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The Impact of Terrorism on Financial Markets

The positive price effects of IS-terrorism on the European (social) Media and Telecom Industry

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PREFACE AND ACKNOWLEDGEMENTS

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ABSTRACT

In this paper we examine the impact to financial markets of the IS-related terrorism wave in Europe since 2015 by testing the possible positive price effects on European media firms. We first examine the effects of terrorism and individual terrorist characteristics on the European stock market. We find negative transitory effects which - in view of the absence of a long-term fundamental impact - corresponds to market efficiency as markets recover instantaneously from temporary investor shocks. Second, we examine the possible benefits of terrorism on the European (social) Media and Telecom industry. We find positive and permanent stock price effects indicating a reversed (lip-stick) effect for (social) media firms in times of increasing terrorist threat. The results may imply that the industry actually benefits from the sensation-seeking public in times of fear and uncertainty caused by terrorism.

Keywords: European IS-terrorism, stock price effects, investor sentiment, (social) media and telecom industry, market efficiency theory, fugitive attacks

JEL Classification: G10, G12, G14, G41

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1. Introduction

On June 29th 2014, the first day of the holy month of Ramadan, the leader of the former Islamic state of Iraq and the Levant (ISIL) Abu Bakr al-Baghdadi officially declared the Islamic State as a world-wide caliphate, calling upon all Muslims in the world to pledge allegiance to him (Warrick, 2015). Following his pledge of allegiance, it is estimated that between 27,000 and 31,000 foreign IS recruits—mainly from the Middle-East and North Africa—have travelled to Iraq and Syria to fight for the caliphate. According to estimations, experts say that between 20% and 30% of these foreign recruits have returned home ever since they joined the caliphate as IS-fighters since 2014[1]. The turmoil and political unrest in the Middle-East and especially in the Iraqi and Syrian region caused a massive outflow of political refugees fleeing for their lives to safer and more prosperous places such as in the west. What followed was the E.U. refugee crisis which is considered as one of the most severe global humanitarian crises in modern history. The massive outflow meant that the Islamic extremist ideology and the savagery of terrorism—which had been fuelled inside the core of ISIS territory for many IS-fighters—was about to be carried home.

On January 7th 2015, two brothers armed with rifles forced their way into the offices of the Charlie Hebdo satirical newspaper in Paris, killing 12 and injuring 11. The Charlie Hebdo massacre is the first Islamic jihadist terrorist attack after the official founding of IS a few months earlier. It was perceived as a huge shock to the French people as well as other citizens across the globe. The attacks are considered as the start of what later appeared to be one of the deadliest terrorist waves ever to have occurred on European soil. The media anticipated on the 2015 IS-terrorist wave by increasing their media coverage on terrorist threat by focussing especially on the historical, political and social-cultural context regarding the encounter of terrorism. However, there is another context to terrorist threat—namely the economic context of terrorism—which seems to be over shadowed. In this paper we shed light upon this field by examining the economic and financial consequences of the increasing terrorist threat to the European economy since 2015. This paper conducts a novel research and approaches terrorism from an economic perspective rather than a political or historical one.

Previous research on the economic effects of terrorism focus mainly on large-scaled and centrally-coordinated attacks such as the 9/11 attacks and the Madrid bombings in 2004. Overall, the two main existing views in the economic literature regarding the economic effects of terrorism are the pro-efficiency view and the non-efficiency view. On the one hand, the literature finds structural effects on stock prices in response to terrorist events for a wide range of markets and industries such as financial markets, commodity markets, the tourism industry and the defence industry. Assuming no

[1] https://ing.org/an-overview-of-isis/

fundamental economic impact, these findings oppose the strong form of the market efficiency theory as introduced by Fama et al. (1969), who state that rational investors make rational investment decisions and that therefore all market prices should contain all public and private information. Previous literature finds that terrorist attacks affect investor sentiment which in turn causes irrational investment behaviour which eventually leads to the observed mispricing in stock prices. These non-efficiency supporters find that these stock price effects persist in the long-run, meaning that markets are not efficient as they do not recover quickly from such deviations from fundamental value, therefore causing structural mispricing. On the other hand, supporters of the pro-efficiency view find no structural significant effect of terrorism on the economy at large nor on stock prices. Terrorist events may cause shocks to investor sentiment in the short-run, however these effects disappear almost instantaneously meaning there is no stock price effect in the long-run. Therefore, because of market efficiency, these temporary price effects caused by irrational investor behaviour are quickly reversed and eliminated by efficiently functioning markets. In this paper, besides merely looking at the effects of European IS-terrorism on the European stock markets, we extend our implications and examine the broader overall matter on whether European markets operate efficiently or not.

The 2015 European terrorist wave is unique due to the high frequency (hence the name wave) of attacks and their less centrally coordinated nature. Characterising these attacks are the lower amounts of casualties per attack, in which many cases the attacks are unsuccessful and perpetrated by lone-wolf terrorists therefore causing no casualties at all (see the appendix table A1 for an overview of all attacks examined in this paper). Since the terrorist threat in the E.U. is still recent or actually still present, research regarding these specific European IS-related terrorist attacks has not yet been substantially conducted. This paper contributes to the existing literature by examining the effects of this new form of terrorism occurring in a new geographic area, namely Continental Europe. Our first main research question is therefore formulated as follows:

<u>*Main research question 1:*</u> *How has the 2015 IS-related terrorist wave in Europe affected the overall stock performance of the European stock market?*

We perform a times series regression analysis in order to examine the effects of a total of 53 IS-related terrorist attacks on the European stock market. We study the effects on the European stock market by taking the Stoxx Europe 600 (SE600) as dependent variable. The SE600 is a stock index consisting of 600 large, mid and small capitalization companies across 17 European countries. Besides looking at the overall economic effect of terrorism, we also distinguish between certain terrorist characteristics such as country, severity (unsuccessful, severe, extreme etc.) or weapons used (suicide, armed assault, driver etc.) and test how each characteristic differently affects stock prices. Overall, we find temporary negative stock price effects for the SE600 in response to terrorist attacks. We find that markets recover from initial stock price shocks caused by terrorism, indicating that the stock price effects are transitory instead of permanent. Thus, our results are tentatively in line with the pro-efficiency view in which the efficient functioning of the market eliminates all mispricing instantaneously.

Besides contributing to research by examining new forms of terrorism in new areas, this paper additionally contributes to existing literature by examining the economic effects on an industry not linked to terrorism often before. In the second part of this paper we examine a possible reverse and positive stock price effect of terrorism on the (social) media and telecom industry. Results of previous studies that show negative stock price effects of terrorism on for instance the airline or tourism industry seem plausible and straight forward. However, would it also be possible for certain markets and industries to benefit from the increasing threat of terrorism? We find out by examining a possible reverse effect on the (social) media and telecom industry. The reason behind choosing this industry is that we expect increasing demand for information in times of fear and uncertainty caused by terrorist events. In moments of high terrorist threat (i.e. after the occurrence of an attack) people watch news broadcasts on TV, browse Facebook or Twitter for the latest eyewitness-posts, open YouTube to view the latest footage, read online articles on media sites or they buy the newspaper the next morning in order to be fully updated on all news surrounding the terrorist attack. Due to fear and anxiety caused by terror, people become consumed by information regarding terror as it affects everybody in their daily lives. Perešin (2007) suggests that an interactive relationship exists between the media industry and the presence of terrorism. He claims that media firms deliberately provide sensation-seeking news items, as demanded by the public, and that terrorist organizations can in turn ensure themselves from maximum presence in the media, therefore manipulating and exploiting free media for their own purpose. In this paper, we test Perešin's claims on whether the European (social) media industry actually benefits from the 2015 terrorist wave by deliberately covering sensation-seeking news items regarding terrorist events. The second main research question of this paper is therefore formulated as follows:

Main research question 2: *How has the 2015 IS-related terrorist wave in Europe affected the overall stock performance of the European (social) media and telecom industry?*

When taking the entire sample of 53 attacks, we find no reverse positive effects of terrorism on the media and telecom industry. However, when narrowing down the sample to 33 attacks in which the terrorists managed to escape the scene without being caught or killed, the results change. For these so-called 'fugitive attacks', we find significant and permanent positive price effects for these (social) media firms. For regular attacks, the threat and sensation is instantly over after the perpetrators are caught or killed. Fugitive attacks, in contrast, are continuous with the perpetrators being in hide-out and authorities rising the national terrorist threats to its highest levels. These fugitive attacks contain additional sensational value as they cause extra fear and uncertainty among the public. In contrast to the transitory effects on the SE600 returns, the effects on the (social) media firms are permanent. If the fundamental situation for media is not substantially impacted by these terrorist attacks, one could conclude that markets are non-efficient, since we observe structural mispricing caused by structural deviations in stock prices. A possible explanation for this phenomenon is that media markets are small and illiquid, and operate in an innovative and vastly changing environment, conditions in which create market frictions and thus cause efficiency violations.

We further discuss and interpret the results later on. First, section 2 will provide further political background on the founding, rapid uprise and downfall of IS. In section 3 we provide a theoretical framework in which we discuss all previous key-literature regarding the economic effects of terrorism. Section 4 formulates and substantiates the hypotheses. Section 5 focuses on the data gathering process regarding the terrorist events and stock prices used in our analysis. Section 6 describes the methodology used in order to get to the final results. Section 7 presents the results followed by a discussion and interpretation. Section 8 focusses on the overall implications of this paper's results, and further purifies these implications by providing robustness checks which further strengthen the statistical quality of the research. Section 9 concludes in which we accept or reject the hypothesis and answer the two main research questions.

2. Political background

Before providing the theoretical framework on the effects of terrorism on European financial markets, it is important to gain further insights into the background of terrorism. This paper examines the effects of IS-related terrorist attacks in Europe on the European stock prices. Before performing such analysis, one must gain further knowledge and understanding on this specific form of IS-related terrorism that spread over Europe since 2015. By providing political and historical context, insights are gained into why and how Europe coped with such an increasing threat in the first place. How was IS founded and what factors contributed to their rapid success and growth? How did the IS ideology spread to Europe so fast and how did terrorist activity within this continent experience such an uprise ever since? What is the current state of IS in the Middle-East and what are its future prospects? Before moving on to the scientific and empirical sections regarding the economic effects of terrorism, a brief overview of important political and historical events regarding the founding and spread of IS are given in order to gain a better overall picture of the political situation surrounding the increase of IS-related terrorism since 2015.

2.1 Founding of ISIS

Jasko et al. (2018) analyse the phenomenon of ISIS and its unique history. According to their findings, the founding of ISIS portrays three main and unique features which contributed to the success and rapid growth of the organization. The first feature is the unique personality of its founder Abu Musab al-Zarqawi, who is generally recognized as the founding father of the organization and is said to have laid the ideological foundation of the organization. The roots of IS trace back to 2004, when Abu Musab al-Zarwaqi—formally part of Osama bin Laden’s Al Qaeda Network—formed ‘Al Qaeda in Iraq’. Due to Zarqawi’s charisma, contacts and organizational skills, his terrorist cell grew fast. It was Zarqawi’s ‘Management of Savagery’ strategy in which he planned to draw the U.S. into an exhaustive and long-lasting conflict in Iraq, which would damage its image as a superpower. In order to do so, he planned to instigate a spiral of sectarian violence between the Sunni and the Shias in Iraq and its neighbouring countries, therefore fuelling a war and dividing the country which could form the basis to create the caliphate. Although killed in a U.S. airstrike in 2006, his vision spread and landed eight years later in 2014 when IS conquered and overran northern Iraq and eastern Syria.[2]

The second feature of IS’ success is related to the geopolitical situation in the Middle-East following the U.S. led invasion of Saddam Hussein’s regime in Iraq in 2003. Following U.S. intervention, Hussein’s supporters—the Baathists—who were not captured or put in military prisons, fled and went

[2] https://www.theatlantic.com/ideas/archive/2018/11/isis-origins-anbari-zarqawi/577030/

into hiding. Later on, many of these former followers of Saddam Hussein's Baathist regime have been known to hold high positions in the IS regime [3]. The American intervention reached its peak in 2007 with a military backing of 170.000 soldiers as a response to the growing sectarian violence in the country[4]. As a response to the increasing violence, the U.S. launched the American-Iraqi Sahwa campaign in 2007, in which the U.S. turned their back to the Sunni leaders and paid and armed non-Sunni tribal militias to fight at their service. As a result, former Sunni fighters became targets for the Iraqi army– which predominantly consisted out of Shiite's.

In December 2013 the U.S. had withdrawn most of its troops. The weakness of the interim government left a power vacuum, therefore creating an ideal setting for Islamic extremism to cease power. Following the trend of 2007, the Iraqi government along with the Iraqi security forces deliberately marginalized Sunni leaders in the political sphere. Inspired by the Arab Spring of 2011, large protest movements against the government emerged. In April 2013, a 'purge' carried out by Iraqi security forces left more than three hundred civilians dead in the anti-government protest camps. At this time the anger of the Iraqi Sunnis was brought to an absolute peak. In 2010, Abu Bakr-Al-Baghdadi assumed control of a weakened Al-Qaeda Iraq (AQI) and took advantage of all the chaos and turmoil in Iraq and the region surrounding it. He managed to unite and radicalise all groups derogated by the American backed Shiite Iraqi government. For these reasons, Iraqi Sunni's together with the former Baathists teamed up with former members of Baghdadi's Al-Qaeda's Iraq (AQI) branch, creating what later became known as the Islamic State of Iraq (ISI). When ISI took power over Mosul in June 2014, they succeeded in doing so partly due to the support of some Sunni tribes who felt cheated by the American backed Shiite regime and had given up their faith in a political solution.

The third and final feature of IS' success was the outburst of the Syrian civil war in 2011. When Arabic spring social protests against Bashar al-Assad's regime erupted, Baghdadi strategized new opportunities to expand territory across the Syrian border. In 2012, Baghdadi sent a number of operatives in order to set up a Syrian branch. Baghdadi's strategy was to merge with Al-Nusra, a Syrian Salafist jihadist organization fighting against Syrian government forces with the aim to establish an Islamic state in the Syria. In April 2013, al-Baghdadi offered a merger of the ISI with al-Nusra Front under the name of the Islamic State of Iraq and the Levant (translated as the "Islamic State of Iraq and al-Sham", ISIS). However, al-Nusra turned out to be more independent than Baghdadi had anticipated and rejected the deal. Following the rejection, Baghdadi bypassed collaboration with al-Nusra and created his own military representative in Syria. In 2013 and 2014, ISIS successfully conquered the al-Raqqa province in Syria.

[3] https://ing.org/an-overview-of-isis/
[4] https://www.mo.be/en/analysis/how-iraq-ended-up-with-is-and-angry-sunnis

By taking advantage of all three factors mentioned above, IS experienced a series of territorial successions in both Syria and Iraq, in which they became a powerful terrorist militant group seizing control over large parts within the region. On June 29, 2014—the first day of the holy month of Ramadan—ISIL officially declared itself as the Islamic State (IS), now a world-wide caliphate with Abu Bakr al-Baghdadi as the caliph calling on all Muslims in the world to pledge allegiance to him (Warrick, 2015).

2.2 Uprise IS and its aftermath

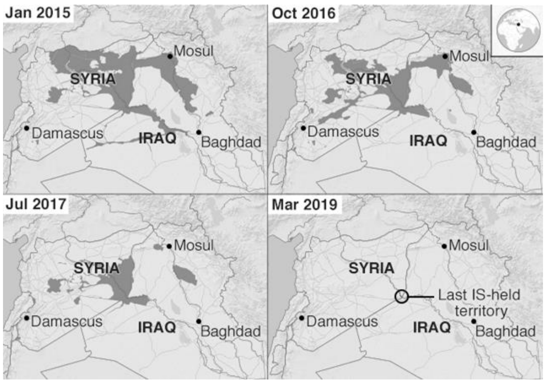
The chaos caused by IS in Iraq and Syria caused both an outflow and inflow of civilians to the region. An outflow was caused by civilians fleeing for their lives, hoping to seek better living conditions in free western democracies in the EU, not too far away from home. Inflows were caused by radicalised Muslims over the globe willing to fight for their caliphate. It is estimated that between 27,000 and 31,000 foreign recruits, mainly from the Middle-East and North Africa, have travelled to Iraq and Syria since fighting broke out in 2011 [5]. But why were these foreign jihadists so determined to fight in a country so remotely away? Through its propaganda and recruitment process, IS targets those who are outcasts in their own community, minorities in their own country, discriminated against in Western countries, have no food or shelter or possess a criminal record.

Out of all these recruits, experts estimate 20% to 30% to have returned home, which also applies for European IS-fighters returning back to Europe where borders had already been tested by huge flows of migrants[6]. The radicalised Islamic ideology accompanied with the savagery of terrorism which had been fuelled inside the core of ISIS territory for many IS-fighters was about to be carried home. The IS ideology spread across to continental Europe, where jihadist started planning and organizing terrorist attacks in the name of the caliphate. At its peak, the Islamic State took in approximately $800 million in taxes on annual basis. Safe within the caliphate's boundaries, Islamic State operatives could plan terrorist operations, such as the 2015 Paris attacks that killed 130 people, and coach and inspire other recruits to carry out attacks in their home countries. And so a wave of IS-related terrorist attacks emerged in Europe as well as the rest of the world, in which hundreds of terrorist attacks over the globe have been claimed by the terrorist caliphate. As is further discussed in the data section we use the Global Terrorism Database (GTD) to find that a total of 53 IS-related attacks took place over 11 European countries from 2015 until 2019.

[5] https://ing.org/an-overview-of-isis/
[6] https://ing.org/an-overview-of-isis/

The rapid rise of the Islamic state was followed by a rapid downfall. Instantaneously after the founding and rapid territorial growth of IS in 2014, the U.S. led international coalition against IS was formed at the 4/5 September 2014 NATO summit in Wales[7]. During this summit, Australia, Canada, Denmark, France, Germany, Italy, Turkey and the United Kingdom agreed to support the fight against IS both militarily and financially. Indirectly, these nine countries would fight IS by supporting anti-IS forces in Iraq and Syria by providing supplies and air support. The summit was the start of what later turned out to become a broader movement fighting the threat of IS in the Middle-East. On December 3rd 2014, another 49 countries (Russia and China not included) joined the coalition and formed the Global Coalition to Counter the Islamic State of Iraq and the Levant, in which the same goals were addressed to push back and defeat IS and its threatening ideology[8]. After many air strikes, intensive support for military operations, capacity building, and training on the ground, ISIS weakened on both militarily and financial grounds. The organization lost control over large amounts of territory in Iraq, and several of its leaders were killed or captured. In the following figure it is noticeable how ISIS territory rapidly shrunk following the intervention of the global coalition against ISIL.

Figure 1: How the area under IS control shrunk



Source: Conflict Monitor by HIS Markit, BBC

On March 23rd 2019, the Kurdish-led Syrian Democratic Forces (SDF) officially claimed the defeat of IS by stating that the Islamic State's five-year caliphate is over after the militants' defeat in Syria. It was the last territory in the hands of IS which had been taken back by the international coalition backed SDF [9]. Although this victory is considered as the day that ISIS officially lost their territory, it certainly doesn't mean the end of world-wide Islamic extremist threat. [10]

In this section we provide historical and political context with regards to the founding, spread and downfall of IS in order to gain better knowledge and understanding on this conflict before examining

[7] http://time.com/3273185/isis-us-nato/
[8] https://2009-2017.state.gov/r/pa/prs/ps/2014/12/234627.htm
[9] https://www.bbc.com/news/world-middle-east-47678157
[10] https://www.nytimes.com/2019/03/24/us/politics/us-isis-fight.html

its economic consequences as analysed later on in this paper. Although many articles and papers devote time and attention to the historical and political context, in this paper we aim to shed light upon the economic aspect of terrorism which is less predominantly present surrounding the discussion on terrorist threat. We examine the effects of these IS-related terror attacks in Europe on the European economy. After having provided the political and historical background, the next section examines the economic and financial scientific background regarding the effects of terrorism.

