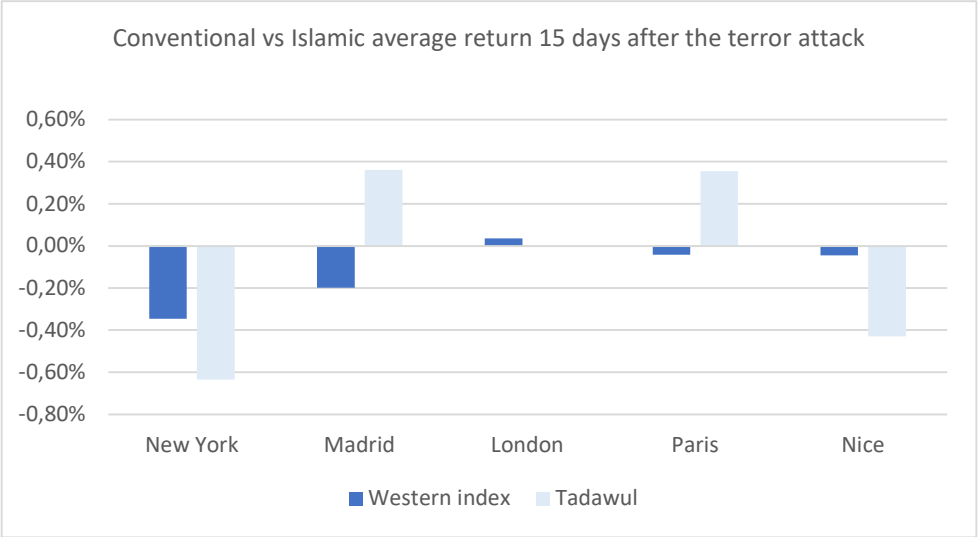

Illustration 20. Conventional vs Islamic average 15-day return

The graph shows that 15 trading days after the terror attack, the average return of the Tadawul was way worse than the return of the Western equity. In the case of Madrid, London and Paris, the Tadawul did not react negatively to the terroristic incident.

3.3. Cumulative return

The table below shows the cumulative returns of the respective country affected by the terror attack 5 days after the attack.

Table 11. Ranking cumulative 5-day return

Attack	Index	Cumulative return	Rank
11 September 2001	DJIA	- 15.385%	5
Madrid bombing 2004	IBEX	- 4.426%	4
London bombing 2004	FTSE	1.750%	1
Paris attacks 2015	CAC40	1.409%	2
Nice truck attack 2016	CAC40	- 1.161%	3

While for New York and Madrid, the impact of the terror attack was clearly reflected by the equity market, the impact for the remaining three terror attacks remained rather low to non-visible already 5 days after the conduction of the attack.

The table underneath denotes the cumulative returns calculated for 15 days after the terroristic incident.

Table 12. Ranking cumulative 15-day return

Attack	Index	Cumulative return	Rank
11 September 2001	DJIA	- 5.190%	5
Madrid bombing 2004	IBEX	- 2.979%	4
London bombing 2004	FTSE	0.539%	1
Paris attacks 2015	CAC40	- 0.632%	2
Nice truck attack 2016	CAC40	- 0.689%	3

With regards to the persistence of the impact stemming from a terror attack, the results indicate that the terror attacks in New York and Madrid had an impact on the equity market also 15 trading days after the terror attack. The London, Paris and Nice terror attack did not have an impact 15 trading days after the terroristic incident.

The table below shows the comparison between the cumulative returns between the conventional and Islamic terror attack 5 trading days after the terroristic incident.

Table 13. Comparison 5-day cumulative return Western vs Islamic equity

Attack	Western index	Tadawul cumulative return
11 September 2001	- 15.385%	- 5.843%
Madrid bombing 2004	- 4.426%	0.091%
London bombing 2004	1.750%	- 1.407%
Paris attacks 2015	1.409%	- 0.704%
Nice truck attack 2016	- 1.161%	- 0.909%

The above shows, that the immediate impact on the equity was more severe for the Western indices in the cases of 11 September and the Madrid bombing. For the other terror attacks, no noticeable impact was found.

The table below denotes the cumulative returns 15 trading days after the respective terror attack. The obtained results of the Western index are compared against the Tadawul results.

Table 14. Comparison 15-day cumulative return Western vs Islamic equity

Attack	Western index	Tadawul cumulative return
11 September 2001	- 5.190%	- 9.521%
Madrid bombing 2004	- 2.979%	5.416%
London bombing 2004	0.539%	0.032%
Paris attacks 2015	- 0.632%	2.533%
Nice truck attack 2016	- 0.689%	- 6.438%

The table above shows that the long-run impact of the 9/11 terror attacks was more severe for the Islamic equity than for the Western equity. The same pattern was found for the Nice truck attack. While Islamic equity dropped in the aftermath, the conventional equity did not react. For the other three cases, no remarkable reaction of the equity market was found.

3.4. Cumulative abnormal return

The below table shows the cumulative abnormal returns of the country affected by the terror attack 5 days after the terroristic incident. The results were obtained by employing the event study methodology, as described afore. The full results of the event study can be found in the appendix.

Table 15. Ranking cumulative abnormal 5-day return

Attack	Index	Cumulative abnormal return	Rank
11 September 2001	DJIA	- 14.800%	5
Madrid bombing 2004	IBEX	- 2.979%	4
London bombing 2004	FTSE	0.539%	1
Paris attacks 2015	CAC40	- 0.830%	2
Nice truck attack 2016	CAC40	- 1.235	3

The table underneath denotes the cumulative abnormal returns 15 days after the terrorist attack. The results were obtained using the event study methodology and the full results can be found in the appendix.

Table 16. Ranking cumulative abnormal 15-day return

Attack	Index	Cumulative abnormal return	Rank

11 September 2001	DJIA	- 2.700%	4
Madrid bombing 2004	IBEX	- 3.313%	5
London bombing 2004	FTSE	- 0.434%	1
Paris attacks 2015	CAC40	- 0.665%	2
Nice truck attack 2016	CAC40	- 0.783%	3

The below table presents the results (cumulative abnormal returns) obtained by the event study methodology. The cumulative abnormal returns of the Western index are compared against the abnormal returns of the Tadawul.

Table 17. Comparison 5-day cumulative abnormal return Western vs Islamic equity

Attack	**Western index**	**Tadawul cumulative abnormal return**
11 September 2001	- 14.800%	- 3.887%
Madrid bombing 2004	- 3.955%	0.548%
London bombing 2004	0.191%	- 3.934%
Paris attacks 2015	- 0.830%	- 1.582%
Nice truck attack 2016	- 1.235%	- 0.265%

For 9/11 and Madrid, the immediate impact of the terror attack on the equity market was higher for the Western indices compared to the Tadawul. However, for London and Paris, the Tadawul reacted stronger than the Western indices. For the Nice truck attack, the CAC40 reacted stronger than the Tadawul. Nonetheless, also the Tadawul fell by about -0.3% on the succeeding trading day after the attack.

The graph below shows the reaction of both the DJIA compared with the Tadawul in the aftermath of a terror attack, i.e., in the succeeding 15 trading days.

Table 18. Comparison 15-day cumulative abnormal return Western vs Islamic equity

Attack	**Western index**	**Tadawul cumulative abnormal return**
11 September 2001	- 2.700%	- 9.978 %
Madrid bombing 2004	- 3.313%	0.702 %

London bombing 2004	- 0.434%	- 4.937 %
Paris attacks 2015	- 0.665%	3.894 %
Nice truck attack 2016	- 0.783%	- 4.395 %

For the terror attack of 11 September 2001, London and the Nice truck attack, the Tadawul revealed a stronger impact compared to Western equity. For Nice and New York, the index did not react in the succeeding 5 days after the attack, it showed a bigger impact 15 days after the terror attack.

3.5. Maximum drawdown

The below graph shows the development of the maximum drawdown from day 1 until day 15 after the terror attack.

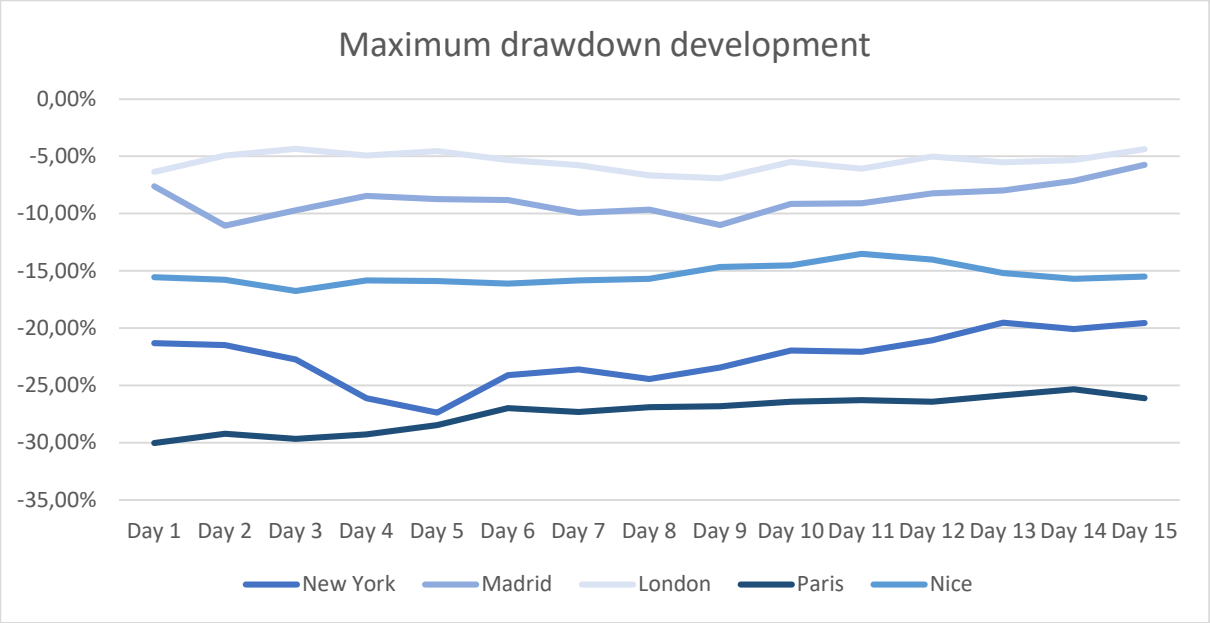

Illustration 21. Development of maximum drawdown

From the graph it can be seen that the maximum drawdown deteriorated heavily in the aftermath of the 9/11 terror attacks. It plunged from 21% to about 27%. Also, in the case of Madrid the maximum drawdown declined, however, recovered faster than for New York. In the case of the other terror attacks, the maximum drawdown did not show any remarkable behavior. The table below shows the maximum drawdown 15 days after the terror activity and its respective ranking.

Table 19. Ranking maximum drawdown 15 days

Attack	Index	Maximum drawdown	Day	Rank
11 September 2001	DJIA	- 27.360%	5	5
Madrid bombing 2004	IBEX	- 11.057%	9	3
London bombing 2004	FTSE	- 7.252%	0	1
Paris attacks 2015	CAC40	- 10.829%	1	2
Nice truck attack 2016	CAC40	- 16.117%	6	4

It should be denoted, that in the case of the Nice terror attack, the Brexit vote also played an important role with regards to the market reaction. Shortly before the terror attack, the market has dropped as a response to the economic uncertainty stemming from the UK leaving the EU. This has led to a drop of equity prices as well as to increased volatility. However, since many investors manage their portfolios by determining stop loss and maximum drawdown levels before entering into a position, the maximum drawdown is included as a criterion.

The below graph shows the maximum drawdown for 15 trading days after the respective terror attack. The number obtained for the Tadawul is compared against the maximum drawdown of the Western equity index.

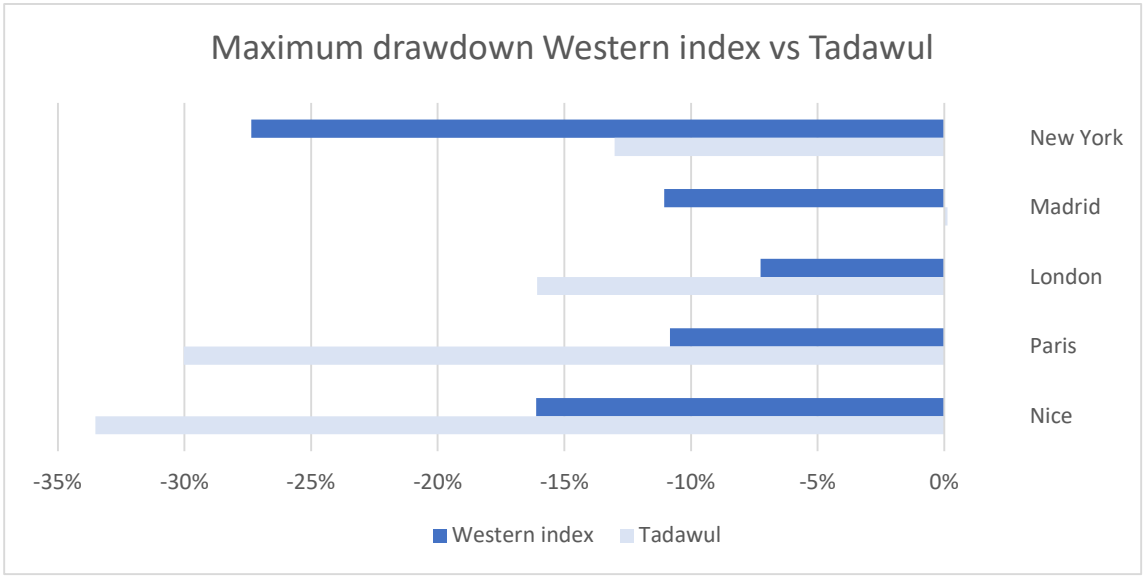

Illustration 22. Maximum drawdown Western index vs Tadawul

In the case of London, Paris and Madrid, the Tadawul has declined more than the conventional counterparts. In the aftermath of the 9/11 terror attacks, the Tadawul has also declined, however, not as much as the DJIA. After the Madrid bombing, the Islamic equity did not show

any reaction in the consecutive 15 trading days after the terror attack. The corresponding figures of the chart are displayed in the table below.

Table 20. Comparison maximum drawdown Western vs Islamic equity

Attack	Western index	Tadawul
11 September 2001	- 27.360%	- 13.017%
Madrid bombing 2004	- 11.057%	0.133%
London bombing 2004	- 7.252%	- 7.252%
Paris attacks 2015	- 10.598%	- 30,022%
Nice truck attack 2016	- 16.117%	- 33.516%

3.6. Time to recovery of index

The below chart shows the time to recovery, measured by trading days. The recovery is determined by assessing, how long it took the index to recover to its pre-terror attack level.

Table 21. Ranking time to recovery of index

Attack	Index	Days	Rank
11 September 2001	DJIA	40	5
Madrid bombing 2004	IBEX	21	4
London bombing 2004	FTSE	3	2
Paris attacks 2015	CAC40	2	1
Nice truck attack 2016	CAC40	9	3

The table below provides information about the respective countries index level before the terroristic activity occurred, as well as the date of recovery, i.e., when the index regained or exceeded its pre-attack level.

Table 22. Index levels per terror attack

Attack	Index	Point in time	Date	Index level
11 September 2001	DJIA	Pre-attack date	10.09.01	9,605.50
		Recovery date	09.11.01	9,608.00
Madrid bombing 2004	IBEX	Pre-attack date	10.03.04	10,156,31
		Recovery date	08.04.04	10,191.90

London bombing 2005	FTSE	Pre-attack date	06.07.05	9,195.21
		Recovery date	11.07.05	9,209.85
Paris attacks 2015	CAC40	Pre-attack date	13.11.15	5,157.01
		Recovery date	17.11.15	5,256.75
Nice truck attack 2016	CAC40	Pre-attack date	14.07.16	4,873.63
		Recovery date	27.07.16	4,887.65

The table below compares the time of recovery measured by trading days between the afore noted Western indices vs. the Saudi Arabian Tadawul, which is representing a proxy for the recovery time of Islamic equity indices.

Table 23. Comparison time to recovery of index Western vs Islamic equity

Attack	**Western index**	**Tadawul**
11 September 2001	40	126
Madrid bombing 2004	21	1
London bombing 2005	3	15
Paris attacks 2015	2	6
Nice truck attack 2016	9	1

The table below provides information about the index level of the Saudi Arabian Tadawul pre- and post- the terror attacks which have occurred in on Western targets.

Table 24. Comparison of index levels Western vs Islamic equity

Attack	**Tadawul**	**Point in time**	**Date**
11 September 2001	Pre-attack date	10.09.01	677.70
	Recovery date	17.03.02	684.62
Madrid bombing 2004	Pre-attack date	10.03.04	1,309.17
	Recovery date	14.03.04	1,311.10
London bombing 2005	Pre-attack date	06.07.05	3,415.29
	Recovery date	27.07.05	3,416.37
Paris attacks 2015	Pre-attack date	12.11.15	1,888.86
	Recovery date	22.11.15	1,914.19
Nice truck attack 2016	Pre-attack date	14.07.16	1,776.25

	Recovery date	27.07.16	1,781.31

As it can be seen from the tables above, in the case of 9/11, the London bombing as well as the Paris attacks it took the Tadawul longer than the conventional indices to recover to its pre-attack levels.

3.7. Time to normalization of returns

The table below provides additional information to the event study methodology. It shows how fast the respective countries equity index has come back to normal conditions, measured by the significance of returns. The results of the event study methodology have shown that the returns remained abnormal with regards to the global equity index MSCI for different amounts of time. The summary of the findings is provided below.

Table 25. Ranking time to normalization of returns

Attack	Western Index	Days	Rank
11 September 2001	DJIA	7	5
Madrid bombing 2004	IBEX	3	4
London bombing 2004	FTSE	3	4
Paris attacks 2015	CAC40	3	4
Nice truck attack 2016	CAC40	1	3

The underneath table compares the number of days which both the respective Western index and the Tadawul needed in order to normalize with regards to statistical significance.

Table 26. Comparison normalization of returns Western vs Islamic equity

Attack	Western index	Tadawul
11 September 2001	7	14
Madrid bombing 2004	3	0
London bombing 2004	3	9
Paris attacks 2015	3	1

Nice truck attack 2016	1	1

The chart shows that while Western indices have reacted to the occurrence of terror attacks, the Saudi index has not or barely reacted, with the exception of the 9/11 terror attack. A statistical significance of 0 days indicates that no abnormal returns were generated in the aftermath of the Madrid bombing on the Saudi stock exchange.

3.8. Standard deviation

In order to determine the impact of the terror attack on the returns and their respective volatility, the standard deviation for 5 days after the terroristic event is calculated and consequently annualized. The prices used for the calculation include the log-returns from the daily closing prices.

Table 27. Ranking 5-day standard deviation

Attack	Western Index	Standard deviation (annualized)	Rank
11 September 2001	DJIA	45.355%	5
Madrid bombing 2004	IBEX	36.023%	4
London bombing 2004	FTSE	24.028%	3
Paris attacks 2015	CAC40	20.984%	2
Nice truck attack 2016	CAC40	13.320%	1

The results show that the terror attacks of 11 September 2001 have triggered the highest volatility and the Nice truck attack resulted in the lowest volatility in the equity market. In order to ensure robustness of results, the table below provides a more detailed analysis of the standard deviation of the respective index under investigation. The calculations are not just based on a sample of 5 days but include the time horizon of 250 and 15 days before the event as well as 5 and 15 days after the terror attack. The 250 days ensure the robustness of results and show the long-run volatility. The 15 days before the attack were chosen in order to determine whether enhanced volatility has already prevailed before the conduction of the attack. The 5 and 15 days after the attack should deliver insights into how the market has digested the bad news resulting from the terror attack.

In order to judge the persistence of the shock on the equity markets and more specifically on the standard deviation was, the calculation was also performed for a time window of 15 trading days after the terror attack.

Table 28. Ranking 15-day standard deviation

Attack	Western Index	Standard deviation (annualized)	Rank
11 September 2001	DJIA	44.463%	5
Madrid bombing 2004	IBEX	24.640%	4
London bombing 2004	FTSE	17.096%	3
Paris attacks 2015	CAC40	15.445%	2
Nice truck attack 2016	CAC40	12.543%	1

The above table reveals a similar picture as for the standard deviation for 5 days. The impact of terror attacks on the volatility of the stock returns has declined, with 9/11 being the most impacted by the attacks and Nice being the least impacted. In the tables underneath, the calculations are listed for all maturities (250 and 15 days before as well as 5 and 15 days after).

Table 29. Volatility DJIA

Dow Jones Industrial Average (9/11)			
Number of days	**Before/After**	**Volatility per day**	**Volatility annualized**
250	Before	1.246%	19.698%
15	Before	1.250%	19.758%
5	After	2.869%	45.355%
15	After	2.812%	44.463%

The analysis of the standard deviation for the 9/11 terror attacks show that volatility has spiked tremendously after the terror attacks. While before the conduction of the attacks the long-run volatility level was around 20%. The 20% volatility level was also prevailing about 15 days before the conduction of the attack. After the terror attack, trading remained closed until 17

September 2010 and market dropped, paired with an increase in volatility. The level reached was around 45% and it prevailed also 15 days after the terror attack.

Table 30. Volatility IBEX

IBEX (Madrid bombing)			
Number of days	**Before/After**	**Volatility per day**	**Volatility annualized**
250	Before	1.035%	16.357%
15	Before	1.262%	19.954%
5	After	2.278%	36.023%
15	After	1.558%	24.640%

As it can be seen in the table above, for the IBEX, a similar picture can be drawn as for the DJIA in 2001. After the conduction of the terror attack, volatility has spiked from the long-run level of about 16% to a level of 36% immediately after the attack. However, market has calmed down and the volatility has declined by about 12 percentage points.

Table 31. Volatility FTSE

FTSE (London bombing)			
Number of days	**Before/After**	**Volatility per day**	**Volatility annualized**
250	Before	0.624%	9.861%
15	Before	0.418%	6.615%
5	After	1.520%	24.028%
15	After	1.081%	17.096%

The FTSE100 was trading at very low volatility levels in the long run before the London Underground bombing. The long-run volatility level was around 10%. In the immediate aftermath of the London bombing the volatility spiked to around 24% and decreased to around 17% in the consecutive 15 days after the terroristic incident.

Table 32. Volatility CAC40 (Paris attacks)

CAC40 (Paris attacks)			
Number of days	**Before/After**	**Volatility per day**	**Volatility annualized**
250	Before	1.308%	20.674%

15	Before	0.939%	14.840%
5	After	1.327%	20.984%
15	After	0.977%	15.445%

As it can be denoted from the table above, the volatility level for the trading year preceding the Paris attacks in 2015 was around 20%. The terror attacks happened on Friday evening, however, trading resumed normally the next Monday and volatility remained at its long-run level for the 5 days succeeding the terror attack.

Table 33. Volatility CAC40 (Nice attack)

CAC40 (Nice attack)			
Number of days	**Before/After**	**Volatility per day**	**Volatility annualized**
250	Before	1.503%	23.760%
15	Before	3.344%	52.879%
5	After	0.842%	13.320%
15	After	0.793%	12.543%

The long-run volatility level of the CAC40 was at around 23.76%. What is striking about the volatility development is the inflated volatility 15 days preceding the Nice truck attack. This is devoted to the Brexit referendum which triggered a market correction and increased volatility. The month of enhanced volatility has also influenced the long-run volatility, which might also be inflated, due to the Brexit vote. However, the CAC40 did not react to the Nice truck attack in July of 2016.

In the following graphs, the standard deviation for both the Western index and the Islamic equity index are displayed. The standard deviation has been calculated using various time windows. The 250 days denote the long-run standard deviation, while the 15 days prior to the event are giving a better understanding about the prevailing market regime before the terroristic incident. The 5 days standard deviation after the terroristic activity displays the immediate response of the equity market. The 15 trading days succeeding the terror attack aim to give an overview on how fast the market recovers from the shock. The results have been annualized in order to ensure comparability.

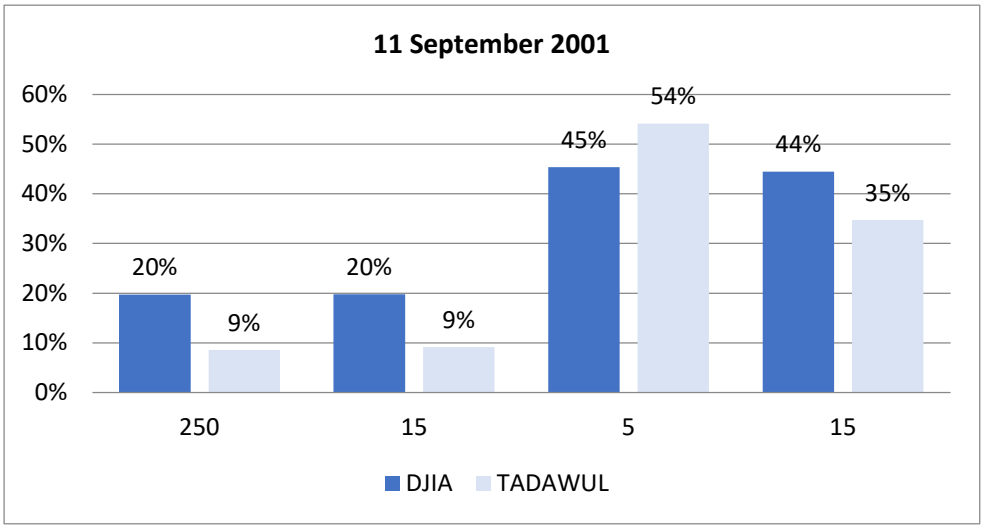

Illustration 23. Standard deviation Western vs Islamic equity (9/11)

The chart above shows that both on long-run and shortly before the terror attacks of 11 September, the Tadawul had lower volatility than the DJIA. In the 5 days succeeding the terror attack, the volatility in the market surged to 45% and 54% respectively. While for the Dow Jones, the volatility almost remained at the 45% level in the 15 days succeeding the terror attack, the volatility of the Tadawul declined.

The chart below shows the impact on the volatility after the Madrid bombing in 2005.

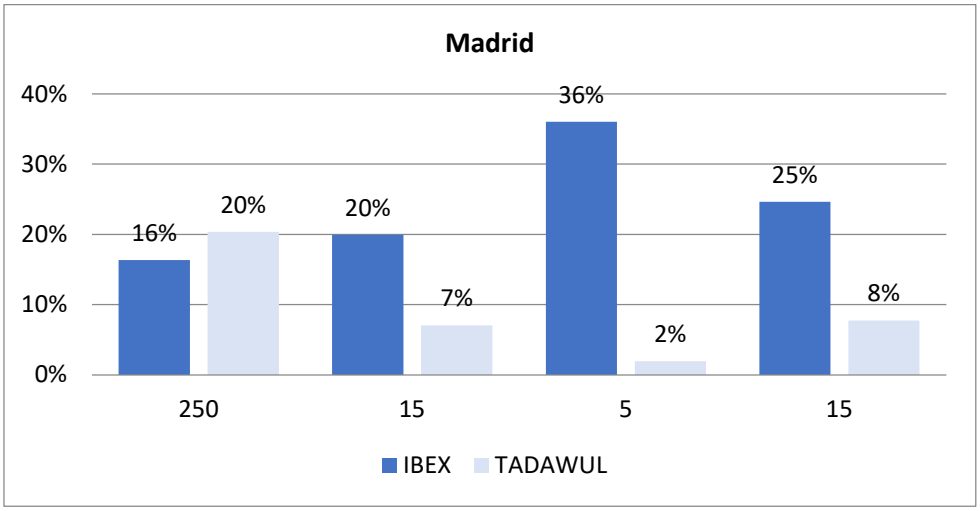

Illustration 24. Standard deviation Western vs Islamic equity (Madrid bombing)

The 250 trading days preceding the Madrid bombing, the IBEX and Tadawul showed similar volatility. However, the 15 trading days preceding the Madrid bombing, the Tadawul revealed clearly lower volatility. While the IBEX volatility spiked after the terror attacks, the Tadawul volatility revealed almost no volatility. The 15 days succeeding the terror attack, the Tadawul volatility remained low, while climbing slightly.

The chart below depicts the long- and short-run volatility of the FTSE compared with the Tadawul volatility.

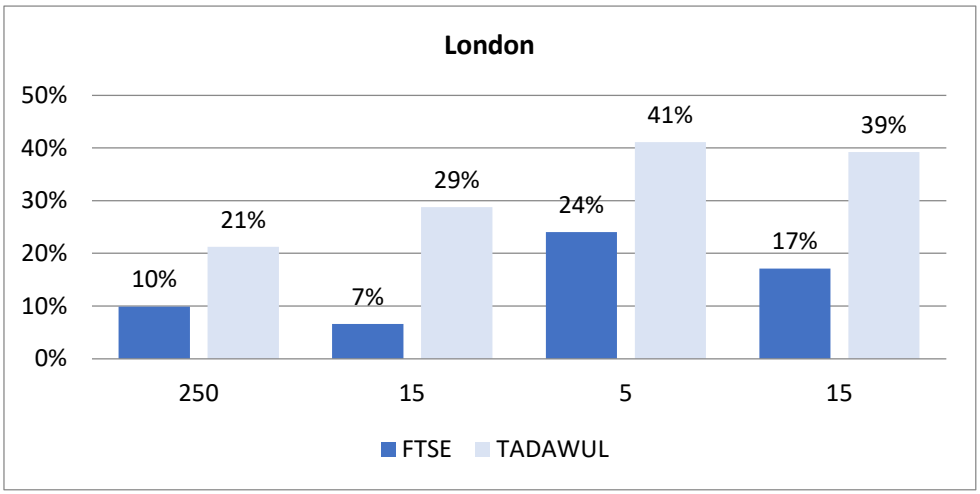

Illustration 25. Standard deviation Western vs Islamic equity (London bombing)

The overall volatility before the London bombing was very low for the FTSE, trading between 7 and 10%. The Tadawul showed higher volatility throughout the year. After the bombings, both indices revealed enhanced volatility, for the Tadawul it exceeded the 40% volatility and remained high, even 15 days after the event.

The below chart depicts the volatility of the CAC40 and the Tadawul (conventional vs. Islamic equity) compared for 250 and 15 days preceding the Paris attacks, as well as 5 and 15 days after the terror attacks.

