An Economic Look at Terrorism

The effects of terrorism on uncertainty and confidence in the Netherlands

Jurriën de Bruijn*

January 2016

Exam number: 343156
E-mail address: jurdebruijn@live.nl

ERASMUS UNIVERSITY ROTTERDAM
Erasmus School of Economics
Department of Economics

Supervisor: Prof. Dr. J. Swank

*M.Sc. Policy Economics student at Erasmus School of Economics and research intern at CPB Netherlands Bureau for Economic Policy Analysis

Acknowledgements

This thesis is dedicated to all the people who touched my life in one way or another: to my parents, who have always supported me in pursuing my ambitions and taught me to keep my feet on the ground; to my colleagues at the CPB, who engaged with me in valuable discussions; to my supervisor, Prof. Dr. Job Swank, who has been very committed to providing me with valuable guidance and detailed comments. Finally, I wish to thank my friends, Daan and Sander, for their unique contribution to my personal and academic development, one that is difficult to put into words.

Abstract

This thesis aims to assess the macroeconomic consequences of terrorist attacks. Different terrorism datasets have been constructed to estimate these effects. Based on daily time series analysis, evidence is provided that most major terrorist attacks only have a temporary negative effect on stock returns and a temporary strong positive effect on economic uncertainty. Such terrorist attacks are inconsequential for oil prices. Based on monthly time series analysis, terrorist attacks have a negative short-run effect on the Dutch consumer confidence indicator of three points on average, depending on the severity of the attack. Evidence is provided from the literature that the impact of these effects on GDP growth is limited.

Contents

1 Introduction

The emergence of Islamic State and the threat that its fighters pose to Western interests is a major policy concern. Despite rising investments in security and anti-terrorism, Western society remains vulnerable, with the recent terrorist attacks in Paris being a horrible reminder of this. But how resilient is the economy to these threats? The September 11 attacks in New York shook global capital markets, whereas the shooting at Charlie Hebdo did not provoke investors' reactions despite all the media attention. Why are the effects different?

This study aims to assess the macroeconomic consequences of terrorist attacks. It is difficult to directly estimate the effect of terrorism on GDP, because GDP data are not frequently published. Also, terrorist attacks, fortunately, do not happen frequently.[1] Nevertheless, it is possible to analyse a range of separate channels in isolation. These could be channels that directly affect expenditure, such as destroyed buildings, trade barriers, government expenditure, tourism and housing prices. Many studies have shown the effect of terrorism on these channels and that their consequent GDP effects are limited.[2]

The link between terrorism and oil prices is occasionally addressed in the media,[3] and the prevailing view in early academic studies is that oil price shocks reflect the change in the supply of oil following wars and terrorism in the Middle East. Recent studies suggest that the effect of terrorism on oil prices is inconsequential.[4] Using the same methodology as for financial markets, this thesis confirms that terrorist attacks have no direct impact on oil prices.

What has been relatively unexplored is the literature on terrorism and the uncertainty or confidence of consumers and investors. These indicators are important for GDP growth and will be the focus of this study. In this study, implied volatility indices are used to proxy for daily uncertainty. For consumer confidence, monthly data from Dutch household surveys are used.

Terrorism attacks differ according to their severity, that is, in the number of fatalities

[1] Two studies that used an identification strategy to measure GDP effects directly are Abadie and Gardeazabal (2003) and Eckstein and Tsiddon (2004). Two decades of terrorism depressed GDP in the Basque Country by as much as 10%. A similar effect can be found in Israel during the 2001-2003 Intifada.

[2] These channels are briefly discussed in Appendix B.

[3] In media (Economist Intelligence Unit., 2003; Sachs, 2004) and US Congress report (Pirog, 2005).

[4] Kilian (2008); Blomberg et al. (2009); Meßmer (2011); Coleman (2012).

caused. These characteristics have to be aggregated to construct an index to measure their impact. Three datasets are constructed in this study: a unique index is constructed with the Global Terrorism Database, the impacts of 81 individual major terrorist attacks are evaluated and Dutch Google Trends data are analysed to rank attacks at the level of attention they generated.

The results show that most major terrorist attacks only have a temporary negative effect on stock returns and a temporary strong positive effect on economic uncertainty. Major terrorist attacks have a negative short-run effect on the Dutch consumer confidence indicator of three points, on average, depending on the severity of the attack. Literature is provided on how the impact of these effects on GDP growth is limited.

A contribution is made to the literature by estimating the effect on stock returns for the Dutch market. Also, the effect is estimated on implied volatility indices, such as the VIX and VAEX, instead of actual stock variances. This allows us to link the estimated effect to the literature on volatility and growth. Daily data and a mean-adjusted-returns approach is used to identify the effect of an attack on the financial markets. In contrast to other event studies on the topic, this study accounts for non-normality in daily returns. The same methodology is used to confirm that oil markets are not prone to price effects after a terrorist attack. Finally, this study formally present the effect of terrorist attacks on consumer confidence.

This thesis continues with a review of the existing literature on financial markets and consumer confidence. Section 3 conceptualises terrorism, describes the datasets used and discusses the empirical strategy. Section 4 presents the results and Section 5 provides the concluding remarks on the implications of these results for economic growth. In the Appendix, an additional literature overview is provided, discussing less important channels through which terrorism can affect economic growth. It also contains an initial reflection on the results of the November 2015 attacks in Paris.

2 Related literature

The literature on the effect of terrorism on uncertainty and consumer confidence is relatively unexploited. The following literature review first discusses the effect of terrorism on stock returns and volatility in financial markets. Volatility in financial markets is available on a high frequency and is widely used as a proxy for uncertainty. Then the literature review proceeds by discussing the literature on terrorism and consumer confidence.

The number of empirical studies on terrorism and financial markets has vastly increased since 2001. These studies suggest that, most likely, only major terrorist attacks or intense periods of terrorism have a temporary negative effect on stock returns and a strong temporary positive effect on volatility. The size of the effects may depend on the type of the attack and the country characteristics. The few studies that look at consumer confidence suggest there is a negative effect in the short run after a major attack.