3. Theoretical background

Previously, a substantial amount of research has been conducted on the economic impacts of terrorism in many different ways. Before formulating the hypotheses, it is important to evaluate prior research regarding the overall effects of terrorism on stock performances and financial markets in order to obtain a better overall view on the different theoretical views in this field. The first section provides a summary on different papers that examine these economic effects of terrorism on a diverse range of industries (stock markets, airline industry, tourism industry etc.). The second section portrays prior literature regarding the involvement of (social) media firms in times of increasing terrorist threat within society.

3.1 Impact of terrorist events on equity market performance

Econometric analysis on the economic effects of terrorism has been widely conducted throughout the years. Devotion to this field of research experienced a sharp spike after the 9/11 attacks in the U.S. in 2001. These devastating attacks not only substantially affected U.S. society as a whole but also largely affected international relations, politics, the economy and financial markets over the globe. The attacks led to an overall gained interest in the field of economic research on the economic and financial effects of terrorism.

Charles and Darne (2006) find that international stock markets experience large shocks in response to the 9/11 attacks, both temporary and permanently for 10 global equity indices using the outlier detection methodology. Nikkinen et al. (2006) investigate the impact of the September 11 attacks on market returns and volatility and find only temporary effects using data from 53 equity markets. Overall, they find significant increases in volatility and significant short-run negative stock returns across regions, which recover quickly afterwards. They find that these effects vary across regions and that less globally economic integrated regions (e.g., Middle-East and North Africa) experience less exposure towards these shocks than highly economic integrated regions.

Research is not only limited to the 9/11 attacks. Mnasri and Nechi (2016) focus on the economic impact of terrorist activity in Middle-Eastern and Northern-African countries (MENA region) from 2000 till 2015. They perform an event study alongside an improved bootstrapping test to evaluate the impact of terrorist attacks on the volatility of stock markets within the MENA region. Results show that the impact of terrorist attacks on financial markets' volatility lasts about 20 trading days, which is considered to be long compared to the effects of similar events in developed markets.

Moving to Asia, where Chaudhry et al. (2018) investigate the impact of terrorism on stock markets dynamics in the SAARC region (South Asian Association for Regional Cooperation) using an event study analysis and fixed effect regression technique. In line with previously discussed papers, they find that stock market returns for all countries in the sample are negatively affected on the day of the attacks, whilst on the post day only the less affected countries are negatively affected.

Kolias et al. (2011) test and compare the effect of terrorist activity on two indices; the London stock exchange (LSE) and the Athens stock exchange (ASE). Their aim is to test whether market size and market maturity play a role in the determining stock price effects. They find that the ASE—as small capitalisation market—is more sensitive to terrorist attacks than the larger and more mature London stock market. Their explanation is that the larger and more mature London market has more effective institutional arrangements in place, with more effective internal checks and balances that absorb information in a more efficient manner following exogenous shocks such as terrorist attacks. Results from their event study methodology therefore indicate that size and maturity are indeed possible determinants of markets' reactions.

Despite investigating different attacks in different regions, all previous papers have in common that they find significant short term and permanent decreases in stock returns and increases in stock volatility. Therefore, to balance the theoretical framework, we must also shed light upon research with the opposite findings and implications. Goel et al. (2017) explore the relationship between global financial markets (i.e. stock indices, bond markets, commodity markets etc.) and large-scale terrorist incidents (33 attacks in the U.S. and 16 outside the U.S.). With the exception of the 9/11 terrorist attacks, their results show that acts of terrorism do not have a significant economic effect on stock and bond market returns. They reject the 'flight to safety behavior' theory which holds when investor uncertainty leads to a significant shift in equity, bond and commodity prices.

Chen and Siems (2004) also assess the effects of terrorism on global capital markets and test how these effects evolve over time. They examine the U.S. capital market's response to 14 terrorist/military attacks dating back to 1915 and test the global capital markets' response to two more recent events: Iraq's invasion of Kuwait in 1990 and the September 11, 2001 terrorist attacks. In line with Goel et al. (2017), they find no significant shifts in prices. They suggest that U.S. capital markets have become more resilient than in the past and recover sooner from terrorist attacks than other global capital markets. Their evidence suggests that this increased market resilience can be partially explained by a stable banking and financial sector that provides adequate liquidity to promote market stability and minimize panic.

Using a more recent dataset, Eldor and Melnick (2018) study the impact of terrorist attacks on the European stock markets after the upsurge of attacks that started in November 2015 in Paris. Applying the methodology developed in Eldor and Melnick (2004), they find that these terrorist attacks have a significant impact on the U.S. market, but no significant impact on the European markets. However, since Eldor and Melnick (2018) use a sample of attacks ranging from November 2015 till August 2017, they miss out on other determining attacks that occur after this period. Their sample is therefore incomplete compared to the sample set used in this paper, meaning we cannot fully compare the results between both papers.

Finally, Eldor and Melnick (2004) focus on terrorist activity in Israel by analyzing the effects on the Israeli stock- and foreign exchange markets. The authors conduct novel research and distinguish between different terrorist characteristics and their corresponding price effects. They touch light upon a lucrative aspect in the field of economic analysis on terrorism since they distinguish between location, type of attack, target, number of casualties and the number of attacks per day. In this paper, we apply a similar methodology in order to examine the effects of individual terrorist characteristics on stock performance. The authors identify a structural break in stock price returns before and after the start of a new terrorist wave which started on September 27th 2000, right after the Oslo Peace agreements which initiated increasing terrorist attacks from Palestinian side. In a working paper of a year later, the authors revise their previous paper and find that the decline in share prices results from a continued deterioration in expected future cash flows and not due to an increased risk premium. In response, investors start to substitute stock market investments for short-term government bonds in response to terror attacks which leads to the observed decline in stock prices.

Eldor and Melnick (2004) also distinguish between transitory effects and permanent effects and find that stock prices are only permanently affected for suicide attacks and the amount of people killed and injured during attacks. They find that the the Israeli markets do not become desensitized to terror over time and that financial markets continue to function efficiently. Referring to Chen and Siems (2004), they argue that past market liberalization policies in Israel ostensibly contributed to coping with the terror. They conclude by suggesting that their findings extend to western societies because of Israel’s democratic regime, free markets, and well-developed financial markets. In this paper we test this final claim by conducting the same methodology in which we examine similar IS-related terrorist attacks but now using a more recent dataset. The results and cohering implications are presented and discussed later on in section 7.

3.2 Impact of terrorist events on other industries

Besides examining the effects on stock markets, research regarding the economic effects of terrorism also focusses on other fields and industries. Carter and Simkins (2004) perform a multivariate regression on U.S. airline stocks returns in response to the 9/11 attacks. They claim that the market believes that major airlines with higher amounts of cash reserved benefit whereas the smaller airlines with less cash reserves do not. Their evidence suggests that investors anticipate on the increased likelihood of financial distress within the industry. Drakos (2004) conducts a similar approach by examining U.S. as well as international airline stocks in response to the 9/11 attacks. Rather than analysing price changes from an investor behaviour perspective, Drakos focusses on explaining price changes through changes in underlying risk. He finds a structural break in systematic risk (market beta) as well as the idiosyncratic risk for airline companies and concludes that the systematic risk has on average more than doubled, implicating higher costs and risks for airline firms in raising capital.

Related to the airline industry is the tourism industry. Threats to security influence tourists' risk perceptions and travel decisions and therefore affect the travel and leisure industry as a whole. Adeloye and Brown (2018) investigate British domestic tourists' risk perception in the light of the rapidly growing global trend of terrorism. They find that due to an emotional response of fear and anxiety, the willingness to travel depends on the reason for travel, visual presence of security services, the nature of the attacks and the way the media is perceived and has influence. Drakos and Kutan (2003) examine the effects of terrorism in a regional setting for the countries Greece, Turkey and Israel from 1991 to 2000. Their empirical evidence indicates that terrorism significantly reduces tourist arrivals and lowers overall tourism revenue for the region as a whole due to spill-over effects from one country to another in the region. However, there is also evidence for a temporary substitution effect in which destinations are substituted by travellers for other destinations within the same region.

Apergis and Apergis (2016) examine the impact of the November 2015 Paris attacks on 24 global defence companies using an event study analysis. They find significant positive price effects for these defence companies on the day of the attack well as on the days that follow. These findings coincide with the so called reversed 'lipstick' effect, as described by Rodeheffer et al. (2012), in which the observed market reaction counter-cyclically moves against the overall observable trend. This paper examines a similar trend by studying the same reverse positive price effects of terrorism but then on the media industry.

All papers discussed till now examine the effect of terrorism on one a specific market or industry. The following papers focus not only on one specific market, but on overall macroeconomic output factors. Abadie and Gardeazabal (2008) find a positive relation between terrorism and the allocation of productive capital to other countries. The increasing uncertainty accompanied by terrorism leads to a reduced expected return to investment and thus a capital outflow to other countries. This results in large movements of capital across countries only if the world economy is sufficiently open. Higher levels of terrorist risks are associated with lower levels of net foreign direct investment positions. More specifically, they find that a one standard deviation increase in the terrorist risk is associated with a fall in the net foreign direct investment position of about 5% of GDP.

Blomberg et al. (2004) find a significant negative effect of terrorism on economic growth throughout 177 countries from 1968 till 2000. However, the impact of terrorism is smaller when compared to other conflicts such external wars or internal conflict. On top of that, in times of increasing terrorist threat they find a redirection of economic activity away from investment spending and towards government spending, however this effect differs per country. For advanced economies the evidence of a negative association between terrorism and economic growth appears to be smaller and less significant when compared to emerging and developing markets.

3.3 Involvement of the media industry during terrorist events

The first part of this paper focusses on the effects of terrorism on stock markets. The second part of this paper focuses on the effects of terrorism on the (social) media and telecom industry. For this reason, it is important to gain more insights into the role and influence of the media in times of increasing terrorist threat. Eldor and Melnick (2010) investigate the role of the media on the impact of terrorism on the Israeli economy. They examine to what extent newspapers cover terrorist attacks by distinguishing between the number of articles per newspaper, the positioning of articles, whether photos are included and the size of the headlines. They find that media coverage is an important channel through which terrorism produces economic damage and that this damage increases monotonically with the amount of media coverage. They do however find that this extra economic damage caused media coverage diminishes over time.

In line with Eldor and Melnick (2010), Scott (2001) subsequently confirms the significant role of the media in times of terrorist threat in which he finds that the media causes deteriorating economic damage to the economy. However, he develops a theory in which terrorists congest the media in equilibrium, meaning that the more the media provides coverage on one terrorist attack, the less it will cover on another. In other words, since media coverage is limited, so are the marginal negative effects on the economy caused by media coverage on additional terrorist incidents.

Jetter (2014) analyses media behaviour and how media attention is devoted to worldwide terrorist attacks between 1998 and 2012. First of all, he finds that suicide missions receive significantly more coverage, which could explain their increased popularity among terrorist groups. Second, less attention is devoted to attacks in countries located further away from the U.S. Third, acts of terror in countries governed by leftist administrations draw more coverage. Fourth, the more a country trades with the U.S., the more media coverage an attack in that country receives.

Finally, Perešin (2007) claims the existence of an interactive relationship between the media industry and terrorist organizations. He suggests that media firms deliberately provide sensation-seeking news items in reaction to a sensation-seeking public as way of attracting more readers or viewers and thus increasing profits. Terrorist organizations can in turn ensure themselves to maximum coverage in the media in a way that they optimally manipulate and exploit the media for their purposes. Perešin further elaborates that the mass media itself provide a global platform to terrorism, which even further reinforces the fear among the public. Perešin (2007) concludes that because the media has such influence on the perceptions of the public, they have large influence over policy decision making and thus on international relations as a whole.

All the papers discussed in this section help create an overall view of the economic impact of terrorism on certain industries and how the media plays an important role in further enhancing these economic effects in response to terrorism. Using this theoretical framework, insights are gained in the different economic views regarding terrorism which are used to formulate the hypotheses in the next section. We use all previous studies mentioned in this section to be able to place our findings in a certain context and to give meaning and interpretation to the results we find later on in this paper.

4. Hypotheses

Using the literature presented in the theoretical framework, we are able to set expectations and formulate the hypotheses regarding both sections of this paper on the effects of terrorism on the European stock market and on the media and telecom industry.

4.1 Hypotheses on the overall European stock market

As we observed in the previous section, the literature regarding the effect of terrorism on financial markets is two-sided. On the one hand the literature finds evidence in which the impact of terror is structural in which shifts in prices hold in the long-run. Under the condition that these terrorist events do not cause simultaneous structural shifts in the underlying fundamental asset value within the market, these papers seem to reject market efficiency. That is because market efficiency suggests investors to act rationally, meaning prices should reflect all public and private information available. In case there is a structural break in asset pricing caused by terrorism without structural changes in the underlying fundamental asset value, the structural shift in pricing appears to be caused by an irrational and sentimental component present among investors, which indicates market inefficiency. On the other hand, the literature finds evidence in which the impact of terrorism is negligible, or only temporary if present in the first place. Again, under the condition that these terrorist events do not cause simultaneous structural shifts in the underlying fundamental asset value within the market, this side of the literature seems to support market efficiency. That is because price effects are either non-present or instantaneously eliminated and adjusted back in the short-run, indicating that possible market frictions caused by short-run sentimental price effects are quickly eliminated by the market. In this case, markets are efficient as prices quickly convert back to original fundamental value.

When reading through all literature regarding the economic effect of terrorism, papers supporting the pro-efficiency view seem to predominate. Not only in liberalized and open economies such as the U.S., but also Middle-Eastern, North African and Asian countries experience temporary negative effects in which prices quickly convert back to original levels. The transitory price effects caused by terrorism appear to be especially evident for firms and industries operating in the U.S. market, indicating efficient U.S. markets. Reasoning behind efficiency in the U.S. market is that the U.S. economy is large, open, liberalised and contains a stable banking/financial sector that provides adequate liquidity to promote market stability and minimize panic. Looking at the similarities in market characteristics between the European and U.S. market, we consistently expect similarities with respect to market efficiency between both markets.

Additionally, Eldor and Melnick (2004) similarly claim that the temporary negative effects found in their paper extend to western societies because of Israel's liberalization policies, democratic regime, free markets, and well-developed financial markets. Kolaric and Schriereck (2016) examine the same wave of IS-terrorist attacks in the E.U. since 2015 and find a significant strong short-term effect on the valuation of European airline companies after the attacks. By combining these papers, we formulate the first three hypotheses regarding the economic effects of terrorism on the European stock market. The first two hypotheses relate to the expected signs of the price and volatility effects. The third hypothesis relates to the price effects being temporary or permanent, which provides insight into support of either the pro-efficient or a non-efficient view under the condition that fundamental values remain unaffected. When reviewing the economic literature regarding terrorism, most papers find negative effects on equity returns and positive effects on the cohering volatilities. We therefore expect similar negative price effects and positive volatility effects to hold for the European stock market. We expect these effects to be transitory instead of permanent due to similarities in market characteristics and thus market efficiency between the U.S. and European stock market. The first three hypotheses are therefore stated as follows:

Hypothesis 1: The 2015 IS-related terrorism wave in Europe results in negative stock price effects for the overall European stock market.

Hypothesis 2: The 2015 IS-related terrorism wave in Europe results in positive volatility effects for the overall European stock market.

Hypothesis 3: Due to an efficient European market, the effects of terrorism on stock prices and volatility are transitory instead of permanent.

4.2 Hypotheses for the media and telecom industry

Previous literature shows evident proof in which many industries such as the airline and tourism industry experience economic loss following terrorist attacks and events. However, for some industries this is not the case. Hill et al. (2012) study the so called 'lip-stick effect' and examine the consumer behaviour of women in times of economic recessions. During economic decline, money is scarce, consumer confidence is low and consumers lower their expenditures and save money. Hill et al. find an opposite effect in which women—in times of economic recession – deliberately increase their spending on beauty products as a way to increase their attractiveness for mates. In this paper, we try to find such a counter-cyclical lip-stick effect, but then looking at the reverse effects of terrorism rather than economic decline. As mentioned in the literature review, Apergis and Apergis (2016) find a significant positive reaction for 24 global defence companies after the Paris attacks on November 13th.

Although these findings provide interesting insights into the reversal effects of terrorism, the reasoning behind it is rather straight forward. An increase in terroristic threat means governments take actions to increase national security and therefore subsequently increase army spending which in turn benefits the defence industry. In this paper, we seek to find such a reverse effect of terrorism on the (social) media and telecom industry. We find that the relation between media stock prices and terrorism has not yet been conducted when examining previous literature, which further enhances the contribution of this paper in the field of financial economics and behavioural finance.

In the literature review we show that the media plays an important role in covering news items related to terrorism. Eldor and Melnick (2010) illustrate how the media produces additional economic damage and show how powerful and influential the media therefore are in times of fear and anxiety caused by terrorism. Zhang et al. (2011) examine the relation between Twitter messages (tweets) and stock returns. They collect the Twitter feeds for six months and categorize all daily tweets as either hopeful or fearful. They analyse the correlation between U.S. indices and the tweets and found that the fearful tweet percentage significantly negatively correlates with returns of the Dow Jones, NASDAQ and S&P 500. They conclude that checking Twitter for emotional outbursts gives a predictor of how the stock market will be doing the next day.

Zhang et al. claim that (social) media firms are able to create and feed strong sentiment in such a way that they determine stock prices as well as economic output. Their findings show how engaged people are with the media and how dependent they have become on media items, especially in times of fear and uncertainty. They thus show how influential (social) media firms are with respect to investors sentiment and investor behaviour. The conclusion of the article is to show how predominantly the (social) media acts in times of fear, crisis and uncertainty and thus also in times of terrorist activity. By taking into account this media dependence among the public in uncertain times, we expect that (social) media firms and telecom firms benefit in times of increasing terrorist events and attacks.

Terrorism is something that directly or indirectly affects the lives of the public on a daily basis. In response to their fear, people seek as much information as possible to such an extent that information regarding terrorism becomes overhyped and sensationalized as suggested by Perešin (2007). The (social) media industry deliberately fuel this hype by providing the desired sensational information regarding attacks by a sensation-seeking public. People demand to be updated on the most recent attacks and therefore watch live news broadcasts on TV, check out the latest eye-witness footage on Twitter, receive Safety Check notifications on Facebook from friends that were geographically near the attack and so forth. People grab their smartphones, check social media, turn on the TV and purchase the newspapers the next morning simply because people are addicted to information. The most extreme example in line with this phenomenon is the recent shooting in Christchurch, New

Zealand, in which 50 Muslims were killed when the gunmen live-streamed the attack on Facebook Live. Following the shooting, Facebook removed 1.5 million copies of the mosque-attack video[11]. Footage spread rapidly on YouTube and Twitter and was shared in private messaging apps after the tech companies cracked down on public posts. Facebook announced that it had removed over the 1.5 million copies of the video following the video-post and that copies could still be found on major tech sites as of today[12]. The fast spread of horrific footage like this shows the sensation-seeking nature of the public and how people desperately desire information regarding terrorism because it affects them personally. We hypothesize that the demand for information spikes in times of increasing terrorist attacks and that this increase in demand for (social) media products and services leads to increase in users, higher (advertising) revenues and thus positive stock price effects in response to terrorist attacks.