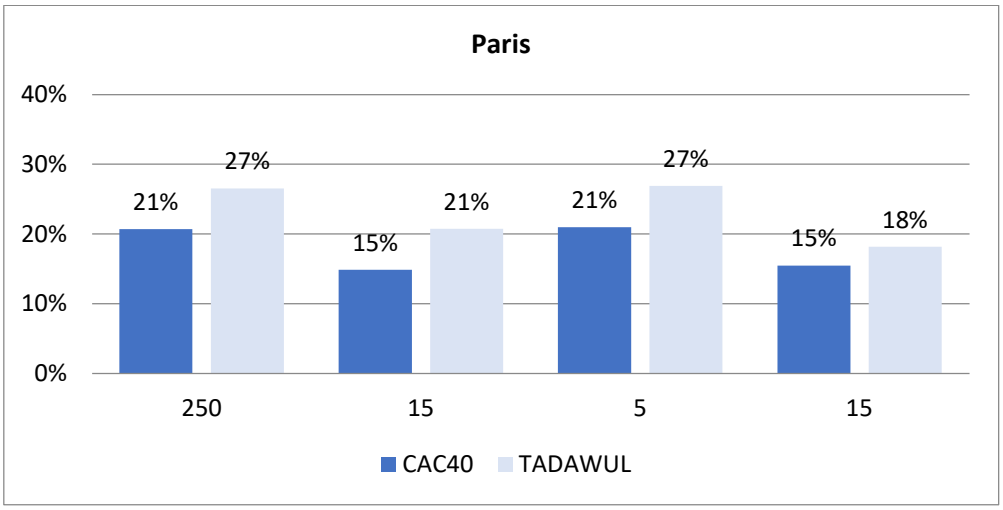

Illustration 26. Standard deviation Western vs Islamic equity (Paris attacks)

While the CAC40 was moving within both time horizons between 15 and 21% volatility, the Tadawul was fluctuating between 18 and 27%. Overall, both indices did not show tremendous reaction to the Paris terrorist attack.

The below chart denotes the volatility of both the CAC40 and the Tadawul before and after the Nice truck attack in 2016.

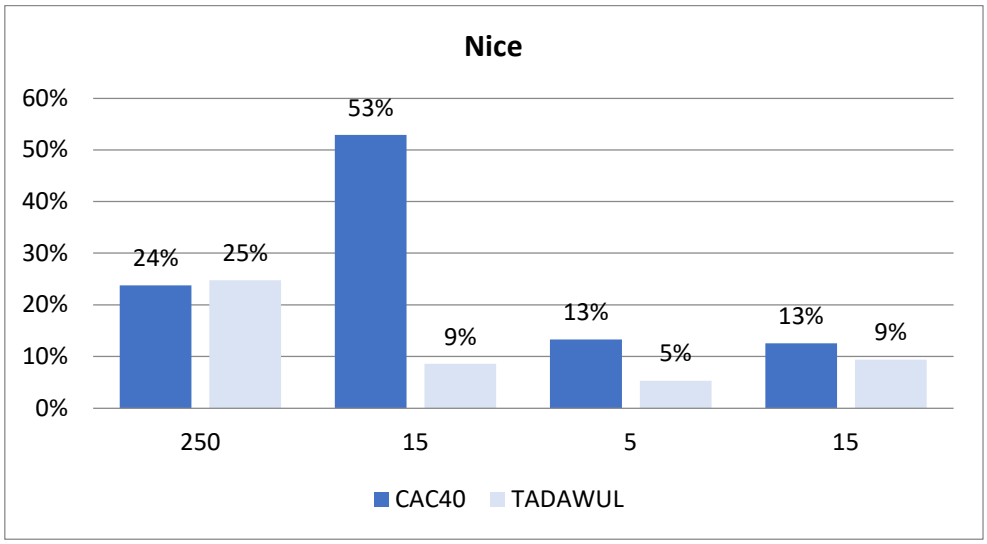

Illustration 27. Standard deviation Western vs Islamic equity(Nice attack)

While the CAC40 was trading at high levels 15 days before the attack, the Tadawul showed a small long-run volatility. The 53% volatility of the CAC40 15 days preceding the terror attack can be attributed to the Brexit referendum, which surprised market participants. The concern about the economic consequences of Britain leaving the EU, for both UK and the union have caused a market drop. The market drop was followed by high volatility in the equity market. However, both indices did not react to the truck attack on Bastille Day.

3.9. Semi deviation

The below charts show the semi deviation, which is also referred to as target or downside deviation. It denotes the deviations of the realized returns underperformance with regards to a pre-defined target return. The realized returns are given by the returns of the respective countries' equity index while the target returns are given by the global equity index MSCI World.

Table 34. Ranking 5-day semi deviation

Attack	Western Index	Standard deviation (annualized)	Rank
11 September 2001	DJIA	56.879%	5
Madrid bombing 2004	IBEX	23.661%	4
London bombing 2004	FTSE	14.612%	1
Paris attacks 2015	CAC40	15.488%	2
Nice truck attack 2016	CAC40	16.803%	3

The chart below shows the semi-deviation from the target countries equity index in relation to the global equity index denoted by the MSCI world. The time frame for the calculation is 15 days.

Table 35. Ranking 15-day semi deviation

Attack	Western Index	Standard deviation (annualized)	Rank
11 September 2001	DJIA	32.839%	5
Madrid bombing 2004	IBEX	14.684%	4
London bombing 2004	FTSE	12.821%	2
Paris attacks 2015	CAC40	13.125%	3
Nice truck attack 2016	CAC40	12.410%	1

The following charts denote the semi-deviation of the Tadawul and DJIA. The results were obtained by comparing the returns of both the Tadawul and DJIA against the returns of the global equity index MSCI world.

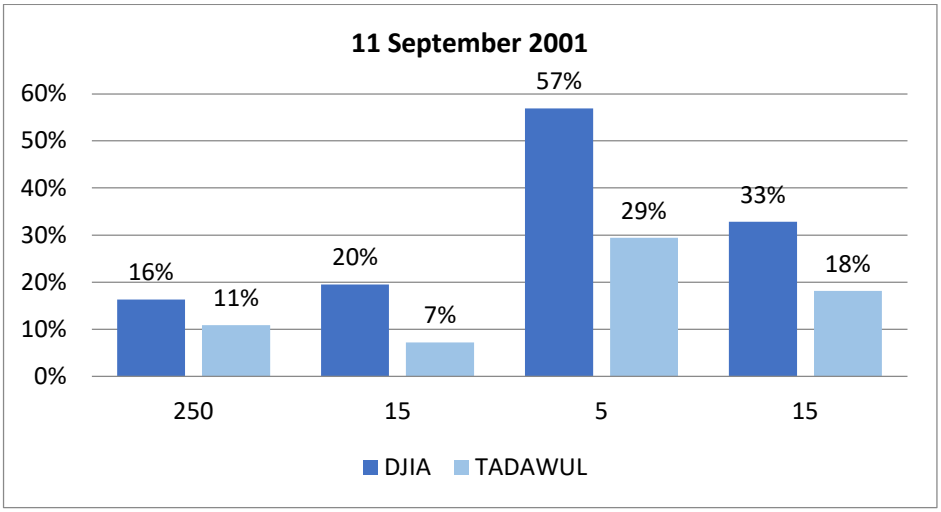

Illustration 28. Western vs Islamic semi deviation (9/11)

As it can be seen from the chart above, the semi-deviation for the DJIA spiked in the aftermath of the 9/11 terror attacks, even though the market remained closed from trading for almost 7 days. Also, the semi-deviation of the Tadawul increased, however, not as striking as the semi-deviation of the DJIA. Both semi-deviations declined in the 15 trading days succeeding the terror attack.

The below chart shows the semi-deviation preceding and succeeding the Madrid bombing in 2005.

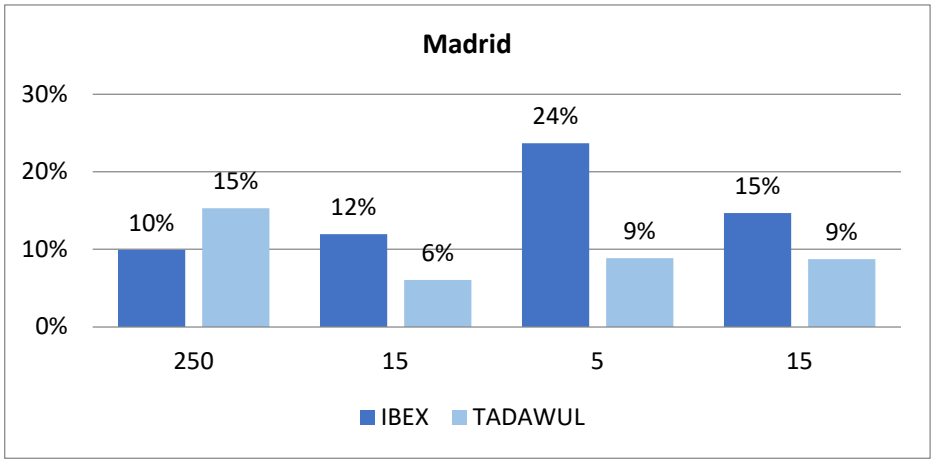

Illustration 29. Western vs Islamic semi deviation (Madrid bombing)

From the chart it is visible, that the semi-deviation of the IBEX was trading around 12%, however, semi-deviation climbed dramatically in the 5 trading days immediately after the Madrid bombing. The Tadawul did not react to the terror attacks.

The below chart shows the semi-deviation of both the FTSE and the Tadawul.

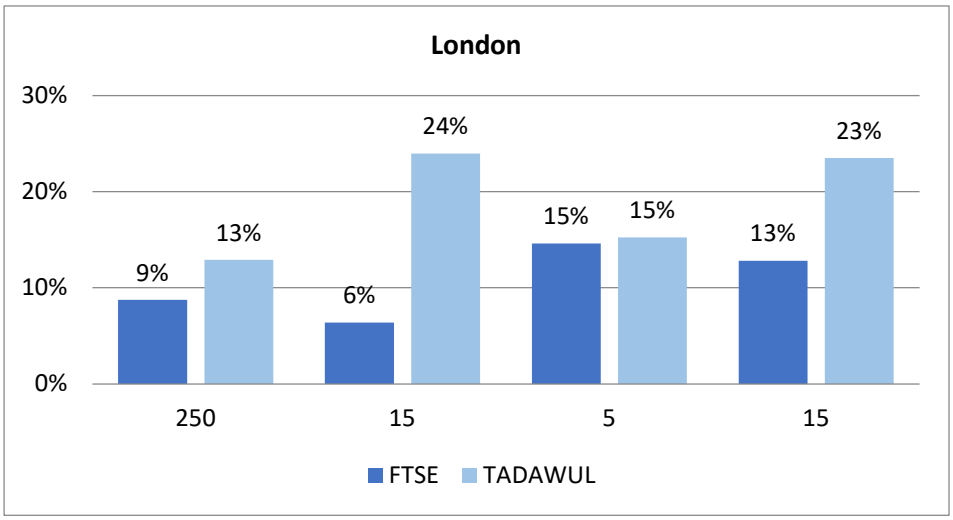

Illustration 30. Western vs Islamic semi deviation (London bombing)

While the semi-deviation of the Tadawul was high compared to the 250-day average, it plunged from 24% to 15% immediately after the London bombing. Summing it up, there was no recognizable reaction of the Tadawul in the aftermath of the London bombing

The chart below denotes the semi-deviation of both the Tadawul and the CAC40.

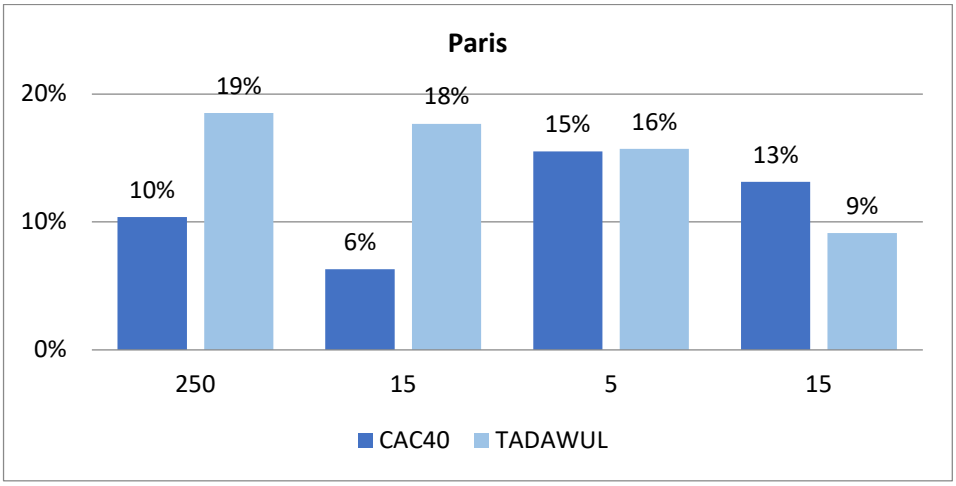

Illustration 31. Western vs Islamic semi deviation (Paris attacks)

As it can be seen from the chart above, the semi-deviation of the Tadawul remained constant throughout the period, however, plunged 15 days after the attack. From this it follows, that there was no meaningful reaction to the Paris terror attacks in 2015. The CAC40 was more volatile than the Tadawul, and volatility spiked from 6% preceding the terror attack to 15% in the succeeding 5 trading days. It remained enhanced also 15 trading days after the attack.

The below chart shows the semi-deviation of both the CAC40 and the Tadawul before and after the terror attack in Nice.

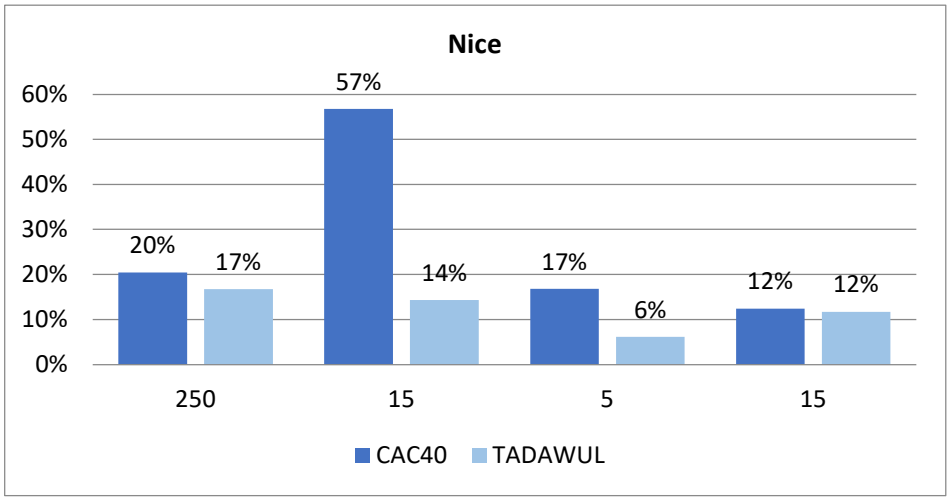

Illustration 32. Western vs Islamic semi deviation (Nice attack)

From the chart it is visible, that the volatility of the Tadawul remained constant throughout the whole observed period, fluctuating between 12% and 17%. Overall, the Tadawul did not react to the truck attack in Nice. Also, the CAC40 did not show fluctuations with regards to the Nice terror attack. The 57% semi-deviation are attributed to the Brexit vote, which surprised market participants and caused a market correction, accompanied by inflated volatility.

3.10. Abnormal volatility

The below chart shows the cumulative abnormal volatility 5 days after the terroristic incident. The results were obtained by employing a GARCH (1,1) in order to forecast the volatility. The forecasted volatility was consequently compared against the realized volatility and summed up for the 5 consecutive trading days after the terror attack.

Table 36. Ranking abnormal volatility

Attack	Western Index	Abnormal volatility	Rank
11 September 2001	DJIA	9.361%	5
Madrid bombing 2004	IBEX	0.813%	3
London bombing 2004	FTSE	2.704%	4
Paris attacks 2015	CAC40	- 1.698%	2
Nice truck attack 2016	CAC40	- 4.077%	1

The GARCH (1,1) specifications of the volatility forecasts for the respective indices are displayed below. VL denotes the long-run volatility, both daily and annualized.

Table 37. GARCH (1,1) model parameters per index

GARCH (1,1)	DJIA	IBEX	FTSE	CAC40	CAC40

μ	-0.071%	0.157%	0.067%	0.056%	-0.064%
α_0	0.001%	0.000%	0.003%	0,.002%	0.003%
α_1	6.282%	11.847%	6.325%	14.562%	26.807%
β_1	86.782%	87.566%	18.324%	72.160%	63.695%
VL daily	1.209%	1.463%	1.030%	1.232%	1.343%
VL annualized	19.113%	23.124%	16.280%	19.481%	21.228%

The below table displays a comparison between the abnormal volatility (measured by comparing the forecast of the GARCH (1,1) against the realized volatility) of both the Western equity and the Saudi Arabian equity. The abnormal volatility was consequently cumulated for the 5 trading days succeeding the terror attack.

Table 38. Comparison abnormal volatility Western vs Islamic equity

Attack	**Western Index**	**Tadawul**
11 September 2001	9.361%	12.070%
Madrid bombing 2004	0.813%	- 5.156%
London bombing 2004	2.704%	3.725%
Paris attacks 2015	- 1.698%	- 3.210%
Nice truck attack 2016	- 4.077%	-5.773%

The below table displays the GARCH (1,1) specifications of the Tadawul returns for each of the five terroristic incidents.

Table 39. Tadawul GARCH (1,1) model parameters

GARCH (1,1)	**9/11**	**Madrid**	**London**	**Paris**	**Nizza**
μ	0.032%	0.286%	0.251%	-0.051%	-0.030%
α_0	0.000%	0.002%	0.000%	0.002%	0.003%
α_1	12.202%	47.830%	14.611%	24.246%	23.447%
β_1	74.074%	40.779%	83.460%	71.575%	64.049%
VL daily	1.207%	1.3802	1.423%	1.405%	1.297%
VL annualized	19.077%	21.8229	22.492%	22.221%	20.511%

3.11. Sharpe ratio

The below table shows the Sharpe ratio for each of the affected indices 5 trading days after the terror attack. The Sharpe ratio is calculated by using the excess returns over standard deviation. The excess returns are given by the difference of index return and risk-free rate.

Table 40. Ranking 5-day Sharpe ratio

City	Index	Return	Risk free rate	Standard deviation	Sharpe ratio	Rank
New York	**DJIA**	- 14.618%	0.027%	6.414%	- 2.283	5
Madrid	**IBEX**	- 4.450%	0.027%	5.094%	- 0.879	4
London	**FTSE**	1.715%	0.065%	3.398%	0.486	1
Paris	**CAC40**	0.661%	-0.002%	2.968%	0.223	2
Nice	**CAC40**	- 1.170%	-0.005%	1.884%	- 0.618	3

The table shows that after the terror attacks in New York, the Sharpe ratio was the lowest. In the case of London and Paris, a positive Sharpe ratio was achieved.

The below table shows the Sharpe ratio calculated for the 15 trading days after the conduction of a terror attack. The Sharpe ratio puts the excess return (given by index return – risk free rate) into relation with the realized volatility.

Table 41. Ranking 15-day Sharpe ratio

City	Index	Return	Risk free rate	Standard deviation	Sharpe ratio	Rank
New York	**DJIA**	- 5.603%	0.102%	10.891%	- 0.524	4
Madrid	**IBEX**	- 3.104%	0.083%	6.036%	- 0.528	5
London	**FTSE**	0.458%	0.195%	4.188%	0.063	1
Paris	**CAC40**	- 0.696%	-0.006%	3.783%	- 0.183	2
Nice	**CAC40**	- 0.731%	-0.014%	3.072%	- 0.233	3

The Sharpe ratio calculated for 15 trading days after the terroristic incident shows similar results like the Sharpe ratio for 5 trading days. The lowest Shape ratios were denoted for the terror attacks of Madrid and New York, followed by the terror attack in Nice. The Sharpe ratio for Paris remained slightly negative, while for London in turned positive.

The below table compares the Sharpe ratios of both the conventional equity with the Islamic equity. The ratio was calculated for a time horizon of 5 trading days after the terror attack has happened.

Table 42. Comparison 5-day Sharpe ratio Western vs Islamic equity

Attack	**Western index**	**Tadawul**
11 September 2001	- 2.283	- 0.782
Madrid bombing	-0.879	0.268
London bombing	0.486	- 0.272
Paris attacks	0.223	- 0.203
Nice truck attack	- 0.618	- 1.243

The Sharpe ratio was worse for the Western index after the 9/11 terror attack and the Madrid bombing. For Paris and London, the Sharpe ratios of both indices were quite similar. However, after the Nice truck attack the Western index achieved a better result than the Tadawul.

The below table displays the Sharpe ratio of the Western index and the Tadawul. It has been calculated using a time horizon of 15 trading days after the conduction of the attack.

Table 43. Comparison 15-day Sharpe ratio Western vs Islamic equity

Attack	**Western index**	**Tadawul**
11 September 2001	- 0.524	- 1.123
Madrid bombing	- 0.528	2.889
London bombing	0.063	- 0.057
Paris attacks	- 0.183	0.547
Nice truck attack	-0.233	- 2.765

The results show that after the 9/11 terror attacks, the Madrid bombing as well as the Nice truck attack, the Sharpe ratio calculated for the Tadawul showed worse results than the Sharpe ratio of the Western index.

The below graph shows the Sharpe ratios of the Tadawul, calculated for a time horizon of 250 and 15 days prior to the attack as well as 5 and 15 days after attack. Since different time frames

were used for the calculation, the results are not comparable. However, an overview over the long-run development as well as the sentiment shortly before the attack is provided.

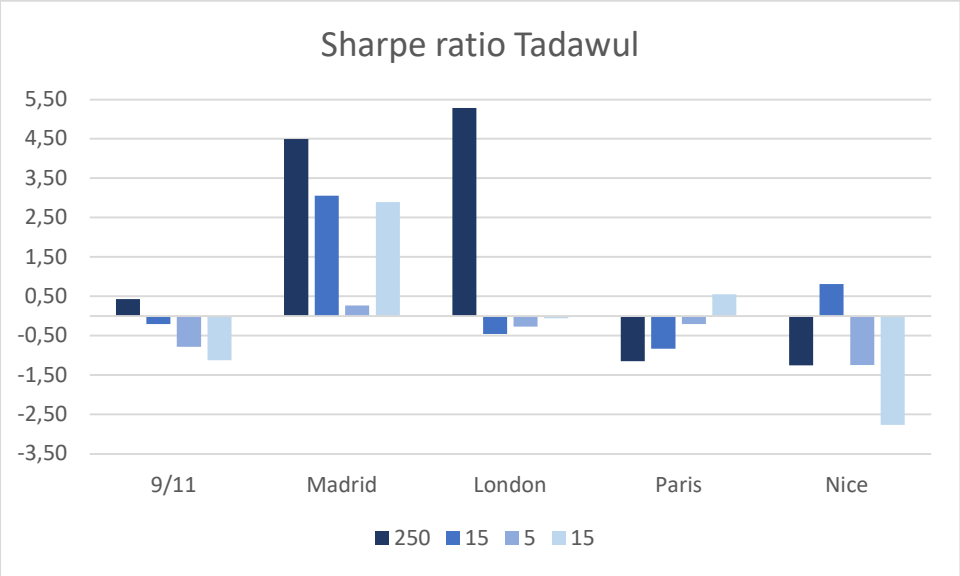

Illustration 33. Tadawul Sharpe ratio

From the graph it can be seen that for Madrid and London, the 250-day Sharpe ratio was extremely high. This is attributed to the extremely good performance of the Tadawul in both cases. Within the 250 trading days preceding the terror attack, the Tadawul has doubled in value for both cases.

3.12. Sortino ratio

The below table gives on overview over the Sortino ratio. While the Sharpe ratio measures the excess return over the standard deviation, the Sortino ratio uses the semi-deviation or target deviation.

Table 44. Ranking 5-day Sortino ratio

City	Index	Return	Risk free rate	Semi deviation	Sortino ratio	Rank
New York	**DJIA**	- 14.618%	0.027%	8.044%	- 1.821	5
Madrid	**IBEX**	- 4.450%	0.027%	3.346%	- 1.338	4
London	**FTSE**	1.715%	0.065%	2.066%	0.799	1
Paris	**CAC40**	0.661%	- 0.002%	2.190%	0.302	2
Nice	**CAC40**	- 1.170%	- 0.005%	2.376%	- 0.490	3

The ranking shows that after the terror attacks in New York, the worst Sortino ratio was achieved. This is followed by the Sortino ratio of 1.34 after the Madrid bombing in 2004. The stock market revealed positive Sortino ratios after the London bombing and Paris attacks.

The below table shows the Sortino ratios calculated for 15 trading days after the respective terror attack.

Table 45. Ranking 15-day Sortino ratio

City	Index	Return	Risk free rate	Semi deviation	Sortino ratio	Rank
New York	**DJIA**	- 5.603%	0.102%	8.044%	- 0.709	4
Madrid	**IBEX**	- 3.104%	0.083%	3.597%	- 0.886	5
London	**FTSE**	0.458%	0.195%	3.140%	0.084	1
Paris	**CAC40**	- 0.696%	- 0.006%	3.215%	- 0.215	2
Nice	**CAC40**	- 0.731%	- 0.014%	3.040%	- 0.236	3

The Sortino ratios 15 trading days after the terror attack indicate, that after the 9/11 terror attacks the market has recovered faster from the market shock than after the Madrid bombing. The Sortino ratio achieved was worse in the case of the Madrid bombing. However, both Sortino ratios were negative as well as the Sortino ratios calculated for 15 trading days after the Paris and Nice terror attacks.

The below graph shows a comparison of the Sortino ratios for different time frames as well as different terror attacks.

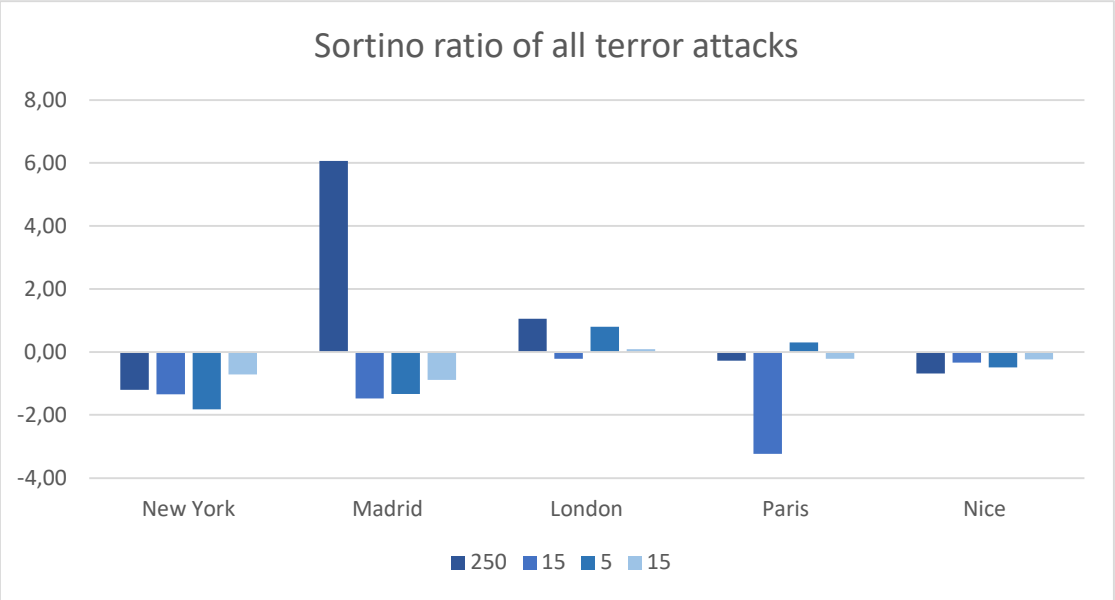

Illustration 34. Sortino ratios of all terror attacks

The high Sortino ratio of the IBEX can be attributed to the outstanding performance of the equity index in 2004. It achieved a total return of about 62% at a volatility of about 16%. The highly negative Sortino ratio 15 trading days before the Paris attacks can be attributed to the Brexit referendum of 23 June 2016 which caused a market correction.

The table underneath shows the comparison for the Sortino ratios calculated based on the data for 5 trading days after the terroristic activity.

Table 46. Comparison 5-day Sortino ratio Western vs Islamic equity

Attack	**Western index**	**Tadawul**
11 September 2001	- 1.821	- 1.229
Madrid bombing	- 1.338	0.396
London bombing	0.799	- 0.628
Paris attacks	0.302	- 0.276
Nice truck attack	- 0.490	- 2.128

The results indicated that the impact on the Tadawul with regards to the Sortino ratio was not as high in the case of the 11 September 2001 and Madrid terror attacks. For the other cases, the Islamic equity showed more severe reaction than the Western equity.

The below table shows a comparison of the Sortino ratios calculated for the time horizon of 15 trading days after the terror attack.

Table 47. Comparison 5-day Sortino ratio Western vs Islamic equity

Attack	Western index	Tadawul
11 September 2001	- 0.709	- 1.552
Madrid bombing	- 0.886	4.788
London bombing	0.084	- 0.090
Paris attacks	- 0.215	0.638
Nice truck attack	- 0.236	- 4.015

The results indicated that the impact was more severe on the Islamic equity in the cases of the 9/11 terror attack as well as the Nice truck attack. In 2004, when the Madrid bombing happened the Tadawul hat an outstanding year, achieving a total return for the trading year of 2004 of more than 100%. This is reflected by the high Sharpe ratio. The below table shows the parameters and values assigned in order to calculate the Sortino ratios.

Table 48. Sortino ratio Tadawul (9/11)

11 September 2001 - Tadawul					
Number of days	**Before/after**	**Tadawul total returns**	**Risk free rate**	**Semi deviation**	**Sortino ratio**
250	Before	7.322%	3.626%	6.173%	0.599
15	Before	- 0.323%	0.146%	1.682%	- 0.279
5	After	- 5.934%	0.049%	4.869%	- 1.229
15	After	- 9.422%	0.133%	6.157%	- 1.552

The overall return of the Tadawul can be regarded as low throughout 2001, trading also at low volatility. However, for the full year a slightly positive Sortino ratio was achieved.

Table 49. Sortino ratio Tadawul (Madrid bombing)

Madrid bombing - Tadawul					
Number of days	**Before/after**	**Tadawul total returns**	**Risk free rate**	**Semi deviation**	**Sortino ratio**
250	**Before**	92.539%	1.142%	15.008%	6.090
15	**Before**	5.343%	0.055%	1.253%	4.221
5	**After**	0.091%	0.017%	0.186%	0.396

15	**After**	5.537%	0.049%	1.146%	4.788

In 2001 the Tadawul achieved an outstanding Sortino ratio of about 6.0, which can be attributed to the overall index performance of almost 100%. The Tadawul did not show any significant reaction in the immediate aftermath of the terror attack.

Table 50. Sortino ratio Tadawul (London bombing)

London bombing - Tadawul					
Number of days	**Before/after**	**Tadawul total returns**	**Risk free rate**	**Semi deviation**	**Sortino ratio**
250	**Before**	113.872%	1.752%	15.065%	7.442
15	**Before**	- 3.080%	0.146%	5.017%	- 0.643
5	**After**	- 1.531%	0.050%	2.518%	- 0.628
15	**After**	- 0.399%	0.152%	6.154%	- 0.090

Also, in 2005, the Tadawul has achieved an outstanding Sortnio ratio for the full year. The index gained more than 100% throughout the 250 trading days preceding the terror attack, with a semi deviation of about 15%. The Islamic equity showed a slightly negative Sharpe ratio during the 15 trading days before as well as the 5 and 15 trading days after the terror attack in London.