2.1 Terrorism and financial markets

Previous studies show that firms targeted in a terrorist attack face negative stock price reactions. Karolyi and Martell (2010) took firm-level evidence from 75 attacks and showed that there was an average short-term stock price return of -0.8% per firm per attack. This effect was greater when the lives of employees were lost. Terrorist attacks can also affect aggregate price movements. Drakos (2010) used data from 22 global stock indices during 1994-2004 and found that there were average negative stock returns of -0.6% on the day of a terrorist attack. Brounen and Derwall (2010) confirmed these results and, although the price reactions were stronger in the domestic market, their results show that attacks can also have an impact on markets outside the targeted country. Capital markets, especially the US market, are, however, becoming more resilient to large terrorist and military attacks over time. Chen and Siems (2004) showed this by comparing the impact of the 14 largest attacks since 1900.

The negative average effect in the above studies is likely to be caused by a limited number of terrorist attacks. Stock markets in Japan (Graham and Ramiah, 2012), Indonesia (Graham and Ramiah, 2013), Pakistan (Gul et al., 2010), Greece (Liargovas et al., 2010) and Australia (Ramiah et al., 2010) only experienced an impact from the September 11 attacks in New York and from domestic terrorism, while the impact of other major

international attacks, such as in Madrid, London, Mumbai and Bali, was only marginal. Studies that looked further than the first trading day after an attack show that these effects are only temporary (Kollias et al., 2011b; Chesney et al., 2011). Among all the major attacks investigated, the 9/11 attacks affected global financial markets the most, both in mean and variance (Charles and Darné, 2006). The US market was affected less than European markets, but this may have been due to the closing of the US stock exchanges until September 17, which relieved a lot of the panic.

Next to a temporary negative effect on stock returns, studies have shown that terrorist attacks have a temporary positive effect on stock return variances.[5] Volatility spikes can be seen around the declaration of the 'war on terror' and the start of the Iraq war (Fernandez, 2008), and the 9/11, Madrid and London terrorist attacks (Nikkinen and Vähämaa, 2010). However, consistent with studies on stock returns, the effects appear to be temporary. Kollias et al. (2013) found that the increase in volatility on the London Stock Exchange after the metro bombings was transmitted to other major European stock markets, such as Frankfurt and Paris. Chulia et al. (2009) found a similar result for the 9/11, Madrid and London terrorist attacks. They found that volatility was transmitted between the US and the Eurozone after 9/11, but only found volatility spikes in the Eurozone after the Madrid and London bombings. Various studies[6] have found that systemic risk increased after the 9/11 attacks, but two of them only found such a result for developing countries and not for the major developed stock indices, indicating resilience in these markets.

The characteristics of the financial market's home country affect the size of the impact. Evidence shows that developed countries (Arin et al., 2008) and countries with a large stock exchange (Kollias et al., 2011a) face a smaller impact. This can be explained by the diversified, liquid and sound nature of these markets (Johnston and Nedelescu, 2006), the effective institutional arrangements (Kollias et al., 2011b) or the adoption of 'disaster plans'. For example, after the 9/11 attack, the Federal Reserve provided liquidity via repurchase agreements (deposits at Federal Reserve banks were more than five times the average level) and the Federal Open Market Committee lowered the federal funds rate by 50 basis points to 3%, with further reductions made that October (Neely, 2002). On the other hand, countries involved in bilateral trading (Kumar and Liu, 2013) or with more international financial assets at risk (Nguyen and Enomoto, 2011) are more

[5] Arin et al. (2008); Gulley and Sultan (2006); Nikkinen et al. (2008); Essaddam and Karagianis (2014).

[6] Brounen and Derwall (2010); Straetmans et al. (2008); Richman et al. (2005).

prone to contagion from major terrorist attacks abroad (Nikkinen and Vähämaa, 2010). Regions that faced an intense period of terrorism (Israel during the 2001-03 Intifada[7]) or a prolonged terrorism war (two decades in the Basque country[8]) experienced a downfall of up to 10% in market capitalisation.

Finally, the literature recognises that the size of the effect also depends on the characteristics of the attack. According to Eldor and Melnick (2004) and Kollias et al. (2011a), the number of fatalities and wounded people correlates positively with the impact on stock return variances. As for the type of attack, suicide incidents may ease reactions, since the perpetrators no longer cause an immediate threat (Kollias et al., 2011b). This may explain the smaller effect of the London suicide bombings compared to the bombings in Madrid, where there was initial uncertainty about the perpetrator group and its hiding place (people first believed the ETA was responsible for the bombing). The timing of the attack may also be an important explanatory variable in the reaction of the market (Johnston and Nedelescu, 2006). The September 11 attacks happened in a period of economic uncertainty and a possible downturn, whereas the 2004 Madrid bombings took place during a global economic growth period.

2.2 Terrorism and consumer confidence

The few studies that estimate the effect of terrorism on consumer confidence point in the direction of a temporary but significant effect. A decrease in confidence may in turn have an effect on consumption expenditure.

That consumer confidence is important in explaining consumption expenditure is best explained with the theory of 'animal spirits'. From a theoretical perspective, there is the 'information' view and the 'animal spirits' view. The first tells us that future consumption is based on the rational optimisation of consumption cycles (Hall, 1979), so that confidence plays no role in the future expenditure pattern of households. Keynes (1936) introduced the notion of 'animal spirits' and the concept of 'naive optimism', which tells us people's economic behaviour is also driven by emotions.[9] The potential impact of terrorist attacks on expenditure through the confidence channel was also recognised by Fischer (2001)

[7] Zussman et al. (2008); Eldor and Melnick (2004).

[8] Abadie and Gardeazabal (2003); Barros and Gil-Alana (2009).