For the telecom industry we hypothesise similar results. In times of increasing terrorist activity, people's demand for communication—through mobile telephone data or data usage for television and internet—increases. Just as for the media industry, we expect that this increase in demand for telecom data among users is translated into higher future growth prospects, higher revenue and thus higher share prices.

We hypothesize that these effects on (social) media and telecom firms are especially evident for attacks in which terrorists manage to escape after the attack. The attack is followed by a sensational manhunt led by the authorities in which the perpetrators are on the run as the public is even further pushed into a period of fear and anxiety. The manhunt on the suspects, which is extensively broadcasted on (social) media platforms, means the attack is continuous and ongoing. We refer to these attacks as fugitive attacks, since the terrorists manage to flee the scene and therefore become fugitives in society. These fugitive attacks create even more fear and uncertainty among the people as authorities raise security threats to its highest levels and advise people to stay inside in which people start to follow the sensational news updates provided by the media. We hypothesise that the reverse positive effects for these fugitive attacks will therefore be even larger. The final hypotheses are stated as follows:

Hypothesis 4: *the European media and telecom firms, as well as the social media firms Facebook, Alphabet and Twitter, experience reverse and positive stock price effects following the 2015 IS-related terrorism wave in Europe.*

[11] https://www.bbc.com/news/technology-48276802
[12] https://edition.cnn.com/2019/03/20/tech/whatsapp-new-zealand-attack-video/index.html

Hypothesis 5: The magnitude of these stock price effects for the (social) media and telecom firms is even larger for fugitive attacks in which the terrorist(s) flee(s) the scene.

Hypothesis 6: Due to market efficiency, these reverse positive effects for media firms are transitory instead of permanent.

5. Data

An important aim in academic research is to conduct research using an as elaborate and accurate data set as possible. In this section, we explain where our data comes from, how the data is narrowly filtered and how the data is accurately processed in order to get to the final data set applied for this research. We explain how data is gathered on the different terrorist characteristics of the final 53 IS-terrorist attacks in our sample. We also explain how data is gathered on stock prices and volatilities for the European stock market as well as for the European (social) media and telecom industry. We finally illustrate how the data is quantified and transformed into variables that are subsequently used in the econometric analysis throughout our paper.

5.1 Data on terrorism

In this paper, we specifically focus on terrorist attacks that occurred in Europe after the founding of the Islamic State in 2014. We classify the perpetrators of these attacks as radicalised Muslims who are directly connected with the caliphate by fighting for IS in Iraq and Syria, or indirectly connected due to their inspiration and radicalisation by the IS ideology through means of propaganda. Ever since the founding of IS in 2014 and the accompanied rise of E.U. refugee crisis, terrorist attacks on European soil drastically increased. The first real visible attacks classified as jihadist terrorism after the founding of IS in 2014 were the attacks on the Charlie Hebdo satirical newspaper headquarter on January 7th 2015. The attack took the lives of 12 and another 11 got injured. The attack is considered to be the first substantial attack in a series of deadly attacks what later became the 2015 IS-related terrorist wave throughout continental Europe[13]. For this reason, we use this date as starting point in our sample of terrorist attacks.

In this paper, we examine the effects of 53 terrorist attacks on European stock prices. In this section we describe how we came to with these final 53 attacks in our data base. In selecting the final list of IS-related terrorist attacks, we consult the Global Terrorism Database (GTD) as source for world-wide terrorist information. We use all IS-related attacks—that is all attacks classified by the GTD as jihadist or ISIL-related after the 2014 IS founding— for all European countries from January 2015 until April 2019. Unfortunately, the GTD contains only attacks that range until 2017. Because this paper requires the most recent data set possible, we consult other sources of terrorist information in order to make the data set as up to date as possible. We therefore consult the Europol database, which contains more recent information regarding European IS-related terrorist attacks. Europol is the law enforcement agency of the European Union and supports the 28 E.U. Member States in their fight against terrorism,

[13] EUROPEAN UNION TERRORISM SITUATION AND TREND REPORT (TE-SAT) 2016". Europol. 2016

cybercrime and other serious and organised forms of crime[14]. When forming the final list of European IS-terrorist attacks, it is important to filter out attacks with reduced significance and relevance for the contribution of this paper. Generally, attacks are added to the list when they are jihadist-orientated or IS-inspired. However, few examples occur in which the attacks listed in the GTD lack relevance for the sake of this paper's research. By examining the GTD and filtering out attacks that are not classified as IS-terrorist attacks according to Europol (as they are not mentioned in their annual reports on European Terrorism), we narrow down to a final sample of attacks that optimally contributes to the research of this paper. Examples of attacks that may seem jihadist-related but still lack relevance and are thus excluded from the final terrorist data-set are:

1. Attacks that are related to Islamic ethnic conflicts, such as Islamic ethnic groups fighting each other over territory in the Albania and Macedonia region. These attacks are geographically- and ethnically-related instead of religiously- or politically-related and are therefore not accounted for as IS-related attacks.
2. Attacks that are IS-related but do not occur on European soil. For instance, the migrant boat battle in 2015 in which extremist Muslims attacked and killed twelve Christian migrants by throwing them overboard on a boat heading to Italy[15].
3. Attacks in which the perpetrators' motive is assumed to be linked to mental disorder rather than terrorism. An example is the 2016 Russel stabbing in London, in which a 19-year-old Somali refugee stabbed six innocent people on the street. At first, the attack was considered to be inspired by a jihadist motive, later on however the perpetrator appeared to have a mental disorder rather than a true radicalised Islamic political motive.

Especially the third example illustrates the difficulty in which to identify the perpetrators of terrorist attacks as it is not always an easy process to determine the exact motive of the perpetrator. The radicalisation among so called 'lone wolves' in their own personal environment may be the result of a psychological disorder rather than a true political or religious motivation. For some cases it is therefore challenging to differentiate between these two motives. For this reason, Europol does not classify certain attacks as terrorist events because the motive is too complex, therefore classifying the attacks as grey-zone attacks. These grey-zone terrorists may be ethnically related to Islam, however it is difficult to identify whether their motives are truly politically and religiously connected to Islam at the same time. On the one hand, these attacks are not fully IS-related for the reasons given above. But on the other hand, they do cause the same psychological fear and uncertainty to the public and to investors sentiment which we seek to examine in this paper: how fear caused by Islamic related terrorist events influences investor sentiment and therefore investment behaviour. Excluding these attacks therefore means excluding possible important information on investor behaviour in response to

[14] https://www.europol.europa.eu/about-europol
[15] https://www.bbc.com/news/world-europe-32337725

Islamic related terrorist threat. For this reason, we include a third source of terrorist information to see how news relating attacks is presented to the public. For all attacks in which the motive is not directly clear, we consult newspapers, news articles, terrorist blogs and political institutions' webpages (EU, UN etc.) to examine to what extent news coverage on attacks by the media involves a true jihadist and Islamic radicalised motive. In this process, six grey-zone attacks are added to the final list of terrorist attacks because the media has clearly portrayed these attacks to be politically and religiously related to Islam already from the start when the first news item was published.

Examples of grey-zone attacks that are not classified as terrorist events by Europol, but still added to the final list are:

1. The Louvre Machete Attack (February 2017): a 29-year old Egyptian man armed with two large knives and shouting "God is great" in Arabic lunged at a military patrol near an entrance to the Louvre. The attack enhanced further fear of a decline in tourism since 70% of Louvre's visitors are foreign nationals.[16]
2. The 2018 Strasbourg attack (December 2018): a Gunmen kills five and injures over a dozen at the famous Strasbourg Christmas market. The anti-terrorist section of the Paris prosecutor's office declared the incident to be an act of terrorism, however Europol did not confirm[17].
3. The 2019 Utrecht tram-attack (March 2019): Turkish-born Gokmen Tanis kills four, wounds five others and was arrested after a city-wide manhunt. Thus far, the national police strongly considers a terrorist motive, however Europol did not confirm.

By combining the GTD, Europol and other media sources, we present the final list of 53 European IS-related terrorist attacks in table 1. In the appendix in table A1 we additionally provide a more extensive list of all 53 attacks with all cohering characteristics. Looking at table 1, we find that Turkish and French attacks are considered as the deadliest, where the amount killed per attack is 42.9 and 11.4 respectively. When looking at the entire sample in which 679 people are killed in total, 44% of all casualties come from Turkish attacks whereas 37% of all casualties come from French attacks. When observing the statistics on weapons used, we find that the highest death rates are for suicide and armed assault attacks, where the percentages killed are 53% and 29% respectively.

After having completed the final list of attacks, the next step is to gather all relevant terrorist characteristics per attack, which we retrieve from the GTD and Europol. Information is gathered on the following characteristics:

1. Start date and start time of the attack
2. End date and end time of the attack

[16] https://www.nytimes.com/2017/02/03/world/europe/louvre-paris-shooting-soldier.html?_r=0
[17] https://www.nytimes.com/2018/12/12/world/europe/france-strasbourg-shooting.html

3. Location of the attack
4. Number of people killed per attack
5. Number of people injured per attack
6. The weapon of attack used
7. If the perpetrators manage to escape leading to a post-attack manhunt (yes/no)

Table 1: Summary statistics of all IS-related terrorist attacks in Europe from 2015-2019

Category		**Number of attacks**	**Killed**	**Injured**	**Average killed per attack**	**Proportion killed per category**	**Proportion injured per category**
Country	France	22	250	944	11.4	0.37	0.29
	Turkey	7	300	1015	42.9	0.44	0.31
	Germany	6	13	84	2.2	0.02	0.03
	Belgium	6	36	351	6	0.05	0.11
	U.K.	4	35	640	8.8	0.05	0.19
	Russia	2	16	65	8	0.02	0.02
	The Netherlands	2	4	8	2	0.006	0.002
	Denmark	1	2	6	2	0.003	0.002
	Sweden	1	5	14	5	0.007	0.004
	Spain	1	16	152	16	0.02	0.05
	Finland	1	2	8	2	0.003	0.002
	Total	53	679	3287	12.8	1	1
Severity	Unsuccessful	19	0	78	0	0	0.02
	Less severe	18	53	217	2.9	0.08	0.07
	Severe	11	199	1325	18.1	0.29	0.40
	Extreme	5	427	1667	85.4	0.63	0.51
	Total	53	679	3287	12.8	1	1
Weapon	Driver	9	133	786	14.8	0.15	0.20
	Bombing	2	0	30	0	0	0.01
	Cold weapon	21	22	96	1	0.03	0.02
	Armed Assault	15	252	782	16.8	0.29	0.20
	Suicide	11	460	2289	41.8	0.53	0.57
	Total	58*	867	3983	14.95	1	1

* The total amount of attacks in the weapon category is higher than 53 since attacks can have more than one weapon

For the first three characteristics, we use the closing stock prices of firms so that we can optimally grasp the effects of terrorist attacks that occur during the day. The timing of the attack is therefore essential in order to determine the exact trading day that captures the effects of these terrorist attacks. For a large range of attacks, Europol and the GTD provide accurate information regarding the date, timing and location. However, for some attacks, data on the exact timing is not given. For these attacks, we consult media sources to find the timing of news posts covering the attacks, which is plausible as investors are eventually informed on such terrorist events through these media sources. As illustration, if an attack occurs before CEST 17:00 (UTC +2) when stock markets close, the attack is still accounted for on that same day. If an attack occurs after CEST 17:00 (UTC+2), the attack is accounted for on the first trading day after. For example, the first explosions of the November 13th

Paris series of attacks started on Friday at nine o'clock in the evening and continued until later in the night. In this case, the attacks are accounted for on the first trading day that follows, namely on Monday November 16th. However, timing still remains arbitrary. For example, when attacks occur five minutes before the stock market closing time, it is almost impossible for the effects to be fully incorporated in the closing prices within five minutes. Therefore, we add lagged dummies to capture these delayed effects on the days after the attack. We further elaborate on this method in the next section on methodology.

For the third, fourth and fifth characteristic no major obstacles are experienced. For the amount of people killed or injured per attack, we exclude the number of killed or injured terrorists from the total count. The reasoning behind this is that including the terrorist would lead to a severity bias. For instance, when comparing the attacks in Barcelona on august 17th 2017—in which 8 perpetrators killed 16 people—to the Nice attacks on July 14th 2016—in which one perpetrator killed 86 innocent people—we see that excluding the perpetrators gives us a better image of the net impact of a terrorist attack.

For the sixth characteristic we introduce the five weapons of attacks as introduced by Eldor and Melnick (2004). These five weapons are:

1. Driver: Attack in which a vehicle is driven into the crowd.
2. Bomb: Attack in which a bomb is detonated.
3. Armed assault: Attack which involves the use of guns or rifles.
4. Cold weapon: Attack which involves the use of knifes, machetes, swords etc.
5. Suicide: Attack in which the perpetrator commits suicide by using suicide vests.

Most attacks are characterized by using only one of the weapons listed above. However, there are cases in which attacks are characterized by having more than one weapon. An example is the 2017 London Bridge attack, in which the perpetrators first drove into pedestrians walking the London Bridge and afterwards stabbed pedestrians on the street at Borough Market. Here the attack clearly consists out of two parts in which each part uses a different weapon (cold weapon and driver). However, for the 2016 Berlin truck attack, 11 out of 12 people were killed when the perpetrator drove a truck into visitors of a Christmas market. The twelfth victim was the original truck driver who was shot prior to the attack. Although multiple weapons are used during this attack (namely driver and armed assault), the primary weapon is the truck. Therefore, only when there is no clear distinction between primary and secondary weapon, will the attack be characterized as having multiple weapons.

For the seventh and last characteristic, we distinguish between attacks which stop right after the attack took place either because the perpetrators were arrested or killed, and attacks in which the perpetrators managed to escape meaning that the attack is ongoing and continuous. In section 4 we hypothesize that the greater the uncertainty, fear and sensation caused by attacks, the greater the impact on investor sentiment and therefore investor behavior. Attacks in which perpetrators flee the scene and authorities increase the threat of terrorism to its highest level, cause extra uncertainty and fear among the public as the perpetrators are still out there and possibly commit more attacks as a result. For example, the perpetrator of the 2016 Berlin truck attack fled the scene on December 19th and managed to flee as far as Milan in Italy, where he was killed in front of a railway station four days later. These attacks contain additional information since they cause an even higher threat to the public which fears that more attacks will happen soon. The information regarding the ending of the attack is then used to determine whether an attack is categorized as a ‘fugitive attack’ or not. In section 6 on methodology, we further explain how we transform the information on fugitive attacks in order to create the fugitive dummies that we use in our statistical analysis.

5.2 Data on stock returns for European markets

After collecting all relevant information and characteristics on terrorist attacks, next step is to gather information on stock prices. The first part of this paper measures the effect of terrorism on the overall European market. As proxy for the overall European market, we use the Stoxx Europe 600 index (SE600). The SE600 Index represents 600 large, mid and small capitalization companies across 17 countries of the European region including Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland and the United Kingdom[18]. Because of the wide range of firms represented in the index as well as the diversity in capitalization among these firms, the index provides a reliable representation of the overall European market and economy. The index is preferred over the Stoxx Europe 50 index, which contains a smaller and less diverse representation of firms within the European market since only the 50 largest European firms are used. The Stoxx Europe 50 is nevertheless added to the list of indices and taken into account for robustness checks later on.

Besides looking at the overall SE600 index, we add all national indices of the eleven countries (France, UK, Belgium, Germany, The Netherlands, Russia, Turkey, Denmark, Sweden, Finland and Spain) that suffer from terrorism to measure the effects of terrorism on each individual index. We also add the U.S. S&P 500 index as control variable in order to measure the abnormal returns of terrorism, which we will further discuss later on in the methodology section. Finally, we add the MSCI World

[18] https://www.stoxx.com/index-details?symbol=SXXP

index in order to gain insights on whether the 2015 IS terrorist wave also affects global stock markets. The MSCI World index is a broad global equity index that represents large and mid-cap equity performance across 23 developed markets [19].

For all equity indices mentioned above, we gather data via Datastream on the daily prices and the daily 5-year historical volatilities from January 2015 till April 2019. We use the daily closing equity prices, since these prices optimally capture the news regarding terrorist attacks that occur during day-time (before the exchanges close at CEST 17:00). The 5-year historical volatility measures how far the closing prices move away from a central average price, in which this average price is taken over the five years. The 5-year historical volatility is preferred over the regular price volatility available on Datastream for two reasons. First, the 5-year historical value gives a more relative interpretation since it portrays not the absolute value of the volatility but instead a fraction of the firm's volatility with respect to the average 5-year price. Second, the 5-year historical volatility has a substantial higher amount of available data since regular price volatilities contain high amounts of missing values.

Table 2 presents an overview of all relevant equity indices as described above. Added to the table are the mean price returns on days with and without terrorist attacks. The last column provides a t-test statistic which indicates significant differences between both means. When examining table 2, it is noticeable that all equity indices (except for Turkey) display positive mean returns on days without attacks and a negative mean returns on days with attacks. This already gives an indication of a certain correlation between the terrorist attacks and stock price returns. However, when looking at the t-test statistics for the mean difference, it is noticeable that only the French CAC 40 index displays a significant difference. This is likely due to the fact that France experienced the most attacks of all countries (22 out of 53 attacks occur in France) which therefore presumably causes a more significant impact on the economy. Only one out of fifteen indices experience a significant difference, which indicates the demand for a more sophisticated model accompanied by more explanatory (control) variables. In the next section, we will introduce and elaborate on these models further. But first, we discuss how data is gathered on the media and telecom stock prices.

5.3 Data on stock returns for the media and telecommunications industry

As second part of this paper, we measure the effects of terrorist attacks on the media and telecommunication industry. The reasoning behind choosing the media and telecom industry is that we hypothesize about the presence of a possible reverse 'lip-stick effect'. For media firms, which consists

[19] https://www.msci.com/world

Table 2: Summary statistics of the equity indices' mean returns on days with and without terrorist attacks

Index	Country/ Area	No attack (Obs: 1058)	Attack (Obs: 53)	T-test (H0: diff=0)
STOXX Europe 600	EU	0.0002	- 0.0016	1.3185 (0.1875)
S&P 500	USA	0.0003	- 0.0003	0.5454 (0.5856)
STOXX Europe 50	EU	0.0002	- 0.0022	1.5094 (0.1315)
MSCI WORLD	Global	0.0003	- 0.0009	1.1177 (0.2639)
CAC 40	France	0.0003	- 0.0023	1.7127* (0.0870)
FTSE 100	U.K.	0.0002	- 0.0014	1.2844 (0.1993)
BEL 20	Belgium	0.0002	- 0.0016	1.3528 (0.1764)
DAX 30	Germany	0.0003	- 0.0017	1.2655 (0.2060)
AEX	The Netherlands	0.0003	- 0.0015	1.2801 (0.2008)
MOEX RUSSIA	Russia	0.0006	- 0.0005	0.7506 (0.4530)
BIST NATIONAL 100	Turkey	0.0001	0.0001	-0.0085 (0.9932)
OMX COPENHAGEN	Denmark	0.0003	- 0.0005	0.5026 (0.6153)
OMX STOCKHOLM	Sweden	0.0002	- 0.0014	1.0447 (0.2964)
OMX HELSINKI	Finland	0.0003	- 0.0008	0.7388 (0.4602)
IBEX 35	Spain	0.00005	- 0.0025	1.5324 (0.1257)

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01
All significant coefficients are highlighted in grey.

of broadcasting companies, newspapers, online news webpages, social media firms etc., we hypothesize that the fear and uncertainty caused by terrorism leads to an increased demand for information. This spike in demand causes more sales and thus more profits and therefore positively affects stock prices. For telecom firms, which consist out of TV, mobile and internet providers, the same reasoning holds. In times of fear and uncertainty, the demand for information (and thus the usage of data provided by these telecom firms) increases, which in turn positively affects stock prices.