Table 51. Sortino ratio Tadawul (Paris attacks)

Paris attacks - Tadawul					
Number of days	**Before/after**	**Tadawul total returns**	**Risk free rate**	**Semi deviation**	**Sortino ratio**
250	**Before**	- 29.963%	0.399%	19.351%	- 1.569
15	**Before**	- 4.205%	0.029%	3.571%	- 1.186
5	**After**	- 0.761%	0.011%	2.798%	- 0.276
15	**After**	2.467%	0.033%	3.813%	0.638

The overall performance of the Tadawul throughout the 250 trading days preceding the terror attacks of Paris was negative. The index was down about 30%, trading at elevated semi-volatility of about 20%. This is reflected in the negative Sharpe ratios which can be observed throughout all calculate periods.

Table 52. Sortino ratio Tadawul (Nice attack)

Nice attacks - Tadawul					
Number of days	**Before/After**	**Tadawul total returns**	**Risk free rate**	**Semi deviation**	**Sortino ratio**
250	**Before**	- 30.323%	0.836%	18.741%	- 1.663
15	**Before**	1.792%	0.083%	1.486%	1.150
5	**After**	- 0.908%	0.028%	0.440%	- 2.128
15	**After**	- 6.271%	0.083%	1.583%	- 4.015

The overall negative performance of the Islamic equity is also reflected in the negative Sortino ratios. However, the Tadawul showed strongly negative Sortino ratios in the 5 trading days succeeding the Nice terror attacks.

The graph below shows the overall development and calculations for the Sortino ratios of the Tadawul.

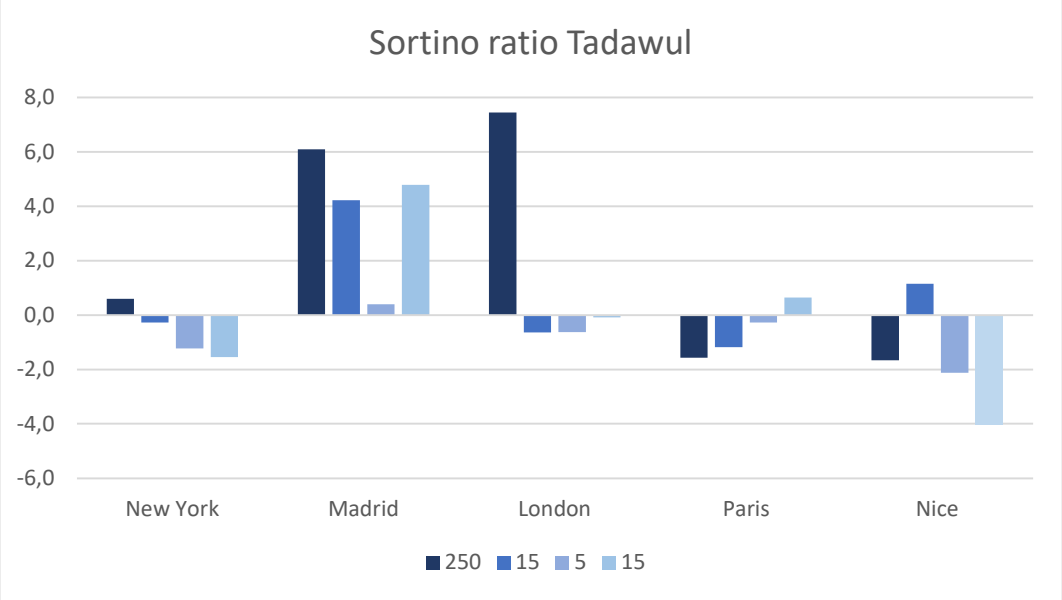

Illustration 35. Tadawul Sortino ratio

As already noted afore, the highly positive Sortino ratios for the 250 trading days before the Madrid and London bombing can be attributed to overall outstanding performance of the Tadawul. In both cases about 100% performance have been achieved.

3.13. Information ratio

The below table shows the Information ratios calculated for 5 trading days after the conduction of a terror attack. Consequently, they are ranked from 1-5 with 1 being the lowest impact and 5 being the most severe impact.

Table 53. Ranking 5-day Information ratio

City	Index	Tracking error	Index returns	MSCI return	Innformation ratio	Rank
New York	**DJIA**	3.563%	- 14.618%	- 2.839%	- 3.306	5
Madrid	**IBEX**	1.711%	- 4.450%	- 0.549%	- 2.280	3
London	**FTSE**	1.616%	1.715%	-0.727%	1.511	1
Paris	**CAC40**	1.369%	0.661%	1.723%	- 0.777	2
Nice	**CAC40**	1.220%	- 1.170%	2.292%	-2.837	4

The table shows that after the 9/11 terror attacks, the DJIA plunged about 15% in the consecutive 5 trading days, while the global equity measured by the MSCI World only dropped about 3%. The tracking error was rather low, and the Information ratio is the worst among the five analyzed terror attacks. Hence, the rank 5 is assigned.

The table below denotes the Information ratios calculated for 15 trading days after a terroristic activity. The 5 terror attacks are consequently ranked, according to the severity of the impact.

Table 54. Ranking 15-day Information ratio

City	Index	Tracking error	Index returns	MSCI return	Innformation ratio	Rank
New York	**DJIA**	3.029%	- 5.603%	- 12.075%	2.136	1
Madrid	**IBEX**	1.030%	- 3.104%	0.331%	- 3.335	4
London	**FTSE**	1.139%	0.458%	1.565%	-0.972	2
Paris	**CAC40**	0.983%	- 0.696%	2.416%	- 3.167	3
Nice	**CAC40**	0.982%	- 0.731%	3.562%	- 4.370	5

The results show that 15 trading days after the Nice terror attack, the index returns of the CAC40 remained at around -0.75% while the MSCI World has already recovered, trading at 3.5%. In the 15 trading days after the 9/11 terror attacks, the DJIA has already recovered from its low,

trading at around -5.6% while the rest of the world (measured by the MSCI) still traded around 12% down. The deviation paired with a low tracking error results in a high Information ratio.

The below chart shows the Information ratios calculated for 250 and 15 trading days before the terror attack as well as 5 and 15 trading days after.

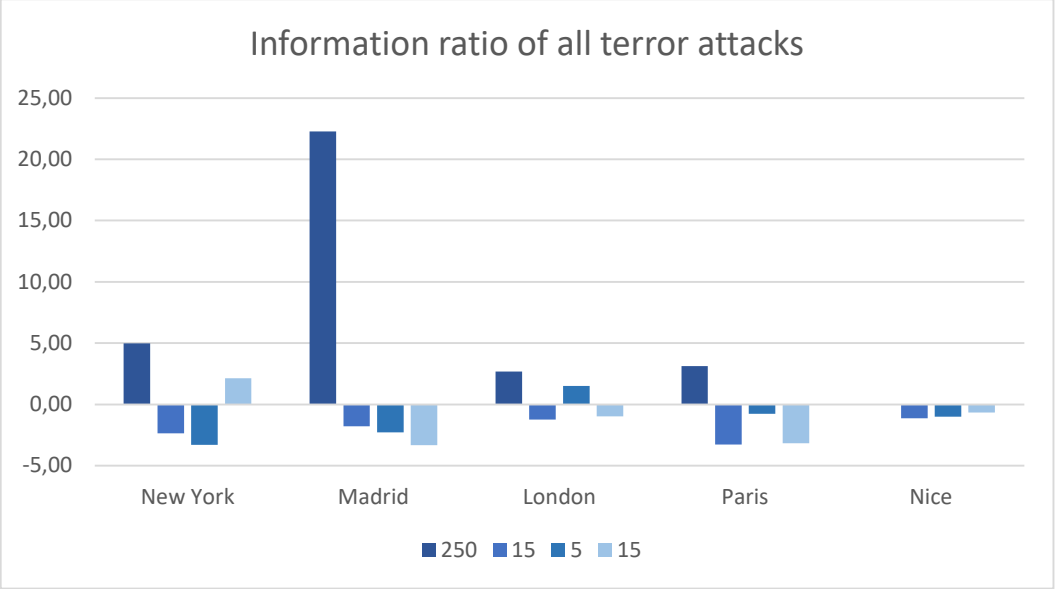

Illustration 36. Information ratios of all terror attacks

The outstandingly high Information ratio of the 250 trading days preceding the Madrid bombing in 2004 can be attributed to the overall performance of the IBEX. During the afore noted period the IBEX had a total return of around 62% while the MSCI World return was at around 44%. With a tracking error of less than 1%, the Information ratio soared to around 22.

The below chart shows the Information ratio of the 9/11 terror attacks, calculated for various time horizons.

Table 55. Comparison 5-day Information ratio Western vs Islamic equity (9/11)

Information Ratio – Tadawul 9/11					
Number of days	**Before/after**	**Tracking error**	**Tadawul total returns**	**MSCI return**	**Information ratio**
250	Before	1.138%	7.322%	- 32.797%	35.249
15	Before	1.221%	- 0.323%	- 7.235%	5.659

5	After	2.567%	- 5.934%	- 3.905%	- 0.790
15	After	1.660%	- 9.422%	- 10.606%	0.713

While the MSCI lost about one third of its value in the 250 trading days preceding the 9/11 terror attacks, the Tadawul rose by 7%. With a tracking error of about 1.1%, the Information ratio surged to about 35. After the 9/11 terror attacks, the Tadawul fell almost 6% ain the succeeding 5 trading days, while the global equity fell only around 4%. The following table shows the Information ratios calculated for time horizons before and after the Madrid bombings of 2004.

Table 56. Comparison 5-day Information ratio Western vs Islamic equity (Madrid bombing)

Information Ratio – Tadawul Madrid					
Number of days	**Before/after**	**Tracking error**	**Tadawul total returns**	**MSCI return**	**Information ratio**
250	Before	1.423%	92.539%	42.020%	35.504
15	Before	1.066%	5.343%	- 2.733%	7.579
5	After	0.947%	0.091%	0.177%	- 0.091
15	After	1.033%	5.537%	2.963%	2.490

The overall outstanding Information ratio of the Tadawul in the preceding 250 trading days of the Madrid bombing can be attributed to the total return of the Tadawul. While the Islamic equity surged about 100% in value, the global equity rose only by about 40%.

The following table shows the Information ratio of the Tadawul preceding and succeeding the London bombing.

Table 57. Comparison 5-day Information ratio Western vs Islamic equity (London bombing)

Information Ratio – Tadawul London					
Number of days	**Before/after**	**Tracking error**	**Tadawul total returns**	**MSCI return**	**Information ratio**
250	Before	1.389%	113.872%	11.029%	74.0335
15	Before	1.891%	- 3.080%	2.047%	- 2.7120

5	After	2.132%	- 1.531%	- 0.889%	- 0.3012
15	After	2.255%	- 0.399%	0.793%	- 0.5286

The Tadawul outperformed the MSCI total return tremendously, yielding a yearly performance of around 113%. The MSCI also rose during the same time horizon (250 trading days preceding the terror attack of London) however, only by 11%. The following table shows the Information ratios calculated before and after the Paris attacks in 2015.

Table 58. Comparison 5-day Information ratio Western vs Islamic equity (Paris attacks)

Information Ratio – Tadawul Paris					
Number of days	**Before/after**	**Tracking error**	**Tadawul total returns**	**MSCI return**	**Information ratio**
250	Before	1.587%	- 29.963%	0.564%	- 19.231
15	Before	1.454%	- 4.205%	- 1.082%	- 2.148
5	After	1.166%	- 0.761%	1.723%	- 2.131
15	After	0.935%	2.467%	0.372%	2.241

The overall weak Information ratio of the Tadawul can be justified by its poor performance throughout the 250 trading days preceding the Paris attacks. During that time horizon, the Islamic equity index lost about 30%. After the conduction of the attacks, the Tadawul fell while the global equity rose by around 1.7%. The below chart shows the Information ratios 250 and 15 trading days before the Nice truck attack, as well as 5 and 15 trading days after.

Table 59. Comparison 5-day Information ratio Western vs Islamic equity (Nice attack)

Information Ratio – Tadawul Nice					
Number of days	**Before/after**	**Tracking error**	**Tadawul total returns**	**MSCI return**	**Information ratio**
250	Before	1.423%	- 30.323%	- 0.069%	- 21.263
15	Before	1.529%	1.792%	4.947%	- 2.064
5	After	0.487%	- 0.908%	0.126%	- 2.125
15	After	0.814%	- 6.271%	0.254%	- 8.018

The table shows that the Tadawul has lost about 30% within 250 trading days before the Nice truck attack. During the same period, the MSCI world remained almost unchanged and hence, the Information ratio reflects the overall poor performance of the Islamic equity. After the Nice truck attack, the Tadawul fell from about -1% 5 trading days after the attack to around -6% 15 trading days after the attack. In the same time frame, the global equity index remained unchanged.

The below graphs show a comparison between the Information ratios calculated for the Western indices vs. the Islamic equity. The calculations have been performed for each of the 5 terror attacks and for all 4 afore noted time periods.

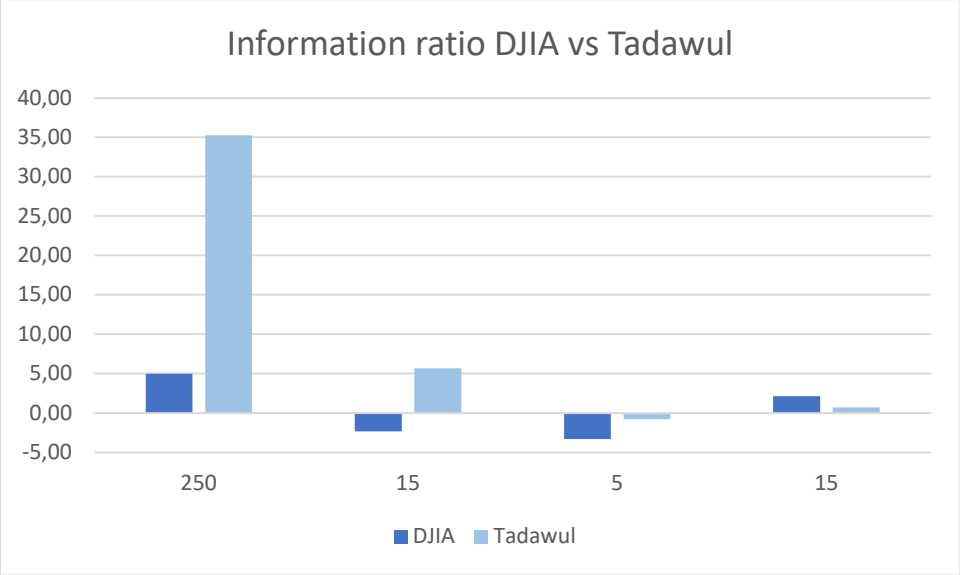

Illustration 37. Information ratio DJIA vs Islamic equity (9/11)

As it can be seen from the graph above, the DJIA Information ratio has performed worse than the Information ratio calculated for the Islamic equity except for the 15 trading days after the terror attack. The below chart shows the comparison between the IBEX and the Tadawul Information ratios.

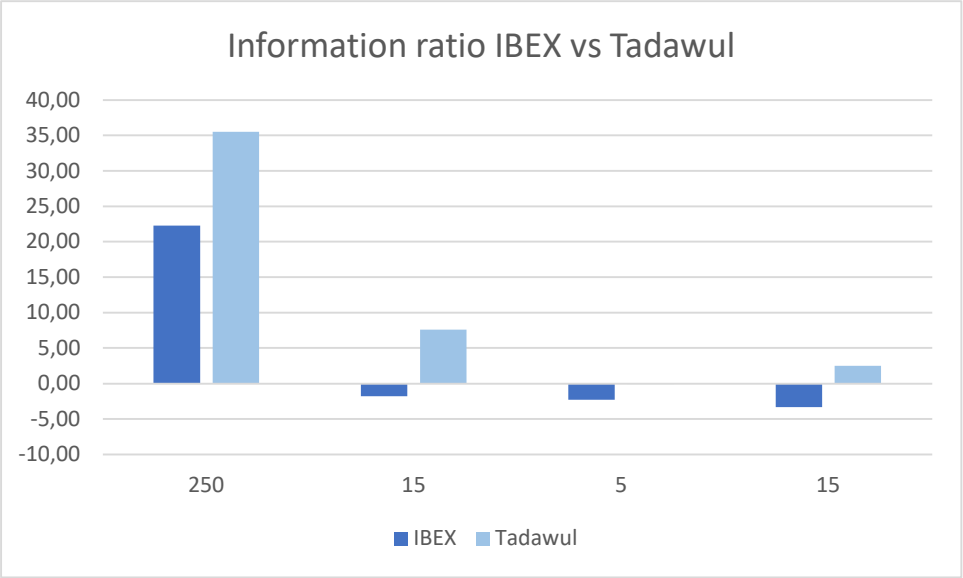

Illustration 38. Information ratio IBEX vs Islamic equity (Madrid bombing)

The Information ratios shows that the Tadawul has performed better than the IBEX for all time frames calculated. This can be attributed to the overall high performance of the Islamic equity within the time frames measured. The below chart compares the Information ratios of the FTSE and the Tadawul.

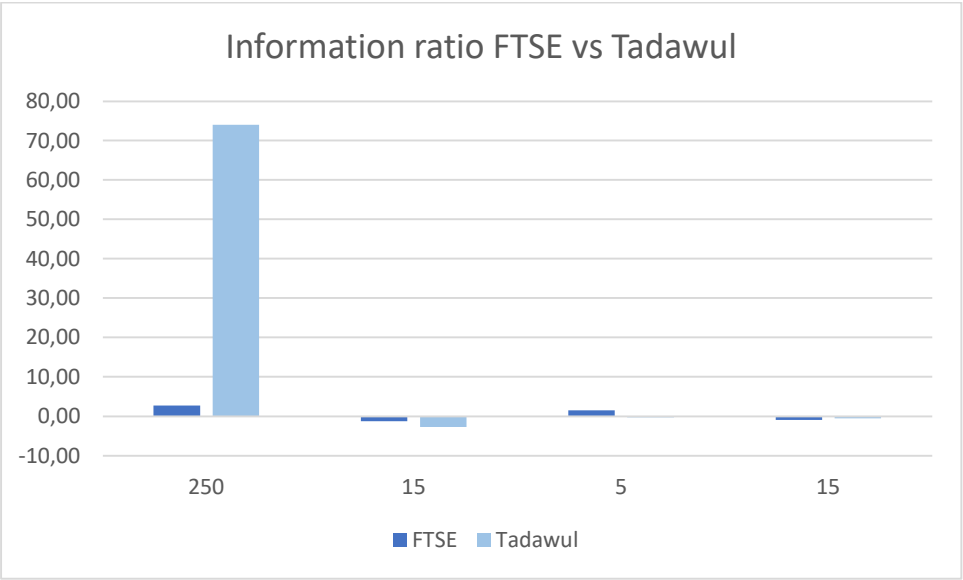

Illustration 39. Information ratio FTSE vs Islamic equity (London bombing)

The Islamic equity had an outstanding trading year 250 trading days before the London bombings, achieving a total return of more than 100%. This return is reflected by the high Information ratio. The below chart shows the Information ratios of both the CAC40 and the Tadawul before the Paris attacks in 2015.

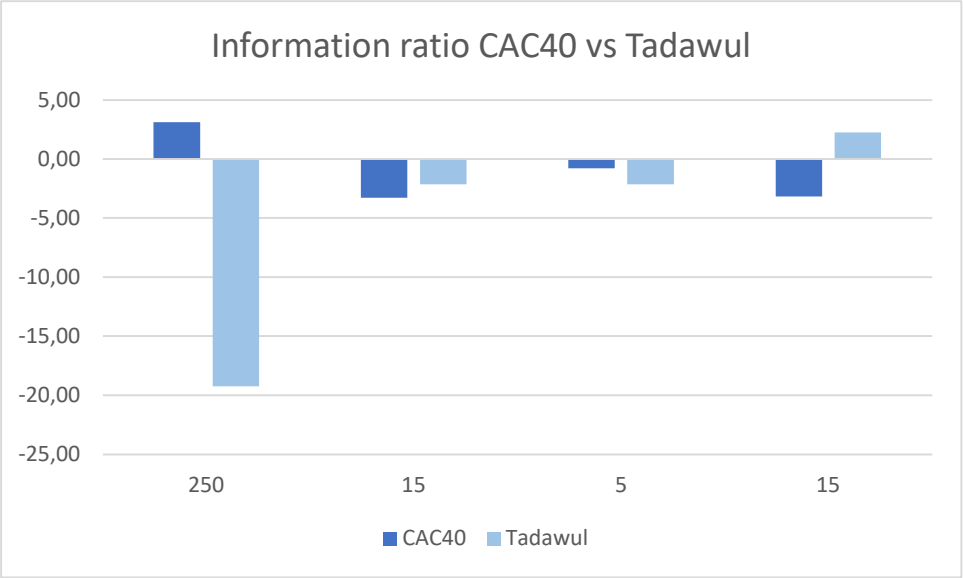

Illustration 40. Information ratio CAC40 vs Islamic equity (Paris attacks)

While the CAC40 showed positive Information ratio for the 250 trading days before the Paris attacks, the Tadawul's Information ratio was clearly negative. 15 trading days after the terror attacks, the CAC40 revealed a negative Information ratio, while the Tadawul outperformed. The below chart compares the Information ratio of the CAC40 with the Tadawul before and after the Nice truck attack in 2016.

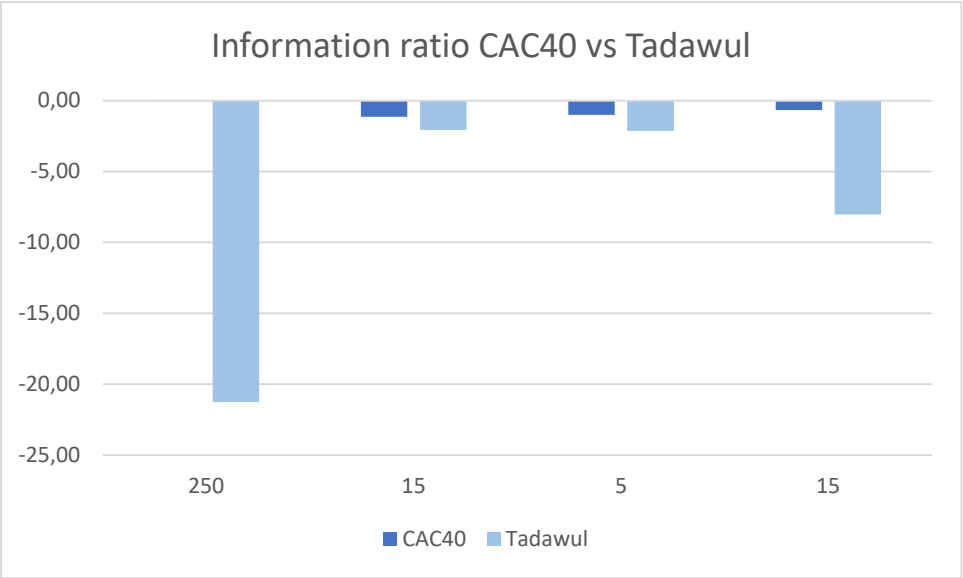

Illustration 41. Information ratio CAC40 vs Islamic equity (Nice attack)

The chart shows that the Information ratios remained negative for both indices throughout the analyzed periods. However, the Tadawul clearly underperformed the CAC40 for all time horizons observed, which results in low Information ratios.

The below table shows the scores assigned to each terror attack for the criteria listed in the results section.

Table 60. Overall results Western equity

Criteria	11 September 2001	Madrid bombing	London bombing	Paris attacks	Nice truck attack
Number of fatalities	5	4	1	3	2
Number of people injured	5	4	3	1	2
Average return (5 days)	5	4	2	1	3
Average return (15 days)	5	4	1	2	3
Cumulative return (5 days)	5	4	1	2	3
Cumulative return (15 days)	5	4	1	2	3
Cumulative abnormal return (5 days)	5	4	1	2	3
Cumulative abnormal return (15 days)	4	5	1	2	3
Maximum drawdown	5	3	1	2	4
Time to recovery of index	5	4	2	1	3
Time to normalization of returns	5	4	4	4	3
Standard deviation (5 days)	5	4	3	2	1
Standard deviation (15 days)	5	4	3	2	1
Semi deviation (5 days)	5	4	1	2	3
Semi deviation (15 days)	5	4	2	3	1
Abnormal volatility	5	3	4	2	1
Sharpe ratio (5 days)	5	4	1	2	3
Sharpe ratio (15 days)	4	5	1	2	3

Sortino ratio (5 days)	5	4	1	2	3
Sortino ratio (15 days)	4	5	1	2	3
Information ratio (5 days)	5	3	1	2	4
Information ratio (15 days)	1	4	2	3	5
Total score	**103**	**88**	**38**	**46**	**60**

The below table shows the comparison of the impact between the Western and the Islamic equity in the aftermath of terror attacks. The tables are grouped according to each of the five terroristic incidents.

Table 61. Total scores Western vs Islamic equity

Criteria	11 September		Madrid bombing		London bombing		Paris attacks		Nice truck attack	
	Western	Islamic	Western	Islamic	Western	Islamic	Western	Islamic	Western	Islamic
Average return (5 days)	1	0	1	0	0	1	0	1	1	0
Average return (15 days)	0	1	1	0	0	1	1	0	0	1
Cumulative return (5 days)	1	0	1	0	0	1	0	1	1	0
Cumulative return (15 days)	0	1	1	0	0	1	1	0	0	1
Cumulative abnormal return (5 days)	1	0	1	0	0	1	0	1	1	0
Cumulative abnormal return (15 days)	0	1	1	0	0	1	1	0	0	1
Maximum drawdown	1	0	1	0	0	1	0	1	0	1
Time to recovery of index	0	1	1	0	0	1	0	1	1	0

Time to normalization of returns	0	1	1	0	0	1	1	0	1	1
Standard deviation (5 days)	0	1	1	0	0	1	0	1	1	0
Standard deviation (15 days)	1	0	1	0	0	1	0	1	1	0
Semi deviation (5 days)	1	0	1	0	0	1	0	1	1	0
Semi deviation (15 days)	1	0	1	0	0	1	1	0	1	0
Abnormal volatility	0	1	1	0	0	1	1	0	1	0
Sharpe ratio (5 days)	1	0	1	0	0	1	0	1	0	1
Sharpe ratio (15 days)	0	1	1	0	0	1	1	0	0	1
Sortino ratio (5 days)	1	0	1	0	0	1	0	1	0	1
Sortino ratio (15 days)	0	1	1	0	0	1	1	0	0	1
Information ratio (5 days)	1	0	1	0	0	1	1	0	0	1
Information ratio (15 days)	0	1	1	0	1	0	0	1	0	1
Total score	**10**	**10**	**20**	**0**	**1**	**19**	**9**	**11**	**10**	**11**

The total score shows that the impact of the 9/11 terror attacks has hit both the Islamic equity and the Western index alike. Both have achieved a total point score of 10. It should be denoted, that for the impact after 5 trading days, the DJIA showed a more severe impact than the Tadawul for most of the criteria. However, when comparing the Tadawul with DJIA after 15 trading days after the terror attack, the DJIA has already started to recover, while the impact on the Islamic equity appeared to be persistent for a longer time period.

Additionally, the results show that the Tadawul did not react to the Madrid bombing at all. Neither returns nor standard deviation have reacted to the bombings. The market sentiment and performance remained unchanged before and after the terror attack, while trading at low volatility.

The Tadawul has reacted more sensitive to the London bombings than the FTSE. However, both indices did not show tremendous reaction in the aftermath of the attacks. Overall, the impact was less severe than compared to the Madrid bombings and the 11 September 2001 terror attacks.

Based on the total score, the overall impact of the Paris attacks on the equity attacks were similar. The CAC40 achieved a total score of 9, while the Tadawul achieved a score of 11. With regards to the short-term impact (5 trading days) the Tadawul showed enhanced sensitivity compared to the Western index. However, for the 15 trading day time horizon the impact appears to be more persistent for the CAC40.

The results for the Nice truck attack show that the impact on both equity indices was similar. While the CAC40 achieved a total score of 10, the Tadawul achieved a total score of 11. The results indicate that the impact on the return were more severe for the Islamic equity, while the volatility of the Western index reacted more sensitive.

4. Discussion

This work investigates the impact of Islamist terror attacks on global equity markets using five selected terroristic incidents. The main goal of the dissertation is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity the focus of the analysis will measure the return and volatility impact of the chosen terror attacks.

In order to assess the aforenoted, two research questions have been formulated. The first research question evaluates whether the overall impact of terror attacks decreases throughout time. The second research question evaluates whether the impact of terror attacks on Islamic equity indices are as hard as on Western indices.

In order to explore the relationship between the changes in investor sentiment following terroristic incidents, a multiple-criteria decision analysis is employed. The results are achieved by using 22 different risk and performance ratios in addition to qualitative criteria. An amplified number of criteria is introducing aiming to measure specifically the impact on return and volatility and its short-term (5 to 15 days) and long-term (from 2001 until 2016) change. Additionally, the enhanced number of criteria intentions to avoid an estimate bias triggered by a narrow focus on only a limited number of parameters and benchmarks.

In order to identify the terroristic incidents which have happened all across the globe The Global Terrorism Database (GTD) has been used. It is the most comprehensive database for terrorist attacks and terroristic activities in the world. The GTD comprises terroristic events from 1970 until now and the database includes more than 190,000 events. By using the extensive collection of the GTD, five terror attacks were chosen. The criteria for the choice of the terror attacks include that the motive for the conduction is Islamist-inspired, the target of the terror attack has to ben European or American soil and the combined number of people dead and injured has to exceed 500. The five terroristic events corresponding to the criteria are the 11 September 2001, the Madrid bombing of 2004, the London bombing of 2005, the Paris attacks of 2015 as well as the Nice truck attack of 2016.