[9] This has been further developed by Katona (1951, 1975), Blanchard (1993), Acemoglu and Scott (1994) and Akerlof and Shiller (2010).

shortly after the September 11 attacks:

> *It is the indirect effects that will matter most, in particular, in the short term much depends on the effects on consumer and investor confidence and spending, which were already under strain and have been strained further by the attacks.*
>
> — Stanley Fischer, 32^{nd} IAFEI World Congress, Mexico, 18 October 2001

The empirical part of this thesis elaborates on the work down by Stokman (2014). His article implies that dummies for nearby wars and a few terrorist attacks have a significant negative influence on consumer confidence. The effect is autonomous; it does not influence the coefficients of the traditional determinants of consumer confidence in his model. These determinants have been identified by DNB (2007) and Neisingh and Stokman (2013) and can be used to explain the variation in Dutch consumer confidence very accurately. They are used in this study and are further discussed in the model and data sections.

The few studies for the United States on terrorism and consumer confidence show mixed conclusions. Garner et al. (2002) state that, although the 9/11 attacks may have lowered consumer confidence, it would also have declined if the attacks had not occured. Consumer confidence was surprisingly resilient and began to recover before the end of 2001. In another study, Keyfitz (2004) analysed the war and terrorism related events of 2001-2003 and concluded that the shocks were large enough to lower US growth in 2002 (0.1 percentage points) and 2003 (0.3 percentage points) via lower consumption expenditure.

3 The model

3.1 Measuring terrorism

The conceptualisation of terrorism is a critical first step in the model. In line with the related literature on this topic, this thesis uses the following widely used definition: 'terrorism is the premeditated use or threat to use violence by individuals or sub-national groups to obtain a political or social objective through the intimidation of a large audience beyond that of the immediate non-combatant victims' (originally Enders and Sandler (2011), p.4). Three terrorism datasets are constructed in this thesis that adhere to this definition. They are introduced now for clarity purposes, and their construction is explained in more detail in the data section.

The first dataset is referred to as 'GTD' and includes the aggregated daily number of fatalities due to terrorism per world region. Data are extracted from the Global Terrorism Database, which comprises information on more than 100,000 terrorist attacks globally from 1970-2014.

The second dataset also has a daily frequency, but only includes 81 dummy variables for major terrorist attacks. These attacks directly involved the Netherlands, other major economies or had an exceptionally high death toll. It was constructed because the literature suggests that only major terrorist attacks have an effect on financial markets. This dataset is referred to as 'Events'. Both the 'GTD' and the 'Events' dataset are used to estimate the effect of terrorism on stock returns, uncertainty and oil prices.

The third dataset is used to evaluate the impact of terrorist attacks on consumer confidence. Consumer confidence is only measured on a monthly basis, so this dataset has a monthly frequency. The variable has a value 1 in months directly after 10 major terrorist attacks and zero otherwise. The decision on which attacks to include in this dataset followed logically from the findings for the estimations on a daily frequency (only some major terrorist attacks were shown to have a significant effect). Furthermore, the Google Trends archives are used to measure how much attention was paid to the attacks by isolating the amount of searches to 'terrorism' or similar keywords relative to the total amount of Google searches. This index is used as an alternative to the dummy variable. Therefore, this third dataset is referred to as 'Google'.

3.2 Modelling financial markets

Equation 1 is used to estimate the effect of terrorism, measured by the 'GTD' dataset, on daily returns. After using global fatalities per day, the sample is split into regions of the world to account for the geographical locations of the attacks.

$$ER_t = \alpha + \beta GTD_t + \sum_{i=1}^{p} \rho ER_{t-i} + \sum_{i=1}^{q} \theta \epsilon_{t-i} + \epsilon_t \tag{1}$$

Equation 2 presents the estimated model for 81 individual attacks of the 'Events' dataset:

$$ER_t = \alpha + \sum_{i=1}^{81} \beta_i Events_{it} + \sum_{i=1}^{p} \rho ER_{t-i} + \sum_{i=1}^{q} \theta \epsilon_{t-i} + \epsilon_t \tag{2}$$

The dependent variable ER_t in Equations 1 and 2 refers to the excess returns of stock market indices, implied volatility indices and oil prices. Excess returns are actual returns minus expected returns. In firm-based studies, the return of a market index can be used as an approximation of the expected return. However, this study already uses market indices. The excess returns are calculated following Brown and Warner (1980) and MacKinlay (1997). First, the logarithmic percentage returns are:

$$R_t = 100 \ln(\frac{P_t}{P_{t-1}}) \tag{3}$$

where P_t is the index' closing price at time t. To approach the expected return $\bar{R}_t$, rolling averages of actual returns are used. Then the excess returns are:

$$ER_t = R_t - \bar{R}_t = R_t - \frac{1}{63} \sum_{t=-2}^{t=-64} R_t \tag{4}$$

The results of the augmented Dickey-Fuller test (Dickey and Fuller, 1981) are presented in Appendix Table A.8. The tests reject the presence of a unit root in the log excess returns.[10]

Autocorrelation is present in the residuals of Equations 1 and 2. This is common for daily financial data (Fama, 1970; Campbell et al., 1997). Therefore, the lagged values of the returns (AR terms) and the error term (MA terms) are included in both equations. The numbers of lags vary and are based on the Schwarz Information Criterion.

[10]Under the null hypothesis of this test, ER_t is a random walk, whereas with the alternative, it is a stationary process that reverts to its mean zero. It is used to test whether yesterday's returns have a significant effect on today's change in returns. Random walk series are problematic for forecasting, since a common trending path in the response and prediction variables may falsely suggest a causal relationship.