Since this paper examines the effects on stock price returns for the eleven countries that have been directly involved in terrorist attacks, the sample for firms in the media and telecom industry is simultaneously narrowed down to these same eleven countries. We measure the effects of terrorism only there where it has actually occurred. Although almost all European countries are either directly or indirectly by IS-terrorism since the start of the terrorist wave in 2015, only the eleven countries that have actually directly experienced these terrorist attacks feel the true fear and anxiety within society. Therefore, we only measure the effects of terrorism there where it has actually occurred.

Just like for the European equity indices, data on the daily closing prices and the daily 5-year historical volatility for the media and telecom industry is obtained through Datastream from January 2015 till April 2019. The sample consists of a total of 217 media firms over 11 countries, and 32 telecom firms over 8 countries, since not all countries have telecom firms that are publicly listed. To provide a better and more comprehensive understanding on these types of media firms, three examples of such firms are:

1. Eutelsat: A French listed satellite broadcasting operator firm. '*We connect users even in the remotest locations, from Europe, Africa and the Middle-East to Asia and the Americas. Whether it's broadcasting video, streaming content or connecting the remotest corners of the earth, we are continually adapting and innovating to ensure you can deliver on your promises'*[20].
2. RELX (previously known as Reed Elsevier): a British-Dutch publisher on scientific, technical and medical material. Global provider of information-based analytics and decision tools for professional and business customers. '*We help scientists make new discoveries, doctors and nurses improve the lives of patients and lawyers win cases. We prevent online fraud and money laundering and help insurance companies evaluate and predict risk. Our events enable customers to learn about markets, source products and complete transactions.'* [21]
3. Daily Mail: United Kingdom's second-biggest-selling daily newspaper firm which is publicly listed in London. '*Providing latest breaking news, showbiz & celebrity photos, sport news & rumours, viral videos and top stories.'*[22]

To provide a more comprehensive understanding on the types of firms within the telecom industry, three examples of such firms are:

1. Immarsat: A British satellite telecommunications company offering global mobile services. *'Inmarsat's global satellite communications enable the connected world. On land, at sea and in the air, we provide mobile voice and data services that governments, enterprises and individuals can rely on'.* [23]
2. Deutsche Telekom (T-Mobile): German telecommunications company headquartered in Bonn. *'One of the world's leading integrated telecommunications companies, with some 178 million mobile customers, 28 million fixed-network lines, and 20 million broadband lines.'* [24]

[20] https://www.eutelsat.com/en/home.html
[21] https://www.relx.com/
[22] https://www.dailymail.co.uk/home/index.html
[23] https://www.inmarsat.com/about-us/what-we-do/
[24] https://www.telekom.com/en/company/at-a-glance

3. Tele2: a telecommunications operator headquartered in Stockholm, Sweden. *'Tele2 offers mobile services, fixed broadband and telephony, data network services, content services and global IoT solution.'* [25]

5.4 Data on stock returns for the Alphabet, Facebook and Twitter

When examining the media and telecommunications industry, we are especially interested in how social media firms react in response to terror. As hypothesised in section 3, we expect social media stock prices to react even stronger in the light of terrorism. However, since there are only six publicly listed social media firms world-wide[26], there is no true separate industry for which data can be gathered. Therefore, rather than collecting data for the entire industry, we collect data for each individual social media firm. Out of the six social media firms, three firms (Renren Inc, Sina Corporation and Weibo) are listed in China and target mainly the Chinese market and are therefore less relevant for our research. We therefore focus on the remaining three U.S. listed social media firms which we briefly discuss below. Again, for each firm data is gathered through Datastream from January 2015 till April 2019 on daily closing prices and on the daily 5-year historical volatility. The three publicly listed social media firms in our sample are:

1. Alphabet Inc: an American technology company operating the world's largest internet search engine (Google), offering a range of other products including Android, Chrome, Gmail, Google+, Google Glass, Google Maps, Google Play and YouTube[27].
2. Facebook Inc: An American online social media and social networking service company used to stay connected with friends and family, to discover what's going on in the world and to share and express what matters to them[28].
3. Twitter Inc: American online news and social networking service in which its mission is to power positive global change by fostering respectful conversations, creating deeper human connections, and encouraging diverse interactions among individuals and teams[29].

Table 3 displays an overview of all (social) media firms and industries examined in this paper as well as the corresponding summary statistics on the mean returns on days with and without attacks. We compare the means of returns between both the attack- and the fugitive dummies. We observe mixed results for the attack dummy on all industries. However, when looking at the fugitive dummy, we observe consistent higher returns on days with fugitive attacks for all industries except for Alphabet.

[25] https://www.tele2.com/about/who-we-are
[26] http://investsnips.com/list-of-publicly-traded-social-media-companies/
[27] http://investsnips.com/google-goog/
[28] https://newsroom.fb.com/company-info/
[29] https://about.twitter.com/en_us/company/our-culture.html

We observe a significant difference for the media industry which is our main area of focus. These statistics indicate a presumable positive relation between media returns and fugitive attacks. In the next section we test these presumptions by adding all required control variables to the model to see if we indeed observe positive stock price effects for media firms after fugitive attacks.

Table 3: Summary statistics of the industry/firm mean returns on days with and without terror attacks

Firm/ industry	Sample size	Dummy	Dummy=0 *	Dummy=1 *	t-test (H0: diff=0) **
Media	217	Attack	-0.0002	-0.0014	2.36**
			(209,550)	*(10,396)*	(0.0183)
Media	217	Fugitive	-0.0003	0.0011	-2.10**
			(213,967)	*(5979)*	(0.0354)
Telecom	32	Attack	-0.0003	-0.0008	0.48
			(82,080)	*(1521)*	(0.6282)
Telecom	32	Fugitive	-0.0003	0.0013	-1.16
			(82,718)	*(883)*	(0.2462)
Facebook	1	Attack	0.0007	0.0004	0.14
			(1058)	*(53)*	(0.8897)
Facebook	1	Fugitive	0.0007	0.0025	-0.56
			(1081)	*(30)*	(0.5784)
Alphabet	1	Attack	0.0009	-0.0015	1.18
			(1058)	*(53)*	(0.2399)
Alphabet	1	Fugitive	0.0008	-0.0005	0.48
			(1081)	*(30)*	(0.6327)
Twitter	1	Attack	-0.0002	0.0031	-0.71
			(1058)	*(53)*	(0.4780)
Twitter	1	Fugitive	-0.00007	0.0013	-0.23
			(1081)	*(30)*	(0.8190)

* Below the Dummy coefficients in parentheses in columns 5 and 6 are the number of observations per firm/industry.
** t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01.
All significant coefficients are highlighted in grey.

In conclusion, in this data section we explain how data is gathered on the equity prices for all European and global indices, the European media and telecom industry and for the three social media firms Alphabet, Facebook and Twitter. In the next section we elaborate on how we process the data and what research design is used in order to obtain the final results for the effects of terrorism on stock prices and volatilities.

6. Methodology

After having described how the data is gathered, next we elaborate on how the data is processed and what statistical methods and techniques are implemented in order to transform the data into empirical output. The first section focuses on how terrorism is modelled using a statistical approach. The second section focusses on the statistical techniques and the regression models used in order to quantify the impact of terrorism on the European stock market. Finally, we explain the same for all (social) media and telecommunication firms.

6.1 Modelling terrorism

After having gathered data on European IS-terrorist attacks, we transform and quantify the characteristics of each attack into dummy variables. For each trading day, we define an attack dummy variable that equals 1 if an attack occurs on that day and 0 otherwise. We do the same for each terrorist characteristic, in which the characteristic dummy equals 1 if it the attack belongs to that certain characteristic and 0 otherwise. More specifically, for each trading day we create country attack dummies, which takes the value 1 if the attack took place in that country or 0 otherwise (i.e. France = 1 if attack occurred in France or 0 if not). The same is done for the weapon dummies (i.e. Driver = 1 for an attack if a vehicle is driven into the crowd or Driver=0 otherwise). Next, the amount of people killed and the amount injured per attack are added as quantitative variables to the same dummy matrix for each trading day. These quantitative variables then provide insights into the relationship between the number casualties and changes in the stock prices or volatilities, and thus provides the marginal stock price effect of terrorism per casualty. Besides analysing these quantitative effects, we categorize each attack based on the number of casualties and see whether differences in effects arise between these categories. We create a new set of dummies which we call severity dummies, which fall in either one of the following four created categories:

1. Unsuccessful attack (equals 1 if an attack has no fatalities, equals 0 if otherwise)
2. Less severe attack (equals 1 if the attack has between one and ten fatalities, equals 0 otherwise)
3. Severe attack (equals 1 if the attack has between eleven and forty fatalities, equals 0 otherwise)
4. Extreme attack (equals 1 if the attack has more than forty casualties, equals 0 if otherwise)

By creating these severity dummies, we now gain insights in the different price effects between the four severity categories rather than only obtaining the marginal price effect per person killed or injured. In this way we gain information regarding the different effects between attacks without fatalities (unsuccessful attacks) and attacks with fatalities (less severe, severe and extreme) and therefore test investor sentiment since we observe how investors react to attacks in which the damage is mainly psychological (unsuccessful attacks) and attacks in which damage is real, tangible and physical (successful attacks). If our results show significant negative stock price effects for unsuccessful attacks, this may indicate the presence of a certain behavioural bias among investors. That is because for unsuccessful attacks, there is a reduced loss in physical fundamental value and instead, the damage is more likely to be caused by psychological element. Hence, by adding these severity dummies we test the implications of the efficient market hypothesis as introduced by Fama et al. (1969), who state that efficient prices should incorporate all available information and that all prices should reflect the fundamental value of the underlying assets.

In efficient markets, the information of a terrorist attacks should be instantaneously incorporated in market prices. However, for some terrorist attacks in our sample this may be challenging. For example, attacks that occur five minutes before the closing of the exchange at 16:55 are still accounted for on that same trading day when applying our methodology. In practice, it is almost impossible for the attack to be fully incorporated within those five minutes. On top of that, it is difficult to determine the exact time between the moment of the attack and the moment information is released and perceived by investors regarding the terrorist attacks. There seems to be a certain subjective boundary as to whether the attack may or may not be fully incorporated in the prices of that same day on which the attack occurred. Therefore, due to the subjective and discrete nature of this process in determining the accountability of terrorist attacks, we allow the impact of a terrorist attack to be incorporated in prices either on the day of the attack or the day after (the forward lagged day) without violating market efficiency (Eldor and Melnick, 2004). In this way, we measure possible lagged effects of terrorist attacks that have not fully been captured before 17:00 on the trading day itself. Therefore, besides including only the day of the attack itself, we additionally add the first (forward) lag dependent variable in order to test whether the price effects are possibly realized during the next trading day. Besides adding the first lag, we also add a second (forward) lag to the regressions in order to test whether these price effects revert and adjust back during the second day after the attack. In this way, we test whether the effects measured are transitory—which is the case when prices convert back during the second lag—or permanent—which is the case if price effects do not re-adjust during the second lag. We further elaborate on this matter later on in section 7 on results.

For the 33 fugitive attacks in our sample (attacks in which the perpetrators flee the scene and the attack continues for multiple days) we create fugitive dummy variables for each trading day which equals one if an attack occurred that day in which the terrorist managed to escape from the authorities and also equals 1 for each day that follows in which the perpetrators are still in hide-out. The fugitive dummy equals 0 if otherwise. If the perpetrator cause casualties on the days they are in hide-out, both the fugitive dummy as well as the attack dummy equal 1. An example is the 2015 January 7th Charlie Hebdo shooting, in which the perpetrators killed and injured 12 and managed to escape afterwards. The next day, in a suburb of Paris, the gunmen shot and killed a police officer and the day after they killed another four citizens after taking hostages in a kosher supermarket. The attack took the lives of 17 innocent people spread over three days and is therefore characterised as a severe attack according to our severity criteria. Still, the three attacks are treated as three separate attacks as they are spread over three days. All these three attacks are therefore considered to belong to both the attack and fugitive dummy variables. A different approach is taken for the 2016 Berlin attack, in which the perpetrator managed to escape to Milan after the attack and was killed four days later. During his hide-out, the suspect did not commit any extra casualties and so the attack dummy equals zero whereas the fugitive dummy equals one on each additional day that the perpetrator was in hide-out. The fugitive dummy thus captures all days in which the perpetrator was in hide-out and in which authorities initiated a manhunt which led to terrorist threat being increased to its highest level. We hypothesize that for these fugitive days—which cause additional fear, sensation and uncertainty—stock price effects are even greater due to shocks to investor sentiment.

An alternative way in modelling terrorism is using the Global Terrorism Index (GTI) as is introduced by the institute for Economics and Peace (IEP). The GTI is an annual index per country which combines the number of incidents, fatalities, injuries and the sum of property damages together to form an index that provides information on terrorist activity per country. Although the index provides useful information in terms of the changes in terrorist activity and terrorist threat over the years within certain countries, it is not suitable for our research design since we measure the daily effects of terrorism and analyse the price and volatility effects of each individual terrorist characteristic on a daily basis. The GTI does not provide daily differentiation with respect to terrorism nor does it differentiate among different terrorist characteristics (such as suicide, armed assault etc.). Instead it measures the aggregate yearly effect of terrorism within a specific country and is therefore not suitable for our methodology. For this reason, we bypass the GTI and instead hold on to the research design as described above.

6.2 Modelling the effects of terror on European stock markets

Terrorism is a threat that European countries have coped with for centuries. Terrorism comes and goes, meaning that although one can never predict the occurrence of a terrorist attack, the attacks cannot be considered as sporadic events since the occurrence will always persist throughout time. Illustrative for this claim is the IS-terrorist wave of 2015, in which Europe experienced 53 attacks in occurring in a time span of only four years. For this reason, the economic consequences regarding the attacks cannot be analysed as an event study. Because of the continuous process, the study of the consequences of terror requires an econometric analysis of the time series type. Therefore, this paper constructs a time series methodology of the terror attacks and their characteristics, in which the modelling of the terror characteristics has been explained in the previous section.

In order to calculate the daily abnormal returns for the European stock market index in response to terrorism, we implement a two-factor model approach as is introduced by MacKinlay (1997). The first factor of the model consists of the U.S. stock market index, the S&P 500. This index is used as a fundamental control variable in order to capture any relevant information that concerns worldwide economic events. Although the S&P 500 explains a significant part of the European stock market behaviour, the index alone may not sufficiently explain enough. Generally speaking, the U.S. and European economy experience similar economic trends. However, as we have seen for instance during the recent 2008 banking crisis, paths can deviate from time to time. Although both economies were severely struck by the crisis, the U.S. economy recovered sooner whereas the E.U. entered a so-called second phase referred to as the Euro sovereign debt crisis (Lane, 2012). Therefore, a second factor is required in order to capture these differences in growth patterns between both markets. The second factor added to the model are the historical (lagged) past stock returns of the European stock market index, which captures historical economic trends within the European market itself. The basic two-factor model is formulated in the following equation (1):

$$R_t = \alpha + \delta R_{t-1} + \beta {R_t}^{S\&P500} + u_t \qquad (1)$$

where R_t is the is the log of the Stoxx Europe 600 (SE600) daily return, α is the alpha, R_{t-1} is the log of the one-period lagged return, δ is historical return-sensitivity, ${R_t}^{S\&P500}$ is the log of the daily return of the S&P 500, β is the market-sensitivity (market beta) and the residual u_t is a white noise innovation. Before further specifying the model, we first test the presence of a unit root in our sample of index returns throughout the entire sample period. This is essential because we need to reject the presence of a unit root since we require stock price returns to be stationary instead of non-stationary. We provide empirical evidence on this matter by conducting an Augmented Dickey Fuller test for unit roots, using daily data from the SE600 from 2015 till 2019. The results are presented in table 4.

Table 4: Test for unit root

	ADF	1% critical level	5 % critical level
Level – SE600 index *	-2.04	-3.96	-3.41
First difference – SE600 index **	-61.04	-3.43	-2.86

* Log levels including constant and trend
** Log differences including constant

Looking at the results, we conclude that the presence of a unit root cannot be rejected for the log price levels of the SE600, whereas the presence of a unit root is strongly rejected for the first differences, i.e. the returns of the SE600. We conclude from the results that our dataset regarding the SE600 returns is indeed stationary.

Next, we test the validity of the S&P 500 as chosen fundamental control variable. The S&P 500 is chosen due to similarities in market characteristics between the U.S. and the E.U. such as the liberalization policies between both capital markets, the openness of both markets to free capital movements, and the relatively large number of stocks that are simultaneously traded on European and U.S. markets. Since these are only assumptions, we require additional statistical evidence to statistically confirm this claim on market similarity. Therefore, we perform a Granger causality test in order to test the Granger causality between the European and U.S. markets. The results are presented in table 5.

Table 5: Granger causality test (six lags)

Null hypothesis	F-statistic	Degrees of freedom	Probability
Dlog (SE600) does not Granger cause Dlog(S&P 500)	2.04	6	0.057
Dlog (S&P 500) does not Granger cause Dlog(SE600)	80.54	6	0.000

We find that the first hypothesis, in which European stock returns determine U.S. stock returns, is rejected at a 95% confidence interval. However, the second hypothesis in which U.S. returns determine European returns is not rejected due to a highly significant F-statistic of 80.54. Therefore, the Granger causality tests indicate a strong Granger causality from the S&P 500 index to the SE600 index and not the other way around. All in all, the results approve the S&P 500 index to function as a valid fundamental control variable in our basic equation (1) mentioned earlier:

$$R_t = \alpha + \delta R_{t-1} + \beta R_t{}^{S\&P500} + u_t \qquad (1)$$

After having statistically substantiated the two-factor model presented in basic-equation (1), we next move on to further specifying the residual u_t. Until now, we identified both the S&P 500 index and the historical (lagged) SE600 returns as the two factors in our model which filter out all other effects and leave only the true abnormal return caused by terrorism. The informational content regarding terrorist attacks must therefore be captured in the u_t white noise innovation. We further decompose u_t into two components in the following way:

$$u_t = \varphi_t + \varepsilon_t \tag{2}$$

Where φ_t is the innovation associated with the terrorist attack and ε_t is pure noise. We further decompose the innovation component regarding the terrorist attacks as follows:

$$\varphi_t = \gamma T_t \tag{3}$$

Where γ is a vector of specified parameters and T_t is a dummy on any attack or characteristic. In other words, for each type of attack, γ captures the coefficient of interest regarding a certain attack (i.e. price effect of a suicide attack) and T is the dummy value which takes on value 1 if attack or characteristic occurs or zero otherwise (i.e. equals one for a suicide attack, or zero otherwise). We can now insert the innovation associated with the terror attacks presented in equation (3) into the basic-equation (1) and get the following equation (5):

$$R_t = \alpha + \delta R_{t-1} + \beta R_t^{S\&P500} + \gamma T + \varepsilon_t \tag{5}$$

As mentioned earlier, we include a one-period lag and two-period lag in addition to the original terrorist attack dates. We do so in order to capture possible delayed effects in the first lag and possible reverse effects in the second lag and thus test whether the measured effects are transitory or temporary. We add both lags to T and get to the final equation (6):

$$R_t = \alpha + \delta R_{t-1} + \beta R_t^{S\&P500} + \gamma_0 T_t + \gamma_1 T_{t-1} + \gamma_2 T_{t-2} + \varepsilon_t \tag{6}$$

Finally, table 6 provides interpretation of the signs of the coefficients of the terrorist characteristics and their lagged values. The plus-signs indicate that coefficients are statistically different from zero, whereas the minus-signs indicate that the coefficients are not statistically different from zero. The first interpretation provides no information as all coefficients show no significant difference from zero, meaning we cannot draw any conclusions regarding market efficiency. The second and the third interpretations imply markets to be efficient, since all terrorist effects are incorporated in prices right away without any lagged effects or adjustments during the second lag. For the fourth and fifth interpretations, markets may be inefficient as we observe price adjustments during the second lag as γ_2 is significantly different from zero, implicating that possible market frictions or inefficiencies cause the effects to be delayed. In this case we would argue the markets to be inefficient in the semi-strong form. On the other hand, in case initial transitory price effects observed in γ_0 or γ_1 are caused by possible irrational or sentimental mispricing by investors, then a significant γ_2 may be the result of efficient functioning markets as the mispricing is instantaneously eliminated by arbitrageurs and thus corrected for by the market. By understanding the signs and their interpretations in the table, we gain insights into whether the effects are transitory or permanent, which therefore provides information on whether markets are efficient or not.