As already noted afore, in order to determine the impact of a terror attack on equity markets holistically, various measurements and calculations are introduced. The underlying data for the

calculations comprises a time frame of 250 trading days before the terror attack until 15 trading days after the terror attack for all 5 attacks and all indices and rates included. The data needed in order to conduct a holistic analysis include the daily end of day prices of the following equity. The indices used are the DJIA for the US, the IBEX for Spain, the FTSE100 for the UK and the CAC40 for France. With regards to the risk-free rate, the effective fed funds rate has been used as a proxy for the US, the EONIA for Spain and France and the LIBOR for the UK. The risk-free rate has been in accordance with the investment horizon, which is considered to be one day. The MSCI World Index has been chosen as a reference index against which the afore noted country equity indices are compared. It can be regarded as the representation of global equity as it includes 1,600 stock across 23 industrialized nations. In order to obtain a proxy for the reaction of equity to Islamic-inspired terror attacks the Saudi Arabian equity index (Tadawul) has been chosen. This choice can be justified as Saudi Arabia shows the strongest economic performance in terms of GDP in the GCC region as of 2018. As of 2018 Statistics of the International Monetary Fund show that Saudi Arabia had a GDP of approximately 800,000 million USD and a GDP per capita of 24,000 USD (IMF, 2020). While the data needed for the calculations was highly available for the Western world, this was not the case for Saudi Arabia. The overnight rates, which are considered as a proxy for the risk-free rate for the US, Europe and UK were accessible. However, for the Saudi Arabian market the overnight tenor was not available before November 2016. The Saudi Arabian Interbank Offered Rate (SAIBOR) can be regarded as a daily reference rate, which is issued by the Saudi Arabian Monetary Authority based on the average interest rate Saudi banks offer to lend unsecured funds to one another. The shortest tenor available in the Saudi market posed the 1-month interbank offered rate. Hence, it has been chosen as a proxy for the risk-free rate.

The afore noted data has consequently been used in order to calculate various risk- and return measures. Various measures, ratios and time horizons are introduced in order to conduct the analysis. By focusing on only one single measurement and time frame the results would be biased. The aim of this study is to provide an objective and universal assessment of the impact of Islamic terror attacks on equity indices and hence it aims to overcome the afore mentioned estimation bias. The time frames considered for the calculations of the ratios are 250 trading days before the attack, 15 trading days before the attack, 5 trading days after the attack as well as 15 trading days after the attack. The time horizon of 250 trading days before the terror attack has been chosen in order to ensure the statistical robustness of the results. In order to achieve meaningful statistical results, the sample size needs to be sufficiently high. As previous studies

have shown that the impact of terror attacks on equity markets I only short-lasting, shorter time spans preceding and succeeding the terror event have been included. The calculations for the 15 trading days' time frame before the terror attack allows to judge, whether the figures under investigation have already shown abnormal behavior from the long run (250 days) shortly before the conduction of the terror attack. Additionally, the 15 days before the attack were chosen in order to determine whether enhanced volatility has already prevailed before the conduction of the attack. The 5 days' time span succeeding the terror attack allows to judge the immediate impact of the terror attack on the respective index, while the 15 days allow to assess if and how fast an equity index has recovered from the attack or if the impact of the terror attack prevails for a longer time horizon and at which intensity.

After the estimation of the parameters and their consecutive calculation, a scoring system is derived. The obtained results for each of the five terror attacks are compared against one another and ranked according to the severity of the impact on the respective equity market. The highest impact is assigned with rank number 5, while the lowest impact is assigned rank number 1. The scores are summed up in order to allow for the assessment of the total impact.
For the comparison between conventional and Islamic equity, the scores of either 1 or 0 are assigned, depending on which equity index showed the higher impact. 1 is assigned to the index with the higher effect.

The first criteria under investigation was the number of fatalities. In the 9/11 terror attacks the highest number of people died, while in London the least number of people died. The second criteria under investigation was the number of people injured. Also, for this criterion the 9/11 terror attacks showed the highest number of people injured, followed by the Madrid bombing. The least number of people were injured during the Paris attacks.

The consecutive criteria were the average return for both 5 days and 15 days after the attack. For both of the afore noted the 11 September 2001 terror attacks showed the worst average return. With regards to the comparison between Islamic and conventional equity, the results show that based on the average return, both the Western and the Islamic equity showed the same impact. However, it is worth mentioning that the impact of the market shock on the Islamic equity was mostly only seen after a longer time horizon than on the Western equity market. This indicates an overall lower market efficiency of the Islamic equity.

Subsequently, the cumulative returns for both 5 days and 15 days after the terroristic incident have been calculated and compared. A similar picture as with the average returns is observable, for both time horizons the 9/11 terror attacks showed the most severe impact, followed by the Madrid bombing. Ranked third with regards to this criterion is the Nice truck attack. When comparing Western equity against Islamic equity the results indicate that the overall impact was quite similar across all terror attacks.

The following criteria under investigation poses the abnormal return due to exogenous shocks, which is determined by employing an event study. Typically, the event study is used to determine the abnormal returns (AR) of an individual company's stock price with regards to the stock market index. As within this study the reaction of the entire stock market is assessed, an equity index comprising a sample of the entire world's equity is used. By using the MSCI world as a proxy for the global stock market performance, the expected return of a specific countries' equity index is modeled. The implementation was done by setting up a linear regression in order to determine the expected returns of the respective countries' equity index. Consequently, the cumulative abnormal return is calculated, and the ranks are assigned. The results show that after the 9/11 attacks the worst cumulative abnormal return was observable for the 5-day time horizon while for the 15-day time-horizon the Madrid bombing showed worse results. When comparing the Islamic equity against Western equity it is visible, that for four out of five terror attacks assessed the Islamic equity has incurred a higher MDD in the aftermath.

Successively, the maximum drawdown is the next criterion to be assessed. The maximum cumulative loss measured from a high to a consequent low is commonly denoted as the maximum drawdown (MDD). It measures the worst loss (largest drawdown) of a financial market within a pre-specified time interval. It also captures the worst possible market timing and the maximum occurring loss resulting from the bad market timing. The lowest MDD was realized after the London bombing. What is worth noting is that the Nice truck attack showed an extremely high maximum drawdown. Nonetheless, the highest MDD was realized after the 11 September 2001 terror attacks.

The consequent criterion under investigation was the time to recovery of the index. For this criterion, again, the 9/11 terror attacks showed the longest time to recovery. The shortest time to recovery was needed after the Paris attacks. Except for the 9/11 terror attacks it took the

Islamic equity after all terror attacks longer than the Western equity to recover from the market shock.

A related criterion to the afore noted poses the time to normalization of returns. The normalization of returns is defined as the number of days until the abnormal returns do not show any statistical significance for 3 consecutive days. While the New York terror attacks again scored the highest, it is worth noting that the time to recovery was the same for the Madrid and London bombing as well as the Paris attacks. Both the Islamic and Western equity showed even reactions after a terror attack in terms of normalization of returns.

The standard deviation for 5 days and 15 days after the terror attack poses the consequent criteria. For both times under investigation the highest effect was noticeable in the 9/11 terror attacks, followed by the Madrid bombing. Ranked third was the London bombing. The Islamic equity and the Western equity showed similar reactions in terms of standard deviation of returns.

Investors associate risk with outcomes, which fail to meet their respective expectation. An investor's risk is not associated with large positive returns. The (target) downside deviation can be defined as root-mean-square of the deviations of the realized returns underperformance from a pre-defined target return. All returns exceeding the target return are considered to be 0. The afore noted justifies the introduction of the downside deviation for 5 days and 15 days as the next criteria. The downside deviation denotes the deviance of the returns of the respective countries' equity index from the global equity index MSCI world. Again, after 9/11 the downside deviation was the most inflated, followed by the Madrid bombing. The results show that the impact on Western equity was higher than on Islamic equity measured by downside deviation.

Another important factor when assessing the impact of an event on the equity market poses the impact on volatility. Hence the next criteria under investigation assesses the abnormal volatility of the equity indices. A GARCH (1,1) is employed and consecutively, a volatility forecast is derived in order to assess the event impact. The GARCH model was chosen as it is able to capture the volatility clustering effect, which is extremely visible in times of market turmoil's following market shocks. The predicted volatility of the GARCH (1,1) is consequently compared against the realized volatility of the equity index on a daily basis. In terms of

volatility, the New York attacks had the biggest impact on the equity market. The second-biggest impact in terms of volatility was observable in the aftermath of the London bombing. The least volatility was realized after the Nice truck attack. Upon the comparison between Islamic and Western equity the results show that the terror attack has triggered higher volatility in the Islamic equity markets than in the Western equity markets.

Risk adjusted performance measures (RAPM) set the expected reward into relation with a risk measure. Within this study, the RAPMs are used for setting the realized return into relation with the realized volatility, both before and after the terror attack. This is done in order to provide a holistic overview over the impact.

The first risk adjusted performance measure and the next criterion on the list poses the Sharpe ratio, which was again assessed by using the 5-day and 15-day time horizon after the terror attack. The Sharpe ratio was first introduced by Sharpe in 1966 in order to compare the performance of various mutual funds. The Sharpe ratio denotes the risk premium over the standard deviation, i.e. the difference between the realized return and the return of the risk-free asset over the standard deviation. 15 days after the terror attack, the Madrid bombing showed the lowest Sharpe ratio, while 5 days after the terroristic incident, the 9/11 terror attacks showed the lowest Sharpe ratio. The Islamic equity showed slightly worse Sharpe ratios than the conventional equity when comparing for both time spans.

The Sortino ratio was introduced in the 1980s and was supposed to provide a better choice when measuring and comparing different performances within different skews of return distribution. The Sortino ratio can be expressed as the risk premium over downside deviation. The results obtained are similar to the ones of the Sharpe ratio, with the Madrid bombing showing the lowest Sortino ratio 15 days after the attacks, while New York scored the lowed Sortino ratio for the 5-day time horizon. The best Sortino ratios were achieved after the London bombing. When comparing Western against Islamic equity, the impact on both equity indices are very similar and no striking differences in reaction or obtained results can be denoted.

The last criterion under analysis was the information ratio, which is often referred to as a more generalized version of the Sharpe ratio. The information ratio provides similar content like the Sharpe ratio, with the main difference being that the information ratio compares the portfolio or index return against a benchmark, while the Sharpe ratio compares the portfolio or index

return against the risk-free rate. The information ratio is therefore beneficial for measuring the relative returns of a portfolio. The information ratio is given by the difference between the portfolio and benchmark return, divided by the tracking error. Within the assessment of terror attacks, the tracking error is used in order to determine if and to what extent the returns of the affected countries equity index deviate from a pre-selected global equity index. The 9/11 terror attacks showed the worst information ratio 5 days after attacks, followed by the Nice truck attack. When assessing the 15-day time horizon after the conduction of the attack, the Information ratio revealed the worst results, i.e. the biggest impact for the Nice truck attack and the best for the 9/11 terror attacks. Upon the comparison of Western vs. Islamic equity, the results show that impact measured by the information ratio was far worse on the Islamic equity than on the Western equity.

The impact score showed that the terror attack with the most severe impact on the financial market were the 9/11 terror attacks. It achieved a score of 103 points out of 110 points maximum possible, followed by the Madrid bombings of 2004, achieving 88 points. Ranked third is the Nice truck attack, with 60 points followed by the Paris attacks and the Nice truck attack, attaining 46 and 38 points respectively. Even though the point score of the Nice truck attack was higher than the scores for London and Paris, the impact is still down about 40% comparing to the New York terror attacks. For 18 out of 22 criteria which were used, the 11 September 2001 terror attacks reached the highest rank, i.e. with the most severe impact. Also, for the case of the Madrid bombing, the ranks which were assigned were no lower than 3. For London, Paris and Nice the assigned ranks were evenly distributed, ranging mostly from 1-3.

The overall sensitivity of investors with regards to the terroristic incidents decreases throughout time. The scores of both the Nice truck attack and the London bombing were comparingly low when comparing against the 103 points realized for the New York terror attacks and the 88 points with regards to the Madrid bombing. The total point score achieved for the Nice truck attack, which happened in 2016 was about 60% higher than the score achieved for the London bombing. Also, in the case of the Paris terror attacks a 20% higher point score was realized.

This indicates, the market participants sensitivity with regards to terror attacks decreases with an increased number of frequencies. This is also supported by the findings of Bevilacqua, et al (2020) who conducted a study which comprises the realized and implied volatility of the VIX in the aftermath of terror attacks which have happened in the past 17 years. The results show that realized volatilities exhibit less sensitive behavior in recent years and hence, the trend of

desensitization can also be detected with regards to volatility. However, even though the sensitivity decreases, the severity of the impact depends on the individual circumstances of the terror attack, as well as overall market sentiment and economic environment.

Another reason for why markets reacts differently when it comes to terror attacks poses the fact that institutional investors have learned throughout time to assess the long-lasting impact of terror attacks very efficiently. Experience has shown that markets tend to bounce back to pre-attack levels quickly. This holds even for the biggest attacks with the most severe impact, like the 9/11 terror attacks. The findings of Markoulis and Neofytou (2019) indicate that the majority of terrorist attacks which have happened between 2015 and 2017 did not cause significant negative market attacks, since investors might assume that these attacks are one-off events.

The terror attacks on the London Underground have realized the lowest score among the five terror attacks analyzed. The terror attack which have happened in London in 2005 were similar to those happening in Madrid in 2004 and hence, the impact on the financial market was expected to be similar. Both terror attacks have used bombing as means for conduction, both of them have happened in the early Thursday morning with trading resuming normally after the attack. Additionally, there were only about 15 months in between the two happenings. However, while the overall impact on the financial market after the Madrid bombing was assigned a point score of 88, the impact on the London bombing was about 38. From this it follows, that the impact of the London Underground bombing was about 56% less than the impact of the Madrid bombing. These results indicate, that investors digest terror attacks better with increasing number of frequencies.

Kollias, Papadamou and Stagiannis (2011) find similar results, which indicate that the significant abnormal returns were widespread across the majority of sectors within the Spanish market, however, this was not the case in the aftermath of the London attacks. Also, in the case of Madrid the market has recovered way faster than after the London attacks. A possible explanatory factor poses the size, the structure and the liquidity of both markets, which are very different. Also, the type of the attack has influenced the impact and time to recovery. While in London, the attackers were suicide bombers, the terrorist cell which was responsible for the Madrid bombing was only neutralized a few days after the attacks and hence, has still posed a potential threat.

Bevilacqua, et al (2020) has also shown that the Madrid bombing had a severe impact on the volatility index. The volatility index of the S&P500 (VIX) has only recovered slowly to its pre-attack levels after the Madrid tube bombing. This can be justified since it was the first religiously inspired attack of such a magnitude within Europe. The results of the study indicate that for terror attacks which occur within a short period of time, the implied volatility barely reacts to terroristic activities. This can be regarded as reasonable, since the financial markets might still be in recovery from a previous terrorist attack. Another justification poses the argument that investors attribute less importance to a terror attack when they are similar in type, style and conduction (Bevilacqua, et al. 2020). Johnston and Nedelscu (2005) point out, that the impact of the Madrid bombing on the equity market was negligible on a long-run time horizon. Both the S&P500 and the EURO STOXX declined in response to the attacks but have fully recuperated within the next weeks. The immediate response of the governmental authorities as well as their clear communication and elucidations have contributed to the long-term well-being of the stock market.

Both the Paris attacks as well as the Nice truck attack showed similar overall scores, achieving 46 and 60 points respectively. Both terror attacks have happened after markets had closed the trading day already. However, the Paris attacks have happened on a Friday night, with market remaining closed throughout the weekend. The 2 days in between the attack and the succeeding market opening gave investors, traders and other market participants an increased cool-down period. Uncertainty about the frequency, the number of fatalities and injured as well as the economic costs of the property damaged prevails in the market when terror attacks happened within trading hours or shortly before the start of trading. This uncertainty is abolished when markets remain closed and gives investors an additional cool-down period, which allows them to analyze the economic damage caused by the terror attack in more detail.

Another important and influential factor which contributes to the overall magnitude of the impact in the aftermath of a terror attack poses the investor sentiment. Papakyriakou, et al. (2019) proposes that stock markets with positive investor sentiment return to pre-attack levels sooner, compared to countries or market phases when negative investor sentiment prevails. Stock markets sustain significant economic losses on the event day and the following trading day. After the first two trading days, stock markets tend to decline more gradually. However, countries which are associated with a higher decline in post-event investor sentiment show

higher declines in equity returns. The difference in investor sentiment, which is subject to change especially in cool-down phases such as volatility interruptions and market closing might lead to different reactions on the next trading day. The higher impact score of the Nice truck attack compared with the London bombing and the Paris attacks can also be attributed to the overall negative sentiment in the equity market which had prevailed at that time. On 23 June 2016 the United Kingdom held a referendum in order to decide about the future of the UK within the European Union, where 52% of the British voted for leaving the EU. This came surprisingly for many market participants and caused a market correction in the consecutive days after the Brexit vote. When the Nice truck attack happened on 14 July 2016, negative investor sentiment has still dominated the market. Following Papakyriakou, et al. (2019), the negative investor sentiment has caused a bigger impact (as measured by return and volatility) on the equity market in the aftermath of the Nice truck attack.

The fact that the Nice truck attack of 2016 is negligible when comparing against the Madrid bombing and the 9/11 terror attacks is also supported by Bevilacqua, et al (2020). In the case of the Nice truck attack, the volatility index VIX did not reveal significant abnormal behaviors. In this regard, Javaid and Kousar (2018) argued that the investor's behavior is highly influenced by the type of weapon which was used for conducting the terror attack. Explosives increase the stock market volatility the most, since the severity in terms of human causalities and infrastructure damage is somewhat higher compared to other weapons. However, while for the Nice attack the returns and volatility remained somewhat stable, the driver attack in Barcelona in August 2017 produced significant abnormal returns. Bevilacqua, et al (2020) suggests, that the difference in return and volatility behavior stems from the fact that Spain has gone through vicious economic boom and bust cycles. Unlike the German or the French economy, the Spanish economy is more vulnerable to exogenous shocks causing economic turmoil. Bouoiyour and Selmi (2019) support this finding and argue, that the German stock market was able to recover quickly from the terror attacks in Berlin and Munich due to thigh competitiveness of the German economy, allowing for quick salvage.

Even though the magnitude of the impact varies significantly from one terror attack to one another, Bevilacqua, et al (2020) showed that the VIX delivered significant abnormal returns in the aftermath of a terror attack. This argument holds for the Madrid bombing, the London bombing, the Brussels airport bombing as well as the Nice truck attack. the impact of the 9/11 terror attacks was the most severe in terms of time to recovery. It took the VIX the longest time

to recover to its pre-attack levels. More generally, terror attacks on US grounds including the Boston marathon bombing of 2013 as well as the Orlando nightclub shooting in 2016 have produced significant abnormal returns of the VIX.

Also, Javid and Kousar (2018) have argued that the impact on the equity market is heavily dependent on the type of terror attack which have been conducted, i.e. different types of weapons, firearms or explosives used within a terror attack have different effects on an investor's behavior. This might also explain why terror attacks lead to different investor reaction in equity markets. The psychological effects which are triggered through suicide bombings cause the highest sensibility of investors and hence have the highest impact on the financial market. The second biggest impact on the financial market is caused by bombings, due to the extensive economical damage as well as the high possibility of several blasts happening shortly after one another. Further, explosives increase the volatility within an equity market the most. Explosives are followed by firearms in terms of impact on the equity markets. Also, the target of the terror attack influences an investor's response, with a religious site as the target triggering the biggest impact.

Another important aspect when assessing the impact of terror attacks on financial markets is the respective (local) time of each terroristic incident in order to be able to include or exclude the happening day within the calculations. On 11 September 2001, the stock exchanges in New York have never opened for trading and remained closed for the consecutive week, reopening only on 17 September 2001. For Madrid and London, even though both attacks happened before the respective market open, trading hours remained unchanged and markets opened as scheduled in both cases. However, occasions happening outside of trading hours, as it was the case for the Paris and Nice attacks, give investors the chance to reconsider and analyze the damage of terroristic happenings in more detail before making an investment decision. This argument does not just hold with regards to the trading hours, but also to the respective weekday. Further, overall insecurity with regards to the ongoing happenings prevails if terror attacks happen within the trading hours and might lead to panic reactions of market players. Summing it up, it should be denoted that extended or non-existent digestion time for investors might yield in a different in the market reaction.

Both the Western and the Islamic equity showed similar reactions to the occurrence of terror attacks in the Western world. For 3 out of 5 terror attacks, namely the London bombing, the

Paris attacks as well as the Nice truck attack the impact on the Islamic equity was more severe than on the Western equity. With regards to the 9/11 terror attacks, both indices analyzed have achieved the exact same point score. In the aftermath of the Madrid bombing, the Tadawul did not react to the terror attack at all.

In the case of the 9/11 terror attacks, the immediate impact of the shock on the Western equity was more severe than on the Islamic equity. While after the 5 trading days after the terror attack the Dow Jones suffered from tremendous losses paired with a spike in volatility, the Tadawul showed less reaction. However, when comparing the impact 15 trading days after the attack, the opposite reaction was observed. While the DJIA was already recovering from the market shock, making up for the incurred losses with volatilities going down, the Tadawul suffered tremendous losses simultaneously with increasing volatility. Out of 20 points possible, the Islamic equity as well as the Western equity have both achieved 10 points. These findings are in line with the results of Rompotis (2017) who proposes that Islamic exchange traded funds perform worse than their conventional counterparts starting from the fifth day following a terroristic incident.

This finding is supported by Nikkinen, et al. (2010) showing that for European and other developed countries, the effects of the 9/11 terror attacks are small compared to the rest of the world, including the Middle East and North African countries. While the returns and volatility of developed markets recover shortly after the attacks, the impact on the Middle Eastern market appears to be of more longevity. When analyzing the short-term behavior of returns all countries, except for the Middle East and Northern Africa exhibited a similar downturn without any significant statistical differences. When considering the globalization effects under which financial markets are expected to reveal uniform responses to shocks, the magnitude of market reaction still differs considerably from one region to another, depending on the level of integration with the international economy.

Bouri, et al. (2016) analyzed the impact of geopolitical risks, such as terroristic threats on return and volatility of Islamic equity. The results indicate that geopolitical risks are generally found to impact the volatility of Islamic equity rather than the returns. Overall, the tests with regards to Islamic equity show that those securities behave similar to their conventional counterparts with regards to geopolitical risks.

In the aftermath of the Madrid bombing, the Tadawul did not reveal any reaction to the terror attacks. While the IBEX dropped with increasing volatility for both 5 trading days and 15 trading days after the attack, the Tadawul has neither shown significant abnormal returns nor an erratic change in volatility. For all criteria and parameters analyzed, the IBEX showed worse figures than the Tadawul.

With regards to the London bombing, the results achieved show the opposite of the Madrid bombing. The ratios for the Tadawul were worse than the ones calculated for the FTSE. From this it follows, that the impact of the terror attack on the Islamic equity was far worse than on the conventional equity. The Tadawul achieved a score of 19 out of 20 points, while the FTSE realized only 1 point.

Rizvi and Arshad (2012) argue that during crisis modes in the market, the correlation between Islamic indices and conventional equity reveal a negative trend. Dynamic volatilities as well as conditional correlations between Western and Islamic indices have been subject to change within different crisis regimes. Also, Aslam et al. (2018) supported the finding that the reactions in the aftermath of terror attacks can vary significantly. Aslam et al. (2018) analyzed the Asian stock market, which showed varying behavior in the aftermath of a terror attack. While Dhaka, Jakarta, Colombo and the Philippines showed severe losses on the day of the event, in Bangladesh and Sri Lanka the stock returns deteriorated only the day after event. The stock returns in Bombay did not show any significant reaction to the terroristic events. The findings of Aslam, et al (2018) indicate that the reaction to the terror attacks vary heavily. This might provide a proper justification for why the Tadawul reacted more sensitive to the London bombing, while it reacted less the Madrid bombing.

After the Paris terror attacks, both the conventional and the Islamic equity have shown reaction to the terror attacks. The Western index (CAC40) achieved 9 points, while the Islamic equity achieved 11 points. The results indicate that the immediate impact after the terror attacks, i.e. 5 trading days after the attack were more severe on the Tadawul. In the consecutive 15 trading days, it took the FTSE longer to recover from the market shock than the Tadawul.

Out of 20 points possible with regards to the impact score, the Tadawul has achieved 11 points while the CAC40 has achieved 10 points in the aftermath of the Nice truck attack. In the immediate aftermath of the attacks (5 trading days) the CAC40 showed a more severe impact

than the Islamic equity. However, upon analyzing the 15 trading days after the terror attack, the impact was still visible in the index behavior of the Tadawul, while it has already vanished in the Western index. It took both indices the same number of days until the returns have normalized as measured by statistical significance.

As already noted afore, for 3 out of 5 terror attacks, the Islamic equity has shown a more severe impact than the conventional equity. In this regard, another factor which influences the reaction of Islamic equity to terror attacks poses the fact, that equity investments need to be compliant with Sharia principles. In order to comply with Sharia prohibitions, qualitative and quantitative criteria need to be screened and consequently assessed. Sharia screenings are performed by Sharia scholars who are in charge of the Sharia compliance of Islamic equity investments. Qualitative as well as quantitative screens are supposed to ensure that an investment is halal. Companies, whose core business activity (qualitative criteria) includes banking and interest-related businesses, narcotics including alcohol and tobacco, contraceptives including condoms and the anti-baby-pill as well as gambling and the involvement in the production or distribution of pork are prohibited (Hassan and Antoniou, 2006, Yordanova, 2018). In addition to the qualitative screening, also quantitative screening is performed. This is necessary insofar as the percentage of a company's involvement in riba and trading of money against money influences whether the investment is prohibited or not. With Islamic scholars being extremely inflexible, it would not be possible for Muslims to invest into equity, as it is almost impossible to find a company which is not indebted or repaying a loan to a financial institution (Derigs and Marzban, 2008). In order to overcome this issue, debt-to-asset ratios among others are introduced in order to ensure Sharia compliance of the investment. In order to determine the quantitative compliance of a company with Sharia rules, the Sharia screening process involves the in-depth analysis of the annual report. The Sharia screens check for liquidity, interest rate payments and receivable, debt screens as well as non-permissible income. Hence, the Sharia screening is heavily dependent on the frequency of the publication of the financial reports. Resultingly, the Sharia screening process is highly dependent on the frequency of a company's statement publishing. Quantitative Sharia screens are performed through analyzing a company's financial ratios, including liquidity, interest, debt and income and consequently comparing the ratios against a maximum allowable threshold (Derigs and Marzban, 2008). The Dow Jones Sharia Supervisory Board has deployed standards for the Islamic equity community. Sharia compliance is only fulfilled if a company's total debt divided by the 12-month market capitalization must not exceed more than 33%. The same holds for a company's total of cash

and interest-bearing securities as well as its accounts receivables divided by the 12-month average market capitalization must not exceed 33% (Hayat and Kraeussl, 2012).

From the afore noted a bias in the equity selection of Islamic investors arises. Islamic equity investments are limited towards sub-optimally leverage companies, which might have difficulties in finding external debt finance (Hayat and Kraeussl, 2012). This limitation exposes Islamic investors to small growth stocks. Especially during market turmoil's and exogenous shocks which might be triggered by terror attacks, companies might have to increase their debt ratios and consequently might become incompliant with Sharia rulings in case the 33% threshold is exceeded. The buy-and-hold strategy which is very common among Western market participants is not implementable for Muslim investors. Additionally, also the threshold with regards to accounts receivable might be problematic as it triggers a bias to investments into companies which face liquidity issues. Low receivables indicate an unsatisfactory working capital.

As investors have to adjust their investment decisions based on financial ratios of the target companies chosen for the investment, this might result in a stronger sell-off of Islamic equity in cases of market turmoil.

Another issue which is related to the drawbacks of the Islamic finance framework poses the fact that the Islamic financial industry currently operates under rules which were intended to serve the conventional banking system. The IFSB has employed the Basel framework, including asset risk weighting and credit risk mitigation among others. The regulatory framework of Basel III poses a challenge to the Islamic financial industry, creating concerns about liquidity risks and risk management (Mohielding, 2012). Additionally, many Islamic institutions have adopted the conventional way to do banking business, while adding some purely Islamic activities. As Islamic finance is incompatible with neo-classical economics, many Islamic financial institutions became profit-orientated with a focus on increasing wealth and hence, reducing the duty of social responsibility (Sabirzyanov and Hashim, 2015). Similarly, many aspects under Islamic finance suffer from an imitation of conventional investment instruments (Hayat and Malik, 2014).

The afore noted conflict between ensuring Sharia compliance while integrating into international standards of the financial industries has led to inefficiencies in the equity market,

which contribute and influence the overall digestion and time span needed for recovery from market shocks.

The Sharpe ratio, which was used within the dissertation as one of the criteria, has also been employed by El Amri and Hamza (2017) in order to compare the market index performance between Islamic versus conventional equity over a time horizon from 2003 until 2011. The results indicate as well that the faith-based screens do not impact the overall investment performance significantly. Additionally, it was found, that there is no long-run relationship between the Islamic equity and their conventional counterparts. However, in the short run this is subject to change and causal links can be found. This holds especially for short-term shocks and a spillover from conventional to Islamic indices was found. These spillover effects can be seen within 4 days after the happening of the shock. This is supported by the results of this work which shows that overall the Islamic equity reacts in different magnitudes to shocks which have happened on Western equity.

Even though the magnitude of the terror attack's impact on the indices differs from one terror attack to another, four out of five terror attacks under evaluation have triggered reactions for both the Islamic and the conventional equity indices. Mutual risk transmission between Islamic and conventional equity was also found by Hammoudeh, et al (2014) providing empirical evidence for the presence of contagion effects between the two markets under investigation. From this it follows, that Sharia-based principles with regards to equity investing do not make Islamic financial markets much different from its conventional counterparts. Under the assumption of contagion effects between Islamic and conventional equity markets, the investment into Islamic equity also provides low to no diversification effects from a portfolio management perspective. Both the results within this work as well as the findings of Hammoudeh, et al (2014) point out, that there are similarities between those markets especially when it comes to news-based uncertainty.

Furthermore, Aloui et al. (2016) argues similarly to Hammoudeh, et al (2014) in support of co-movement and contagion effects between the two markets. Aloui et al. (2016) analyzed the co-movement between an investor's sentiment and Islamic vs conventional equity returns. The results suggest that there is strong co-movement between the two returns, which, however, shifts across times and frequencies. From this it follows that Islamic equity does not behave differently than its conventional counterparts. Aloui et al. (2016) also conclude that the Sharia

rules do not influence the investor sentiment and the Islamic equity returns. This is consistent with the findings of this study, which showed that the impact of terror attacks on Islamic equity markets was similar to the impact on conventional equity markets.

Also, Ahmed (2019) assessed the impact of political risk on Sharia-compliant products, compared against conventional investment products. Islamic equities markets are not immune to global sources of risk or sheltered from contagion effects caused by financial crises or other market shocks. The study of Ahmed (2019) supports the co-movement between conventional and Islamic equity and lends no support to the decoupling hypothesis.

Upon the analysis of the contagion effects between Islamic equity and other asset classes, Nagayev et al. (2016) have analyzed the association between Islamic equity and commodities. The results suggest that there is strong co-movement between the two afore noted asset classes between 1999 and 2015. Nonetheless, analysis of the correlation also revealed that it was very volatile throughout the analyzed time period and reacted very sensitively to market shocks.