The distributions of the daily excess returns depart from normality, which one can also see in Appendix Table A.6. There are too many observations in the fat tails of the distribution (high kurtosis) and these values are more often negative (positive skew). This is also reflected in the Jarque-Bera tests, which reject the null of normally distributed residuals in all regressions even when the data are transformed to monthly data. Previous analysts in this field (Graham and Ramiah, 2013) have argued that one should not worry about the non-normality given the large sample size. Others have noted that it may be problematic to use the reported t-test, but did not correct for it (Brown and Warner, 1985; Hein and Westfall, 2004). In the estimations of this study, the standard errors are corrected with the bootstrap method. The strong assumption of an asymptotic distribution can be dropped using this method and information is used from the actual data. The data are treated as the population and a random sample from this population is taken. The mean of this sample is computed and the process is repeated numerous times. These means are used to construct a histogram, which provides an empirical estimate of the shape of the distribution (Efron, 1979). In this study, the bootstrap is performed with 1,000 repetitions.[11]

Caution is required before concluding that terrorist attacks are the only driver of excess returns on a certain day. Other news may have had an impact as well. All this variation ends up in the error term. Other financial event studies (that I know of) have not controlled for this. It may be an idea to control for macroeconomic variables, but there are limited data sources available on a daily frequency and the literature is inconclusive on the sign of these relationships. I extended Equations 1 and 2 with the 3-month Euribor rate and the dollar/euro exchange rate. The results are presented in Appendix Table A.7. It turns out that these rates do not explain any variation in the daily excess stock

[11]For more information see Kreiss and Lahiri (2012), Ford and Skinner (2009), Ruiz and Pascual (2002) and Kramer (2000). To understand the potential increase in Type I errors (where we falsely reject our null hypothesis and thus overestimate the effect) and Type II errors (where we underestimate the effect), see also Table 9 in Ford and Kline (2006). They replace residuals with non-normals of infinite size generated with a Generalized Lambda Distribution based on the four moments of the data, which is further explained in Karian and Dudewicz (2000). They illustrate the problems caused by non-normality in hypothesis testing by comparing the 'correct' critical values to the asymptotic critical value (1.96) for a range of skewness and excess kurtosis. A non-normal disturbance similar to the distribution of the VIX ER_t leads to critical t-statistics of -1.86 (t^-) and 2.24 (t^+). This upper value is just 14% higher than its asymptotic value.

returns. To still control for other news, an informal check has been performed. This is only possible for Equation 2, where the dates of the 81 terrorist attacks are clear. I went through the news headlines on the dates of statistically significant events and questioned whether the effect could have been caused by something other than the terrorist attack concerned. This way, the significant effect of two attacks has been questioned in the Results section. Furthermore, it is assumed that terrorists do not take into account macroeconomic conditions when planning an attack. Hence, omitted variable bias is not expected.

3.3 Modelling consumer confidence

Equation 5 is used to estimate the effect of terrorism, measured by the 'Google' dataset, on consumer confidence:

$$CC_t = \alpha + \beta_t Google_t + \gamma_t Wars_t + \sum \theta_{jt} M_{jt} + \delta_t CC_{t-1} + \epsilon_t \tag{5}$$

Where $Google_t$ is the monthly dummy variable (or alternatively the attention index) for terrorist attacks, and $Wars_t$ is a monthly dummy variable with the value 1, in months in which there is a war situation that is important to the Netherlands. These wars are mentioned in Appendix Table A.5, and they have been included after Stokman (2014) suggested in his article that there is a negative relation between wars and consumer confidence.

$\sum M_{jt}$ presents all of the variables used to control for other determinants of consumer confidence. This is needed as consumer confidence is only measured on a monthly basis. The literature provides a set of economic indicators and some trust indicators that can be used to model consumer confidence very accurately. The expected signs and sources of these control variables are shown in the data section and in Appendix Table A.8.

CC_{t-1} is included in the equation because consumer confidence in the previous period is a very good explanatory variable of the current period's consumer confidence level. Furthermore, HAC standard errors are used to overcome the presence of heteroskedasticity and serial correlation in the residuals of the model.

3.4 Data

3.4.1 Terrorism

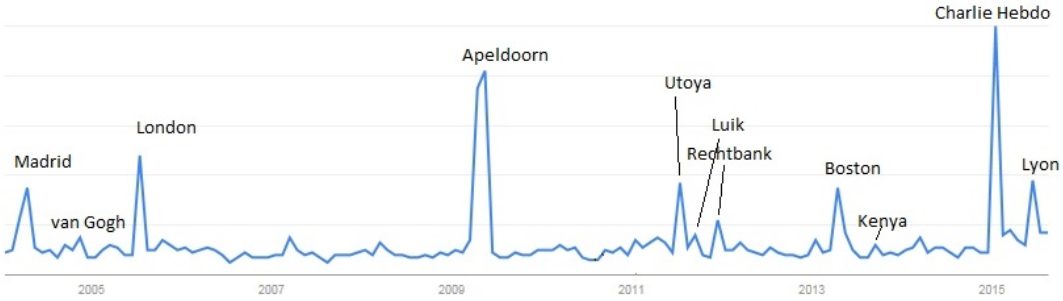
For the 'GTD' dataset, the Global Terrorism Database is used. It is updated by the National Consortium for the Study of Terrorism and Responses to Terrorism at the University of Maryland. To be included in the GTD, an incident must be intentional, it must be the result of a conscious calculation on the part of a perpetrator, it must entail some level of violence or immediate threat of violence and the perpetrators of the incidents must be sub-national actors. In contrast to other databases, it is open-source, including information on 141,966 terrorist attacks globally from 1970 through to 2014 and is updated annually. With so many events, the question arises if all observations in this database are eligible to be classified as terrorism and suitable to be included in the dataset for this thesis. Since we use the formal definition used in the related literature, events are excluded when it is not clear that that they adhere to this.[12] Selecting the sample leaves us with 119,596 observations. A terror index is then defined as the absolute number of fatalities per day for all of these attacks. The number of fatalities in the weekend are added to the consecutive Monday to balance the dataset with the financial datasets. An overview of the daily fatalities per region is provided in Appendix Table A.3.