Table 6: Identifying terrorist effects as transitory or temporary

Interpretation	Coefficients			
	γ_0	γ_1	γ_2	$\gamma_0 + \gamma_1 + \gamma_2$
1. No information	-	-	-	-
2. Transitory information and efficient market	+	+	-	-
3. Permanent information and efficient market	+	+	-	+
4. Transitory information with lagged effects	+	+	+	-
5. Permanent information with lagged effects	+	+	+	+

6.3 Modelling the effects of terror on media and telecommunication firms

In the previous section, we explain the methodology regarding the stock price effects of terrorism on European equity prices. For the fundamental market control variable, it is not possible to use the SE600 index as market benchmark as this is already our dependent variable. After conducting a Granger causality test, we found that the U.S. S&P 500 index is the appropriate benchmark. For the media and telecommunication industry, we apply a different approach. Since we test the same effects of terrorism on stock prices but now use media and telecom stock prices as dependent variable rather than the market index as a whole, it is now possible to use the SE600 market index as fundamental control variable. For these regressions, we replace the fundamental control component by the CAPM market control component and so get to the new equation. We add the SE600 index to the Capital Asset Pricing Model (CAPM) element to determine the new fundamental market control and add this element to the existing equations.

As introduced by Sharpe (1964), CAPM is as a way to demonstrate the relationship between the risk of a specific asset or stock portfolio and the expected return to the investors in a reasonable equilibrium market. Investors may obtain a higher expected rate of return on their holdings only by incurring additional risk. The market presents investors with two prices: the price of time (the pure interest rate) and the price of risk, the additional expected return per unit of risk borne. We include both prices to the model and also take into account the systematic risk or the beta, which represents the market-sensitivity of the firm. The CAPM element is formulated as follows:

$$R_f + \beta(R_{Market} - R_f) \quad (7)$$

Where R_f is the risk-free rate (the 1-year E.U. government bond yield), β represents the market sensitivity (market beta) and R_{Market} is the return on the SE600 European market index. By inserting the CAPM element (equation 7) into the previous final equation (6), we get the following model:

$$R_t = \alpha + \delta R_{t-1} + R_f + \beta({R_t}^{STOXX600} - R_f) + \gamma_0 T_t + \gamma_1 T_{t-1} + \gamma_2 T_{t-2} + \varepsilon_t \qquad (8)$$

By inserting the CAPM element into the former equation (6), we create an almost identical model between the SE600 stock market and the media and telecom industry which means results are more comparable. Another advantage of this research method is that abnormal returns are easy to calculate but still take into account all risks related to expected returns.

A viable alternative in determining the final equation for media and telecom firms is to implement alternative asset pricing models such as the three-factor model introduced by Fama and French (1992). The three-factor model expands on the CAPM by adding two variables, size and book-to-market equity, and captures the cross-sectional variation in average stock returns associated with market growth, firm size, leverage, book-to-market equity and earnings-price ratios between firms and industries. This model would be useful when examining a sample of firms across different sectors or industries. However, since we only examine two industries separately, we can assume that there is no cross-sectional variation in terms of size and value across firms within the media or telecom industry. For this reason, adding additional factors that control for size and value would be unnecessary, meaning that the final model including the CAPM element already sufficiently controls for movements in the market.

In addition to the media and telecom industry, we also examine the three publicly listed social media firms as mentioned in the data section. For these firms we seek to find a similar model with respect to previous models. We take the same model as in equation (8) and substitute the European SE600 index for the U.S. S&P 500 index as market benchmark given the fact that all these social media firms operate in the U.S. as they are American publicly listed firms. Therefore, the final model for the social media firms in the sample of this paper is:

$$R_t = \alpha + \delta R_{t-1} + R_f + \beta({R_t}^{S\&P500} - R_f) + \gamma_0 T_t + \gamma_1 T_{t-1} + \gamma_2 T_{t-2} + \varepsilon_t \qquad (9)$$

Until now we have provided information on how data is gathered and processed and what methods and modelling techniques are used in order to transform the data into scientific empirical results. In the next section, we present these results regarding the economic impact of terrorism on the European stock market, the media and telecom industry and on the three social media firms.

7. Results

In this section we present the empirical output of all regressions regarding the effects of terrorist attacks on stock prices. The section is divided in three parts. The first part discusses the results regarding the effects of terrorist attacks on the European stock market. The second part discusses the results of terrorist attacks on the European media and telecom industries. The third part discusses the results of terrorist attacks on the three specific social media firms Facebook, Twitter and Alphabet.

7.1 Results for the effect of terrorist attacks on the European stock market

The first results we discuss are from the basic equations, in which we test the fundamental quality of the basic model. In these regressions we test the overall effect of terrorism, without adding any terrorist characteristics yet. We add year dummies to control for year fixed effects and thereby capture the influence of aggregate time-series trends. We also adjust standard errors for the potential presence of heteroscedasticity and serial correlation. The results are presented in table 7. The first three models represent the basic equations using the SE600 log price returns as dependent variable. Models four to six present the basic equations using the SE600 log historical volatility changes as dependent variable.

The first model includes both factors of our two-factor model, the fundamental S&P 500 control variable and the lagged dependent variable. We see that the fundamental variable, significantly co-moves with the SE600 for almost 60%. We obtain significant results for both the Breusch-Pagan test—which tests the presence of heteroscedasticity—and the Breusch-Godfrey LM-test which tests the presence of serial correlation. We reject the null hypothesis for both tests which indicates the presence of heteroscedasticity and serial correlation throughout our data set. Thus, in order to correct for heteroscedasticity and serial correlation, we apply robust standard errors throughout the paper in order to control for this. In the second model we add the attack dummy variable to the previous model, which indicates the occurrence of one of the 53 attacks in our dataset. We observe temporary effects during the first and second lag, in which prices increase by 0.3% on the first lag and decrease by 0.3% during the second lag. We see that stock prices drop by 0.1% on the day of the attack, however since the coefficient is insignificant there is not enough evidence to statistically confirm this.

As Fama et al. (1969) suggest in their paper on market efficiency, the findings may be a result of the large and liquid nature of the European stock markets. In line with market efficiency, we could argue that due to the initial price drop of 0.1% on the attack date, arbitrageurs subsequently purchase stocks during the first lag to profit from this mispricing, which in turn positively affects stock prices during the first lag. Due to its large and liquid nature, the European stock market is represented by many arbitrageurs and low transaction costs. Both elements lead to higher demands for stock during the first

Table 7: Fundamental-equation regressions on the SE600 price return and 5-year historical volatility

	Dependent variable					
	Log (SE600 return)			Log (SE600 volatility)		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0007*	0.0007*	0.0007*	0.0001***	0.0001***	0.0001***
	(0.060)	(0.061)	(0.061)	(0.003)	(0.003)	(0.003)
Fundamental	0.5928***	0.5932***	0.5930***	0.3843***	0.3844***	0.3842***
	(0.000)	(0.000)	(0.000)	(0.000)	(0..000)	(0.000)
Lag	0.0260	0.0272	0.0260	0.4764***	0.4765***	0.4766***
	(0.289)	(0.264)	(0.290)	(0.000)	(0.000)	(0.000)
Attack		-0.0014			0.0002**	
		(0.201)			(0.037)	
Attack first lag		0.0034**			-0.0001*	
		(0.023)			(0.090)	
Attack second lag		-0.0027*			0.0001	
		(0.059)			(0.979)	
Sum Attack		-0.0007			0.0001	
(1+2+3)		(0.750)			(0.640)	
Fugitive			0.0001			-0.0001
			(0.919)			(0.618)
Fugitive first lag			-0.0006			0.0001
			(0.773)			(0.180)
Fugitive second			0.0012			-0.0002*
lag			(0.558)			(0.096)
Sum Fugitive			0.0007			-0.0001
(1+2+3)			(0.618)			(0.532)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Breusch-Pagan	95.42***	60.10***	60.25***	573.48***	573.61***	574.49***
test	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LM-test	812.42***	808.85***	814.37***	11.54***	11.03***	11.85***
(Breusch Godfrey)	(0.000)	(0.000)	(0.000)	(0.0007)	(0.0009)	(0.0006)
Adjusted - R^2	0.3549	0.3564	0.3545	0.8342	0.8343	0.8341
Observations	3718	3718	3718	3718	3718	3718

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

lag when investors anticipate and seek to profit from the existing mispricing. This positive demand effect is further enhanced by the general expectation among investors that markets (arbitrageurs) react to mispricing caused by terrorist events on the day after the attack, in which stock prices increase even further. Both investors and arbitrageurs anticipate on these expectations which results in a positive price effect during the first lag. During the second lag, arbitrageurs eliminate arbitrage opportunities by short selling the stock, which can explain the observed reverse price effects during the second lag.

This finding is further substantiated when looking at the structural effect ($\gamma 0+ \gamma 1+ \gamma 2$, the sum of all three coefficients) in which we find a negative stock price effect of 0.07%. Due to the insignificance of the sum of the coefficients, we reject the presence of a permanent effect, meaning that the transitory effects observed in the first two lags have been eliminated as they do not hold in the long-run. The result seems to overlap with Chen and Siems's (2004) and Nikkinen et al.'s (2006) theory in which the short-run negative price effects recover quickly as markets have become resilient due to stable, open and liberalized financial markets. We observe similar temporary shocks in response to terrorist attacks followed by efficient market recovery in which the long-run effects are eliminated due to the stable and resilient nature of the European stock market.

In the third model, we replace the attack dummy by the fugitive dummy. We would expect the results to be larger in magnitude and significance, however we find no such results which indicates no enhanced effects for fugitive attacks on the European stock market. Later on, we will further discuss the effects of the fugitive dummy on the (social) media and telecom industries, in which we see that the fugitive dummy does in fact have greater impact on stock returns.

Model 4 presents the results for the basic equation using the SE600 volatility change as dependent variable. We see that both the fundamental—the volatility of the S&P 500—as well as the Lag dependent variable are significant determinants in predicting the SE600 volatility. Again, there is a strong indication of heteroscedasticity and serial correlation throughout the data set, therefore robust standard errors are applied to the models to correct for this. In model 5 we add the attack dummy variable and obtain similar temporary effects as in model 2. On the day of the attack, volatility significantly increases by 0.02% which may be caused by political turmoil and uncertainty, leading to increasing underlying risks caused by the increasing threat of terrorist activity within the continent. The volatility of the SE600 significantly decreases by 0.01% during the first lag, indicating similar recovery of the market. The insignificant structural 0.01% increase in volatility of terrorist attacks in response to terrorism indicates the effects to be temporary instead of permanent. The results appear to be in line with findings of Nikkinen et al. (2006), Mnasri and Nechi (2016) and Goel et al. (2017) in which the impact of terrorist attacks on financial markets' volatility lasts only about 20 trading days, indicating that terrorist attacks do not have a significant or lasting economic effect on volatility. In model 6 we replace the attack dummy by the fugitive dummy and observe similar temporary effects but no permanent effects, indicating no enhanced or exclusive effects on volatility for attacks in which perpetrators flee the scene.

Next, we focus on the specific effects of each individual terrorist characteristic on the SE600 stock returns and test how these cross-sectional effects differ per characteristic. We regress each characteristic individually using the same two-factor model in order to determine the abnormal return for each terrorist characteristic. We control for world-wide economic events (i.e. crisis etc.) by adding the S&P 500 index as fundamental control variable. We include the lag of the SE600 to control for changes in European economic trends. Furthermore, we add year dummies to control for year fixed effects and thereby capture the influence of aggregate time-series trends. Finally, all standard errors are adjusted for the potential presence of heteroscedasticity and serial correlation within the dataset by applying robust standard errors when necessary. The results are presented in table 8.

Table 8: The effect of European IS- terrorist attacks on the SE600 index price returns

Dependent variable: Log (SE600 return)		γ0	γ1	γ2	γ0+ γ1+ γ2	Adjusted - R^2
Regressions with Dummy variables						
Country	France	-0.0019 (0.328)	0.0051* (0.097)	-0.0027 (0.329)	0.0005 (0.906)	0.2851
	UK	-0.0021 (0.177)	0.0016 (0.548)	-0.0015** (0.014)	-0.0021 (0.501)	0.2784
	Germany	0.0004 (0.908)	0.0043** (0.029)	-0.0022 (0.611)	0.0026 (0.663)	0.2794
	Russia	-0.0064*** (0.001)	0.0040** (0.014)	-0.0025 (0.452)	-0.0050 (0.243)	0.2792
	Turkey	0.0037 (0.183)	0.0026 (0.423)	-0.0032 (0.416)	0.0032 (0.583)	0.2801
	Denmark	-0.0017** (0.011)	0.0001 (0.930)	0.0088*** (0.000)	0.0071*** (0.000)	0.2788
	Belgium	-0.0034** (0.014)	-0.0011 (0.682)	-0.0037 (0.127)	-0.0082** (0.037)	0.2795
	Sweden	0.0019*** (0.000)	-0.0003 (0.222)	0.0008*** (0.004)	0.0024*** (0.003)	0.2781
	Spain	-0.0058*** (0.000)	-0.0045*** (0.000)	0.0023*** (0.000)	-0.0079*** (0.000)	0.2786
	Finland	-0.0045*** (0.000)	0.0024*** (0.000)	-0.0029*** (0.000)	-0.0050*** (0.000)	0.2783
	Netherlands	-0.0042** (0.105)	0.0030** (0.035)	-0.0069*** (0.000)	-0.0081** (0.012)	0.2794
Attack type (casualties)	Unsuccessful	-0.0029 (0.149)	0.0038 (0.177)	-0.0035 (0.225)	-0.0026 (0.533)	0.2846
	Less severe	-0.0017 (0.312)	0.0013 (0.548)	-0.0011 (0.569)	-0.0014 (0.670)	0.2790
	Severe	0.0006 (0.699)	0.0034 (0.199)	-0.0034 (0.295)	0.0006 (0.883)	0.2801
	Extreme	0.0022 (0.607)	0.0063 (0.177)	-0.0012 (0.719)	0.0074 (0.307)	0.2802
Attack type (weapon)	Driver	-0.0012 (0.331)	-0.0021 (0.295)	-0.0034* (0.058)	-0.0068** (0.028)	0.2795
	Bombing	-0.0026*** (0.008)	0.0015* (0.051)	-0.0017 (0.135)	-0.0027 (0.129)	0.2782
	Cold weapon	-0.0033** (0.028)	0.0018 (0.197)	-0.0017 (0.326)	-0.0032 (0.226)	0.2816
	Armed assault	-0.0009 (0.765)	0.0080* (0.056)	-0.0028 (0.444)	0.0042 (0.441)	0.2872
	Suicide	0.0010 (0.639)	0.0046 (0.126)	-0.0040 (0.169)	0.0016 (0.702)	0.2817
Regressions with quantitative variables						
	Killed	-0.0001 (0.877)	0.0001 (0.148)	-0.0001** (0.013)	0.0001 (0.806)	0.2824
	Injured	-0.0001 (0.868)	0.0001 (0.360)	-0.0001** (0.012)	-0.0001 (0.709)	0.2804

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

The terrorist dummies are characterized by country, severity (based on casualties) or weapon. For almost all countries except for Turkey, we observe temporary effects since either γ0, γ1 or γ2 displays significant coefficients, indicating significant temporary change. By looking at the sum of the three coefficients (γ0+ γ1+ γ2), we observe that significant permanent effects of terrorism on the SE600 are present only in the smaller and less severely affected countries. These countries include Denmark, Belgium, Sweden. Spain, Finland and The Netherlands. When looking at the bigger and more severely struck countries, we observe no such permanent effects. These countries include France, UK, Germany, Russia and Turkey. A possible explanation for the dispersion in price effects between these smaller and bigger countries is that the bigger countries possess more political power, dispose over more powerful armies, exercise more international political influence and are therefore more politically engaged in international conflicts such as the fight against IS in the Middle-East. Because these countries have been involved in conflicts for longer periods over time, they have also experienced higher frequencies of terrorist attacks throughout history. Thus, investors are less shocked and therefore react less intensively in response to attacks occurring in these countries, which could explain the reduced permanent nature of these effects. When examining the smaller and less influential countries, which are less predominantly involved in international conflicts such as the fight against IS, investors would less likely expect attacks to occur here. Due to the unexpected nature of these attacks, investors react more fiercely as they did not see it coming, therefore causing a greater and more permanent effect on the SE600 index.

Moving on to the severity category on casualties, we observe no temporary nor permanent effects. We can nevertheless extract information from these results. Apparently, there are no categorical differences in price effects between unsuccessful and extreme attacks. A possible explanation for this phenomenon is that investors react to the attack itself, and that this reaction does not depend on whether an attack is unsuccessful, less severe, severe or extreme. The occurrence of the attack itself, and the corresponding information creating fear and uncertainty among the public, causes the shock. Therefore, the severity categorical distinction does not explain cross-sectional dispersion in price effects between the severity categories. Whether the attack is considered as unsuccessful or extreme is neglected, what counts is that the attack occurred in the first place which in turn causes the psychological shock and thus overall shock to the European economy.

For the third category on attack weapons, we observe temporary effects for bombing, cold weapon and armed assault. Remarkably, suicide attacks display no temporary- nor permanent effects, which is inconsistent with previous literature of Eldor and Melnick (2004), who find that suicide attacks are one of few attacks that actually have permanent damage on the Israeli economy. The same inconsistency holds when comparing the results to Jetter (2014), who finds that suicide attacks receive significantly more coverage and therefore cause more economic damage, which could explain the increased popularity for suicide attacks among terrorist groups. For the driver attacks, the effects are permanent and are estimated to decrease SE600 stock prices by 0.7% on aggregate. A possible reasoning behind these results is that when looking at the history of attacks in Europe and other western democracies, suicide and bombing attacks (i.e. Madrid in 2004 and London in 2005) and also armed assault attack (i.e. Utoya attacks in 2011) were commonly used weapons for strategic and political attacks like these. However, since the 2015 IS-terrorist wave in Europe, there is a noticeable changing trend regarding the nature of terrorist attacks. Before the wave, attacks were typically more centrally coordinated causing high collateral damage and many casualties. After the start of the 2015 wave, attacks are more typically characterised by their uncoordinated nature and are typically carried out and organized by so-called lone-wolf terrorists. Therefore, the use of vehicles and vans as weapons, which require no major preparations in terms of organization, experienced a spike over the years and is considered as a new technique that causes as much substantial damage at as low costs. Driver attacks, with respect to other weapon attacks, can therefore be viewed as a new element in this 2015 IS-terrorist wave. Driver attacks are accompanied with new and unexpected informational content, which increases investor shocks and thus explains the significant and permanent negative effects on the SE600 index returns.