Rompotis (2017) examined the performance and volatility of three Islamic and non-Islamic ETFS in the aftermath of the Charlie Hebdo, the Paris and the Nice terror attacks. The returns of the two evaluated groups vary within the consecutive days of a terrorist action. One group outperforms the other on one day, and the other group outperforms on another day. Also, cumulative returns behave similarly to the afore noted daily returns, which means that they are also varying across several time periods. Abnormal returns show that the Islamic equity funds perform worse than the conventional ETFs. This is in line with the findings of the thesis, which show that the Islamic equity performs overall worse than the conventional one.
Also, Hassan and Antoniu (2006) compared the performance of Islamic equity with the performance of the global stock market. The goal was to examine the impact of Sharia screenings on the investment performance. As Islamic equity investors have a bias towards technology companies, Islamic equity performed extraordinarily well before the bursting of the Dot-com bubble, however, suffered from crashing equity markets afterwards. The screening processes employed on Islamic equity funds imply a positive or negative bias with regards to the stock selection. This bias is influenced by the market phase and selected industry. Additionally, Islamic equity is also dependent on the development of investment strategies as well as risk assessment tools which have to be Sharia-compliant (Hassan and Antoniou, 2006). This is also supported by Merdad et al. (2010) who compared the performance between Islamic

and conventional equity in Saudi Arabia. The results reveal that the Islamic funds underperform the conventional funds throughout the whole period. The investment restrictions due to Islamic law provides a good hedge for conventional funds during times of market turmoil. By using the CAPM, also Hayat and Kraeussl (2012) employed a performance analysis of 145 Islamic equity funds. Their results suggest as well that Islamic equity indices underperform their respective as well as conventional benchmarks throughout the time horizon from 2000 until 2009. Additionally, they found that the performance of funds which invested in global Islamic equity was worse than the performance of funds which focused on local stock markets. Hayat and Kreaussl (2012) conclude that Islamic equity till has a long journey to take before being a real competitor to conventional equity funds. This is due to the fact that an investor who buys an Islamic equity fund is facing more risks compared to the conventional ones.

Hadhek, Halfaoui and Lafi (2019) also conclude, that in the long run the emerging markets suffer more from terroristic activities than developed markets. This is also related to the macroeconomic development, political stability and favorable climate. Also, with an increased number of terror attacks investors lose the confidence and the overall stock market performance will decrease resultingly. While emerging markets suffer from terror attacks, the frontier markets show no correlation with the impact of terroristic activities.

It should also be denoted that the Saudi Arabian stock exchange has different opening hours and trading days than the New York Stock Exchange (NYSE). While the NYSE is open from Monday until Friday from 09.30 until 16.00, the Saudi Arabian Stock Exchange Is opened from Sunday until Thursday, from 10:00 – 15:00. The difference in time shift and trading hours as well as trading days leads to a time shift with regards to the impact of exogenous shocks. Also, the holidays on which the market is opened or closed for trading are different, and hence the time at which the impact arrives on the stock market might be blurred. This has been tried to overcome within the dissertation by introducing the number of trading days as a time measure in order to be aligned with regards to the time frame and horizon. However, with extended or truncated market open or market close the overall sentiment in the market is subject to change. This leads to different market reactions and investment decisions. With markets being closed after the conduction of a terror attack, an in-depth analysis of the economic consequences can be performed. When markets are open immediately before or during a terror attack, investment

decisions are based on assumptions and subject to the information disclosed by the government authorities and the media.

Conclusion

Terrorism can be regarded as one of the most evident issues of this century. It does not just affect the lives of a country's citizen but does also have widespread consequences for the economy. Historically, terror attacks have not just led to loss of life and personal injuries of the victims affected by terrorist actions, but also lead to political instability and unrest, curtailing global GDPs, causing damage and loss of property while creating an atmosphere of fear through the usage of brutal violence. Additionally, it manifested the widespread concerns about the short-term and long-term impacts on the world economy and especially on the possible destabilization of financial markets due to the damage on growth and investment as well as fiscal consequences. The total number of deaths being attributed to terrorism account for about 16,000 deaths as of 2018 with 71 countries being affected by terrorism globally. The global economic impact of terrorism has amounted to $33 billion in constant purchasing power parity terms. The overall global cost of violence amounts to 14.1 trillion USD as of 2018 (Global Terrorism Database, 2020).

News associated with terrorism are quickly spilling over to financial markets all across the globe. Terror attacks manifest extensive apprehensions about the short-term and long-term impact on the economy and especially on an impending destabilization of financial markets due to decelerated growth rates and reluctant investments. It triggers the desire for a wish premium among investors in order to be compensated for enhanced risk due to the terror attacks. Unexpected events cause such as terror attacks cause fear, shock and negative investor sentiment, resulting in panic-selling responses and consequent sharp stock market declines accompanies by enhanced volatility. With the stock market being the economic barometer of a country, the reaction of market participants to the conduction of terror attacks provides a suggestion of the perceived economic damage.

Economic analysis on the effects of terrorism on the economy and more specifically on the financial markets have received great attention by previous literature, including the studies of Bevilacqua, et al (2020), Bouoiyour and Selmi (2019), Papakyriakou, et al. (2019), Javaid and Kousar (2018) as well as Aslam, et al (2018) among others. However, less attention has been paid to the reaction of Islamic equity to terror attacks. Islamic equity is subject to several rules established by the Sharia, excluding various industries such as the gambling, alcohol or pork industry due to religious prohibition. Also, companies with high leverage or interest-bearing

debt ratios are prohibited for investment. This leads to a bias in the equity selection, and hence, Islamic equity might react differently to market shocks stemming from terror attacks.

This work investigates the impact of terror attacks on equity markets, and especially how the impact has changed throughout time. The main goal of the study is to provide a holistic assessment with regards to the impact of terror attacks on the respective countries' equity index affected by the terror attack as well as a comparison of the impact on conventional and Islamic equity. The focus of the analysis will measure the return and volatility impact of the chosen terror attacks. In order to assess the aforenoted, two research questions have been formulated. The first research question evaluates whether the overall impact of terror attacks decreases throughout time. The second research question assesses whether the impact of terror attacks on Islamic equity indices are as hard as on Western indices. By comparing the effects on both Islamic and Western equity, it is also tested for contagion effects between the afore noted. This comparison can additionally be regarded as the assessment of the impact between developed and emerging market countries.

In order to explore the relationship between the changes in investor sentiment following terroristic incidents, a multiple-criteria decision analysis is employed. The aim is to obtain a holistic analysis of the impact of selected terror attacks on global financial markets while capturing the change in the investor sentiment following a terroristic incident. The results are achieved by using 22 different risk and performance ratios in addition to qualitative criteria. An amplified number of criteria is introducing aiming to measure specifically the impact on return and volatility and its short-term (5 to 15 days) and long-term (from 2001 until 2016) change. Additionally, the enhanced number of criteria intentions to avoid an estimate bias triggered by a narrow focus on only a limited number of parameters and benchmarks. The criteria under investigation are employed with regards to the main equity index of the country affected by the terror attack. After the estimation of the parameters and their consecutive calculation, a scoring system is derived. The obtained results for each of the five terror attacks are compared against one another and ranked according to the severity of the impact on the respective equity market. The highest impact is assigned with rank number 5, while the lowest impact is assigned rank number 1. The scores are summed up in order to allow for the assessment of the total impact. For the comparison between conventional and Islamic equity, the scores of either 1 or 0 are assigned, depending on which equity index showed the higher impact. 1 is assigned to the index with the higher effect.

In order to identify the terroristic incidents which have happened all across the globe The Global Terrorism Database (GTD) has been used. It is the most comprehensive database for terrorist attacks and terroristic activities in the world. The GTD comprises terroristic events from 1970 until now and the database includes more than 190,000 events. By using the extensive collection of the GTD, five terror attacks were chosen. The criteria for the choice of the terror attacks include that the motive for the conduction is Islamist-inspired, the target of the terror attack has to ben European or American soil and the combined number of people dead and injured has to exceed 500. The five terroristic events corresponding to the criteria are the 11 September 2001, the Madrid bombing of 2004, the London bombing of 2005, the Paris attacks of 2015 as well as the Nice truck attack of 2016.

The data needed in order to conduct a holistic analysis include the daily end of day prices of the following equity. The indices used are the DJIA for the US, the IBEX for Spain, the FTSE100 for the UK and the CAC40 for France. With regards to the risk-free rate, the effective fed funds rate has been used as a proxy for the US, the EONIA for Spain and France and the LIBOR for the UK. The risk-free rate has been in accordance with the investment horizon, which is considered to be one day. The MSCI World Index has been chosen as a reference index against which the afore noted country equity indices are compared. It can be regarded as the representation of global equity as it includes 1,600 stock across 23 industrialized nations. In order to obtain a proxy for the reaction of Islamic equity to Islamic-inspired terror attacks the Saudi Arabian equity index (Tadawul) has been chosen. This choice can be justified as Saudi Arabia shows the strongest economic performance in terms of GDP in the GCC region as of 2018. As of 2018, statistics of the International Monetary Fund show that Saudi Arabia had a GDP of approximately 800,000 million USD and a GDP per capita of 24,000 USD (IMF, 2020). While the data needed for the calculations was highly available for the Western world, this was not the case for Saudi Arabia. The overnight rates, which are considered as a proxy for the risk-free rate for the US, Europe and UK were accessible. However, for the Saudi Arabian market the overnight tenor was not available before November 2016. The Saudi Arabian Interbank Offered Rate (SAIBOR) can be regarded as a daily reference rate, which is issued by the Saudi Arabian Monetary Authority based on the average interest rate Saudi banks offer to lend unsecured funds to one another. The shortest tenor available in the Saudi market posed the 1-month interbank offered rate. Hence, it has been chosen as a proxy for the risk-free rate.

The criteria which were included in the assessment include the number of fatalities as well as the number of injuries per incident. The criteria which have been used for the analysis include an event study methodology in order to assess the abnormal returns as well as the time to normalization of returns measured by statistical significance. Additionally, a GARCH (1,1) has been employed in order to obtain a volatility forecast which was consequently compared against the realized volatility in the market. Also, the standard deviation, downside/target deviation as well as the cumulative and average returns have been assessed. The risk adjusted performance measures included in the assessment comprise the Sharpe ratio, the Sortino ratio, and the Information ratio. Additionally, the maximum drawdown as well as the time to recovery of the index have been computed for all of the five afore-mentioned indices.

The overall scores reveal that the 9/11 terror attacks have triggered the biggest impact on the equity market. This was followed by the Madrid bombing. Ranked third was the Nice truck attack, followed by the Paris attacks and lastly the London bombing. Out of 110 maximally achievable points, the New York attacks realized 103 points, the Madrid bombings 88, the Nice truck attack 60, followed by the Paris attacks with 46 points and the London bombings with 38 points.

The results show that even though the impact might deviate from incident to incident, the overall trend reveals a decrease in magnitude of the impact. Literature proposes that the reasons for this might be related to the overall investor sentiment, which is subject to change within different market regimes. Another reason for the differences might stem from the nature of the attacks. While for the case of suicide attacks, the threat of another incident happening is abolished, while this is not the case for other types of attacks. Also, the weekday and daytime of the incident influences the overall impact of a terror attack on the equity market. Closed markets give investors time to assess the economic impact in more depth, while observing the governmental reaction and the development of the terror attacks. When terror attacks happen within trading hours or shortly before market start, market participants are incapable of making a proper economic assessment and hence, have base their investment decision on other criteria. Lastly, the differences in the magnitude can also be explained by the overall economic situation of the country affected by the terror attack. Within stable economies, the impact is less severe compared to economies which have gone through vicious economic boom and bust cycles.

When comparing the Islamic equity with the conventional equity, the results are mixed. For 3 out of 5 terror attacks, the magnitude of the impact on the Islamic equity was bigger than on the conventional equity. For the remaining two terror attacks the impact on the Islamic equity was balanced to non-existent. In this regard, another factor which influences the reaction of Islamic equity to terror attacks poses the fact, that equity investments need to be compliant with Sharia principles.

Qualitative and quantitative criteria are supposed to ensure that an investment is considered halal. The qualitative criteria include the prohibitions of investments into companies whose core business activity includes interest-related business, narcotics as well as gambling. The quantitative criteria put a constraint on the capital structure of the desired investment company. From the afore noted a bias in the equity selection of Islamic investors arises. Islamic equity investments are limited towards sub-optimally leverage companies. The equity investment is not just biased towards inadequately finance companies, but also restrained to companies with low account receivables. This indicates an unsatisfactory working capital. This limitation exposes Islamic investors to small growth stocks. Especially during market turmoil's and exogenous shocks which might be triggered by terror attacks, companies might have to increase their debt ratios and consequently might become incompliant with Sharia rulings in case the 33% threshold is exceeded. The buy-and-hold strategy which is very common among Western market participants is not implementable for Muslim investors and might result in a sell-off following market crashes caused by terror attacks as a consequence of the change in the capital structure and overall economic situation of a company.

Overall, a lag in the reaction of the Saudi Arabian stock market was observed, which can be attributed to the difference in trading hours and trading days of the week. Additionally, the effect of the terror attack appears to be longer lasting than in developed markets. This is linked to the macroeconomic development of emerging market economies, the political stability and investor sentiment. The sensitive reaction of Islamic equity on terror attacks conducted in the Western world provide empirical evidence for the contagion effects between the two markets. Short term co-movement between conventional and Islamic equity can be observed, even though the magnitude of the impact might differ.

The first research question evaluated whether the overall impact of terror attacks decreases throughout time. Within this study as the 9/11 terror attacks in 2001 had by far the biggest

impact on the equity market achieving a score of 103 out of 110 points maximally possible. The lowest score had the London bombings (2005) with 38 points. The Madrid bombing (2004) achieved 88 points, the Nice truck attack (2016) scored 60 points and the Paris attacks (2015) scored 46 points. Even though the impact measured by the overall scored did not decrease monotonously over time, the results revealed an overall decline in the severity of the impact.

The second research question assessed whether the impact of terror attacks on Islamic equity indices were as hard as on Western indices. Within this study it was found that for 3 out of 5 analyzed terror attacks the Islamic equity showed a more sever reaction to the occurrence of the terroristic incident. These three terror attacks include the London bombing, the Paris attacks as well as the Nice truck attack. In the case of the 9/11 terror attacks both the Western and the Islamic equity showed similar results, while the Islamic equity did not react to the Madrid bombing in 2004.

The work contributes to the overall understanding of the linkage between conventional and Islamic equity, arguing that there are strong contagion effects between the two markets as a response to exogenous shocks. The work provides a holistic overview over the impact of terror attacks through the introduction of about 20 different decision criteria, including quantitative and qualitative ones. The methodology and the inclusion of a wide-ranging set of parameters was chosen with the intention to avoid a bias of the results through the focus on only one criterion. The work might help market participants by raising awareness that there are spillover effects between conventional and Islamic equity based on the increasing global market integration. This might lead to the production of superior investment decisions with regards to market behavior in the aftermath of a terror attack.

Bibliography

1. Ahmed, W. M. (2019). Islamic and conventional equity markets: Two sides of the same coin, or not?. The Quarterly Review of Economics and Finance, 72, 191-205. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1062976918300358

2. Al Mansoori, H.M. (2015). The Arab spring and political Islam in the Middle East: 2008-2014, Conference Paper of the Qatar University. Retrieved from https://www.researchgate.net/publication/280924024_The_Arab_spring_and_political_Islam_in_the_Middle_East_2008-2014

3. Alexander, C. (2008). Value at Risk Models, West Sussex, England: John Wiley & Sons Ltd.

4. Alexiev, A. (2007). Islamic finance or financing Islamism? Occasional Papers Series, 29, 1-17. Retrieved from https://www.jstor.org/stable/10.2307/resrep05051

5. Aloui, C., Hkiri, B., Lau, C.K.M., Yorvaya, L. (2016). Investor's sentiment and US Islamic and conventional indexes nexus: A time-frequency analysis, *Finance Research Letters, 19,* 54-59. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1544612316301039

6. Andersen, T.G., Bollerslev, T., Christoffersen, P.F., and Diebold, F.X. (2006),"Volatility and Correlation Forecasting,"in G. Elliot, C.W.J. Granger, and Allan Timmermann (eds.),Handbook of Economic Forecasting. Amsterdam: North-Holland, 778-878.

7. Arif, S., Suleman, T. (2014). Terrorism and Stock Market Linkages: An Empirical Study from Pakistan, MPRA Paper No. 58918, Faculty of Management Science, IQRA University, School of Economics and Finance, Victoria University. Retrieved from https://mpra.ub.uni-muenchen.de/58918/1/MPRA_paper_58918.pdf

8. Aslam, F., Rafique, A., Salman, A, Kang, H.G., Mohti, W. (2018). The Impact of Terrorism on Fianncial Markets: Evidence from Asia. The Singapore Economic Review, (63)5, 1183-1204. Retrieved from https://www.worldscientific.com/doi/abs/10.1142/S0217590815501118

9. Ballack, E. (2019). The concept of Arab-Muslim Finance as a Component of Islamic Economic Model, Working Paper, Taras Shevchenko National Unversity of Kyiv. Retrieved from https://www.researchgate.net/profile/Alla_Kobylianska/publication/332349523_Biznes-navigator_No1_50_2019/links/5caf319892851c8d22e3744f/Biznes-navigator-No1-50-2019.pdf#page=17

10. Bar, S. (2008). The religious sources of Islamic terrorism, *The Theory and Practice of Islamic Terrorism* (pp. 11-20). Palgrave Macmillan, New York. Retrieved from https://www.aclu.org/sites/default/files/field_document/ACLURM001331.pdf

11. Bas, B., Van Veen, T. (2017). Terrorist Attacks and Financial Markets, CESifo working Paper, No. 6324, Center for Economic Studies and Ifo Institute. Retrieved from https://www.econstor.eu/bitstream/10419/155566/1/cesifo1_wp6324.pdf

12. Baur, D.H., Lucey, B.M. (2010). Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold. *The Financial Review*, *45(2010)*, 217–229. Retrieved from https://brianmlucey.files.wordpress.com/2011/05/gold_safehavenorhedge_fr.pdf

13. Bazinet, K.R. (2001, September 17). A Fight Vs. Evil, Bush and Cabinet Tell U.S., Daily News, 17 September 2001. Retrieved from https://web.archive.org/web/20100505200651/http://www.nydailynews.com/archives/news/2001/09/17/2001-09-17_a_fight_vs__evil__bush_and_c.html

14. BBC (2016, 21 July) Nice attack: Prosecutor says suspect had accomplices, *BBC.* Retrieved from https://web.archive.org/web/20160721181557/http://www.bbc.co.uk/news/world-europe-36859312

15. BBC News (2004, January 18). Full-text: Al-Qaeda Madrid claim. Retrieved from http://news.bbc.co.uk/2/hi/europe/3509556.stm

16. BBC News (2004). Madrid bomb cell neutralized. Retrieved from http://news.bbc.co.uk/2/hi/europe/3626235.stm

17. BBC News (2005, July 11). "I'm lucky to be here, says driver". Retrieved from http://news.bbc.co.uk/2/hi/uk_news/4671767.stm

18. Bennett, C., Gil, M.A. (2012). Measuring Historical Volatility, Grupo Santander, Equity Derivatives, Madrid. Retrieved from https://dynamiproject.files.wordpress.com/2016/01/measuring_historic_volatility.pdf

19. Benninga, S. (2008). *Financial modeling* (3 ed.). Boston, MA: MIT Press.

20. Berton, E., Hjelmgaard, K. (2016, July 18). Paris prosecutor: Nice attacker searched online for Islamic State, *USA Today.* Retrieved from https://eu.usatoday.com/story/news/world/2016/07/18/nice-attackers-link-islamic-state-puzzles-investigators/87239960/

21. Bevilacqua, M., Morelli, D., Uzam, P.S.R. (2020). Asymmetric implied market volatility and terrorist attacks. *International Review of Financial Analysis, 67.* Retrieved from https://www.sciencedirect.com/science/article/pii/S1057521919303187

22. Binder, J. (1998). The Event Study Methodology Since 1969*, Review of Quantitative Finance and Accounting,* 11, 111 – 137. Retrieved from https://www.researchgate.net/profile/John_Binder/publication/5157403_The_Event_Study_Methodology_Since_1969/links/09e4151118c161e11f000000/The-Event-Study-Methodology-Since-1969.pdf

23. Bouoiyour, J., Selmi R. (2019). The Financial Costs of Terror: Evidence from Berlin and Munich Attacks. The Eruopean Journal of Comparative Economics. Retrieved from https://hal.archives-ouvertes.fr/hal-02108636/document

24. Bouri, E., Demirer, R., Gupta, R., Marfatia, H.A. (2018). Geopolitical Risks and Movements in Islamic Bond and Equity Markets: A Note, Defence and Peace Economics, 30(3), 367-379. Retrieved from https://www.tandfonline.com/doi/abs/10.1080/10242694.2018.1424613

25. Brealey, A.R., Myers, S.C., Allen, F. (2011). Principles of Corporate Finance, 10th Edition, Irwin, United States: McGraw-Hill.

26. Breeden, A., De Freytas-Tamura, K. (2015, November 19). Chief Suspect in Paris Attacks Died in Raid, France Says, *The New York Times.* Retrieved from https://www.nytimes.com/2015/11/19/world/europe/paris-attacks.html

27. Brown, S. J., & Warner, J. B. (1980). Measuring Security Price Performance. *Journal of Financial Economics*, *8*(3), 205–258.

28. Bruce Lawrence, ed. (2005). Messages to the World: The Statements of Osama Bin Laden. Verso. p. 23. ISBN 1844670457. Archived from the original on 2019-01-07. Retrieved 2018-09-13.

29. Capie, F., Mills, T.C., Wood, G. (2005). Gold as a hedge against the dollar. *Journal of International Financial Markets, Instiutions and Money, 15*(4), 343-353. Retrieved from https://www.sciencedirect.com/science/article/pii/S1042443104000794?via%3Dihub

30. Chance, D.M., Brooks, R. (2016). Introduction to Derivatives and Risk Management, 10 Edition, South-Western College Pub

31. Chaudhry, N., Roubaud, D., Akther, W., Shahbaz, M. (2018). Impact of terrorism on stock markets: Empirical evidence from the SAARC region, *Finance Research Letters*, 26, p. 230 – 234. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S154461231730524X

32. Chesney, M., Reshetar, G., Karaman, M. (2011). The impact of terrorism on financial markets: an empirical study. *Journal of Banking and Finance, (35)*2, 253-267. Retrieved from https://www.zora.uzh.ch/id/eprint/45798/8/2011_Th_impact.pdf

33. Chow, J., Kostov, N. (2015, November 17). France honors victims of Paris terrorist attacks, *The Wall Street Journal.* Retrieved from https://www.wsj.com/articles/france-honors-victims-of-paris-terrorist-attacks-1448635450

34. Clarke, R.G., de Silva, H., Thorley, S. (2015). Analysis of Active Portfolio Management, CFA Institute, CFA Program Curriculum 2018, Level II

35. *Congress (2006*). Congressional Record. *US Government Printing Office. p. 9909*

36. Corder, G. W., Foreman, D. I. (2009). Nonparametric statistics for non-statisticians: a step-by-step approach. New Jersey: Wiley & Sons.

37. Cornuejols,G., Tütüncü, R. (2007). Optimization Methods in Finance. Mathematics, Finance and Risk. Cambridge University Press. pp. 178–180. Retrieved from http://web.math.ku.dk/~rolf/CT_FinOpt.pdf

38. Cowan, A.R. (1993). Tests for Cumulative Abnormal Returns over Long Periods: Simulation Evidence, *International Review of Financial Analysis, (2)*1, 51-68. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/1057521993900064

39. Damodaran, A. (1999). Estimating risk free rates, Working paper, NYU Stern School of Business, New York. Retrieved from https://scholar.google.at/scholar?hl=de&as_sdt=0%2C5&q=Riskfree+Rates+damodaran&btnG=

40. De la Hamaide, S. (2015, November 14). Timeline of Paris attacks according to public prosecutor, *Reuters.* Retrieved from https://www.reuters.com/article/us-france-shooting-timeline/timeline-of-paris-attacks-according-to-public-prosecutor-idUSKCN0T31BS20151114#h8KRqimXftutLeR3.97

41. Derigs, U., Marzban S., (2008). Review and analysis of current Shariah-compliant equity screening practices. *International Journal of Islamic and Middle Eastern Finance and Management.* Retrieved from https://www.emerald.com/insight/content/doi/10.1108/17538390810919600/full/html

42. Dima, S. M., Dima, B., Megan, O., & Păiuşan, L., (2014), A discussion over IFRS' adoption in Islamic countries, *Accounting and Management Information Systems, 13*(1), 35–49. Retrieved from https://pdfs.semanticscholar.org/65f7/fb6b2f045086e1877677700a93bc201c048a.pdf

43. Dune, L. (2005, July 7). U.S. Stocks Rise, Erasing Losses on London Bombings; Gap Rises, *Bloomberg L.P.* Retrieved from https://www.bloomberg.com/politics?pid=10000103&sid=aflPCIrU37Ns&refer=us

44. Edwards, C.L, Sinzdak, G. (1997). Open Market Operations in the 1990s, Federal Reserve Bulletin. Retrieved from https://www.federalreserve.gov/pubs/bulletin/1997/199711lead.pdf

45. El Amri, H., & Hamza, T. (2017). Are there causal relationships between islamic versus conventional equity indices? International evidence. *Studies in Business and Economics*, *12*(1), 40-60.

46. El Mundo, (2006). El auto de procesamiento por el 11-M – Documentos. Retrieved from https://www.elmundo.es/documentos/2006/04/11/auto_11m.html

47. Eldor, R., Melnick, R. (2004). Financial Markets and terrorism, *European Journal of Political Economy, (20)*, 367-386. Retrieved from https://www.researchgate.net/profile/Rafi_Melnick/publication/222433236_Financial_Markets_and_Terrorism/links/5aead4dcaca2725dabb658d0/Financial-Markets-and-Terrorism.pdf

48. Elgot, J., Phipps, C., Bucks, J. (2015, November 14). Paris attacks: Islamic State says killings were response to Syria strikes, *The Guardian.* Retrieved from https://www.theguardian.com/world/live/2015/nov/14/paris-terror-attacks-attackers-dead-mass-killing-live-updates

49. Estrada, J. (2006). Downside risk in practice, *Journal of Applied Corporate Finance, (18)*1, 177-125. Retrieved from https://blog.iese.edu/jestrada/files/2012/06/DRP-JACF.pdf

50. Ewers M.C., Dicce, R. Poon, J.P.H., Chow, J. & Gengler, J. (2016): Creating and sustaining Islamic financial centers: Bahrain in the wake of financial and political crises, *Urban Geography*. Retrieved from https://www.researchgate.net/profile/Ryan_Dicce/publication/311735067_Creating_and_sustaining_Islamic_financial_centers_Bahrain_in_the_wake_of_financial_and_political_crises/links/5bbe40a8a6fdccf2979230a4/Creating-and-sustaining-Islamic-financial-centers-Bahrain-in-the-wake-of-financial-and-political-crises.pdf

51. Forbes, K., Rigobon, R. (1999). No Contagion, Only Interdependence. *The Journal of Finance, 57*(5*)*. Retrieved from https://www.researchgate.net/publication/5195241_No_Contagion_Only_Interdependence_Measuring_Stock_Market_Co-movements

52. Frieden, T., Kokenes, C. (2009, November 13). Accused 9/11 plotter Khalid Sheikh Mohammed faces New York trial, *CNN.* Retrieved from http://edition.cnn.com/2009/CRIME/11/13/khalid.sheikh.mohammed/index.html

53. Gazdar, K., Grassa, R., Hassan, M.K. (2017). Openness, culture, legal environment and Islamic finance, *Handbook of Empirical Research on Islam and Economic Life.* Retrieved from https://www.elgaronline.com/view/edcoll/9781784710729/9781784710729.00009.xml

54. Global Terrorism Database (2020). National Consortium for the Study of Terrorism and Responses to Terrorism, A Department of Homeland Security Emeritus Center of Excellence led by the University of Maryland. Retrieved from https://www.start.umd.edu/gtd/search/Results.aspx?search=&sa.x=54&sa.y=3

55. Goo, S.K., Eggen, D. (2004, January 28). Hijackers used mace, knives to take over airplanes, San Francisco Chornicle. Retrieved from

https://www.sfgate.com/default/article/Hijackers-used-Mace-knives-to-take-over-2805009.php

56. *Goodman, Al (2004, April 4). "Suspected Madrid bombing ringleader killed". CNN Madrid Bureau Chief. Retrieved from http://edition.cnn.com/2004/WORLD/europe/04/04/spain.bombings/*

57. Graham, M. A., & Ramiah, V. B. (2012). Global terrorism and adaptive expectations in financial markets: Evidence from Japanese equity market. *Research in International Business and Finance, 26*(1), 97–119. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0275531911000419

58. Griffin, A. (2015, November 19). France state of emergency declared for three months, allowing authorities to shut down websites and giving police sweeping new powers, *The Independent.* Retrieved from https://www.independent.co.uk/news/world/europe/france-state-of-emergency-declared-for-three-months-allowing-authorities-to-shut-down-websites-and-a6740886.html

59. Grinold, R.C:, Kahn, R.N. (1999). Active Portfolio Management – A Quantitative Approach for Providing Superior Returna dn Controlling Risk, 2nd edition, McGraw-Hill, . Chicago, IL.

60. Hadhek, Z., Halfaoui, S., & Lafi, M. (2019). Terrorism and Stock Market Performance. *International Research Journal of Finance and Economics,* (171). Retrieved from https://www.researchgate.net/profile/Zouhaier_Hadhek/publication/330937691_Terrorism_and_Stock_Market_Performance/links/5c5c937c45851582c3d59220/Terrorism-and-Stock-Market-Performance.pdf

61. Hamilos, P., Tran, M. (2007). 21 guilty, seven cleared over the Madrid train bombings, The Guardian, Retrieved from https://www.theguardian.com/world/2007/oct/31/spain.marktran

62. Hammoudeh, S., Mensi, W., Reboredo, J. C., & Nguyen, D. K. (2014). Dynamic dependence of the global Islamic equity index with global conventional equity market indices and risk factors. *Pacific-Basin Finance Journal*, *30*, 189-206.