The 'Events' dataset is limited to 81 attacks from 1983-2015 that directly involved the Netherlands, other major economies or had an exceptionally high death toll. An overview of these attacks is provided in Appendix Table A.4. A reason to implement an event-study approach (next to the full measure of terrorism) is to investigate to what extent the results from the full dataset are driven by individual events (such as New York 2001, Madrid 2004 and London 2005). The incidents and their characteristics are cross-checked with the reliable Global Terrorism Database. Regressions use the first active trading day after an attack as the event-day. Time-zone differences are also corrected for.

[12]In particular, i) acts were not aimed at attaining a political, economic, religious, or social goal, ii) acts did not have enough evidence of an intention to coerce, intimidate or convey some other message to a larger audience than to the immediate victims, iii) acts in the context of legitimate warfare activities and iv) when there is doubt as to whether the incident is an act of terrorism or another form of crime and political violence. Conveniently, GTD coded four additional variables for this. Finally, observations are excluded when the GTD is missing information on either the target type, the target nationality, the region of the attack or the date of the attack. I do not expect any bias issues from excluding these observations.

The 'Google' dataset with monthly dummies and attention index is constructed to evaluate the impact on consumer confidence. The Google Trends archives can be used to measure how much attention was created by isolating the amount of relative searches to 'terrorism' or similar keywords. Figure 1 shows the relative amount of searches for 2004-2015. Appendix Table A.5 provides an overview of the monthly dummies and their rank on the attention index.

Figure 1: Relative searches on 'aanslag' (terrorist attack) over time (via Google Trends)



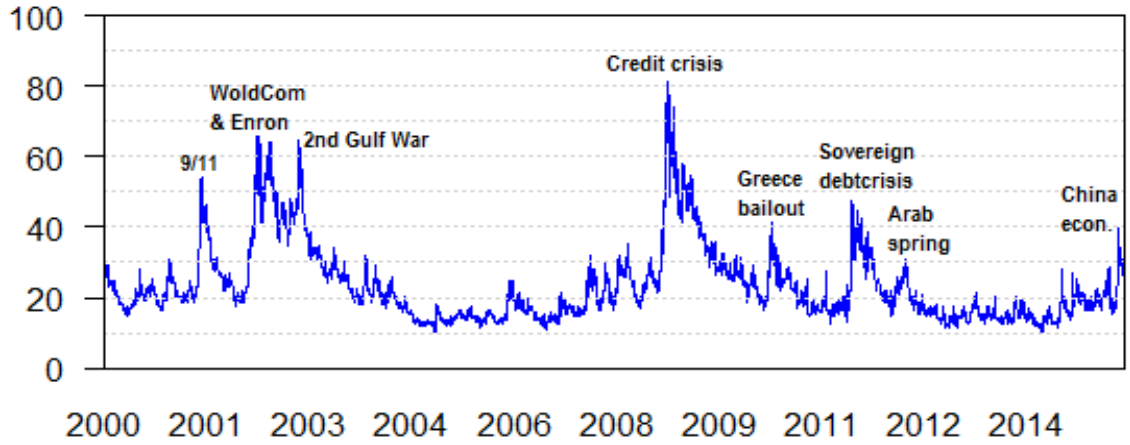
3.4.2 Stock returns, uncertainty and consumer confidence

Two financial indices, available from Datastream, are used for stock returns. The Dutch AEX index is listed on the Amsterdam Stock Exchange and consists of the 25 biggest publicly listed firms in the Netherlands. The return on the AEX is one of the most important indicators of the Dutch economic climate. The dataset includes daily observations from the beginning of the index in 1983. Next to the Dutch AEX, the United States' S&P 500 Index is used to see whether the reaction in the US market to the same attack differs. It covers 80% of the available market capitalisation and includes observations since 1970. Whenever there is a missing data point (due to a national holiday for example), the value from the day before is used and the return is zero. The only observation that is dropped from the sample is the extreme outlier caused by Black Monday (October 19^{th} 1987).

To estimate the effect on uncertainty, a proxy is needed. Volatility in the capital markets is available in the highest possible frequency and provides an instantaneous proxy for the fear and uncertainty felt by investors after an event. In line with the seminal work on uncertainty by Bloom (2006, 2009, 2013); Baker and Bloom (2013), I use the expected 30-day volatility implied by option prices, available from Datastream, to measure the

uncertainty shock of a terrorist attack.[13] The AEX Volatility Index (VAEX) and the Chicago Board Options Exchange Volatility Index (VIX), from 2000 and 1990 respectively, reflect the market estimates of the 30-day volatility implied by looking at option prices. Figure 2 shows to what extent the VAEX rose during recent important events.

Figure 2: Dutch VAEX index on a daily basis



Netherlands Statistics (CBS) has measured consumer confidence on a monthly basis since 1986.[14] A monthly survey is sent to 1,600 households in the Netherlands and collected in the first 10 working days of each month. Seasonally corrected data are used because people tend to be happier when the sun is shining.[15] Statistics of the consumer confidence index are shown in Table A.8 in the Appendix.

The control variables that are used to model consumer confidence are: changes in the unemployment rate (-), growth in real private income (+), the inflation rate (-), perceived inflation (-), growth in housing prices (+), movements on the stock market (+) and the yield spread as an indicator for monetary policy (+). Neisingh and Stokman (2013) show that the loss of public trust in the financial sector and political institutions put downward

[13]Other ways to proxy for uncertainty include the dispersion of GDP forecasts and the Economic Policy Uncertainty Index by Baker et al. (2013). Recently, Kroese et al. (2015) constructed this index for the Netherlands. Nevertheless, I use implied volatility to obtain higher data frequency and capture more information about the whole economy. The correlation with Kroese et al. (2015) is reasonably high at 0.41.

[14]Measured with five sub-questions: i) how do you assess the economy in the recent past, ii) how do you assess the economy for the near future, iii) how do you view your personal financial situation over the recent past, iv) and for the near future, and v) do you consider this is a right time for the purchase of expensive, durable goods? The answers (positive, neutral, or negative) are averaged.