For the quantitative variables regarding the amounts killed or injured per attack, we find temporary negative effects for both the amount killed and injured during the second lag period. The interpretation is that for each person killed in an attack, SE600 returns decrease by 0.006% on average. For each person injured in an attack, SE600 returns decrease by 0.0012% on average. These quantitative variables present the marginal effect on the SE600 for each additional casualty, whereas the severity dummies indicate cross-sectional differences between the categories themselves.

Finally, we discuss the effects of terrorist attacks on the SE600 volatility. The results are less evident than the results for the SE600 returns. We expect coefficients to be positive since attacks cause higher fear and uncertainty, increase political risk and thus cause higher volatility. The results are presented in table 9. For the country category we find similar results for the smaller and less influential countries compared to the SE600 price effects. For Finland, Denmark, Spain and The Netherlands we find permanent effects on volatility. Belgium and Sweden experience no permanent effects whereas Russia, as bigger and more influential superpower, does. The signs of the coefficients are however mixed, meaning there is no clear indication of what direction volatility is expected to move in in response to terrorist attacks. In contrast to the findings on returns, the casualty category does actually appear to provide explanatory information regarding the effects on volatility. For unsuccessful and extreme attacks, the effects are temporary, whereas for severe attacks there is a permanent volatility decrease of 0.04%. The same findings hold for the weapons category, which display temporary effects for suicide, cold weapon and driver. Again, we observe no permanent effects. For the quantitative variables, we find temporary effects for both amounts killed and injured for almost all coefficients. However, again the results are not permanent, meaning that almost all temporary volatility shocks quickly re-adjust due to efficiently functioning European markets, which is line with our previous results for SE600 returns.

After having discussed the results of terrorism on the European stock markets, we now move on to the next part in which we present and discuss the results for the media and telecom industry.

Table 9: The effect of European IS-terrorist attacks on the SE600 5-year historical volatility

Dependent variable: Log (SE600 volatility)		γ0	γ1	γ2	γ0+ γ1+ γ2	Adjusted - R^2
Regressions with Dummy variables						
Country	France	0.0002	-0.0002	0.0001	0.0001	0.7452
		(0.198)	(0.256)	(0.368)	(0.526)	
	UK	0.0001	-0.0001	0.0003*	0.0002	0.7441
		(0.797)	(0.570)	(0.071)	(0.476)	
	Germany	0.0002	-0.0002	-0.0001	-0.0001	0.7443
		(0.258)	(0.168)	(0.704)	(0.923)	
	Russia	-0.0001	-0.0006	-0.0007***	-0.0013***	0.7450
		(0.252)	(0.169)	(0.000)	(0.004)	
	Turkey	0.0001	-0.0003	-0.0001	-0.0003	0.7442
		(0.857)	(0.200)	(0.781)	(0.345)	
	Denmark	0.0006***	0.0001***	0.0004***	0.0011***	0.7442
		(0.000)	(0.001)	(0.000)	(0.000)	
	Belgium	0.0000322	0.0001018	-0.000254	-0.0001201	0.7441
		(0.922)	(0.376)	(0.330)	(0.783)	
	Sweden	0.000001	0.000001	0.000001	.0000272	0.7438
		(0.746)	(0.746)	(0.746)	(0.746)	
	Spain	-0.0007***	0.0004***	0.000001	-0.0003***	0.7444
		(0.000)	(0.000)	(0.782)	(0.000)	
	Finland	0.0004***	0.0001	-0.0007***	-0.0003***	0.7444
		(0.000)	(0.782)	(0.000)	(0.000)	
	Netherlands	0.0010***	0.0001	0.0001	0.0011***	0.7454
		(0.000)	(0.800)	(0.776)	(0.004)	
Attack type (casualties)	Unsuccessful	0.0005**	-0.0003*	0.0001	0.0003	0.7489
		(0.012)	(0.06)	(0.612)	(0.218)	
	Less severe	-0.0001	0.0001	-0.0001	0.0001	0.7442
		(0.704)	(0.275)	(0.435)	(0.948)	
	Severe	-0.0001	-0.0002	-0.0001	-0.0004**	0.7444
		(0.552)	(0.219)	(0.206)	(0.026)	
	Extreme	0.0002**	-0.0004*	0.0002	0.0001	0.7446
		(0.013)	(0.070)	(0.320)	(0.852)	
Attack type (weapon)	Driver	-0.0002	0.0001	0.0003***	0.0002	0.7447
		(0.314)	(0.650)	(0.004)	(0.379)	
	Bombing	0.0004	0.0001	0.0001	0.0004	0.7440
		(0.148)	(0.673)	(0.673)	(0.141)	
	Cold weapon	0.0003**	-0.0001	-0.0001	0.0002	0.7453
		(0.029)	(0.734)	(0.431)	(0.448)	
	Armed assault	0.0002	-0.0002	-0.0001	-0.0001	0.7447
		(0.420)	(0.289)	(0.832)	(0.852)	
	Suicide	0.0001	-0.0004***	0.0001	-0.0003	0.7450
		(0.268)	(0.003)	(0.970	(0.170)	
Regressions with quantitative variables						
	Killed	0.0001*	-0.0001**	0.0001*	0.0001	0.7447
		(0.065)	(0.015)	(0.092)	(0.777)	
	Injured	0.0001	-0.0001***	0.0001**	0.0001	0.7447
		(0.220)	(0.002)	(0.045)	(0.858)	

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

7.2 Results for the effect of terrorist attacks on the European media and telecom industry

This section presents the results regarding the effects of terrorism on the media and telecom industry. In the previous section we mostly find negative temporary effects of terrorist attacks on the European stock market. In this section, we test a so-called reverse 'lip-stick' effect for the impact of terrorism on the media and telecom industry. We expect a reverse effect in which European (social) media and telecom firms actually benefit from the increasing terrorist threat across Europe in recent years. We apply the same methodology as in previous regressions, but now use the returns of the media and telecom industries (separately) as dependent variable. We control for overall European economic growth trends by adding the market premium as fundamental control variable to the regression. The market premium is computed by subtracting the E.U. risk free rate—the 1-year E.U. government bond yield—from the SE600 index return. We extract data on the E.U. government bond yields from Eurostat. We add historical industry returns (one-period lag) of the media and telecom industry to control for previous growth trends within each industry. Furthermore, we add year dummies to control for year fixed effects and thereby capture the influence of aggregate time-series trends. We add firm fixed effects to control for all firm factors that do not vary over time. We include country fixed effects by adding country dummies to control for cross-sectional variation between the eleven countries in our sample. Finally, all standard errors are adjusted for the potential presence of heteroscedasticity and serial correlation within the dataset by applying robust standard errors when necessary. The results are presented in table 10 for the media industry and in table 11 for the telecom industry.

The first two rows in table 10 present the overall effects of terrorist attacks on the media industry. We observe a low market sensitivity (β= 0.31) which therefore categorize media firms to be non-cyclical firms. This is a presumable finding since the demand for information provided by media firms is persistent over time and thus insensitive to economic circumstances within a country. For the attack dummy variable, we observe a significant negative return of 0.1% on the day of the attack. However, the market recovers during the second lag in which prices reversely increase by 0.12%. These temporary effects lead to an overall positive permanent effect if we look at the sum of the coefficients of all three determinants. However, due to the insignificance of this coefficient there is not enough statistical evidence to prove a permanent effect on media returns for all 53 attacks in the sample. This finding could be due to the fact that we take a large sample consisting of 53 attacks. Many of these 53 attacks are considered to be small, unsuccessful or less severe attacks with lower amounts of casualties and collateral damage and therefore lower overall damage when compared to other major and extreme attacks with more casualties and higher economic costs. This claim overlaps with the findings of Scott (2001) who finds that terrorists congest the media in equilibrium, suggesting that too many attacks diminish the marginal effects of additional attacks. The attack dummy may therefore contain too many insignificant attacks to cause a true significant permanent effect. We therefore narrow down the sample by selecting only the 33 fugitive attacks, in which the perpetrators managed to escape the scene, to test if the results are affected.

We add the fugitive dummy to the regressions and observe a positive temporary price effect of 0.17 % during the first lag. We find that overall effect for these fugitive attacks on media returns are positive and highly significant at a 99% confidence level (p=0.005), indicating an overall 0.22% structural

Table 10: The effect of European IS- terrorist attacks on the European *media industry*

Dependent variable: Log (media return)		γ0	γ1	γ2	γ0+ γ1+ γ2	*MarketBeta*	LAG	Adjusted-R^2	Obs.
				Regressions with Dummy variables					
ATTACK		-0.0010**	-0.0001	0.0012**	0.0001	0.31***	-0.12***	0.4494	219,917
		(0.031)	(0.742)	(0.011)	(0.956)	(0.000)	(0.000)		
FUGITIVE		-0.0002	0.0018*	0.0006	0.0022***	0.31***	-0.12***	0.4443	219,917
		(0.826)	(0.075)	(0.357)	(0.005)	(0.000)	(0.000)		
Attack type (casualties)	Unsuccessful	-0.0006	-0.0001	0.0001	-0.0007			0.4497	219,917
		(0.440)	(0.821)	(0.883)	(0.549)				
	Less severe	-0.0005	-0.0008	0.0006	-0.0007			0.4486	219,917
		(0.454)	(0.305)	(0.349)	(0.583)				
	Severe	-0.0013	0.0011	0.0027**	0.0025*			0.4481	219,917
		(0.250)	(0.216)	(0.021)	(0.092)				
	Extreme	-0.0030*	-0.0007	0.0024	-0.0014			0.4488	219,917
		(0.051)	(0.605)	(0.181)	(0.536)				
Attack type (weapon)	Driver	-0.0022	-0.0014	0.0011	-0.0024			0.4503	219,917
		(0.166)	(0.324)	(0.307)	(0.238)				
	Bombing	0.0038	-0.0011	-0.0006	0.0020			0.4499	219,917
		(0.406)	(0.569)	(0.719)	(0.718)				
	Cold weapon	-0.0004	-0.0001	0.0001	-0.0005			0.4496	219,917
		(0.484)	(0.830)	(0.887)	(0.688)				
	Armed assault	-0.0019***	0.0005	0.0023***	0.0008			0.4510	219,917
		(0.009)	(0.494)	(0.007)	(0.502)				
	Suicide	-0.0013*	-0.0005	0.0024**	-0.0024			0.4485	219,917
		(0.087)	(0.517)	(0.022)	(0.172)				
				Regressions with quantitative variables					
Killed		-0.000037**	-0.0000001	0.0000295*	-0.0000124			0.4489	219,917
		(0.022)	(0.736)	(0.086)	(0.594)				
Injured		-0.0000001**	-0.0000001	0.0000001*	-0.0000001			0.4490	219,917
		(0.046)	(0.968)	(0.064)	(0.748)				

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

increase in stock price returns for the media industry as whole. We have two main explanations for this phenomenon. First of all, the permanent positive stock price effect may be caused by shocks to investor sentiment in response to fugitive attacks, which leads to irrational investor behaviour causing structural mispricing. The price effects persist because (inefficient) markets are unable to correct for these shocks, which cause mispricing to persist in the long run. Another possibility is, in line with our hypothesis, that fugitive attacks generate greater fear for the public which leads to a greater demand for information among media users in the after math of an attack. Investors perceive this shift in market demand and recognize that future prospects will improve for the industry as a whole as higher demand means more users, more income (through advertisements) and thus higher stock prices. Investors take this information into account and positively re-evaluate all media firms, leading to positive price effects for the entire industry. The results confirm the hypothesized reverse ‘lip-stick effect’, in which media firms counterintuitively experience positive returns in contrast to the overall negative effects of terrorism on economic markets as is found in the first part of our paper.

Next, we perform the same regressions using the same methodology, controls and fixed effect dummies as the previous regressions in table 10 but now using the log of the returns of the telecom industry as dependent variable. These firms consist mostly out of data providers for mobile telephone, internet and television. We expect to obtain the same reverse lip-stick effect by testing a different but still comparable industry. Due to the higher demand for media services as is found in table 10, we subsequently expect an increase in demand in data usage (mobile, TV or internet) in times of terrorist threat which is provided by these telecom firms. Similar to the media industry, the increase in demand for telecom data among users is expected to improve future growth prospects, create higher industry revenue and thus create higher shareholder value. The results are presented in table 11

Although we expect similar price effects for the telecom industry as is observed for the media industry, terrorism does not appear to have great significant impact on telecom stock price returns. When examining the attack dummy, we see positive temporary effects on the day of the attack and negative returns on both first and second period lags. The overall permanent effect is negative, however since all coefficients lack economic significance, there is no statistical evidence to back these findings. The significant market beta is found to be higher when compared to the media industry market beta. This may be because mobile data usage for streaming TV shows online is considered as less of a fundamental need than obtaining news from the newspapers for instance. When observing the coefficients of the fugitive dummy, the overall permanent effect becomes positive when compared to the permanent effect of the attack dummy. Just as for the media industry, this insinuates a similar positive relation between fugitive attacks and telecom returns. However, due to insignificance among the coefficients, we cannot statistically confirm this claim as statistical evidence lacks.

Table 11: The effect of European IS- terrorist attacks on the European *telecom industry*

Dependent variable: Log (telecom return)		$\gamma0$	$\gamma1$	$\gamma2$	$\gamma0+\ \gamma1+\ \gamma2$	LAG	$Market\ Beta$	Adjusted-R^2	Obs
				Regressions with Dummy variables					
ATTACK		0.0002	-0.0004	-0.0006	-0.0008	-0.12*	0.42***	0.2535	32,386
		(0.750)	(0.561)	(0.525)	(0.635)	(0.079)	(0.000)		
FUGITIVE		0.0017	-0.0001	-0.0001	0.0015	-0.12*	0.42***	0.2440	32,386
		(0.241)	(0.937)	(0.977)	(0.294)	(0.079)	(0.000)		
Attack type (casualties)	Unsuccessful	-0.0024	0.0001	-0.0010	-0.0034			0.2523	32,386
		(0.197)	(0.995)	(0.590)	(0.272)				
	Less severe	0.0004	-0.0043***	-0.0015	-0.0053*			0.2516	32,386
		(0.728)	(0.002)	(0.337)	(0.060)				
	Severe	0.0018	0.0025	0.0008	0.0051*			0.2447	32,386
		(0.433)	(0.167)	(0.645)	(0.053)				
	Extreme	0.0049	0.0046	0.0011	0.0106			0.2544	32,386
		(0.502)	(0.430)	(0.652)	(0.431)				
Attack type (weapon)	Driver	-0.0011	-0.0007	-0.0022	-0.0039			0.2569	32,386
		(0.379)	(0.609)	(0.293)	(0.190)				
	Bombing	0.0030	0.0009	0.0021	0.0060			0.2559	32,386
		(0.339)	(0.738)	(0.476)	(0.197)				
	Cold weapon	-0.0001	-0.0027**	-0.0021	-0.0047*			0.2386	32,386
		(0.998)	(0.042)	(0.119)	(0.067)				
	Armed assault	-0.0006	-0.0009	0.0013	-0.0001			0.2530	32,386
		(0.648)	(0.366)	(0.585)	(0.955)				
	Suicide	0.0020	0.0038	0.0005	0.0062			0.2423	32,386
		(0.434)	(0.237)	(0.832)	(0.375)				
				Regressions with quantitative variables					
Killed		0.0000618	0.0000595	0.0000141	0.0001353			0.2457	32,386
		(0.433)	(0.400)	(0.605)	(0.376)				
injured		0.0000152	0.000016	-0.0000001	0.0000293			0.2401	32,386
		(0.276)	(0.299)	(0.696	(0.346)				

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

A possible reason for the lack of statistical significance for the telecom industry in comparison to the media industry could be explained through the differences in industry characteristics between both industries. For the telecom industry, users buy pre-paid plans at the beginning of each term (month or year). Therefore, the demand for plans does not fluctuate on daily basis and is therefore less sensitive to shifts in demand. In times of terrorist activity, when people use data by watching the news on TV, call friends or post online social media messages, the increase in demand for data does not lead to an increase in revenue because the data provided by these telecom firms is paid for in advance. Investors anticipate on this difference in industry structure, and thus do not positively re-evaluate the future growth prospects of the telecom firms. In other words, for telecom firms there appears to be a weaker relation between terrorist attacks and the overall industry revenue. Media firms, in contrast, do experience a more time-dependent fluctuation of demand. In times of a terrorist wave, people more frequently use social media apps, view news broadcast on TV or read web articles on media webpages related to terrorist events. The daily fluctuation in demand causes a higher revenue sensitivity for media firms. More terrorist attacks mean higher demand in media services which in turn leads to higher (advertising) revenues for the sector. Investors perceive this information and will be more willingly to invest in the media industry, which will in turn lead to higher share prices and thus cause a relative beneficial effect compared to the telecom industry.

After having compared the effects of terrorism on the media and telecom industry, the next section more specifically examines a sub-industry of the media industry, namely the social media industry. The social media firms spread obtained information even more frequently over its users when compared to the regular media industry. Therefore, we dig deeper into this sub-industry as we expect to find even greater and more significant price effects when compared to the media and telecom industry.

7.3 Results for the effects of terrorist attacks on the social media firms Facebook, Alphabet and Twitter

For Facebook, Alphabet and Twitter, we apply the same two-factor model as used in previous regressions. We use the returns of these three social media firms (separately) as dependent variable. We substitute the SE600 by the S&P 500 index in calculating the market premium and add this premium to control for U.S. market trends. The market premium is computed by subtracting the risk-free rate—the 1-year U.S. treasury bond yield—from the S&P 500 market return. Data on these treasury bond yields are extracted from Compustat. We include (one period lag) historical returns of the social media firms returns to control for previous market performance. Furthermore, we add year dummies to control for year fixed effects and thereby capture the influence of aggregate time-series trends. Finally, all standard errors are adjusted for the potential presence of heteroscedasticity and serial correlation within the dataset by applying robust standard errors when necessary. The results are presented in table 12, 13 and 14.

In table 12 we find that the results for Facebook are similar to the media industry. However, since the market beta is greater than one, Facebook is classified as a pro-cyclical firm in contrast to the regular media firms which are classified as non-cyclical. A possible explanation for this could be that social media firms more heavily rely on advertising, and that in bad economic times, advertising budgets for firms decrease, meaning that social media firms as Facebook are more sensitive to changes in economic growth. When analysing the attack dummy, we observe positive significant effects on the all coefficients which indicates a presumable relationship between terrorist attacks and Facebook's performance. However due to lack of significance we cannot statistically confirm this presumption.