63. Hanieh, A. (2019). Variegated Finance Capital and the Political Economy of Islamic Banking in the Gulf, *New Political Economy of Islamic Banking in the Gulf*. Retrieved from https://www.tandfonline.com/doi/abs/10.1080/13563467.2019.1613354

64. Hanieh, A. (2020). New georgraphies of financial power: global Islamic finance and the Gulf, *Third World Quarterly, 41*(2), 525-546. Retrieved from https://www.tandfonline.com/doi/abs/10.1080/01436597.2019.1675505

65. Hansen, P.R., Lunde, A. (2005). Realized Variance and Market Microstructure Noise, Joint StatisticalMeetings, Minneapolis, Minnesota, August 7–11, 2005. Retrieved from http://public.econ.duke.edu/~get/browse/courses/201/spr11/DOWNLOADS/MicroStructure/Hansen-Lunde-JBES-2006+COMMENTS/hansen_lunde_jbes_06.pdf

66. Hassan, A., Antoniou, A. (2006). Equity Fund's Islamic Screening: Effects on its Financial Performance. Retrieved from http://www.iefpedia.com/english/wp-content/uploads/2010/01/PFT149.pdf

67. Hassan, M.K., Lewis, M.K. (2007). Handbook of Islamic Banking, MPG Books, Cornwall. Retrieved from https://books.google.at/books?hl=de&lr=&id=jvTtDzD5uFQC&oi=fnd&pg=PA240&dq=islam+and+financial+markets&ots=75lP7fTYoA&sig=GbAkzI3xGORa1AfTYR8ktFWCbeo&redir_esc=y#v=onepage&q=islam%20and%20financial%20markets&f=false .

68. Hassan, M.K., Miglietta, F., Paltrinieri, A., Floreani, J. (2018). The effect of Shariah board composition on Islamic equity indices performance, *Business Ethics: A European Review,* 27(3). Retrieved from https://onlinelibrary.wiley.com/doi/abs/10.1111/beer.12185

69. Hayat, R., Kraeussl, R. (2011). Risk and return characteristics of Islamic equity funds, *Emerging Markets Review, (12)*2, 189-203. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1566014111000136.

70. Hayat, U., Malik, A. (2014). Islamic Finance: Ethics, Concepts, Practice, *Research Foundation Literature Reviews, (9)*3. Retrieved from https://www.cfainstitute.org/-/media/documents/book/rf-lit-review/2014/rflr-v9-n3-1-pdf.ashx

71. Hossain, S., Ghahramani, M. (2016). Shrinkage Estimation of Linear Regression Models with GARCH Errors. *Journal of Statistical Theory and Applications, (15)*4, 405-423. Retrieved from https://www.atlantis-press.com/journals/jsta/25867323

72. Howell, D., Buckley, M., Nowak M., Gold, M. (2016). France lorry attack: As it happened (all updates from start until 15 July 21:54. *BBC News.* Retrieved from https://www.bbc.com/news/live/world-europe-36799172

73. https://books.google.at/books?id=eCO7Q10SGBUC&pg=PA9909&redir_esc=y&hl=de

74. Hull, J. C. (2009). Options, Futures, and other Derivatives (3rd ed.). *New Jersey, United States of* America.

75. Hunter, M. 2014. Entrepreneurship as a means to Create Islamic Economy. Economics, Management and Financial Markets, 9 (1), 75-100.

76. Imtiaz, A., Tahir, S. (2014). Terrorism and Stock Market Linkages: An Empirical Study from Pakistan. Retrieved from https://mpra.ub.uni-muenchen.de/58918/

77. Insitute for the Analysis of Global Security *(2014). "How much did the September 11 terrorist attack cost America?". Retrieved from http://www.iags.org/costof911.html*

78. Institute for Economics & Peace (2019). Global Terrorism Index 2019, Measuring the Impact of Terrorism. Retrieved from http://visionofhumanity.org/reports/

79. International Monetary Fund (2020). World Economic Outlook Database. Retrieved from https://www.imf.org/en/Publications/SPROLLs/world-economic-outlook-databases#sort=%40imfdate%20descending

80. Jana, R.K., Das, D. (2020). *Did Bitcoin act as an antidote to the Chinese equity market and booster to Altcoins during the Novel Coronavirus Outbreak?* Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3544794

81. Javaid, M.E., Kouser, S. (2018). Impact of Terrorism, Political System and Exchange Rate Fluctuations on Stock Market Volatility. *Iranian Journal of Management Studies, (11)*3, 519-546. Retrieved from https://www.researchgate.net/publication/327824318_Impact_of_Terrorism_Political_System_and_Exchange_Rate_Fluctuations_on_Stock_Market_Volatility

82. Jobst, A., P. Kunzel, P. Mills and A. Sy, 2008, Islamic Bond Issuance: What Sovereign Debt Managers Need to Know, *International Journal of Islamic and Middle Eastern Finance and Management* 1, 330-344.

83. Johnston, R.B., Nedelescu, O.M. (2005). The Impact of Terrorism on Financial Markets, IMF Working Paper, Monetary and Financial Systems Department. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.443.4227&rep=rep1&type=pdf

84. Khan, A.Q., Bhatti, A.A: (2018). Islamic Banking and Finance: A New Paradigm in International Relations, *Journal of Islamic Business and Management, 8*(1), 85-101. Retrieved from https://jibm.org/archieves/volume8-issue1/volume8-issue1-article4/

85. Kidd, D. (2011). The Sharpe ratio and information ratio. Investment performance measurement. Retrieved from https://static1.squarespace.com/static/571a590286db43237523fc11/t/585168b859cc6820f585a41a/1481730238074/The+Sharpe+Ratio+and+the+Information+Ratio.pdf

86. Kollias, C., Papadamou, S., & Stagiannis, A. (2011). Terrorism and capital markets: The effects of the Madrid and London bomb attacks. *International Review of Economics & Finance*, *20*(4), 532-541.

87. Kothari, S. P., & Warner, J. B. (2006). Econometrics of Event Studies. In E. Eckbo (Ed.), *Handbook of Corporate Finance: Empirical Corporate Finance, Elsevier/North-Holland,* 3–36

88. Lauenstein, P., Simic Küster, A. (2016). Information processing and freight and freight forward markets: An event study on OPEC announcements, Working Paper No. 172, Helmut-Schmidt-Universität, Germany. Retrieved from http://hdl.handle.net/10419/155627

89. Lawrence, B. (2005). Messages to the World: The Statement of Osama Bin Laden. Retrieved from https://books.google.at/books?id=3_fRlEZoaioC&printsec=frontcover&dq=bin+Laden+fatwa+1996&hl=en&sa=X&redir_esc=y#v=onepage&q=declaration%20of%20jihad&f=false

90. Lenain, P., Bonturi, M., & Koen, V. (2002). The Economic Consequences of Terrorism. Retrieved from https://www.oecd-ilibrary.org/economics/the-economic-consequences-of-terrorism_511778841283?crawler=true

91. Lewis, K., Mason, P., Moore, K. (2016). 'Islamic terrorism' and the Repression of the Political, Media, Religion and Conflict. Retrieved from https://go.aws/2VoZnCT

92. Lewis, L. (2007, May 6). The jihadi house parties of hate: Britain's terror network offered an easy target the security services missed, says Shiv Malik. *The Times.* Retrieved from https://web.archive.org/web/20110629110221/http://www.timesonline.co.uk/tol/news/uk/article1752338.ece

93. *Lewis, Leo (6 May 2007). "The jihadi house parties of hate: Britain's terror network offered an easy target the security sevices [sic] missed, says Shiv Malik". The Times*

94. Lo, A.W. (2002). The Statistics of Sharpe Ratios. *Financial Analysts Journal, 58*(4). Retrieved from https://alo.mit.edu/wp-content/uploads/2017/06/The-Statistics-of-Sharpe-Ratios.pdf

95. Magdon-Ismail, M., Atiya, A.F. (2004). An Analysis of the Maximum Drawdown Risk Measure, Risk Magazin, 17(10), p. 99 – 102. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=874069

96. Magdon-Ismail, M., Attiya, A.F., Pratap, A., Amrit, A.M., Yaser, S. (2004). On the Maximum Drawdown of a Brownian Motion. Journal of Applied Probability, 41(1), 147-161. Retrieved from http://www.cs.rpi.edu/~magdon/ps/journal/drawdown_journal.pdf

97. Majdoub, J., Mansour, W. (2014). Islamic equity market integration and volatility spillover between emerging and US markets, *North American Journal of Economics and Finance, (29)2014,* 452-470. Retrieved from https://isiarticles.com/bundles/Article/pre/pdf/42357.pdf

98. Mansour, W.; Ben Jedidia, K. & Majdoub, J. 2015. How Ethical is Islamic Banking in the Light of the Objectives of Islamic Law? Journal of Religious Ethics, 43 (1), 51-77.

99. Marimuthu, M; Kolandaisamay, I. & Lai, Khong Y. 2017. Conceptual Understanding of Housing Loan (BaiBithamam Ajil): An Empirical Review. Global Business and Management Research: An Empirical Review, 9 (1), 254-270.

100. Markoulis, S., Neofytou, N. (2019). The impact of terror attacks on global sectoral capital markets: An empirical study, *The Economics of Peace and Security Journal, 14(*1), 46-59. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/59964475/The_impact_of_terror_attacks_on_global_sectoral_capital_markets_An_empirical_study20190709-81524-ys2i6x.pdf?1562664144=&response-content-disposition=inline%3B+filename%3DTHE_ECONOMICS_OF_PEACE_AND_SECURITY_JOUR.pdf&Expires=1592471899&Signature=Kgtbd~IuUFMwPrBjec9~u0p25fCGaRuifDnnvjd~Mob9my7f~3XlR35OP7wT8mwJayawlCd9Ph90XiRk1G8-2PcOFJXXsxMa77bQNw0Is4E6FJG4pG9ZT~wToLQF5lUycHDMMD4L0t~Ps3XinH

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101. Markowitz, H. (1959). Portfolio Selection: Efficient Diversification of Investments. Yale University Press, New Haven: London.

102. Maulidizen, A. (2017). A Critical Analysis of Islam, Economy and Finance in the Early 21st Century, *Hukum Islam, (17)*2. Retrieved from http://103.193.19.206/index.php/hukumislam/article/view/4984

103. McLeod, V., Van Vuuren, G. (2004). Interpreting the Sharpe ratio when excess returns are negative. *Investment Analysis Journal, 33,* 15 -20. Retrieved from https://www.researchgate.net/profile/Gary_Vuuren/publication/285365236_Interpreting_the_Sharpe_ratio_when_excess_returns_are_negative/links/5e8cc6324585150839c77b62/Interpreting-the-Sharpe-ratio-when-excess-returns-are-negative.pdf

104. Merdad, H., Hassan, M.K., Alhenawi, Y. (2010). Islamic versus conventional mutual funds performance in Saudi Arabia: a case study. *Journal of King Abdulaziz University*: *Islamic Economics, 23*(2), 157-193. Retrieved from https://www.kau.edu.sa/Files/121/Researches/58939_29217.pdf

105. Miller, B. (2002, May 1). Skyscraper Protection Might Not Be Feasible, Federal Engineers Say, Orlando Sentinel. Retrieved from https://www.tribpub.com/gdpr/orlandosentinel.com/

106. Moghadam, A. (2008). The Globalization of Martyrdom: Al Qaeda, Salafi Jihad, and the Diffusion of Suicide Attacks. Johns Hopkins University

107. Moghadam, A. (2011). "The United Kingdom and the 77 Bombings". The Globalization of Martyrdom: Al Qaeda, Salafi Jihad, and the Diffusion of Suicide Attacks. JHU Press. p. 199. *ISBN 978-1421401447*

108. Mohieldin, M. (2012). Realizing the potential of Islamic finance. *The World Bank,* 77, March 2012. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/10051/676440BRI0econ00Box367885B00PUBLIC0.pdf?sequence=1

109. Moore, J. (2016, July 18). Nice Attack: Final Moments of Muslim Grandmother Who Was First Victim, *Newsweek.* Retrieved from https://www.newsweek.com/final-moments-muslim-mum-seven-first-killed-nice-attack-481274

110. *Nafeesa, S. (2015, November 15).* Yes, Parisians are traumatized, but the spirit of resistance still lingers, *The Irish Indepdenent.* Retrieved from https://www.independent.ie/world-news/europe/paris-terror-attacks/paris-terror-attacks-yes-parisians-are-traumatised-but-the-spirit-of-resistance-still-lingers-34201891.html

111. Nagayev, R., Disli, M., Inghelbrecht, K., Ng, A. (2016). On the Dynamic Links between Commodities and Islamic Equity, *Energy ecnomics, (58),* 125-140. Retrieved from https://ikr.inceif.org/bitstream/INCEIF/2925/1/IFHubEd5_on_the_dynamic_links_between_commodities_and_Islamic_equities_Ruslan_Mustafa_Koen_Adam.pdf

112. Nakip, M., Gökmen, A., Mohammed, S.A. (2017). Financial Market Segmentation: An Application on Islamic Financial Markets. *Journal of Applied Economics & Business Research, (7)4,* 258-257. Retrieved from https://web.a.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=1927033X&AN=127131972&h=Z49EuSzmhTkFvqCoGkNnkXhZxZ2JFyl5C86pTjLP%2fo1vbsbFMcDTZaPN0NmNkujquQEsovPzNyRERu2ulBLmRQ%3d%3d&crl=c&resultNs=AdminWebAuth&resultLocal=ErrCrlNotAuth&crlhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d1927033X%26AN%3d127131972

113. National Commission on Terrorist Attacks Upon the United States (2004). The Attack Looms, 9/11 Commission Report. Retrieved from https://govinfo.library.unt.edu/911/report/911Report_Ch7.htm

114. National Transportation Safety Board (2002). Flight Path Study – American Airlines Flight 77. Retrieved from https://nsarchive2.gwu.edu//NSAEBB/NSAEBB196/doc02.pdf

115. Nikkinen, J., Omran, M., Sahlström, P., Äijo, J. (2008). Stock returns and volatility following the September 11 attacks: Evidence from 53 equity markets. *International Review of Financial Analysis, (17)*1, 27-46. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S1057521906001001

116. O'Neill, S. (2007). Spain furious as US blocks access to Madrid bombing 'chief'. The Times, London, UK. Retrieved from https://www.thetimes.co.uk/

117. Papakyriakou, P., Sakkas, A., Taoushianis, Z. (2019). The Impact of Terrorist Attacks in G7 Countries on International Stock Markets and the Role of Investor Sentiment. *Journal of International Financial Markets, Institutions and Money, (61),* 143-160. Retrieved from https://nottingham-repository.worktribe.com/preview/2447736/the%20impact%20of%20terrorist%20attacks%20in%20G7.pdf

118. Parlapiano, A., Andrews, W., Park, H., Buchanan, L. (2015, November 17). Finding the Links Among the Paris Attackers, *The New York Times.* Retrieved from https://www.nytimes.com/interactive/2015/11/15/world/europe/manhunt-for-paris-attackers.html?mtrref=en.wikipedia.org&gwh=F58D88ED5C88C1DD67E968E5C86EE862&gwt=pay&assetType=REGIWALL

119. Petneházi, G., Gáll, J. (2019). Exploring the predictability of range-based volatility estimators using recurrent neural networks**.** *Intelligent Systems in Accounting Finance & Management.* Retrieved from https://www.researchgate.net/publication/335094562_Exploring_the_predictability_of_range-based_volatility_estimators_using_recurrent_neural_networks

120. Quttainah, M. A.; Song, L. & Wu, Q. 2013. Do Islamic Banks Employ Less Earnings Management? Journal of International Financial Management & Accounting, 24 (3), 203-233.

121. Ramiah, V., Cam, M., Calabro, M., Maher, D., & Ghafouri, S. (2010). *Changes in equity returns and volatility across different Australian industries following the recent terrorist attacks. Pacific-Basin Finance Journal, 18*(1), 64-76. Retrieved from https://www.sciencedirect.com/science/article/pii/S0927538X0900050X

122. Ramiah, V., Wallace, D., Veron, J.F., Reddy, K., Elliot, R. (2018). The effects of recent terrorist attacks on risk and return in commodity markets. *Energy Economics, 77,* 13-22. Retrieved from https://www.sciencedirect.com/science/article/pii/S0140988318304274

123. Rammal, H.G., Zurbruegg, R. (2007). Awareness of Islamic Banking Products Among Muslims: The Case of Australia, *Journal of Financial Services Marketing,* 12, 65-74.

124. Randolph, E., Valmary, S. (2015, November 13). More than 120 people kille din Paris 'terror attacks', *Yahoo News, Agence France-Presse.* Retrieved from https://news.yahoo.com/least-120-dead-paris-attacks-investigation-source-pta-013205822.html

125. Ratten, V., Rammal, H., Ramadani, V. (2017). Islamic Finance: An Entrepreneurial Management Perspective, *Entrepreneurship and Management in an Islamic Contect,* Springer Verlag

126. Rethel, L. (2017). Economic Governance Beyond State and Market: Islamic Capital Markets in Southeast Asia, Journal of Contemporary Asia, 48(2), 301-321. Retrieved from https://www.tandfonline.com/doi/abs/10.1080/00472336.2017.1404119

127. Reveiz A., León C. (2010) Efficient Portfolio Optimization in the Wealth Creation and Maximum Drawdown Space. In: Berkelaar A.B., Coche J., Nyholm K. (eds) Interest Rate Models, Asset Allocation and Quantitative Techniques for Central Banks and Sovereign Wealth Funds. Palgrave Macmillan, London

128. Richburg, K.B. (2004, March 17). Spain Campaigned to Pin Blame on ETA, The Washington Post. Retrieved from

https://web.archive.org/web/20110208214749/http://www.washingtonpost.com/ac2/wp-dyn/A64633-2004Mar16?language=printer

129. Rizvi, S.A.,R., Arshad, S. (2012). Are Islamic Equity Indices a Safer Haven in Times of Crisis? An Empirical Proof via Investigation of Global Indices using Multivariate Garch DCC. Retrieved from https://www.researchgate.net/profile/Syed_Aun_R_Rizvi/publication/267928261_ARE_ISLAMIC_EQUITY_INDICES_A_SAFER_HAVEN_IN_TIMES_OF_CRISIS_AN_EMPIRICAL_PROOF_VIA_INVESTIGATION_OF_GLOBAL_INDICES_USING_MULTIVARIATE_GARCH_DCC/links/545daf340cf2c1a63bfa6933/ARE-ISLAMIC-EQUITY-INDICES-A-SAFER-HAVEN-IN-TIMES-OF-CRISIS-AN-EMPIRICAL-PROOF-VIA-INVESTIGATION-OF-GLOBAL-INDICES-USING-MULTIVARIATE-GARCH-DCC.pdf

130. Rollinger, T.N., Hoffman, S.T. (2013). Sortino: A ‚Sharper' Ratio, Red Rock Capital. Retrieved from http://redrockcapital.homestead.com/Sortino__A__Sharper__Ratio_Red_Rock_Capital.pdf

131. Rompotis, G. G. (2017). The Impact of Terrorism on Islamic Exchange Traded Funds. *Journal of Islamic Economics, Banking and Finance*, *113*(6218), 1-25.

132. Rosly, S.A. (2005), "Critical Issues on Islamic Banking and Financial Markets", Dinamas Publishing, Kuala Lumpur. Retrieved from https://www.researchgate.net/publication/277057761_Critical_issues_on_Islamic_banking_and_financial_markets_Islamic_economics_banking_and_finance_investments_Takaful_and_financial_planning

133. Roy D. (1952) "Safety First and the Holding of Assets", Econometrics, Vol.20, No.3, pp.431-449, July.

134. Ruppert, D., Matteson, D.S. (2015). Statistics and Data Analysis for Financial Engineering, 2nd Edition, USA, New York: Springer.

135. Sabirzyanov, R., Hashim, M.H. (2015). Islamic Banking and Finance: Concept and Reality, *Journal of Islamic Banking & Finance, (32)*3, 88-102. Retrieved from https://www.researchgate.net/publication/303372905_Islamic_Banking_and_Finance_Concept_and_Reality

136. Salman, S., (2013). Discuss the significance, functions and role of international Shari`ah standard setting bodies such as IFSB and AAOIFI, *Chartered Islamic Finance Professional (CIFP*), INCEIF – The Global University of Islamic Finance. Retrieved from https://www.academia.edu/5294265/The_significance_functions_and_role_of_international_Shariah_standard_setting_bodies_such_as_IFSB_and_AAOIFI

137. Saraç, M., Ülev, S. (2017). Investing in Islamic Stocks: A Wiser öWay to Achieve Genuine Interest-Free Finance. Journal of King Abdulaziz University: *Islamic Economics, (30)*SI, 61-72. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3061369

138. Schmitt, E., Shanker, T. (2005, July 26). U.S. Officials Retool Slogan for Terror War, New York Times. Retrieved from https://www.nytimes.com/2005/07/26/politics/us-officials-retool-slogan-for-terror-war.html

139. Shachmurove, A., Schachmurove, Y. (2004). Annualized Cumulative Returns on Venture-Backed Public Companies Categorized by Industry, *The Journal of Entrepreneurial Finance, (9)3,* 41-60. Retrieved from https://digitalcommons.pepperdine.edu/cgi/viewcontent.cgi?article=1064&context=jef

140. Shaik, S.A. (2011). A critical analysis of Mudarabah a new approach to equity financing in Islamic finance, *Journal of Islamic Banking and Finance.* Retrieved from https://mpra.ub.uni-muenchen.de/19697/1/MPRA_paper_19697.pdf

141. Siddiqui, S. H. 2012. Anatomy and Critique of Islamic Banking. Pakistan Horizon, 65 (3), 35-58.

142. Sortino, F.A., Price, L.N. (1994). "Performance measurement in a downside risk framework", *Journal of Investing, 3*(3), 59-64. Retrieved from https://joi.pm-research.com/content/3/3/59

143. Strother, T.S., Pagano, S. (2018). The Impact of Risk, Uncertainty, and the Perceived Threat of Terrorist Attacks on Equity Markets. *International Review of Business Research Papers, (14)*2, 76-102. Retrieved from https://zantworldpress.com/wp-content/uploads/2018/10/5.-Shawn-1.pdf

144. Sukmana, R., Kholid, M. (2012). Impact of global financial crisis on Islamic and conventional stocks in emerging market: an application of ARCH and GARCH method. *Asian Academy of Management Journal, 2012.* Retrieved from http://www.iefpedia.com/english/wp-content/uploads/2010/12/Impact-of-global-financial-crisis-on-Islamic-and-conventional-stocks-Muhamad-Kholid.pdf

145. Syahiru, S., Engku, R.A.E.A. (2018). Risk Management in Islamic finance: What does Islam Say about Mu Mukhāṭarah? *Journal of Islamic Sciences and Comparative Studies,* Special Issue (1), November 2018, 79 -94. Retrieved from http://journals.iium.edu.my/al-itqan/index.php/al-itqan/article/view/83

146. The Guardian (2002). Bin Laden's "letter to America" Retrieved from https://www.theguardian.com/world/2002/nov/24/theobserver.

147. The Local (2016, July 18). Nice attacker had 'clear' interest in radical Islam. Retrieved from https://www.thelocal.fr/20160717/nice-attacker-body-building-drug-taking-womanising

148. The Newsroom (2015, July 14). 7/7 Anniversary: UK's Risk of Terror Attack Higher Now than Days of London Bombings. *Yorkshire Post.* Retrieved from https://www.yorkshirepost.co.uk/news/crime/77-anniversary-uks-risk-terror-attack-higher-now-days-london-bombings-1817204

149. Tribune News Services. (2016, July 18). Uncle says France attacker was recruited by Algerian Islamic State member, *Chicago Tribune.* Retrieved from

https://www.chicagotribune.com/nation-world/ct-france-nice-truck-attack-20160718-story.html

150. Ullah, M., Khanam, R. and Tasnim, T. (2018). Comparative compliance status of AAOIFI and IFSB standards: An empirical evidence from Islami Bank Bangladesh Limited, *Journal of Islamic Accounting and Business Research*, 9 (4), 607-628. Retrieved from https://www.emerald.com/insight/content/doi/10.1108/JIABR-11-2014-0040/full/html

151. Vecer, J. (2007). Preventing Portfolio Losses by Hedging Maximum Drawdown, Columbia University, Department of Statistics, NY. Retrieved from https://www.researchgate.net/publication/238509247_Preventing_Portfolio_Losses_by_Hedging_Maximum_Drawdown

152. Wadhawan, D., Singh, H. (2019). Estimating and Forecasting Volatility Using Arima Model: A Study on NSE, India, *Indian Journal of Finance, 13(*5), p. 37 - 51. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3479061

153. Walid, A. (2018). How do Islamic versus conventional equity markets react to political risk? Dynamic panel evidence, *International Economics*, Elsevier, vol. 156(C), 284-304. Retrieved from https://www.researchgate.net/publication/325261945_How_do_Islamic_versus_conventional_equity_markets_react_to_political_risk_Dynamic_panel_evidence

154. Widana, G.O.; Wiryono, S. K.; Purwanegara, M. S. & Toha, M. (2015). Exploring the Impact of Islamic Business Ethics and Relationship Marketing Orientation on Business Performance: The Islamic Banking Experience.Asian Academy of Management Journal, 20 (1), 1-25.

155. Yordanova, G.D. (2018). Islamic Finance as Asymmetrical Threat to the Financial Security of Europe, Conference Paper: Challenges for the European Union and NATO in the context of Radicalization, Terrorism and Migration. Retrieved from https://www.researchgate.net/publication/324897845_Islamic_Finance_as_Asymmetrical_Threat_to_the_Financial_Security_of_Europe

156. Zaher, T.S., Hassan, M.K. (2001). A Comparative Literature Survey of Islamic Finance and Banking, *Financial Markets, Institutions and Instruments, 10,* 155-199.

157. Zain, M., Amanullah, M. (2018). Duties and Decision-Making Guidelines for Shariah Committee: An Overview of AAOIFI, *Intellectual Discourse, 26*(2), 729-748. Retrieved from https://journals.iium.edu.my/intdiscourse/index.php/islam/article/view/1229

158. Zoubi, H.A., & Maghyereh, A.I. (2007). The relative Risk Performance of Islamic Finance: A new Guide to Less Risky Investments. *International Journal of Theorethical and Applied Finance, (10)*2, 235-249. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2466029

159. Zulfiquar, S.; Haddad, H.; Al-Shehhi, Y. & Máté, D. (2016). Financial Performance of Islamic Banks in the United Arab Emirates, Pakistan and Jordan: A Case Comparative Study with Dupont Approach. Annals of University of Oradea, 25 (2), 403-409.

Appendix

Event study methodology

11 September 2001 - Dow Jones							
Date	**Day**	**DJIA return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
20.08.01	**Day -15**	0,77%	-1,40%	-0,26%	1,03%	-0,11%	0,81
21.08.01	**Day -14**	-1,42%	-0,51%	-0,11%	-1,32%	-1,43%	-1,04
22.08.01	**Day -13**	1,00%	0,35%	0,04%	0,96%	-0,47%	0,75
23.08.01	**Day -12**	-0,47%	0,08%	0,00%	-0,46%	-0,93%	-0,36
24.08.01	**Day -11**	1,88%	0,43%	0,06%	1,82%	0,89%	1,43
27.08.01	**Day -10**	-0,39%	-0,02%	-0,02%	-0,37%	0,51%	-0,29
28.08.01	**Day -9**	-1,56%	-0,31%	-0,07%	-1,49%	-0,97%	-1,17
29.08.01	**Day -8**	-1,29%	-1,37%	-0,26%	-1,03%	-2,01%	-0,81
30.08.01	**Day -7**	-1,71%	0,12%	0,00%	-1,72%	-3,72%	-1,35
31.08.01	**Day -6**	0,30%	-0,22%	-0,05%	0,36%	-3,36%	0,28
04.09.01	**Day -5**	0,48%	0,64%	0,10%	0,38%	-2,98%	0,30
05.09.01	**Day -4**	0,36%	-0,50%	-0,10%	0,46%	-2,52%	0,36
06.09.01	**Day -3**	-1,94%	1,52%	0,25%	-2,19%	-4,71%	-1,72
07.09.01	**Day -2**	-2,42%	-0,25%	-0,06%	-2,36%	-7,06%	-1,85
10.09.01	**Day -1**	0,00%	-1,29%	-0,24%	0,24%	-6,82%	0,19
Day 0							
17.09.01	**Day 1**	-7,40%	-0,83%	-0,16%	-7,23%	-7,23%	-5,68
18.09.01	**Day 2**	-0,19%	-1,82%	-0,33%	0,14%	-7,09%	0,11
19.09.01	**Day 3**	-1,63%	0,21%	0,02%	-1,65%	-8,75%	-1,30

20.09.01	**Day 4**	-4,47%	-0,67%	-0,13%	-4,34%	-13,08%	-3,41
21.09.01	**Day 5**	-1,69%	0,25%	0,03%	-1,72%	-14,80%	-1,35
24.09.01	**Day 6**	4,37%	-0,76%	-0,15%	4,52%	-10,28%	3,55
25.09.01	**Day 7**	0,65%	-1,93%	-0,35%	1,00%	-9,27%	0,79
26.09.01	**Day 8**	-1,07%	-1,45%	-0,27%	-0,80%	-10,08%	-0,63
27.09.01	**Day 9**	1,32%	-0,34%	-0,08%	1,40%	-8,68%	1,10
28.09.01	**Day 10**	1,90%	-1,51%	-0,28%	2,18%	-6,50%	1,71
01.10.01	**Day 11**	-0,12%	-0,46%	-0,10%	-0,02%	-6,52%	-0,02
02.10.01	**Day 12**	1,28%	0,56%	0,08%	1,20%	-5,33%	0,94
03.10.01	**Day 13**	1,92%	-0,86%	-0,17%	2,08%	-3,24%	1,64
04.10.01	**Day 14**	-0,69%	-2,71%	-0,49%	-0,20%	-3,44%	-0,16
05.10.01	**Day 15**	0,65%	-0,43%	-0,09%	0,74%	-2,70%	0,58

11 September 2001 - Tadawul							
Datum	**Day**	**Tadawul return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
21.08.01	**Day -15**	0,299%	-0,217%	0,011%	0,288%	4,483%	0,520
22.08.01	**Day -14**	0,255%	0,643%	0,051%	0,204%	4,686%	0,369
23.08.01	**Day -13**	0,276%	-0,496%	-0,002%	0,278%	4,964%	0,502
26.08.01	**Day -12**	0,619%	1,517%	0,091%	0,528%	5,492%	0,954
27.08.01	**Day -11**	0,069%	-0,249%	0,010%	0,059%	5,551%	0,107
28.08.01	**Day -10**	0,199%	-1,287%	-0,038%	0,237%	5,789%	0,429
29.08.01	**Day -9**	0,229%	-0,832%	-0,017%	0,246%	6,035%	0,445
30.08.01	**Day -8**	0,219%	-1,817%	-0,063%	0,281%	6,316%	0,509
02.09.01	**Day -7**	-0,350%	0,210%	0,031%	-0,381%	5,935%	-0,689