[15]Another way to control for these seasonal influences is to include the temperature.

pressure on consumer confidence after 2008. Therefore, variables are also included for pension risk (measured by pension coverage rates under 105), for fears about the monetary union (measured by the Greece-Germany sovereign spread) and the popularity of 'right-wing populist' parties (measured by the number of poll seats for LN, LPF, TON, PVV).

4 Results

4.1 The effect on stock returns and uncertainty

Table 1 shows the results from Equation 1, where the excess returns are regressed on the 'GTD' dataset (with the global number of fatalities per day). The signs of the coefficients are as expected and their interpretation is straightforward. For example, an attack with 300 fatalities somewhere in the world is estimated to depress the AEX by 0.3% and increase the AEX's implied volatility by 3% on the day of the attack.

However, we are eager to know whether a terrorist attack in Pakistan has the same impact as a terrorist attack in Germany. Appendix Table A.1 shows the results for a regression where the sample is split into regions of the world to account for the geographical locations of the attacks. One can see that terrorism has a statistically significant influence on excess returns in only a few regions and the coefficients are remarkably low. Firstly, it can be argued that the estimated coefficients in these tables are driven by a few major attacks in Western Europe and Northern America (like 9/11, Madrid, London).[16] Secondly, the coefficient of the S&P 500 for an attack in the US is not statistically significant. This is because their financial markets were closed until September 17^{th} after the 9/11 attacks, so the 'GTD' dataset is prone to measurement errors. For these two reasons, this study continues with the 'Events' dataset and estimates the individual impact of 81 major terrorist attacks on stock returns, implied volatility indices and oil prices. This solves the measurement error because the date of these attacks is linked to the first trading day after these attack.

[16]For example, the estimated effect from a terrorist attack in the United States with 3,000 fatalities depresses the AEX index with (3000 times $-0.002 =$) -6%. These numbers are close to the reaction from the AEX index on the day of the September 11 attacks.

Table 1: Full 'GTD' dataset approach: effects on excess stock returns and uncertainty

Dependent variable: ER_t				
Coefficients reflect excess return in log percentage per fatality per day				
	AEX	S&P	VAEX	VIX
	'83-'14	'70-'14	'00-'14	'90-'14
Daily fatalities in the world	-0.001***	-0.000	0.010***	0.010***
	(-4.47)	(-0.58)	(8.58)	(5.58)
Constant	0.031*	0.003	-0.009	-0.038*
	(1.65)	(0.99)	(-1.03)	(-0.50)
Observations	7,577	11,026	3,756	5,969
Adjusted R^2	0.012	0.013	0.045	0.029
Note: t-statistic in parentheses		*p<0.1 **p<0.05 ***p<0.01		

Figure 3 shows the results from Equation 2 for stock market indices and implied volatility indices.[17] It is presented in a graphical way, with the estimated effect of the terrorist attacks on excess returns on the y-axis. The 81 black and red dots correspond to the estimated effects on the day of (or the first trading day after) those attacks. The x-axis corresponds to the amount of fatalities from those attacks. The red dots correspond to attacks where the effect is statistically significant different from zero (at the 95% confidence level).

It shows that only a handful of terrorist attacks had an effect on stock returns or uncertainty. These are numbered as follows: **1** corresponds to the attack on the US Navy destroyer, the USS Cole, which had stopped to refuel in the port of Aden in Yemen (October 12^{th} 2000), **2** corresponds to the 9/11 attacks (September 11^{th} 2001), **3** corresponds to the train bombings in Madrid (March 11^{th} 2004), **4** corresponds to the metro bombings in London (July 7^{th} 2005) and **5** corresponds to the Boston Marathon bombing (April 15^{th} 2013). The significant effect of two other events may be caused by other news. The **C** stands for the bombings in Casablanca (May 16^{th} 2003), but its effect on stock returns was caused by a spike in the euro rate that specific day. The **S** stands for the hostage tak-

[17] Estimation results for the oil price are presented in Appendix Figure A.1. Terrorist attacks had no effect on Crude Brent oil prices, except for the USS Cole attack in Aden.

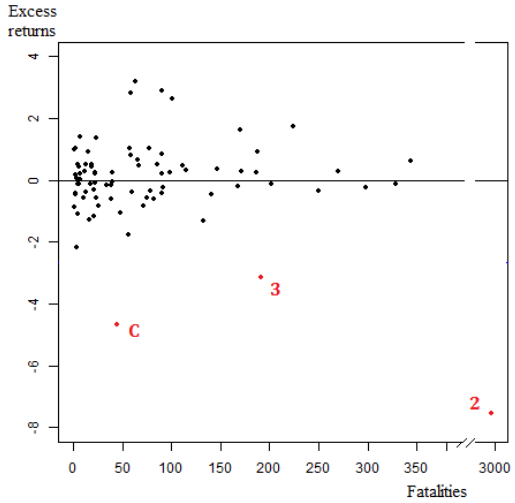
ing in Sidney (December 15^{th} 2014), but its effect on uncertainty was caused by concerns about Europe's economy and the oil price. From the literature, one would expect that a higher number of fatalities would lead to a stronger reaction in the market. However, this conclusion cannot be drawn from Figure 3.

Since only a few attacks caused a reaction in the financial markets, it is a complicated process to run separate regressions with the characteristics of the attacks as independent variables and to make statements about their influence on the results. Nevertheless, an informal interpretation of their influence can still be given by looking at the characteristics of the attacks. Table 2 presents the characteristics of the terrorist attacks that caused an economically and statistically significant return. It also displays attacks where an effect might have been expected, but where there was no reaction in either stock returns or implied volatility. This table also serves economic researchers or policy makers who aspire to compare a possible future terrorist attack with previous ones and predict its potential impact on stock returns and volatility.