When adding the fugitive dummy to the regression, we find a positive and significant permanent increase in Facebook's stock return of 0.41%, indicating a structural increase in Facebook's stock price in response to terrorism. When looking at the quantitative variables on the number of killed and injured per attack, we observe similar positive and significant permanent effects. For each extra casualty caused in an IS-related terrorist attack, Facebook experiences a 0.01% increase in stock price return. For the amounts injured, the marginal effect is a 0.003% increase in Facebook's stock price return. The results show that the extra fear and uncertainty caused by fugitive attacks significantly impact Facebook's share price. The increasing demand—among victims, witnesses and European citizens in general—for information regarding the fugitive attacks spikes in such a way that Facebook benefits from the situation by providing such information through their social media platform. Many news articles, video's and stories are published and shared through Facebook's timeline in response to the attack. In response to the 2015 terrorist wave, Facebook even opened a so called 'Crisis Response' function: an additional sub-platform on Facebook where you can find information regarding crises such as terrorist attacks. As part of the Crisis Response platform, Facebook introduced the so called 'Safety Check' which quickly determines whether people in the affected geographical area are safe during natural or man-made disasters and terror-related incidents[30]. In this way, Facebook benefits from their efficient and dynamic platform in which people spread information rapidly and target a large audience all at once, which are two essential elements in times of crisis regarding terrorist attacks. Therefore, due to the increase in demand for information during terrorist events and by taking advantage of their efficient and dynamic platform, Facebook fully exploits these opportunities which, in the end, may be the reason for the positive stock price effects as observed in table 10.

For Alphabet (GOOGLE), we see similarities in market sensitivity when looking at the market beta.

[30] https://www.facebook.com/about/crisisresponse/

Table 12: The effect of European IS- terrorist attacks on the social media firm *Facebook*

Dependent variable: Log (Facebook return)	γ0	γ1	γ2	γ0+ γ1+ γ2	*Market Beta*	*Lag*	Adjusted-R^2	*Breusch − Pagan*	*LM test*
Regressions with Dummy variables									
ATTACK	0.0002	0.0014	0.0003	0.0019	1.16***	-0.01	0.3123	8.20**	0.804
	(0.903)	(0.272)	(0.853)	(0.432)	(0.000)	(0.646)		(0.0042)	(0.3700)
FUGITIVE	0.0005	-0.0012	0.0048	0.0041*	1.17***	-0.0142	0.3135	8.21**	0.743
	(0.870)	(0.688)	(0.133)	(0.076)	(0.000)	(0.614)		(0.0042)	(0.3888)
Regressions with quantitative variables									
Killed	-0.0000141	0.0000808**	0.0000523**	0.0001189*			0.3132		
	(0.804)	(0.010)	(0.022)	(0.091)					
Injured	-0.0000001	0.0000189***	0.0000126***	0.0000295**			0.3136		
	(0.810)	(0.003)	(0.001)	(0.011)					

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

Table 13: The effect of European IS- terrorist attacks on the social media firm *Alphabet*

Dependent variable: Log (Alphabet return)	γ0	γ1	γ2	γ0+ γ1+ γ2	*Market Beta*	*Lag*	Adjusted-R^2	*Breusch − Pagan*	*LM − test*
Regressions with Dummy variables									
ATTACK	-0.0016	-0.0002	0.0010	-0.0008	1.16***	0.02	0.4693	0.51	2.04
	(0.282)	(0.915)	(0.517)	(0.743)	(0.000)	(0.348)		(0.4773)	(0.1528)
FUGITIVE	-0.0017	-0.0021	0.0042*	0.0004	1.17***	0.02	0.4702	0.50	1.70
	(0.482)	(0.447)	(0.086)	(0.868)	(0.000)	(0.470)		(0.4802)	(0.1925)
Regressions with quantitative variables									
Killed	-0.0000231	0.0000593	0.00001	0.0000462			0.4694		
	(0.642)	(0.232)	(0.840)	(0.595)					
Injured	-0.0000001	0.0000148	0.0000001	0.0000197			0.4697		
	(0.901)	(0.143)	(0.544)	(0.263)					

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

Table 14: The effect of European IS- terrorist attacks on the social media firm *Twitter*

Dependent variable: Log (Twitter return)	γ0	γ1	γ2	γ0+ γ1+ γ2	*Market Beta*	*Lag*	Adjusted-R^2	*Breusch − Pagan*	*LM − test*
				Regressions with Dummy variables					
ATTACK	0.0049	-0.0078	-0.0022	-0.0051	1.22***	0.003	0.1065	22.40***	0.66
	(0.171)	(0.183)	(0.634)	(0.539)	(0.000)	(0.944)		(0.000)	(0.4154)
FUGITIVE	0.0002	0.0021	-0.0014	0.0009	1.22***	0.001	0.1029	15.89***	0.82
	(0.962)	(0.715)	(0.854)	(0.861)	(0.000)	(0.971)		(0.0001)	(0.3658)
				Regressions with quantitative variables					
Killed	-0.0001982	0.00006	0.0000397	-0.0000985			0.1046		
	(0.155)	(0.450)	(0.528)	(0.580)					
Injured	-0.0000371	-0.0000001	0.0000001	-0.0000392			0.1043		
	(0.168)	(0.896)	(0.951)	(0.301)					

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

We classify Alphabet as a pro-cyclical firm due to their dependence on advertising income, which fluctuates as economic circumstances change. When analysing the attack dummy for Alphabet, we observe no significant temporary nor permanent effects on Alphabet's stock price. However, when looking at the fugitive dummy, we observe a positive and significant transitory increase in return of 0.42% during the second lag. Although we observe an overall positive permanent effect, there is not enough statistical evidence to confirm this claim. The reasoning behind the positive temporary effect during the second lag could be found in the same spike in demand for information in times of crisis. People search for footage on YouTube (owned by Alphabet) and browse for information by using the GOOGLE search engine on their phones using the Android system, which is also owned by Alphabet[31]. A difference between Facebook and Alphabet is that Facebook provides a wide range of news sources that have already been bunched together and posted on users' timeline ready to be consumed by simply scrolling through it[32]. These news sources contain the latest footage, witness stories and news items that users have access to right away. Additionally, Facebook's main focus is to connect people through their social platform, something Alphabet does not necessarily specialize in. This is another additional strength since people have the desire to be connected in times of terror and uncertainty. These arguments thus help us to better understand why the effects have a more permanent nature for Facebook and a more transitory nature for Google.

For Twitter we obtain no results that contain explanatory information on stock price effects in response to terrorist events. For both the attack and fugitive dummies, we observe no significant temporary or permanent effects of terrorist attacks on Twitter's stock price. For the fugitive dummy the permanent effect is positive in contrast to the attack dummy. Again, this insinuates a presumable relation between the fugitive dummy and a positive stock price effect, however there is no statistical evidence to back this claim. The reasoning behind the insignificant effects for Twitter may be due the way of functioning of the platform itself when compared to other social media platforms. Twitter users tweet about all sort of encounters in daily life, whether it is about politics or personal experiences. However, Twitter does not specialise as news source provider in the way that Facebook and Alphabet do. Facebook more efficiently bunches a greater and diverse range of news sources together and connects people over the world which makes it a more personal and widely diverse platform, which is especially beneficial in times of terrorist events[33]. Facebook's strategy in designing the Crisis Response could also create higher association among people on Facebook with crisis situations such as terrorist events. Twitter does not follow this path as Twitter has become more of a political platform which is used to spread political ideas regarding policies, rather than spread informational news regarding crises such as terrorism. The assumption is backed by Hong (2013) who studies the impact

[31] https://abc.xyz/investor/static/pdf/20161231_alphabet_10K.pdf
[32] https://www.visualscope.com/twitfb.html
[33] https://www.visualscope.com/twitfb.html

of social media on politics and finds that Twitter has gained a certain political status over the years in which its main function is to reduce inequalities in the political arena. In other words, since Twitter focusses on a different area by fulfilling different demands, this may be the reason why terrorism causes differences in price effects between Twitter and other social media.

After having discussed and interpreted all the results, in the next section we further discuss the implications of these results. What do these results actually mean when looking at the bigger picture? What do these results imply for the overall academic field of financial economics? We provide robustness checks to further purify the statistical power of this research. We also mention the limitations of the research to help and improve future research in further examining the relation between terrorism and media industry performance.

8. Implications, robustness and limitations

After having provided the results and the interpretations, we next discuss the overall and broader implications from the results which are presented in the previous section. We provide an overall and broader picture of what the results actually imply, why they are relevant and how they contribute to existing academic literature in the field of financial economics. We analyse the statistical validity of the paper's methodology and perform robustness checks to even further improve the statistical and economic strength. Finally, we discuss the limitations of the paper and thereby provide suggestions as to how future research regarding the economic costs and benefits of terrorism can improve.

8.1 Implications

The results for the effects of terrorism on the European stock market display significant negative shocks on returns only in the short-run. The transitory nature of the shocks indicate that markets recover almost instantaneously during one of the two lagged periods. The implication of this finding can be explained in two different ways. As we discussed in the theoretical framework, there are two main views regarding the interpretation of stock price effects in response to terrorism, namely the pro-efficiency view and the non-efficiency view. On the one hand, our results could favour the pro-efficiency view. In line with Chen and Siems (2004), Goel et al. (2017), Nikkinen et al. (2006) and Eldor and Melnick (2018)—the observed instant market recovery implies that the European stock market is adequately resilient and efficient to quickly adjust for temporary irrational shocks caused by irrational investor behaviour in response to terrorism. A reason for the possible gained efficiency is the stable European banking and financial sector in which enough liquidity is provided to promote market stability and minimize panic. Other factors that contribute to the gained European market efficiency are the European market liberalization policies, the democratic and open nature of European markets and the overall technological progression causing well-developed and highly integrated financial markets. On the other hand, our results may favour the non-efficiency view, which all depends on changes in the fundamental underlying economic value in response to terrorism. If terrorism indeed deteriorates the underlying fundamental economic value within the market, then the fundamental changes should be reflected in prices, meaning we should observe a structural (rather than a transitory) shift in asset pricing. The transitory effects, as observed via the reverse lagged coefficients in our regressions, would in this case imply incorrect re-adjustments by the market and would therefore imply an inefficient functioning of the market caused by possible irrational market frictions.

We therefore examine the effects of terrorism on the European economy by focussing two measures. First, we obtain information regarding the effects of the 2015 IS-related terrorist wave in Europe on the underlying fundamental economic changes. We refer to a published report by the RAND, an independent non-profit institute that focusses on rigorous, fact-based research and analysis to help policy and decision making throughout the world. According to their calculations, we find that terrorism has a large negative effect on European economic growth between 2004 and 2016 and that the 28 E.U. member states lost around €180 billion in GDP terms due to terrorist attacks[34]. Although €180 billion may seem substantial at first sight, in relation to the aggregated output in the E.U. during the 12 years it is quite insignificant as it represents only 0.1% of accumulated aggregate GDP.

Second, we examine the effects of terrorism on investor sentiment. By doing so, we test whether the observed transitory price effects to SE600 are linked to possible irrational investor biases (and therefore not linked to fundamental economic deviations). In a new set of regressions, we regress the attack and fugitive dummies on the VSTOXX, also referred to as the European 'fear index' which measures the square root of the implied variance across all European options of a given time to expiration and is designed to reflect the market expectations of near-term up to long-term volatility[35]. We apply the same methodology using the same controls as in all previous regressions and the results are presented in table B1 in the appendix. From the table we find that European IS-terrorist attacks significantly increase the VSTOXX fear index by 2.2% in the long-run, indicating a structural positive effect on the risks and fear among investors in response to terrorism. By taking into account these findings, in combination with the negligible economic effects in Europe in response to terrorism, we tend to favour the pro-efficient view. That is because the short-run transitory shocks observed throughout the paper appear to be caused by shocks to investor sentiment rather than real changes in European fundamental economic output. The contrary indication of the efficient market would be the lived (transitory) impact on markets. However, these short-lived effects seem to be caused by higher uncertainty and fear among investors at the time of the event. Due to the efficient functioning of the market, these short-lived effects are eliminated almost instantaneously, which therefore provides evidence in favour of the market efficiency hypothesis.

As second main finding, we find a reverse lip-stick effect for the (social) media industry in response to terrorism, in which media stock returns are positively affected in both the short-run and the long-run. Again, there are two ways of interpreting these findings. First, terrorism may affect investor sentiment and lead to irrational and sentimental structural mispricing. The structural mispricing implies that the (social) media market is inefficient as the market is unable to adjust and recover from these temporary shocks, meaning that the shifts in prices become permanent. A possible explanation for (social) media markets not being able to recover quickly in response to shocks is that the (social) media industry is smaller and less liquid in nature. In their paper on the Efficient Market Hypothesis, Malkiel and Fama

[34] https://www.rand.org/randeurope/research/projects/the-cost-of-terrorism-in-europe.html
[35] https://www.stoxx.com/index-details?symbol=V2TX

(1970) find that the two factors of size and liquidity are essential in determining whether markets function efficiently or not. Due to its dynamic and vastly changing environment caused by technological developments, the (social) media market is characterised by high innovation, high market volatility and thus lower market stability and predictability of future growth rates. Due to these uncertain market conditions, less liquidity is promoted and distributed throughout the market. Also, the size of the media market contributes in explaining the differences in efficiency, in which the size of the (social) media market is substantially smaller than other manufacturing markets in Europe. Especially when looking at the social media industry, we notice that there are only three publicly listed firms. The smaller market size causes inefficiencies due to lower accessibility and higher information- and transaction costs. These higher costs lead to investment frictions and thus lead to markets being unable to recover from exogenous shocks in response to terrorism quickly enough, as we observe in the results for the (social) media firms throughout the paper. In line with this reasoning, Kolias et al. (2011) find that larger and more mature markets (London vs. Athens stock exchange) have different and more effective institutional arrangements in place, with more effective internal checks and balances that absorb exogenous shocks in response to terrorist attacks in a more efficient manner.

Another possible explanation for the permanent nature of the observed stock price effects for (social) media firms is that investors actually rationally believe that increasing terrorist activity leads to a positive impulse for (social) media firms. Investors in turn anticipate on the increase in information demand since the start of the 2015 IS-terrorist wave. They rationally believe that (social) media firms such as Facebook benefit from the structural break and predict that these firms will generate more income (in the form of advertising), higher future value and thus higher stock prices for the entire industry. The positive permanent stock price effects are therefore not a result of irrational investor behaviour, but are based upon the belief that the fundamental value of these (social) media firms will increase in the future as a result of increasing terrorist activity. In these conditions, despite the reduced size and available liquidity within the market, the (social) media industry can therefore still be considered as an efficient market, as prices correctly adapt to new information in response to terrorism. In the end, the interpretation similarly depends on the changes in underlying fundamental economic value within the media market in response to increasing terrorist threat.

8.2 Robustness

In this section we analyse the statistical correctness of this paper's methodology and test the accuracy and validity of our results by performing a sub-set of robustness checks. In this way, we aim to improve the qualitative strength as well as the scientific power of the analysis conducted in this paper. As first robustness check, we return to the basic equation in the first part of the paper on the effects of terrorism on the European stock market, for which we examine the validity of the chosen S&P 500 as fundamental control variable. Although a Granger-causality test was conducted which showed a significant one-way determination of the S&P 500 on SE600 stock prices, one could argue about the presence of a possible simultaneous causality between European terrorist attacks and the S&P 500 index return. In other words, if a terrorist attack occurs in Europe and this attack simultaneously affects U.S. stock prices as a result of integrated and exposed markets, then the S&P 500 itself is not a valid control since it also already contains information regarding the occurrence of European terrorist activity. If this appears to be the case, then the control function of the S&P 500 to filter out all other world-wide economic effects is biased. For this reason, we perform a separate regression on the effects of European terrorist attacks on the returns of the S&P 500. In case we find similar significant temporary price effects for the S&P 500 index, then the index is an inappropriate control and abnormal returns are incorrectly calculated. We use the S&P 500 index return as dependent variable and compute a 30-day S&P 500 simple moving average which we use as new fundamental control variable to control for previous U.S. market trends. The results are presented in the appendix Table B2 and show that there is no such relation between European IS-attacks and movements in the S&P 500, meaning we exclude any possible simultaneous causality between European terrorist attacks and U.S. market returns.

For the second robustness check, we focus on narrowing down and purifying the sample of 53 IS-related terrorist attacks in the sample. This paper uses the price returns of the European SE600 index as dependent variable, an index which consists of the 600 most representative European firms. Turkish and Russian firms are however not included in the index, as these countries are not part of the European Community. This may seem inconsistent as we do include Turkish and Russian terrorist attacks to the total list of attacks in the sample because of their geographical location in continental Europe and their connection to the increasing trend of extremist Islamic terrorism since the start of the 2015 terrorist wave. We therefore expect these Russian and Turkish attacks to provide the same explanatory informational content regarding IS-terrorism as other European attacks which would in turn similarly affect investor behaviour which we aim to measure in this paper. From table 2 presented in the beginning of the paper, we observe that the Turkish Borsa Istanbul 100 index is the only index experiencing positive mean returns on attack days, which already insinuates a presumable insignificant relation between European terrorist attacks and the Turkish stock market. When strictly measuring the effect of terrorism on the SE600, being consistent means that we should not include these Turkish and Russian attacks to the sample. Due to this dilemma, we re-run the regressions and now exclude the nine terrorist attacks that occurred on Turkish or Russian soil. The results are presented in the appendix table B3 and show no significant major changes. The findings are almost identical when compared to the original findings regarding the basic equations presented in table 7, meaning that excluding these Turkish and Russian attacks does not influence the results obtained throughout this paper.

As mentioned in section 4 on Data, we include six terrorist attacks which are characterised as so-called grey-zone attacks. These attacks have not officially been confirmed as act of terrorism by Europol nor the GTD but were nevertheless added to the list after consulting a diverse range of media sources. Since there is a slight subjective component involved in adding these six attacks, we also exclude these attacks from the sample to eliminate this subjectivity and to test whether the results obtained throughout the paper remain the same. The results are presented in the appendix in table B4 and show no major changes in overall findings, except for that the negative coefficient on the day of the attack also becomes significant. This negative effect on the day itself is followed by a significant increase during the first lag, meaning that the markets recover almost instantly from this temporary change. Therefore, the overall finding that terrorism has a transitory effect instead of a permanent effect on SE600 returns remains.

Finally, it is arguable that the two-factor model used in this paper misses out on other important stock price determinants and that the model therefore insufficiently and incorrectly computes the real abnormal return caused by terrorism. The two-factor model controls for world-wide economic events and for historical prices. However, one could argue that other macroeconomic determinants miss out and should therefore be added to more accurately capture the true net effect of terrorism. Therefore, in order to further purify the results of this paper, we add three macroeconomic variables to the regression which should optimally capture all stock price determinants related to macroeconomic output. We gather data on three variables using the ECB's Statistical Data Warehouse. As first macroeconomic control variable, we add the ECB's Financing Rate (weekly frequency), defined as the interest rate banks pay when they borrow money from the ECB. This variable controls for economic forecasts and is linked to the ECB's overall monetary policy[36]. Beside forecasts, we add the E.U. inflation rate to control for actual macroeconomic output. The inflation rate measures to what extent the ECB's monetary policy has actually succeeded with respect to aggregate spending within the Eurozone. Finally, we add the U.S. dollar-Euro exchange rate to capture European output prices relative to price levels in foreign economies and therefore control for relative European economic performance. We re-run the basic equation and the results are presented in the appendix table B5. Even after adding these three additional macroeconomic control variables, we observe that the price effects of terrorism on the European stock market are barely affected. The findings on all our robustness checks therefore further support the validity of the two-factor model and the accuracy of the obtained results throughout the paper.

[36] https://www.ecb.europa.eu/explainers/tell-me/html/mro.en.html

8.3 Limitations

A positive aspect regarding this paper is its all-round coverage on the negative and positive impacts of terrorist attacks on stock prices. A complete and novel story is provided on the effects of terror by examining not one but several industries. This paper focuses on the overall European stock market, the media industry, the telecom industry and the three social media firms Facebook, Alphabet and Twitter. Instead of focussing on one sector, this paper focuses on four (SE600, media-, telecom- and social media industry). However, this upside can also be viewed as a downside since there is no true specialisation and in-depth analysis in one certain sector or industry. The surprising reverse lip-stick effect found for media firms in this paper, could therefore be analysed further in depth when merely taking this industry into account.