03.09.01	**Day -6**	0,157%	-0,670%	-0,010%	0,167%	6,101%	0,301
04.09.01	**Day -5**	-1,085%	0,252%	0,033%	-1,118%	4,984%	-2,021
05.09.01	**Day -4**	-0,560%	-0,764%	-0,014%	-0,545%	4,438%	-0,986
06.09.01	**Day -3**	0,970%	-1,928%	-0,068%	1,038%	5,476%	1,876
09.09.01	**Day -2**	-1,003%	-1,449%	-0,046%	-0,957%	4,519%	-1,731
10.09.01	**Day -1**	-0,593%	-0,343%	0,005%	-0,598%	3,921%	-1,081
11.09.01	**Day 0**	-3,635%	-1,512%	-0,049%	-3,587%	-3,587%	-6,483
12.09.01	**Day 1**	2,175%	-0,458%	0,000%	2,175%	-1,411%	3,932
13.09.01	**Day 2**	-1,306%	0,557%	0,047%	-1,353%	-2,764%	-2,445
16.09.01	**Day 3**	-5,364%	-0,859%	-0,019%	-5,345%	-8,109%	-9,662
17.09.01	**Day 4**	2,287%	-2,711%	-0,104%	2,391%	-5,718%	4,322
18.09.01	**Day 5**	1,832%	-0,431%	0,001%	1,831%	-3,887%	3,310
19.09.01	**Day 6**	0,894%	-1,033%	-0,027%	0,920%	-2,967%	1,663
20.09.01	**Day 7**	-1,990%	-3,154%	-0,125%	-1,866%	-4,832%	-3,372
23.09.01	**Day 8**	-2,574%	-2,634%	-0,101%	-2,474%	-7,306%	-4,472
24.09.01	**Day 9**	-0,211%	3,677%	0,191%	-0,402%	-7,708%	-0,726
25.09.01	**Day 10**	-0,916%	1,176%	0,076%	-0,992%	-8,700%	-1,793
26.09.01	**Day 11**	-1,207%	-0,065%	0,018%	-1,225%	-9,925%	-2,214
27.09.01	**Day 12**	-0,919%	0,876%	0,062%	-0,981%	-10,905%	-1,773
30.09.01	**Day 13**	1,422%	2,128%	0,120%	1,302%	-9,603%	2,354
01.10.01	**Day 14**	-0,008%	-0,437%	0,001%	-0,009%	-9,612%	-0,017
02.10.01	**Day 15**	-0,293%	1,115%	0,073%	-0,366%	-9,978%	-0,661

Madrid Bombing 2004 - IBEX							
Datum	**Day**	**IBEX return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
19.02.04	**Day -15**	0,065%	-0,283%	-0,145%	0,210%	4,050%	0,28034
20.02.04	**Day -14**	-2,906%	-0,790%	-0,548%	-2,358%	1,692%	-3,14144
23.02.04	**Day -13**	0,728%	-0,030%	0,057%	0,671%	2,363%	0,89414
24.02.04	**Day -12**	-0,157%	-0,255%	-0,123%	-0,034%	2,329%	-0,04561
25.02.04	**Day -11**	-1,345%	-0,015%	0,069%	-1,414%	0,915%	-1,88340
26.02.04	**Day -10**	-0,581%	-0,139%	-0,030%	-0,551%	0,364%	-0,73406
27.02.04	**Day -9**	1,360%	0,245%	0,275%	1,085%	1,449%	1,44510
01.03.04	**Day -8**	0,319%	1,156%	1,002%	-0,682%	0,767%	-0,90869
02.03.04	**Day -7**	-1,271%	-0,581%	-0,382%	-0,889%	-0,122%	-1,18442
03.03.04	**Day -6**	-1,476%	-0,509%	-0,325%	-1,151%	-1,273%	-1,53388
04.03.04	**Day -5**	1,062%	0,448%	0,437%	0,625%	-0,648%	0,83256
05.03.04	**Day -4**	1,816%	0,742%	0,671%	1,144%	0,496%	1,52438
08.03.04	**Day -3**	0,000%	-0,615%	-0,410%	0,409%	0,905%	0,54514
09.03.04	**Day -2**	-0,408%	-0,401%	-0,239%	-0,169%	0,736%	-0,22523
10.03.04	**Day -1**	-1,408%	-1,523%	-1,132%	-0,276%	0,460%	-0,36778
11.03.04	**Day 0**	-1,940%	-1,716%	-1,286%	-0,654%	-0,194%	-0,87063
12.03.04	**Day 1**	-1,560%	0,467%	0,452%	-2,012%	-2,206%	-2,68094
15.03.04	**Day 2**	-3,791%	-1,138%	-0,826%	-2,965%	-5,171%	-3,95037
16.03.04	**Day 3**	1,504%	0,927%	0,818%	0,686%	-4,485%	0,91370
17.03.04	**Day 4**	1,360%	0,941%	0,830%	0,530%	-3,955%	0,70634
18.03.04	**Day 5**	-0,303%	0,122%	0,178%	-0,481%	-4,436%	-0,64060
19.03.04	**Day 6**	-0,079%	-0,657%	-0,443%	0,364%	-4,072%	0,48437
22.03.04	**Day 7**	-1,225%	-1,320%	-0,971%	-0,254%	-4,327%	-0,33893
23.03.04	**Day 8**	0,296%	-0,148%	-0,037%	0,333%	-3,994%	0,44395
24.03.04	**Day 9**	-1,495%	-0,277%	-0,140%	-1,354%	-5,348%	-1,80432

25.03.04	**Day 10**	2,042%	1,353%	1,158%	0,884%	-4,463%	1,17829
26.03.04	**Day 11**	0,068%	0,011%	0,089%	-0,021%	-4,485%	-0,02827
29.03.04	**Day 12**	0,938%	1,217%	1,049%	-0,112%	-4,597%	-0,14909
30.03.04	**Day 13**	0,282%	0,310%	0,328%	-0,046%	-4,642%	-0,06066
31.03.04	**Day 14**	0,925%	0,301%	0,320%	0,605%	-4,038%	0,80549
01.04.04	**Day 15**	1,501%	0,874%	0,777%	0,725%	-3,313%	0,96545

Madrid Bombing 2004 - Tadawul							
Datum	**Day**	**Tadawul return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
19.02.04	**Day -15**	0,549%	-0,283%	0,279%	0,270%	-0,103%	0,18931
20.02.04	**Day -14**	0,578%	-0,790%	0,285%	0,292%	0,563%	0,20468
23.02.04	**Day -13**	-0,390%	-0,030%	0,275%	-0,665%	-0,373%	-0,46571
24.02.04	**Day -12**	0,605%	-0,255%	0,278%	0,327%	-0,338%	0,22905
25.02.04	**Day -11**	0,087%	-0,015%	0,275%	-0,188%	0,139%	-0,13161
26.02.04	**Day -10**	0,698%	-0,139%	0,277%	0,421%	0,233%	0,29508
27.02.04	**Day -9**	1,111%	0,245%	0,272%	0,839%	1,260%	0,58759
01.03.04	**Day -8**	0,267%	1,156%	0,260%	0,008%	0,847%	0,00534
02.03.04	**Day -7**	0,834%	-0,581%	0,283%	0,552%	0,559%	0,38628
03.03.04	**Day -6**	-0,555%	-0,509%	0,282%	-0,837%	-0,285%	-0,58622
04.03.04	**Day -5**	0,303%	0,448%	0,269%	0,034%	-0,803%	0,02358
05.03.04	**Day -4**	0,704%	0,742%	0,265%	0,438%	0,472%	0,30708
08.03.04	**Day -3**	0,211%	-0,615%	0,283%	-0,072%	0,367%	-0,05039
09.03.04	**Day -2**	0,136%	-0,401%	0,280%	-0,144%	-0,216%	-0,10067
10.03.04	**Day -1**	0,090%	-1,523%	0,295%	-0,205%	-0,349%	-0,14356
11.03.04	**Day 0**	0,133%	-1,716%	0,298%	-0,164%	-0,164%	-0,11519
12.03.04	**Day 1**	0,014%	0,467%	0,269%	-0,255%	-0,255%	-0,17855
15.03.04	**Day 2**	0,131%	-1,138%	0,290%	-0,159%	-0,159%	-0,11140
16.03.04	**Day 3**	-0,163%	0,927%	0,263%	-0,426%	-0,426%	-0,29817
17.03.04	**Day 4**	-0,023%	0,941%	0,262%	-0,286%	-0,286%	-0,20023
18.03.04	**Day 5**	0,821%	0,122%	0,273%	0,548%	0,548%	0,38385
19.03.04	**Day 6**	0,440%	-0,657%	0,284%	0,156%	0,156%	0,10946
22.03.04	**Day 7**	1,211%	-1,320%	0,292%	0,918%	0,918%	0,64307

23.03.04	**Day 8**	0,151%	-0,148%	0,277%	-0,126%	-0,126%	-0,08812
24.03.04	**Day 9**	0,597%	-0,277%	0,279%	0,318%	0,318%	0,22292
25.03.04	**Day 10**	0,289%	1,353%	0,257%	0,032%	0,032%	0,02262
26.03.04	**Day 11**	-0,424%	0,011%	0,275%	-0,699%	-0,699%	-0,48950
29.03.04	**Day 12**	0,383%	1,217%	0,259%	0,124%	0,124%	0,08678
30.03.04	**Day 13**	0,472%	0,310%	0,271%	0,202%	0,202%	0,14114
31.03.04	**Day 14**	1,384%	0,301%	0,271%	1,113%	1,113%	0,77967
01.04.04	**Day 15**	0,965%	0,874%	0,263%	0,702%	0,702%	0,49137

London Bombing 2005 - FTSE							
Datum	**Day**	**FTSE return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
16.06.05	**Day -15**	0,48%	0,08%	0,07%	0,41%	-3,13%	0,635
17.06.05	**Day -14**	0,87%	0,27%	0,09%	0,78%	-2,35%	1,216
20.06.05	**Day -13**	-0,30%	0,03%	0,07%	-0,36%	-2,71%	-0,569
21.06.05	**Day -12**	0,33%	-0,23%	0,04%	0,29%	-2,42%	0,447
22.06.05	**Day -11**	0,00%	-0,09%	0,06%	-0,06%	-2,48%	-0,093
23.06.05	**Day -10**	0,17%	-0,07%	0,06%	0,11%	-2,37%	0,173
24.06.05	**Day -9**	-0,40%	0,24%	0,09%	-0,49%	-2,86%	-0,764
27.06.05	**Day -8**	-0,41%	0,29%	0,09%	-0,50%	-3,36%	-0,783
28.06.05	**Day -7**	0,29%	0,41%	0,10%	0,19%	-3,18%	0,292
29.06.05	**Day -6**	-0,20%	0,82%	0,14%	-0,34%	-3,52%	-0,534
30.06.05	**Day -5**	-0,70%	-0,32%	0,04%	-0,74%	-4,26%	-1,154
01.07.05	**Day -4**	-0,27%	0,09%	0,07%	-0,34%	-4,60%	-0,528
04.07.05	**Day -3**	-0,24%	0,08%	0,07%	-0,31%	-4,91%	-0,488
05.07.05	**Day -2**	-0,12%	-0,68%	0,00%	-0,12%	-5,03%	-0,195
06.07.05	**Day -1**	0,99%	-0,64%	0,01%	0,98%	-4,05%	1,537
07.07.05	**Day 0**	-2,30%	-0,24%	0,04%	-2,35%	-2,35%	-3,663
08.07.05	**Day 1**	0,94%	0,59%	0,12%	0,83%	-1,52%	1,289
11.07.05	**Day 2**	1,52%	-0,01%	0,06%	1,45%	-0,07%	2,269
12.07.05	**Day 3**	0,60%	-0,43%	0,03%	0,57%	0,51%	0,895
13.07.05	**Day 4**	-0,60%	-0,09%	0,06%	-0,65%	-0,15%	-1,018
14.07.05	**Day 5**	0,40%	-0,03%	0,06%	0,34%	0,19%	0,526
15.07.05	**Day 6**	-0,82%	0,39%	0,10%	-0,92%	-0,73%	-1,435
18.07.05	**Day 7**	-0,47%	-0,17%	0,05%	-0,52%	-1,25%	-0,813
19.07.05	**Day 8**	-0,95%	-0,42%	0,03%	-0,98%	-2,23%	-1,531

20.07.05	**Day 9**	-0,27%	1,00%	0,16%	-0,42%	-2,65%	-0,662
21.07.05	**Day 10**	1,51%	0,99%	0,16%	1,36%	-1,30%	2,118
22.07.05	**Day 11**	-0,61%	0,46%	0,11%	-0,71%	-2,01%	-1,111
25.07.05	**Day 12**	1,11%	-0,19%	0,05%	1,06%	-0,95%	1,653
26.07.05	**Day 13**	-0,52%	0,35%	0,10%	-0,61%	-1,56%	-0,957
27.07.05	**Day 14**	0,19%	-0,15%	0,05%	0,14%	-1,42%	0,220
28.07.05	**Day 15**	1,03%	-0,26%	0,04%	0,99%	-0,43%	1,542

London Bombing 2005 - TADAWUL							
Datum	**Day**	**Tadawul return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
16.06.05	**Day -15**	0,790%	0,711%	0,487%	0,303%	1,340%	0,2416
19.06.05	**Day -14**	1,641%	0,169%	0,370%	1,271%	2,611%	1,0131
20.06.05	**Day -13**	2,123%	-0,358%	0,256%	1,867%	4,478%	1,4882
21.06.05	**Day -12**	-0,490%	0,081%	0,351%	-0,841%	3,637%	-0,6704
22.06.05	**Day -11**	-2,788%	0,269%	0,391%	-3,180%	0,457%	-2,5351
23.06.05	**Day -10**	2,412%	0,032%	0,340%	2,071%	2,528%	1,6513
26.06.05	**Day -9**	-1,269%	-0,230%	0,284%	-1,553%	0,975%	-1,2380
27.06.05	**Day -8**	0,556%	-0,086%	0,315%	0,241%	1,216%	0,1920
28.06.05	**Day -7**	0,825%	-0,071%	0,318%	0,507%	1,723%	0,4042
29.06.05	**Day -6**	-2,240%	0,237%	0,385%	-2,625%	-0,901%	-2,0924
30.06.05	**Day -5**	0,473%	0,286%	0,395%	0,078%	-0,824%	0,0620
03.07.05	**Day -4**	-3,241%	0,405%	0,421%	-3,661%	-4,485%	-2,9191
04.07.05	**Day -3**	1,423%	0,824%	0,511%	0,912%	-3,573%	0,7267
05.07.05	**Day -2**	-1,495%	-0,318%	0,265%	-1,759%	-5,333%	-1,4027
06.07.05	**Day -1**	-1,611%	0,087%	0,352%	-1,963%	-7,296%	-1,5651
07.07.05	**Day 0**	-0,621%	0,077%	0,350%	-0,971%	-0,971%	-0,7743
10.07.05	**Day 1**	-1,840%	-0,679%	0,187%	-2,027%	-2,998%	-1,6158
11.07.05	**Day 2**	-1,978%	-0,637%	0,196%	-2,174%	-5,172%	-1,7334
12.07.05	**Day 3**	-1,238%	-0,238%	0,282%	-1,520%	-6,692%	-1,2120
13.07.05	**Day 4**	4,270%	0,590%	0,461%	3,810%	-2,883%	3,0373
14.07.05	**Day 5**	-0,719%	-0,009%	0,332%	-1,051%	-3,934%	-0,8378
17.07.05	**Day 6**	-3,836%	-0,431%	0,240%	-4,077%	-8,010%	-3,2502
18.07.05	**Day 7**	-4,120%	-0,085%	0,315%	-4,435%	-12,446%	-3,5362

19.07.05	**Day 8**	4,157%	-0,030%	0,327%	3,830%	-8,615%	3,0537
20.07.05	**Day 9**	1,272%	0,391%	0,418%	0,855%	-7,761%	0,6813
21.07.05	**Day 10**	-0,394%	-0,174%	0,296%	-0,690%	-8,450%	-0,5498
24.07.05	**Day 11**	2,056%	-0,421%	0,243%	1,813%	-6,637%	1,4456
25.07.05	**Day 12**	1,152%	1,003%	0,550%	0,602%	-6,035%	0,4803
26.07.05	**Day 13**	1,315%	0,993%	0,548%	0,768%	-5,267%	0,6119
27.07.05	**Day 14**	0,556%	0,459%	0,432%	0,123%	-5,144%	0,0984
28.07.05	**Day 15**	0,500%	-0,188%	0,293%	0,207%	-4,937%	0,1651

Paris Attack 2015 - CAC40							
Datum	**Day t**	**CAC40 return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
23.10.15	**Day -15**	1,405%	1,018%	0,035%	1,370%	-4,249%	2,0830
26.10.15	**Day -14**	-0,196%	-0,096%	0,035%	-0,231%	-4,480%	-0,3507
27.10.15	**Day -13**	-1,172%	-0,514%	0,035%	-1,208%	-5,687%	-1,8357
28.10.15	**Day -12**	1,138%	1,049%	0,035%	1,103%	-4,584%	1,6765
29.10.15	**Day -11**	-0,987%	-0,440%	0,035%	-1,022%	-5,607%	-1,5539
30.10.15	**Day -10**	0,706%	-0,047%	0,035%	0,671%	-4,936%	1,0198
02.11.15	**Day -9**	0,405%	0,548%	0,035%	0,370%	-4,566%	0,5626
03.11.15	**Day -8**	-0,159%	0,129%	0,035%	-0,194%	-4,760%	-0,2948
04.11.15	**Day -7**	-0,699%	-0,205%	0,035%	-0,734%	-5,494%	-1,1165
05.11.15	**Day -6**	0,722%	-0,181%	0,035%	0,687%	-4,807%	1,0448
06.11.15	**Day -5**	-1,103%	-0,374%	0,035%	-1,138%	-5,945%	-1,7296
09.11.15	**Day -4**	-1,289%	-0,753%	0,035%	-1,324%	-7,269%	-2,0130
10.11.15	**Day -3**	-0,464%	-0,064%	0,035%	-0,500%	-7,768%	-0,7595
11.11.15	**Day -2**	1,042%	0,081%	0,035%	1,007%	-6,761%	1,5306
12.11.15	**Day -1**	-1,490%	-1,212%	0,035%	-1,525%	-8,286%	-2,3180
13.11.15	**Day 0**	-1,501%	-1,034%	0,035%	-1,536%	-9,822%	-2,3349
16.11.15	**Day 1**	-0,375%	0,792%	0,035%	-0,410%	-0,410%	-0,6228
17.11.15	**Day 2**	2,290%	0,517%	0,035%	2,255%	2,255%	3,4282
18.11.15	**Day 3**	-0,687%	0,918%	0,035%	-0,722%	-0,722%	-1,0982
19.11.15	**Day 4**	0,976%	0,531%	0,035%	0,940%	0,940%	1,4297
20.11.15	**Day 5**	-0,795%	0,133%	0,035%	-0,830%	-0,830%	-1,2622
23.11.15	**Day 6**	-0,728%	-0,325%	0,035%	-0,763%	-0,763%	-1,1602
24.11.15	**Day 7**	-1,164%	-0,108%	0,035%	-1,199%	-1,199%	-1,8232
25.11.15	**Day 8**	1,271%	0,140%	0,035%	1,236%	1,236%	1,8794

26.11.15	**Day 9**	0,993%	0,353%	0,035%	0,958%	0,958%	1,4564
27.11.15	**Day 10**	-0,454%	-0,209%	0,035%	-0,489%	-0,489%	-0,7430
30.11.15	**Day 11**	0,177%	-0,347%	0,035%	0,142%	0,142%	0,2162
01.12.15	**Day 12**	-0,344%	0,923%	0,035%	-0,379%	-0,379%	-0,5759
02.12.15	**Day 13**	-0,471%	-0,816%	0,035%	-0,506%	-0,506%	-0,7696
03.12.15	**Day 14**	-0,693%	-1,067%	0,035%	-0,728%	-0,728%	-1,1073
04.12.15	**Day 15**	-0,630%	0,981%	0,035%	-0,665%	-0,665%	-1,0107

Paris Attack 2015 - Tadawul							
Datum	**Day**	**Tadawul return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
25.10.15	**Day -15**	-1,485%	1,018%	0,739%	-2,224%	-5,425%	-1,348
26.10.15	**Day -14**	0,633%	-0,096%	-0,193%	0,826%	-4,599%	0,501
27.10.15	**Day -13**	-3,111%	-0,514%	-0,543%	-2,568%	-7,166%	-1,556
28.10.15	**Day -12**	0,272%	1,049%	0,765%	-0,493%	-7,660%	-0,299
29.10.15	**Day -11**	0,098%	-0,440%	-0,481%	0,579%	-7,081%	0,351
01.11.15	**Day -10**	-1,134%	-0,047%	-0,153%	-0,981%	-8,062%	-0,595
02.11.15	**Day -9**	0,311%	0,548%	0,346%	-0,034%	-8,096%	-0,021
03.11.15	**Day -8**	-1,591%	0,129%	-0,005%	-1,585%	-9,682%	-0,961
04.11.15	**Day -7**	1,157%	-0,205%	-0,285%	1,442%	-8,240%	0,874
05.11.15	**Day -6**	-1,061%	-0,181%	-0,265%	-0,796%	-9,036%	-0,482
08.11.15	**Day -5**	-0,525%	-0,374%	-0,426%	-0,099%	-9,134%	-0,060
09.11.15	**Day -4**	1,293%	-0,753%	-0,744%	2,037%	-7,098%	1,234
10.11.15	**Day -3**	-0,400%	-0,064%	-0,167%	-0,233%	-7,331%	-0,141
11.11.15	**Day -2**	1,998%	0,081%	-0,045%	2,044%	-5,287%	1,238
12.11.15	**Day -1**	-0,623%	-1,212%	-1,128%	0,505%	-4,782%	0,306
13.11.15	**Day 0**						
15.11.15	**Day 1**	-2,896%	-1,034%	-0,979%	-1,917%	-1,917%	-1,1619
16.11.15	**Day 2**	1,137%	0,792%	0,550%	0,587%	-1,330%	0,3558
17.11.15	**Day 3**	-0,627%	0,517%	0,320%	-0,947%	-2,277%	-0,5739
18.11.15	**Day 4**	0,529%	0,918%	0,655%	-0,126%	-2,403%	-0,0762
19.11.15	**Day 5**	1,153%	0,531%	0,331%	0,821%	-1,582%	0,4976
22.11.15	**Day 6**	2,036%	0,133%	-0,002%	2,038%	0,456%	1,2350
23.11.15	**Day 7**	-0,434%	-0,325%	-0,386%	-0,048%	0,408%	-0,0293

24.11.15	**Day 8**	0,580%	-0,108%	-0,204%	0,784%	1,191%	0,4749
25.11.15	**Day 9**	0,100%	0,140%	0,004%	0,096%	1,288%	0,0585
26.11.15	**Day 10**	0,525%	0,353%	0,183%	0,342%	1,630%	0,2073
29.11.15	**Day 11**	0,183%	-0,209%	-0,288%	0,471%	2,101%	0,2855
30.11.15	**Day 12**	-0,164%	-0,347%	-0,404%	0,239%	2,340%	0,1451
01.12.15	**Day 13**	0,731%	0,923%	0,660%	0,071%	2,411%	0,0428
02.12.15	**Day 14**	0,749%	-0,816%	-0,796%	1,545%	3,956%	0,9361
03.12.15	**Day 15**	-1,068%	-1,067%	-1,006%	-0,062%	3,894%	-0,0374

Nizza Attack 2016 - CAC40							
Datum	**Day After Event**	**CAC40 return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
23.06.16	**Day -15**	2,383%	1,420%	1,480%	0,903%	-0,962%	1,0434
24.06.16	**Day -14**	-10,045%	-5,029%	-5,296%	-4,749%	-5,711%	-5,4874
27.06.16	**Day -13**	-4,169%	-2,329%	-2,459%	-1,710%	-7,421%	-1,9758
28.06.16	**Day -12**	2,715%	1,726%	1,801%	0,914%	-6,507%	1,0563
29.06.16	**Day -11**	2,977%	2,183%	2,282%	0,695%	-5,811%	0,8033
30.06.16	**Day -10**	0,774%	1,145%	1,191%	-0,417%	-6,228%	-0,4814
01.07.16	**Day -9**	1,434%	0,424%	0,434%	1,000%	-5,228%	1,1552
04.07.16	**Day -8**	-0,820%	0,037%	0,027%	-0,847%	-6,076%	-0,9793
05.07.16	**Day -7**	-2,223%	-0,928%	-0,987%	-1,236%	-7,312%	-1,4280
06.07.16	**Day -6**	-1,903%	-0,292%	-0,319%	-1,584%	-8,896%	-1,8305
07.07.16	**Day -5**	0,568%	0,194%	0,192%	0,376%	-8,520%	0,4343

08.07.16	**Day -4**	1,672%	1,112%	1,157%	0,515%	-8,005%	0,5950
11.07.16	**Day -3**	1,729%	0,829%	0,859%	0,870%	-7,135%	1,0056
12.07.16	**Day -2**	1,908%	0,864%	0,896%	1,012%	-6,123%	1,1695
13.07.16	**Day -1**	0,243%	0,218%	0,217%	0,026%	-6,097%	0,0297
14.07.16	**Day 0**	1,189%	0,520%	0,535%	0,654%	-5,443%	0,7556
15.07.16	**Day 1**	-0,757%	-0,156%	-0,176%	-0,581%	-0,581%	-0,6718
18.07.16	**Day 2**	-0,257%	0,197%	0,195%	-0,452%	-1,034%	-0,5227
19.07.16	**Day 3**	-1,152%	-0,306%	-0,334%	-0,818%	-1,852%	-0,9451
20.07.16	**Day 4**	1,067%	0,505%	0,519%	0,548%	-1,303%	0,6337
21.07.16	**Day 5**	-0,062%	-0,113%	-0,130%	0,068%	-1,235%	0,0789
22.07.16	**Day 6**	-0,262%	0,092%	0,085%	-0,347%	-1,582%	-0,4010
25.07.16	**Day 7**	0,340%	-0,178%	-0,199%	0,538%	-1,044%	0,6220
26.07.16	**Day 8**	0,163%	0,120%	0,114%	0,049%	-0,995%	0,0566
27.07.16	**Day 9**	1,208%	0,021%	0,010%	1,198%	0,203%	1,3840
28.07.16	**Day 10**	0,175%	0,073%	0,064%	0,111%	0,314%	0,1284
29.07.16	**Day 11**	1,163%	0,828%	0,858%	0,305%	0,619%	0,3519
01.08.16	**Day 12**	-0,567%	-0,240%	-0,264%	-0,303%	0,315%	-0,3505
02.08.16	**Day 13**	-1,394%	-0,651%	-0,696%	-0,697%	-0,382%	-0,8060
03.08.16	**Day 14**	-0,597%	-0,181%	-0,203%	-0,395%	-0,777%	-0,4562
04.08.16	**Day 15**	0,244%	0,250%	0,250%	-0,007%	-0,783%	-0,0076

Nizza Attack 2016 - Tadawul							
Datum	**Day After Event**	**Tadawul return**	**MSCI return**	**Expected return**	**Abnormal return**	**Cumulative AR**	**T-stat**
16.06.16	**Day -15**	-0,364%	-0,348%	-0,469%	0,105%	4,350%	0,0713
19.06.16	**Day -14**	-0,006%	0,469%	0,275%	-0,282%	4,068%	-0,1913

20.06.16	**Day -13**	0,252%	1,719%	1,415%	-1,163%	2,905%	-0,7899
21.06.16	**Day -12**	-0,090%	0,278%	0,102%	-0,192%	2,713%	-0,1304
22.06.16	**Day -11**	-0,312%	-0,052%	-0,200%	-0,112%	2,601%	-0,0764
23.06.16	**Day -10**	0,281%	1,420%	1,142%	-0,861%	1,739%	-0,5852
26.06.16	**Day -9**	-1,111%	-5,029%	-4,737%	3,626%	5,365%	2,4632
27.06.16	**Day -8**	-0,213%	-2,329%	-2,275%	2,062%	7,428%	1,4011
28.06.16	**Day -7**	0,226%	1,726%	1,421%	-1,195%	6,232%	-0,8121
29.06.16	**Day -6**	0,315%	2,183%	1,838%	-1,523%	4,709%	-1,0346
30.06.16	**Day -5**	-0,016%	1,145%	0,892%	-0,908%	3,801%	-0,6169
10.07.16	**Day -4**	0,836%	1,112%	0,862%	-0,026%	3,776%	-0,0175
11.07.16	**Day -3**	0,236%	0,829%	0,603%	-0,367%	3,409%	-0,2492
12.07.16	**Day -2**	0,854%	0,864%	0,635%	0,218%	3,627%	0,1482
13.07.16	**Day -1**	0,988%	0,218%	0,047%	0,942%	4,569%	0,6397
14.07.16	**Day 0**	-0,443%	0,520%	0,322%	-0,765%	3,803%	-0,5199
17.07.16	**Day 1**	0,284%	-0,156%	-0,294%	0,578%	0,578%	0,3929
18.07.16	**Day 2**	0,026%	0,197%	0,028%	-0,002%	0,576%	-0,0015
19.07.16	**Day 3**	-0,532%	-0,306%	-0,431%	-0,101%	0,475%	-0,0685
20.07.16	**Day 4**	-0,247%	0,505%	0,308%	-0,556%	-0,081%	-0,3775
21.07.16	**Day 5**	-0,440%	-0,113%	-0,255%	-0,185%	-0,265%	-0,1256
24.07.16	**Day 6**	-1,188%	0,092%	-0,068%	-1,120%	-1,385%	-0,7608
25.07.16	**Day 7**	-0,109%	-0,178%	-0,314%	0,205%	-1,181%	0,1390
26.07.16	**Day 8**	-0,702%	0,120%	-0,042%	-0,660%	-1,841%	-0,4483
27.07.16	**Day 9**	-0,608%	0,021%	-0,133%	-0,475%	-2,316%	-0,3230
28.07.16	**Day 10**	-1,506%	0,073%	-0,086%	-1,421%	-3,736%	-0,9650
31.07.16	**Day 11**	-0,521%	0,828%	0,603%	-1,124%	-4,860%	-0,7634

01.08.16	**Day 12**	0,683%	-0,240%	-0,371%	1,054%	-3,806%	0,7160
02.08.16	**Day 13**	-1,228%	-0,651%	-0,746%	-0,482%	-4,288%	-0,3274
03.08.16	**Day 14**	-0,500%	-0,181%	-0,317%	-0,182%	-4,470%	-0,1238
04.08.16	**Day 15**	0,150%	0,250%	0,076%	0,075%	-4,396%	0,0508

GARCH (1,1)

11 September 2001 - Volatility Dow Jones					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
	Day 0				
17.09.01	**Day 1**	7,3962%	1,1995%	1,1995%	6,1967%
18.09.01	**Day 2**	0,1941%	1,2023%	1,2009%	-1,0082%
19.09.01	**Day 3**	1,6337%	1,2049%	1,2022%	0,4288%
20.09.01	**Day 4**	4,4701%	1,2072%	1,2035%	3,2629%
21.09.01	**Day 5**	1,6904%	1,2095%	1,2047%	0,4809%
24.09.01	**Day 6**	4,3719%	1,2115%	1,2058%	3,1604%
25.09.01	**Day 7**	0,6500%	1,2135%	1,2069%	-0,5634%
26.09.01	**Day 8**	1,0748%	1,2152%	1,2080%	-0,1404%
27.09.01	**Day 9**	1,3222%	1,2169%	1,2090%	0,1053%
28.09.01	**Day 10**	1,8957%	1,2184%	1,2099%	0,6772%