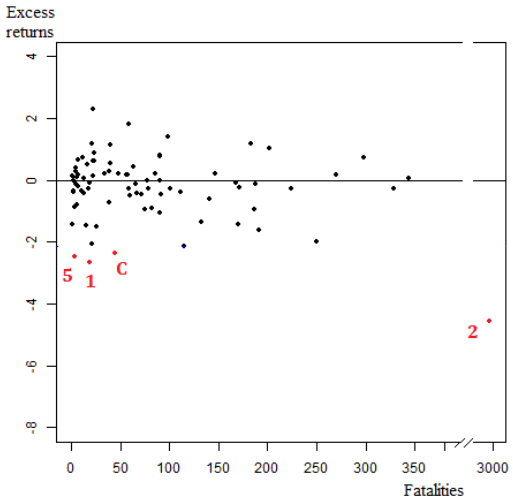
Several informal interpretations can be made: Firstly, the reactions in the financial markets are temporary. This is shown with the numbers between parentheses, which show the amount of trading days it took before the level of the index returned to its pre-attack level.[18] Secondly, the difference between the Dutch and the US markets after the 9/11 attacks show us that closing down the capital market (until September 17 in the US) helped to relieve some economic pain. Also, that the London bombings happened six hours before the S&P market opened could have helped the US investors to oversee the developments, whereas European investors instantly started trading. Thirdly, the difference in reactions could also be caused by the location of the attack. The bombing in Madrid had a continent-wide effect in Europe and the Boston marathon bombing had only an effect in the US Finally, it seems that terrorist attacks carried out by jihadist movements inflict more damage than attacks carried out by an individual acting alone. A possible explanation is that an individual attacker can be captured or killed, while the threat of future attacks by jihadist movements remains. For the same reason, one can expect that a series of attacks causes greater economic damage.

[18] Appendix Table A.2 presents estimations after I converted to monthly data. The statistical significance is lost, which further strengthens my belief that the returns on the capital market and the implied volatility (which proxies uncertainty) experience a shock but rapidly rebound.

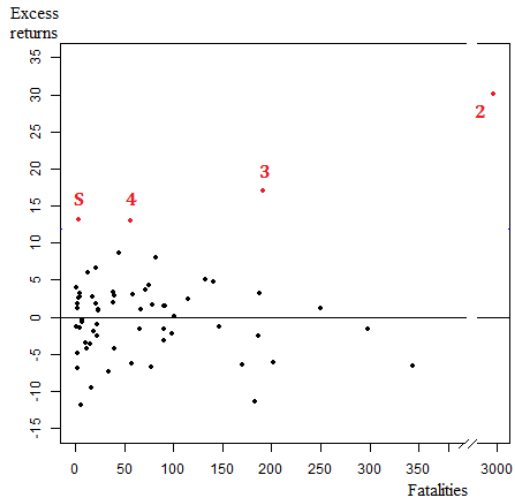
Figure 3: Results from Equation 2 presented graphically. The 81 black and red dots correspond to the estimated effects of the terrorist attacks on excess returns. The red dots correspond to attacks where the effect is statistically different from zero (at the 95% confidence level). The x-axis gives the amount of fatalities in the attacks. Bootstrapped standard errors are used.



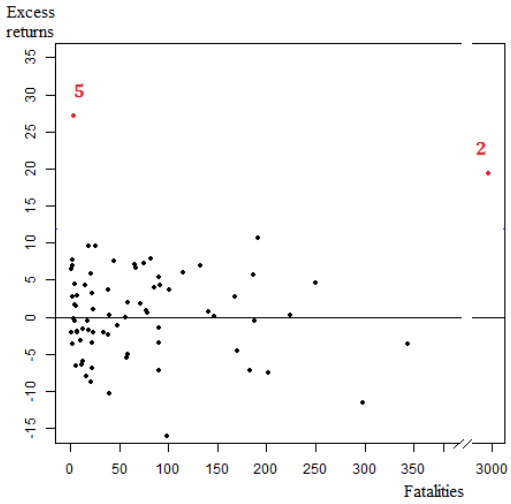
(a) AEX ER_t



(b) S&P ER_t



(c) VAEX ER_t



(d) VIX ER_t

Table 2: Major attacks, their characteristics and their effect. Red, bold values are statistically significant (at the 5% level). The numbers in parentheses reflect the number of trading days until the index returned to its pre-attack level.

Attack	**Date**	**AEX** ER_t	**S&P** ER_t	**VAEX** ER_t	**VIX** ER_t	**Region**	**Fatalities**	**Wounded**
USS Cole	12-10-2000	0.51%	**-2.66%** (1)	-	9.65%	Yemen	19	38
September 11^{th}	11-09-2001	**-7.55%** (39)	**-4.56%** (18)	**30.15%** (41)	**19.30%** (9)	N.America	2,996	6,000
Fortuyn	06-05-2002	-0.89%	-	3.97%	-	W.Europe	1	-
Madrid train	11-03-2004	**-4.66%** (2)	-1.63%	**17.00%** (21)	10.64%	W.Europe	191	1,800
London subway	07-07-2005	-3.15%	0.17%	**12.95%** (1)	2.50%	W.Europe	56	784
Utoya, Norway	22-07-2011	1.02%	-0.12%	3.26%	-0.55%	W.Europe	77	96
Boston marathon	15-04-2013	0.08%	**-2.47%** (7)	2.55%	**27.15%** (14)	N.America	3	264
MH17	18-07-2014	-0.23%	0.72%	-1.61%	-11.58%	Europe	298	-
Charlie Hebdo	07-01-2015	0.28%	0.11%	1.77%	6.91%	W.Europe	12	11
Suicide attack?	**Group**	**Attack type**	**Target nationality**	**Target type**	**Property damage**	**Hostages taken?**	**Transnational?**	
yes	Al-Qa'ida	Bombing	US	Military	Major	no	yes	
no	Individual	Assasination	Dutch	Government	no	no	no	
yes	Al-Qa'ida	Hijacking	US	Business	Catastrophic	yes	yes	
no	Abu Hafs al-Masri	Bombing	Spanish	Transportation	Major	no	yes	
yes	Al-Qa'ida Europe	Bombing	British	Transportation	Major	no	yes	
no	Individual	Armed Assault	Norway	Private Citizens	Minor	no	no	
no	Individuals	Bombing	US	Private Citizens	Unknown	no	yes/no	
no	Under investigation	Airliner	Mostly Dutch	Private Citizens	Minor	no	yes	
no	Islamic State	Armed Assault	France	Media	Minor	no	yes/no	