Also, this paper measures shifts in investor sentiment in response to terrorism by focussing only on actual terrorist attacks. However, there are more events regarding terrorism that may affect stock prices besides the attacks itself. Examples are political events such as the founding of the International coalition against IS in 2014, drone attacks aimed at eliminating highly ranked IS-leaders in IS territory, house raids in the E.U. in which IS-terrorists get caught planning an attack, ground-battles in Iraq or Syria in which IS loses or wins territory and so forth. All these events—which are not actual terrorist attacks but are related to the threat surrounding terrorism—could similarly affect investor sentiment and thus E.U. stock markets in a positive or negative way. For future research, we therefore advise to also focus on these political events rather than merely the attacks itself.

This paper focuses on the positive effects of IS-terrorism and finds positive permanent price effects for the (social) media industry. However, this does not mean that the positive effects apply for every individual attack. Take for instance the recent mass shooting in Christchurch in New Zealand in March of this year, in which 50 Muslims were killed when the gunmen live-streamed the attack on Facebook Live[37]. After the attack, Facebook and other social media giants had been criticised for failing to block images and videos of the real-time terror attack, resulting in major firms pulling back ads in order to put pressure on the policies of these social media firms. This was not the first time Facebook Live has been used to broadcast atrocities. A murder was livestreamed in the U.S. city of Cleveland in 2017, again putting Facebook and other social media giants under pressure. Attacks like these could actually cause negative rather than positive effects on social media firms. Examining these negative effects for a specific set of attacks is limited throughout the paper. Therefore, for future research, it would be interesting to further examine the media industry as a whole and find the overall effects of terrorism

[37] https://phys.org/news/2019-03-facebook-15mn-christchurch-videos-criticism.html

by taking into account a wider range of attacks and other political events over the world that may influence investor sentiment in response to terrorism.

Finally, in this paper we aim to test market efficiency in times of terrorist attacks. However, providing strong conclusions regarding market efficiency is a complex issue as we must gain additional insights into the fundamental economic deviations in response to terrorism to see whether investor sentiment truly affects stock prices. In this paper we measured transitory and permanent effects and tentatively concluded in favour of a pro-efficiency view for European stock markets and against a non-efficiency view for the (social) media market. But in order to truly conclude regarding market efficiency, we require empirical evidence regarding the effects of terrorism on macroeconomic output factors, which is out of the scope of this paper. In this study we have only drawn a tentative conclusion based on limited available research. Therefore, we advise future research to further specialize in the economic effects in order to fully grasp the overall role of efficient markets in times of terrorist threat.

9. Conclusion

In this final section we conclude by answering the main research questions and accepting or rejecting the five hypotheses which are formulated in section 3. We illustrated how the geopolitical situation in the Middle-East led to the rapid founding and spreading of the Islamic State which was founded 2014. Ever since, Europe experienced increasing terrorist threat and activity which led to a total of 53 IS-related terrorist attacks spread over 11 countries. In this paper we analyse the price effects of these 53 IS-related terrorist attacks on the European stock market as well as the European (social) media and telecom industry. Regarding the stock and volatility effects, we form the following six hypotheses:

<u>Hypothesis 1</u>: *The 2015 IS-related terrorism wave in Europe results in negative stock price effects for the overall European stock market.*

<u>Hypothesis 2:</u> *The 2015 IS-related terrorism wave in Europe results in positive volatility effects for the overall European stock market.*

<u>Hypothesis 3</u>: *Due to an efficient European market, the effects of terrorism on stock prices and volatility are transitory instead of permanent.*

<u>Hypothesis 4:</u> *the European media and telecom firms, as well as the social media firms Facebook, Alphabet and Twitter, experience reverse and positive stock price effects following the 2015 IS-related terrorism wave in Europe.*

<u>Hypothesis 5:</u> *The magnitude of these stock price effects for the (social) media and telecom firms is even larger for fugitive attacks in which the terrorist(s) flee(s) the scene.*

<u>Hypothesis 6:</u> *Due to market efficiency, these reverse positive effects for media firms are transitory instead of permanent.*

We find that the 2015 IS-related terrorism wave in Europe negatively affects the SE600 price returns and thus the overall European stock market. Due to shocks to investor sentiment, investors negatively react to terrorism which in turn leads to a significant decline in share price for the 600 firms represented in the index. For volatility we find a positive volatility effect, meaning that terrorism increases the systematic risk of the overall European stock market. The first two hypotheses are therefore confirmed.

The next question is whether these price effects persist only in the short-run, indicating transitory effects, or also in the long-run indicating permanent effects. By taking into account the research conducted by Chen and Siems (2004) and Eldor and Melnick (2018), we hypothesize that European stock markets are efficient and thus recover quickly from the initial temporary shocks to the market. We confirm that the effects of terrorism on European stock prices are transitory and do not hold in the long-run. Because of European stock market efficiency (due to the market being large and highly liquid), all information is quickly incorporated into stock prices. This means that the unexpected informational content regarding terrorism that causes the observed temporary effects are reversed instantaneously due to efficient market mechanisms. On top of that, we find that terrorism has negligible effects on European fundamental economic value (0.1% of accumulated aggregate E.U. GDP) and additionally affects investor sentiment in the long-run (through the VSTOXX fear index), which further proves our point that the observed transitory and irrational price effects are eliminated instantaneously as a result of efficient markets. We therefore confirm the third hypothesis.

For the fourth hypothesis we expect a reverse and positive effect of terrorism on (social) media and telecom stock prices when taking the entire sample of 53 attacks. Using the attack dummy, we observe no outstanding significant price effects which indicates that investors behaviour remains unaffected in response to the 53 attacks in the sample, as many attacks are small, insignificant or unsuccessful. We therefore reject the fourth hypothesis. For the fifth hypothesis, we expect the effects to be more evident when narrowing down the sample to the 33 fugitive attacks. We find positive price effects for the media industry as well as for Facebook and Alphabet. For the telecom industry and for Twitter, we repeatedly find no effects. The results show that the explanatory informational content regarding terrorist attacks—which is caused by greater fear and uncertainty when attacks last multiple days—increases when only taking these 33 fugitive attacks into account. We therefore partly accept the fifth hypothesis only for the media industry as well as for Facebook and Alphabet.

For the sixth and final hypothesis we expect the positive price effects on the (social) media firms to be transitory instead of permanent. For Alphabet the observed price effects are transitory. However, for the media industry and Facebook we obtain permanent effects on stock prices. It is unclear how to interpret these permanent effects. On the one hand it could be argued that they are “irrational”, because terrorist acts have no fundamental impact on the media industry and Facebook, on the other hand there may actually be a significant impact on the profitability of the social media industry and Facebook, given the increased need for information and hence (marketing-) income. But either way, we reject the sixth hypothesis.

As final part of this paper we conclude by answering the two main research questions which are formulated in the beginning of the paper. The two main research questions are:

Main research question 1: How has the 2015 IS-related terrorist wave in Europe affected the overall stock performance of the European stock market?

Main research question 2: How has the 2015 IS-related terrorist wave in Europe affected the overall stock performance of the European (social) media and telecom industry?

The answer to the first research question is that the European stock market is negatively affected by the increasing amount of terrorist attacks since the start of the wave in 2015. However, these negative shocks to the European economy are transitory, meaning that the market quickly recovers from these effects due to efficiency of the European market. The answer to the second research question is that we observe a positive and structural effect on stock returns of 0.2% for the European media industry as well as for Facebook, indicating that the European media industry has benefited from the increasing terrorist threat ever since the outbreak of the IS-terrorist wave in 2015. We confirm our findings of a reverse lip-stick effect of terrorism on the European media industry and suggest that—in line with Perešin (2007)'s finding— the sensation-seeking strategy (if deliberate) of the media industry to act in on the increasing demand for terrorist sensation (by increasing terrorism coverage) has more than well paid off.

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APPENDIX A List of Terrorist attacks

Table A: List of all IS-related terrorist attacks in Europe examined in this paper from January 7th 2015 until March 18th 2019

	Date	Location	Title	Deaths	Injured	Type (casualties)	Weapon	Fugitive attack?
1	January 7th 2015	Paris, France	Charlie Hebdo Shootings	12	12	Severe	Armed Assault	Yes
2	January 8th 2015	Montrouge, France	Charlie Hebdo Shootings	1	1	Severe	Armed Assault	Yes
3	January 9th 2015	Porte de Vincennes, France	Kosher Supermarket Hostage Crisis	4	5	Severe	Armed Assault	Yes
4	February 3rd 2015	Nice, France	Nice Stabbing	0	2	Unsuccessful	Cold Weapon	No
5	February 14th 2015	Copenhagen, Denmark	2015 Copenhagen shootings	2	6	Less Severe	Armed Assault	Yes
6	June 26th 2015	Saint-Quentin-Fallavier, France	Saint-Quentin-Fallavier Attack	1	2	Less Severe	Driver	No
7	July 20th 2015	Suruc, Turkey	2015 Suruc bombing	33	104	Severe	Suicide	No
8	August 21st 2015	Oignies, France	2015 Thalys Train Attack	0	3	Unsuccessful	Armed Assault	No
9	September 17th 2015	Berlin, Germany	2015 Berlin Stabbing	0	1	Unsuccessful	Cold Weapon	No
10	October 10th 2015	Ankara, Turkey	2015 Ankara Bombing	109	500	Extreme	Suicide	No
11	November 13th	Paris, France	November 2015 Paris Attacks	130	413	Extreme	Suicide, Armed Assault	No
12	January 7th 2016	Paris, France	2016 Paris Police Station Attack	0	1	Unsuccessful	Cold Weapon	No
13	January 11th 2016	Marseille, France	Marseille Machete Attack	0	1	Unsuccessful	Cold Weapon	No
14	January 12th	Istanbul, Turkey	January 2016 Istanbul Bombing	13	9	Severe	Suicide	No
15	February 26th 2016	Hanover, Germany	Hanover Stabbing	0	1	Unsuccessful	Cold Weapon	No
16	March 19th 2016	Istanbul, Turkey	March 2016 Istanbul Bombing	4	36	Less Severe	Suicide	No
17	March 22nd 2016	Brussels, Belgium	2016 Brussels Bombings	32	340	Severe	Suicide	No
18	June 13th 2016	Magnanville, France	2016 Magnanville stabbing	2	0	Less Severe	Cold Weapon	No
19	June 28th 2016	Istanbul, Turkey	2016 Ataturk Airport attack	45	230	Extreme	Suicide, Armed Assault	No
20	July 14th 2016	Nice, France	2016 Nice Attack	86	458	Extreme	Driver	No
21	July 18th 2016	Wurzburg, Germany	Wurzurg train attack	0	5	Unsuccessful	Cold Weapon	No
22	July 24th 2016	Ansbach, Germany	2016 Ansbach Bombing	0	15	Unsuccessful	Suicide	No
23	July 26th 2016	Saint-Etienne-du-Rouvray, France	2016 Normandy Church Attack	1	3	Less Severe	Cold Weapon	No
24	August 6th 2016	Charleroi, Belgium	2016 Charleroi Police Stabbing	0	2	Unsuccessful	Cold Weapon	No
25	August 17th 2016	Moscow, Russia	2016 Shchelkovo Police Attack	1	1	Less Severe	Cold Weapon,	No

							Armed Assault	
26	August 20th 2016	Gaziantep, Turkey	2016 Gaziantep Bombing	57	66	Extreme	Suicide	No
27	October 5th 2016	Brussels, Belgium	2016 Brussels Police Stabbing	0	3	Unsuccessful	Cold Weapon	No
28	December 19th 2016	Berlin, Germany	2016 Berlin Attack	12	56	Severe	Driver	Yes
29	January 1st 2017	Istanbul, Turkey	2017 Istanbul Nightclub Shooting	39	70	Severe	Armed Assault	Yes
30	February 3rd 2017	Paris, France	2017 Louvre Machete Attack	0	1	Unsuccessful	Cold Weapon	No
31	March 18th 2017	Garges-lès-Gonesse, France	2017 Orly Aiport Attack	0	2	Unsuccessful	Armed Assault	No
32	March 22nd 2017	London, United Kingdom	2017 Westminster Attack	5	50	Less Severe	Driver	No
33	April 3rd 2017	Saint Petersburg, Russia	2017 Saint Petersburg Metro Bombing	15	64	Severe	Suicide	No
34	April 7th 2017	Stockholm, Sweden	2017 Stockholm Attack	5	14	Less Severe	Driver	Yes
35	April 20th 2017	Paris, France	2017 Champs-Élysées attack	1	3	Less Severe	Armed Assault	No
36	May 22nd 2017	Manchester, United Kingdom	Manchester Arena Bombing	22	512	Severe	Suicide	No
37	June 3rd 2017	London, United Kingdom	2017 London Bridge Attack	8	48	Less Severe	Driver, Col Weapon	No
38	June 6th 2017	Paris, France	2017 Notre Dame Attack	0	1	Unsuccessful	Cold Weapon	No
39	June 19th 2017	Paris, France	2017 Champs-Élysées car ramming attack	0	1	Unsuccessful	Driver	No
40	June 20th 2017	Brussels, Belgium	June 2017 Brussels Attack	0	0	Unsuccessful	Bombing	No
41	July 28th 2017	Hamburg, Germany	2017 Hamburg Attack	1	6	Less Severe	Cold Weapon	No
42	August 9th 2017	Levallois-Perret, France	2017 Levallois-Perret attack	0	6	Unsuccessful	Driver	Yes
43	August 17th 2017	Barcelona, Spain	2017 Barcelona Attacks	15	131	Severe	Driver	Yes
43 *	August 18th 2017	Cambrils, Spain	2017 Barcelona Attacks	1	6	Severe	Driver	Yes
44	August 18th 2017	Turku, Finland	2017 Turku Stabbing	2	8	Less Severe	Cold Weapon	No
45	August 25th 2017	Brussels, Belgium	August 2017 Brussels Attack	0	2	Unsuccessful	Cold Weapon	No
46	September 15th 2017	London, United Kingdom	Parsons Green Bombing	0	30	Unsuccessful	Bombing	Yes
47	October 1st 2017	Marseille, France	Marseille Stabbing	2	0	Less Severe	Cold Weapon	No
48	March 23rd 2018	Carcassonne and Trèbes, France	Carcassonne and Trèbes Attack	4	15	Less Severe	Armed Assault	Yes
49	May 12th 2018	Paris, France	2018 Paris Knife Attack	1	4	Less Severe	Cold Weapon	No
50	May 29th 2018	Liege, Belgium	2018 Liege Attack	4	4	Less Severe	Armed Assault, Cold Weapon	Yes
51	August 31st 2018	Amsterdam, Netherlands	2018 Amsterdam Stabbing	0	2	Unsuccessful	Cold Weapon	No
52	December 11th 2018	Strasbourg, France	2018 Strasbourg Christmas Attack	5	11	Less Severe	Armed Assault	Yes
53	March 18th 2019	Utrecht, Netherlands	2019 Utrecht Attack	4	6	Less Severe	Armed Assault	Yes

* Note that the two Attacks in Spain both occurred in the same weekend, and therefore count as one attack since we measure the combined effect of both attacks on the following trading day on August 18th 2017

APPENDIX B Output on VSTOXX and robustness checks

Table B1: Effects of European IS-related terrorist attacks on the VSTOXX 'fear index'

	Dependent variable	
	Log (VSTOXX return)	
	(1)	(2)
Attack	0.0206***	
	(0.001)	
Attack first lag	0.0026	
	(0.766)	
Attack second lag	-0.0014	
	(0.801)	
Attack sum	0.0217**	
	(0.036)	
Fugitive		0.0192*
		(0.098)
Fugitive first lag		0.0088
		(0.599)
Fugitive second lag		-0.0283**
		(0.012)
Fugitive sum		-0.0002
		(0.983)
SE600 return	-0.4988***	-0.4992***
	(0.000)	(0.000)
SE600 return lag	0.3638*	0.3500
	(0.099)	(0.115)
Fundamental	-0.5018	-0.5445*
	(0.116)	(0.087)
ECB refinancing rate	-0.1223	-0.1187
	(0.385)	(0.401)
Dollar/Euro exchange rate	0.0146	0.0158
	(0.799)	(0.792)
E.U. Inflation rate	-0.0316	-0.0625
	(0.956)	(0.913)
Year Fixed Effects	Yes	Yes
Adjusted-R^2	0.5334	0.5332
Observations	1111	1111

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

Table B2: Stock price effects of IS-related terrorist attacks in Europe on the U.S. S&P 500 index

Dependent variable: Log (S&P 500 return)	γ0	γ1	γ2	γ0+ γ1+ γ2	30 − DAY average	Adjusted-R^2	Obs.
ATTACK	-0.00001	-0.0000001	-0.00001	-0.00003	30.04***	0.9899	1111
	(0.415)	(0.537)	(0.466)	(0.159)	(0.000)		
FUGITIVE	0.00001	-0.00003	0.00002	-0.00000001	30.04***	0.9899	1111
	(0.293)	(0.195)	(0.297)	(0.937)	(0.000)		

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

Table B3: Stock price effects of IS-related terrorist attacks on the SE600 excluding Turkish and Russian attacks

Dependent variable: Log (SE600 return)	γ0	γ1	γ2	γ0+ γ1+ γ2	*Fundamental*	LAG	Adjusted-R^2	Obs.
ATTACK	-0.0020	0.0034**	-0.0026*	-0.0011	0.61***	0.01	0.2907	1102
	(0.105)	(0.024)	(0.068)	(0.611)	(0.000)	(0.800)		
FUGITIVE	-0.0001	-0.0006	0.0013	0.0007	0.61***	0.01	0.2812	1102
	(0.960)	(0.796)	(0.515)	(0.638)	(0.000)	(0.884)		

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

Table B4: Stock price effects of IS-related terrorist attacks on the SE600 excluding grey-zone attacks

Dependent variable: Log (SE600 return)	γ0	γ1	γ2	γ0+ γ1+ γ2	*Fundamental*	LAG	Adjusted-R^2	Obs.
ATTACK	-0.0020*	0.0032**	-0.0024*	-0.0012	0.61***	0.01	0.2895	1,099
	(0.099)	(0.035)	(0.090)	(0.567)	(0.000)	(0.827)		
FUGITIVE	-0.0006	-0.0015	0.0024	0.0004	0.61***	0.01	0.2817	1,099
	(0.720)	(0.498)	(0.236)	(0.778)	(0.000)	(0.916)		

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.

Table B5: Stock price effects of IS-related terrorist attacks on the SE600 including three macroeconomic controls

Dependent variable: Log (SE600 return)	$\gamma 0$	$\gamma 1$	$\gamma 2$	γ0+ γ1+ γ2	$Fundamental$	LAG	Adjusted-R^2	Obs.
ATTACK	-0.0014	0.0032*	-0.0030*	-0.0013	0.61***	0.02	0.2945	1090
	(0.202)	(0.039)	(0.034)	(0.573)	(0.000)	(0.680)		
FUGITIVE	0.0005	-0.0014	0.0009	0.0001	0.61***	0 .01	0.2853	1090
	(0.730)	(0.515)	(0.629)	(0.941)	(0.000)	(0.775)		

Note: t-statistic in parentheses *p<0.1 , **p<0.05 , ***p<0.01 using robust standard errors.
All non-dummy variables have been log-transformed.
All significant coefficients are highlighted in grey.