GARCH(1,1)	**DJIA**
Parameter	**Value**
μ	-0,071%
α_0	0,001%
α_1	6,282%
β_1	86,782%
VL daily	1,209%
VL annualized	19,113%

11 September 2001 - Volatility Tadawul					
Date	**Day**	**Realized Vol**	**Forecasted Vol**	**Term Structure**	**Deviation**
11.09.01	**Day 0**	3,6354%	0,5424%	0,5424%	3,0930%
12.09.01	**Day 1**	2,1752%	0,5407%	0,5415%	1,6345%
13.09.01	**Day 2**	1,3057%	0,5392%	0,5408%	0,7665%
16.09.01	**Day 3**	5,3636%	0,5379%	0,5401%	4,8257%
17.09.01	**Day 4**	2,2870%	0,5369%	0,5394%	1,7502%
18.09.01	**Day 5**	1,8323%	0,5359%	0,5388%	1,2964%
19.09.01	**Day 6**	0,8936%	0,5351%	0,5383%	0,3586%
20.09.01	**Day 7**	1,9903%	0,5344%	0,5378%	1,4559%
23.09.01	**Day 8**	2,5744%	0,5338%	0,5374%	2,0407%
24.09.01	**Day 9**	0,2107%	0,5332%	0,5370%	-0,3226%
25.09.01	**Day 10**	0,9162%	0,5328%	0,5366%	0,3834%

GARCH(1,1)	**TADAWUL**
Parameter	**Value**
μ	0,032%
α_0	0,000%
α_1	12,202%
β_1	74,074%
VL daily	1,207%
VL annualized	19,077%

Madrid Bombing 2004 - Volatility IBEX					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
11.03.04	**Day 0**	1,9396%	1,8681%	1,8681%	0,0716%
12.03.04	**Day 1**	1,5603%	1,8683%	1,8682%	-0,3080%
15.03.04	**Day 2**	3,7910%	1,8685%	1,8683%	1,9225%
16.03.04	**Day 3**	1,5043%	1,8687%	1,8684%	-0,3644%
17.03.04	**Day 4**	1,3601%	1,8690%	1,8685%	-0,5088%
18.03.04	**Day 5**	0,3033%	1,8692%	1,8686%	-1,5659%
19.03.04	**Day 6**	0,0791%	1,8694%	1,8687%	-1,7903%
22.03.04	**Day 7**	1,2252%	1,8696%	1,8688%	-0,6444%
23.03.04	**Day 8**	0,2962%	1,8698%	1,8689%	-1,5736%
24.03.04	**Day 9**	1,4948%	1,8700%	1,8691%	-0,3752%
25.03.04	**Day 10**	2,0421%	1,8702%	1,8692%	0,1719%

GARCH(1,1)	**IBEX**
Parameter	**Value**
μ	0,157%
α_0	0,000%
α_1	11,847%
β_1	87,566%
VL daily	1,463%
VL annualized	23,124%

Madrid Bombing 2004 - Volatility Tadawul					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
11.03.04	**Day 0**	0,1331%	1,0362%	1,0362%	-0,9031%
12.03.04	**Day 1**	0,0138%	1,0871%	1,0619%	-1,0733%
15.03.04	**Day 2**	0,1309%	1,1303%	1,0852%	-0,9994%
16.03.04	**Day 3**	0,1630%	1,1673%	1,1063%	-1,0042%
17.03.04	**Day 4**	0,0234%	1,1990%	1,1255%	-1,1756%
18.03.04	**Day 5**	0,8214%	1,2265%	1,1429%	-0,4052%
19.03.04	**Day 6**	0,4399%	1,2504%	1,1589%	-0,8105%
22.03.04	**Day 7**	1,2105%	1,2711%	1,1735%	-0,0606%
23.03.04	**Day 8**	0,1511%	1,2892%	1,1869%	-1,1382%
24.03.04	**Day 9**	0,5969%	1,3051%	1,1993%	-0,7082%
25.03.04	**Day 10**	0,2893%	1,3189%	1,2106%	-1,0296%

GARCH(1,1)	**Tadawul**
Parameter	**Value**
μ	0,286%
α_0	0,002%
α_1	47,830%
β_1	40,779%
VL daily	1,3802
VL annualized	21,8229

London Bombing 2005 - Volatility FTSE					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
07.07.05	**Day 0**	2,3041%	0,6664%	0,6664%	1,6377%
08.07.05	**Day 1**	0,9449%	0,6512%	0,6589%	0,2936%
11.07.05	**Day 2**	1,5184%	0,6475%	0,6551%	0,8708%
12.07.05	**Day 3**	0,5995%	0,6467%	0,6530%	-0,0472%
13.07.05	**Day 4**	0,5954%	0,6464%	0,6517%	-0,0511%
14.07.05	**Day 5**	0,3993%	0,6464%	0,6508%	-0,2471%
15.07.05	**Day 6**	0,8187%	0,6464%	0,6502%	0,1723%
18.07.05	**Day 7**	0,4720%	0,6464%	0,6497%	-0,1744%
19.07.05	**Day 8**	0,9547%	0,6464%	0,6493%	0,3083%
20.07.05	**Day 9**	0,2676%	0,6464%	0,6490%	-0,3788%
21.07.05	**Day 10**	1,5125%	0,6464%	0,6488%	0,8661%

GARCH(1,1)	**FTSE**
Parameter	**Value**
μ	0,0666%
α_0	0,0032%
α_1	6,3250%
β_1	18,3240%
VL daily	1,0296%
VL annualized	16,2801%

London Bombing 2005 - Volatility Tadawul					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
07.07.05	**Day 0**	0,6211%	1,2495%	1,2495%	-0,6284%
10.07.05	**Day 1**	1,8398%	1,2470%	1,2483%	0,5928%
11.07.05	**Day 2**	1,9784%	1,2446%	1,2470%	0,7338%
12.07.05	**Day 3**	1,2382%	1,2421%	1,2458%	-0,0039%
13.07.05	**Day 4**	4,2704%	1,2397%	1,2446%	3,0307%
14.07.05	**Day 5**	0,7194%	1,2374%	1,2434%	-0,5180%
17.07.05	**Day 6**	3,8363%	1,2351%	1,2422%	2,6012%
18.07.05	**Day 7**	4,1205%	1,2328%	1,2410%	2,8877%
19.07.05	**Day 8**	4,1572%	1,2306%	1,2399%	2,9267%
20.07.05	**Day 9**	1,2725%	1,2284%	1,2387%	0,0441%
21.07.05	**Day 10**	0,3938%	1,2263%	1,2376%	-0,8325%

GARCH(1,1)	**Tadawul**
Parameter	**Value**
μ	0,2508%
α_0	0,0002%
α_1	14,6111%
β_1	83,4604%
VL daily	1,4225%
VL annualized	22,4921%

Paris Attack 2015 - Volatility CAC40					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
13.11.15	**Day 0**				
16.11.15	**Day 1**	0,375%	1,372%	1,372%	-0,9975%
17.11.15	**Day 2**	2,290%	1,368%	1,370%	0,9227%
18.11.15	**Day 3**	0,687%	1,364%	1,368%	-0,6764%
19.11.15	**Day 4**	0,976%	1,360%	1,366%	-0,3846%
20.11.15	**Day 5**	0,795%	1,357%	1,364%	-0,5622%
23.11.15	**Day 6**	0,728%	1,355%	1,363%	-0,6268%
24.11.15	**Day 7**	1,164%	1,353%	1,361%	-0,1884%
25.11.15	**Day 8**	1,271%	1,351%	1,360%	-0,0792%
26.11.15	**Day 9**	0,993%	1,349%	1,359%	-0,3558%
27.11.15	**Day 10**	0,454%	1,348%	1,358%	-0,8939%

GARCH(1,1)	**CAC40**
Parameter	**Value**
μ	0,0559%
α_0	0,0024%
α_1	14,5622%
β_1	72,1596%
VL daily	1,2321
VL annualized	19,4811

Paris Attack 2015 - Volatility Tadawul					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
13.11.15	**Day 0**				
15.11.15	**Day 1**	2,8516%	1,8176%	1,8176%	1,0339%
16.11.15	**Day 2**	1,2472%	1,8285%	1,8231%	-0,5814%
17.11.15	**Day 3**	0,8176%	1,8389%	1,8284%	-1,0214%
18.11.15	**Day 4**	0,4408%	1,8489%	1,8335%	-1,4080%
19.11.15	**Day 5**	0,6249%	1,8583%	1,8385%	-1,2334%
22.11.15	**Day 6**	1,7468%	1,8673%	1,8433%	-0,1206%
23.11.15	**Day 7**	0,7167%	1,8759%	1,8480%	-1,1592%
24.11.15	**Day 8**	0,3390%	1,8841%	1,8526%	-1,5451%
25.11.15	**Day 9**	0,3001%	1,8919%	1,8570%	-1,5918%
26.11.15	**Day 10**	0,2414%	1,8994%	1,8613%	-1,6580%

GARCH(1,1)	**Tadawul**
Parameter	**Value**
μ	-0,0511%
α_0	0,0018%
α_1	24,2463%
β_1	71,5751%
VL daily	1,4054%
VL annualized	22,2214%

Nice Attack 2016 - Volatility CAC40					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
14.07.16	**Day 0**				
15.07.16	**Day 1**	0,7571%	1,4320%	1,4320%	-0,6750%
18.07.16	**Day 2**	0,2570%	1,4556%	1,4439%	-1,1986%
19.07.16	**Day 3**	1,1518%	1,4766%	1,4549%	-0,3248%
20.07.16	**Day 4**	1,0670%	1,4954%	1,4651%	-0,4284%
21.07.16	**Day 5**	0,0620%	1,5121%	1,4746%	-1,4501%
22.07.16	**Day 6**	0,2624%	1,5272%	1,4835%	-1,2648%
25.07.16	**Day 7**	0,3396%	1,5406%	1,4918%	-1,2011%
26.07.16	**Day 8**	0,1633%	1,5527%	1,4996%	-1,3895%
27.07.16	**Day 9**	1,2079%	1,5636%	1,5068%	-0,3557%
28.07.16	**Day 10**	0,1754%	1,5733%	1,5136%	-1,3979%

GARCH(1,1)	**CAC40**
Parameter	**Value**
μ	-0,0645%
α_0	0,0026%
α_1	26,8067%
β_1	63,6948%
VL daily	1,3426%
VL annualized	21,2283%

Paris Attack 2015 - Volatility Tadawul					
Date	**Day**	**Realized vol**	**Forecasted vol**	**Term structure**	**Deviation**
14.07.16	**Day 0**				
17.07.16	**Day 1**	0,28424%	1,4365%	1,4365%	-1,1523%
18.07.16	**Day 2**	0,02566%	1,4502%	1,4434%	-1,4245%
19.07.16	**Day 3**	0,53217%	1,4620%	1,4496%	-0,9298%
20.07.16	**Day 4**	0,24744%	1,4722%	1,4553%	-1,2248%
21.07.16	**Day 5**	0,43956%	1,4812%	1,4605%	-1,0416%
24.07.16	**Day 6**	1,18809%	1,4889%	1,4653%	-0,3008%
25.07.16	**Day 7**	0,10939%	1,4957%	1,4697%	-1,3863%
26.07.16	**Day 8**	0,70235%	1,5016%	1,4737%	-0,7992%
27.07.16	**Day 9**	0,60826%	1,5067%	1,4774%	-0,8984%
28.07.16	**Day 10**	1,50640%	1,5112%	1,4808%	-0,0048%

GARCH(1,1)	**Tadawul**
Parameter	**Value**
μ	-0,0298%
α_0	0,0030%
α_1	23,4469%
β_1	64,0490%
VL daily	1,2972%
VL annualized	20,5109%

Maximum Drawdown

11 September 2001 - Maximum drawdown DJIA					
Date	**Day**	**DJIA price**	**DJIA return**	**Traded volume**	**Maximum drawdown**
	Day 0				
17.09.01	**Day 1**	8.920,70	-7,40%	568.842.600	-21,32%
18.09.01	**Day 2**	8.903,40	-0,19%	373.225.100	-21,47%
19.09.01	**Day 3**	8.759,13	-1,63%	461.128.700	-22,74%
20.09.01	**Day 4**	8.376,21	-4,47%	443.453.900	-26,12%
21.09.01	**Day 5**	8.235,81	-1,69%	627.954.700	-27,36%
24.09.01	**Day 6**	8.603,86	4,37%	406.680.700	-24,11%
25.09.01	**Day 7**	8.659,97	0,65%	352.780.700	-23,62%
26.09.01	**Day 8**	8.567,39	-1,07%	273.232.200	-24,44%
27.09.01	**Day 9**	8.681,42	1,32%	284.276.900	-23,43%
28.09.01	**Day 10**	8.847,56	1,90%	347.781.200	-21,96%
01.10.01	**Day 11**	8.836,83	-0,12%	252.452.400	-22,06%
02.10.01	**Day 12**	8.950,59	1,28%	262.353.500	-21,06%
03.10.01	**Day 13**	9.123,78	1,92%	330.422.900	-19,53%
04.10.01	**Day 14**	9.060,88	-0,69%	310.067.400	-20,08%
05.10.01	**Day 15**	9.119,77	0,65%	259.441.600	-19,56%

11 September 2001 - Maximum drawdown Tadawul					
Datum	**Day ater event**	**Tadawul price**	**Tadawul return**	**Traded volume**	**Maximum drawdown**
11.09.01	**Day 0**	653,50	-3,635%	not available	-5,92%
12.09.01	**Day 1**	667,87	2,175%		-3,85%
13.09.01	**Day 2**	659,21	-1,306%		-5,10%
16.09.01	**Day 3**	624,78	-5,364%		-10,05%
17.09.01	**Day 4**	639,24	2,287%		-7,97%
18.09.01	**Day 5**	651,06	1,832%		-6,27%
19.09.01	**Day 6**	656,90	0,894%		-5,43%
20.09.01	**Day 7**	643,96	-1,990%		-7,29%
23.09.01	**Day 8**	627,59	-2,574%		-9,65%
24.09.01	**Day 9**	626,27	-0,211%		-9,84%
25.09.01	**Day 10**	620,56	-0,916%		-10,66%
26.09.01	**Day 11**	613,11	-1,207%		-11,73%
27.09.01	**Day 12**	607,50	-0,919%		-12,54%
30.09.01	**Day 13**	616,20	1,422%		-11,29%
01.10.01	**Day 14**	616,15	-0,008%		-11,29%
02.10.01	**Day 15**	614,35	-0,293%		-11,55%
03.10.01	**Day 16**	609,38	-0,813%		-12,27%
04.10.01	**Day 17**	609,31	-0,011%		-12,28%
07.10.01	**Day 18**	604,19	-0,844%		-13,02%

Madrid Bombing 2004 - Maximum drawdown					
Datum	**Day after event**	**IBEX price**	**IBEX return**	**Traded volume**	**Maximum drawdown**
11.03.04	**Day 0**	9.961,22	0,133%	199.398.700	-6,17%
12.03.04	**Day 1**	9.807,00	0,014%	211.358.400	-7,62%
15.03.04	**Day 2**	9.442,18	0,131%	347.977.200	-11,06%
16.03.04	**Day 3**	9.585,29	-0,163%	286.586.900	-9,71%
17.03.04	**Day 4**	9.716,55	-0,023%	287.585.600	-8,47%
18.03.04	**Day 5**	9.687,13	0,821%	209.204.700	-8,75%
19.03.04	**Day 6**	9.679,47	0,440%	249.957.900	-8,82%
22.03.04	**Day 7**	9.561,61	1,211%	216.597.800	-9,93%
23.03.04	**Day 8**	9.589,97	0,151%	191.335.600	-9,66%
24.03.04	**Day 9**	9.447,68	0,597%	206.328.100	-11,01%
25.03.04	**Day 10**	9.642,60	0,289%	201.173.300	-9,17%
26.03.04	**Day 11**	9.649,13	-0,424%	170.974.400	-9,11%
29.03.04	**Day 12**	9.740,02	0,383%	153.914.700	-8,25%
30.03.04	**Day 13**	9.767,53	0,472%	119.305.300	-7,99%
31.03.04	**Day 14**	9.858,25	1,384%	169.571.900	-7,14%
01.04.04	**Day 15**	10.007,38	0,965%	241.116.800	-5,73%

Madrid Bombing 2004 - Maximum drawdown Tadawul					
Datum	**Day ater event**	**Tadawul price**	**Tadawul return**	**Traded volume**	**Maximum drawdown**
11.03.04	**Day 0**	1310,91	0,133%	not available	0,13%
12.03.04	**Day 1**	1311,10	0,014%		0,15%
15.03.04	**Day 2**	1312,81	0,131%		0,28%
16.03.04	**Day 3**	1310,67	-0,163%		0,11%
17.03.04	**Day 4**	1310,37	-0,023%		0,09%
18.03.04	**Day 5**	1321,17	0,821%		0,92%
19.03.04	**Day 6**	1327,00	0,440%		1,36%
22.03.04	**Day 7**	1343,16	1,211%		2,60%
23.03.04	**Day 8**	1345,19	0,151%		2,75%
24.03.04	**Day 9**	1353,24	0,597%		3,37%
25.03.04	**Day 10**	1357,16	0,289%		3,67%
26.03.04	**Day 11**	1351,42	-0,424%		3,23%
29.03.04	**Day 12**	1356,60	0,383%		3,62%
30.03.04	**Day 13**	1363,03	0,472%		4,11%
31.03.04	**Day 14**	1382,02	1,384%		5,56%
01.04.04	**Day 15**	1395,42	0,965%		6,59%
11.03.04	**Day 0**	1310,91	0,133%		0,13%
12.03.04	**Day 1**	1311,10	0,014%		0,15%
15.03.04	**Day 2**	1312,81	0,131%		0,28%

London Bombing 2005 - FTSE					
Datum	**Day After Event**	**FTSE price**	**FTSE return**	**Traded volume**	**Maximum drawdown**
07.07.05	**Day 0**	8.985,76	-2,304%	2.818.981.171	-7,25%
08.07.05	**Day 1**	9.071,07	0,945%	1.410.478.200	-6,37%
11.07.05	**Day 2**	9.209,85	1,518%	1.396.466.256	-4,94%
12.07.05	**Day 3**	9.265,23	0,599%	1.653.882.141	-4,37%
13.07.05	**Day 4**	9.210,23	-0,595%	1.719.184.091	-4,93%
14.07.05	**Day 5**	9.247,08	0,399%	1.858.030.204	-4,55%
15.07.05	**Day 6**	9.171,68	-0,819%	2.065.474.822	-5,33%
18.07.05	**Day 7**	9.128,50	-0,472%	2.038.923.194	-5,78%
19.07.05	**Day 8**	9.041,77	-0,955%	2.547.505.239	-6,67%
20.07.05	**Day 9**	9.017,60	-0,268%	1.962.982.212	-6,92%
21.07.05	**Day 10**	9.155,03	1,513%	1.623.414.638	-5,50%
22.07.05	**Day 11**	9.099,76	-0,606%	1.361.514.712	-6,07%
25.07.05	**Day 12**	9.201,06	1,107%	1.318.492.972	-5,03%
26.07.05	**Day 13**	9.153,67	-0,516%	1.530.762.823	-5,52%
27.07.05	**Day 14**	9.171,30	0,192%	2.381.177.438	-5,34%
28.07.05	**Day 15**	9.266,24	1,030%	1.841.934.197	-4,36%

London Bombing 2005 - Tadawul					
Datum	**Day After Event**	**Tadawul price**	**Tadawul return**	**Traded volume**	**Maximum drawdown**
07.07.05	**Day 0**	3394,14	-0,621%	not available	-7,75%
08.07.05	**Day 1**	3332,27	-1,840%		-9,43%
11.07.05	**Day 2**	3266,99	-1,978%		-11,21%
12.07.05	**Day 3**	3226,79	-1,238%		-12,30%
13.07.05	**Day 4**	3367,57	4,270%		-8,47%
14.07.05	**Day 5**	3343,43	-0,719%		-9,13%
15.07.05	**Day 6**	3217,60	-3,836%		-12,55%
18.07.05	**Day 7**	3087,71	-4,120%		-16,08%
19.07.05	**Day 8**	3218,78	4,157%		-12,52%
20.07.05	**Day 9**	3260,00	1,272%		-11,40%
21.07.05	**Day 10**	3247,19	-0,394%		-11,74%
22.07.05	**Day 11**	3314,63	2,056%		-9,91%
25.07.05	**Day 12**	3353,04	1,152%		-8,87%
26.07.05	**Day 13**	3397,43	1,315%		-7,66%
27.07.05	**Day 14**	3416,37	0,556%		-7,15%
28.07.05	**Day 15**	3433,49	0,500%		-6,68%
07.07.05	**Day 0**	3394,14	-0,621%		-7,75%
08.07.05	**Day 1**	3332,27	-1,840%		-9,43%
11.07.05	**Day 2**	3266,99	-1,978%		-11,21%

Paris Attack 2015 - CAC40					
Datum	**Day After Event**	**CAC40 price**	**CAC40 return**	**Traded volume**	**Maximum drawdown**
13.11.15	**Day 0**	5.157,01	-1,501%	117.564.700,00	-10,26%
16.11.15	**Day 1**	5.137,73	-0,375%	111.969.900	-10,60%
17.11.15	**Day 2**	5.256,75	2,290%	123.050.700	-8,53%
18.11.15	**Day 3**	5.220,75	-0,687%	100.363.600	-9,15%
19.11.15	**Day 4**	5.271,94	0,976%	106.803.400	-8,26%
20.11.15	**Day 5**	5.230,18	-0,795%	118.279.900	-8,99%
23.11.15	**Day 6**	5.192,25	-0,728%	99.346.580	-9,65%
24.11.15	**Day 7**	5.132,15	-1,164%	118.792.300	-10,70%
25.11.15	**Day 8**	5.197,82	1,271%	119.792.700	-9,55%
26.11.15	**Day 9**	5.249,71	0,993%	96.150.170	-8,65%
27.11.15	**Day 10**	5.225,95	-0,454%	76.025.460	-9,06%
30.11.15	**Day 11**	5.235,23	0,177%	116.625.500	-8,90%
01.12.15	**Day 12**	5.217,27	-0,344%	131.931.400	-9,21%
02.12.15	**Day 13**	5.192,75	-0,471%	139.201.500	-9,64%
03.12.15	**Day 14**	5.156,87	-0,693%	210.432.000	-10,27%
04.12.15	**Day 15**	5.124,51	-0,630%	163.120.200	-10,83%

Paris Attack 2015 - Tadawul					
Datum	**Day After Event**	**Tadawul price**	**Tadawul return**	**Traded volume**	**Maximum drawdown**
13.11.15	**Day 0**				
15.11.15	**Day 1**	1.834,95	-2,896%	210.937.100	-30,02%
16.11.15	**Day 2**	1.855,92	1,137%	231.722.800	-29,22%
17.11.15	**Day 3**	1.844,32	-0,627%	196.045.900	-29,66%
18.11.15	**Day 4**	1.854,11	0,529%	209.601.100	-29,29%
19.11.15	**Day 5**	1.875,60	1,153%	248.806.200	-28,47%
22.11.15	**Day 6**	1.914,19	2,036%	265.367.500	-27,00%
23.11.15	**Day 7**	1.905,90	-0,434%	232.505.500	-27,32%
24.11.15	**Day 8**	1.916,98	0,580%	179.131.100	-26,89%
25.11.15	**Day 9**	1.918,90	0,100%	192.983.200	-26,82%
26.11.15	**Day 10**	1.929,00	0,525%	213.173.000	-26,44%
29.11.15	**Day 11**	1.932,53	0,183%	226.197.600	-26,30%
30.11.15	**Day 12**	1.929,36	-0,164%	245.654.000	-26,42%
01.12.15	**Day 13**	1.943,51	0,731%	257.676.400	-25,88%
02.12.15	**Day 14**	1.958,11	0,749%	243.451.900	-25,33%
03.12.15	**Day 15**	1.937,31	-1,068%	186.242.300	-26,12%

Nizza Attack 2016 - CAC40					
Datum	**Day After Event**	**CAC40 price**	**CAC40 return**	**Traded volume**	**Maximum drawdown**
14.07.16	**Day 0**	4.873,63	1,189%	96.166.800,00	-14,91%
15.07.16	**Day 1**	4.836,87	-0,757%	88.334.560	-15,56%
18.07.16	**Day 2**	4.824,45	-0,257%	72.556.570	-15,77%
19.07.16	**Day 3**	4.769,21	-1,152%	87.351.740	-16,74%
20.07.16	**Day 4**	4.820,36	1,067%	87.207.250	-15,84%
21.07.16	**Day 5**	4.817,38	-0,062%	91.941.230	-15,90%
22.07.16	**Day 6**	4.804,75	-0,262%	73.820.230	-16,12%
25.07.16	**Day 7**	4.821,10	0,340%	80.240.240	-15,83%
26.07.16	**Day 8**	4.828,97	0,163%	90.861.430	-15,69%
27.07.16	**Day 9**	4.887,65	1,208%	112.475.400	-14,67%
28.07.16	**Day 10**	4.896,23	0,175%	107.115.100	-14,52%
29.07.16	**Day 11**	4.953,50	1,163%	128.784.100	-13,52%
01.08.16	**Day 12**	4.925,48	-0,567%	89.379.690	-14,01%
02.08.16	**Day 13**	4.857,30	-1,394%	108.914.100	-15,20%
03.08.16	**Day 14**	4.828,37	-0,597%	104.933.300	-15,70%
04.08.16	**Day 15**	4.840,16	0,244%	87.724.960	-15,50%

Nizza Attack 2016 - Tadawul					
Datum	**Day After Event**	**Tadawul price**	**Tadawul return**	**Traded volume**	**Maximum drawdown**
14.07.16	**Day 0**	1.776,25	-0,443%	173.648.900	-28,99%
17.07.16	**Day 1**	1.781,31	0,284%	206.421.100	-28,79%
18.07.16	**Day 2**	1.781,76	0,026%	180.509.000	-28,77%
19.07.16	**Day 3**	1.772,31	-0,532%	166.216.800	-29,15%
20.07.16	**Day 4**	1.767,93	-0,247%	183.874.800	-29,32%
21.07.16	**Day 5**	1.760,17	-0,440%	204.579.100	-29,63%
24.07.16	**Day 6**	1.739,38	-1,188%	187.398.900	-30,46%
25.07.16	**Day 7**	1.737,48	-0,109%	129.597.200	-30,54%
26.07.16	**Day 8**	1.725,32	-0,702%	144.749.000	-31,02%
27.07.16	**Day 9**	1.714,86	-0,608%	189.959.300	-31,44%
28.07.16	**Day 10**	1.689,22	-1,506%	166.262.900	-32,47%
31.07.16	**Day 11**	1.680,44	-0,521%	171.878.800	-32,82%
01.08.16	**Day 12**	1.691,97	0,683%	245.190.200	-32,36%
02.08.16	**Day 13**	1.671,32	-1,228%	176.561.000	-33,18%
03.08.16	**Day 14**	1.662,99	-0,500%	168.148.800	-33,52%
04.08.16	**Day 15**	1.665,50	0,150%	123.734.900	-33,42%

Sharpe Ratio

Sharpe ratio - DJIA					
Number of days	**Before/After**	**DJIA total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	Before	- 16.045%	3.534%	19.698%	-0.994
15	Before	- 6.319%	0.143%	4.840%	-1.335
5	After	- 14.618%	0.027%	6.414%	-2.283
15	After	- 5.603%	0.102%	10.891%	-0.524

Sharpe ratio - IBEX					
Number of days	**Before/After**	**IBEX total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	Before	61.797%	1,477%	16,357%	3,688
15	Before	- 4.229%	0,081%	4,888%	-0,882
5	After	- 4.450%	0,027%	5,094%	-0,879
15	After	- 3.104%	0,083%	6,036%	-0,528

Sharpe ratio - FTSE					
Number of days	**Before/After**	**FTSE total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	**Before**	12,491%	3,280%	9,861%	0,934
15	**Before**	-0,139%	0,196%	1,620%	-0,207
5	**After**	1,715%	0,065%	3,398%	0,486
15	**After**	0,458%	0,195%	4,188%	0,063

Sharpe ratio – CAC40					
Number of days	**Before/After**	**CAC40 total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	**Before**	- 2.957%	- 0.061%	20.674%	- 0.140
15	**Before**	- 4.987%	- 0.006%	3.635%	- 1.370
5	**After**	0.661%	- 0.002%	2.968%	0.223
15	**After**	- 0.696%	- 0.006%	3.783%	- 0.183

Sharpe ratio – CAC40					
Number of days	**Before/After**	**CAC40 total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	**Before**	- 14.102%	- 0.160%	23.760%	- 0.587
15	**Before**	- 4.666%	- 0.013%	12.953%	- 0.359
5	**After**	- 1.170%	- 0.005%	1.884%	- 0.618

15	**After**	- 0.731%	- 0.014%	3.072%	- 0.233

Sharpe ratio Tadawul New York					
Number of days	**Before/After**	**Tadawul total Returns**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	**Before**	7,322%	3,626%	8,579%	0,431
15	**Before**	-0,323%	0,146%	2,241%	-0,209
5	**After**	-5,934%	0,049%	7,651%	-0,782
15	**After**	-9,422%	0,133%	8,508%	-1,123

Sharpe ratio Tadawul Madrid					
Number of days	**Before/After**	**Tadawul total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	**Before**	92,539%	1,142%	20,348%	4,492
15	**Before**	5,343%	0,055%	1,730%	3,057
5	**After**	0,091%	0,017%	0,275%	0,268
15	**After**	5,537%	0,049%	1,900%	2,889

Sharpe ratio Tadawul London					
Number of days	**Before/After**	**Tadawul total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	**Before**	113,872%	1,752%	21,223%	5,283
15	**Before**	-3,080%	0,146%	7,042%	-0,458
5	**After**	-1,531%	0,050%	5,816%	-0,272
15	**After**	-0,399%	0,152%	9,617%	-0,057

Sharpe ratio Tadawul Paris					
Number of days	**Before/After**	**Tadawul total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	Before	-29,963%	0,399%	26,502%	-1,146
15	Before	-4,205%	0,029%	5,079%	-0,834
5	After	-0,761%	0,011%	3,805%	-0,203
15	After	2,467%	0,033%	4,453%	0,547

Sharpe ratio Tadawul Nice					
Number of days	**Before/After**	**Tadawul total return**	**Risk free rate**	**Standard deviation**	**Sharpe Ratio**
250	Before	-30,323%	0,836%	24,764%	-1,258
15	Before	1,792%	0,083%	2,101%	0,813
5	After	-0,908%	0,028%	0,753%	-1,243
15	After	-6,271%	0,083%	2,298%	-2,765