4.2 The effect on consumer confidence

Table 3 summarises the estimation results for Equation 5. Column 4 shows that the terrorist attacks included in the Google dataset have an average negative effect on Dutch consumer confidence of 3 points in the subsequent month. Column 5 shows that the size of this effect is influenced by the attention generated by the terrorist attack. The attacks on the World Trade Center and Charlie Hebdo (index 9) thus had a stronger impact on Dutch consumer confidence than, for example, the bombings in Madrid and Boston (index 3). Columns 4 and 5 also include a dummy variable for nearby wars. These wars have an average negative effect of 2 points on Dutch consumer confidence.

Columns 1 to 3 show the results for the economic and trust indicators that have been identified in the literature as determinants of consumer confidence. All estimated coefficients for the economic indicators have their expected sign and explain changes in consumer confidence very accurately (adjusted R^2=0.96). The change in unemployment rate and the rate of inflation are not statistically different from zero in every column. The level of inflation perceived by the population is a better estimator of confidence than the inflation rate. An explanation for this is that households' perception of inflation may rely less on goods and services that are bought less frequently. People tend to give less weight to goods like kitchen appliances or televisions in their perception of inflation than the weight it is given in the official price index (O'Donoghue, 2007). So, if the price changes for goods that are bought weekly differ from goods bought annually, people may have a different perception of inflation, and this affects consumer confidence.

The estimated coefficients for public trust in the financial sector and political institutions show a more ambiguous story. On the one hand, pension risks (measured by coverage rate shortages) negatively affect consumer confidence. On the other hand, the effects from the Greece-Germany 10-year bond spread and the amount of poll votes for right-wing populist parties do not statistically differ from zero, so one cannot say that these trust indicators explain the additional variance of consumer confidence. Perhaps these indicators are not well-suited to capturing fears about the monetary union or lack of trust in traditional political parties, as suggested by Neisingh and Stokman (2013).

Including variables for terrorism and wars did not alter the coefficients of the traditional economic and trust determinants. Therefore, it can be concluded that they have an autonomous negative influence on consumer confidence.

Table 3: Estimation results of determinants of consumer confidence: 1986 M4 - 2015 M8

	(1)	(2)	(3)	(4)	(5)
Constant	-14.10***	-2.21***	-2.41***	-2.20***	-2.24***
	(-4.8)	(-2.6)	(-2.7)	(-2.4)	(-2.4)
Confidence$_{t-1}$	-	0.84***	0.81***	0.78***	0.78***
		(35.3)	(39.0)	(34.4)	(33.6)
Δ Unemployment rate	-26.34***	-3.30	-2.64	-1.04	-1.70
	(-3.4)	(-1.1)	(-0.9)	(-0.4)	(-0.6)
Growth income	2.14***	0.25**	0.27***	0.33***	0.34***
	(5.4)	(2.6)	(3.0)	(3.6)	(3.7)
Inflation rate	-2.04**	-0.41*	-0.31	-0.33	-0.31
	(-2.4)	(-1.8)	(-1.4)	(-1.5)	(-1.4)
Perceived inflation	-0.35***	-0.08***	-0.10***	-0.12***	-0.12***
	(-5.33)	(-5.3)	(-6.6)	(-7.2)	(-7.1)
Growth in house prices	1.39***	0.24***	0.14**	0.18***	0.18***
	(9.58)	(5.4)	(2.2)	(2.9)	(3.0)
Stock index	0.08***	0.02***	0.03***	0.04***	0.04***
	(3.4)	(3.1)	(3.4)	(3.8)	(3.8)
Yield spread	0.78	0.49***	0.52***	0.32	0.31
	(1.1)	(2.8)	(3.0)	(1.6)	(1.6)
Coverage rate shortage	-	-	-0.27***	-0.35***	-0.36***
			(-4.0)	(-4.8)	(-5.1)
Greece-Germany spread	-	-	-0.08*	0.01	0.01
			(-1.7)	(0.1)	(0.2)
Poll seats populism	-	-	-0.05	-0.05	-0.05
			(-1.4)	(-1.5)	(-1.4)
Terrorism dummies	-	-	-	-3.17***	-
				(-5.1)	
Terrorism index	-	-	-	-	-0.49***
					(-4.7)
War dummies	-	-	-	-1.79***	-1.82***
				(-3.2)	(-3.2)
Observations	352	352	350	350	350
Adjusted R^2	0.82	0.96	0.96	0.97	0.97
Jarque-Bera test	5.79*	2.47	4.57	11.83***	10.90***
Breusch-Godfrey LM test	431***	0.18	0.19	0.48	0.50
White test	4.00***	1.47**	1.26*	1.16	1.17

Note: HAC (Newey-West) standard errors *p<0.1 **p<0.05 ***p<0.01

5 Concluding remarks

This thesis has taken an economic look at terrorism by estimating its effect on stock returns, implied volatility indices, oil prices and consumer confidence. The results show that for the Netherlands, only a few catastrophic terrorist attacks (New York, Madrid, London) significantly depressed stock returns and increased uncertainty in the short-run. The attacks also have a negative short-run effect on the Dutch consumer confidence indicator of 3 points on average, depending on the severity of the attack. The terrorist attacks are inconsequential for oil prices.

Previous research can be used as a basis to translate and quantify the effect of these three effects on economic growth via investment and consumption decisions. These individual effects cannot simply be added together, as they may work along the same dynamics and thus overestimate the total effect.[19] The negative effect on stock returns does not affect GDP growth as it is temporary (Verbruggen et al., 2010; DNB, 2011). Only a permanent negative effect on stock returns affects the financial situation of households and firms.[20]

The temporary surge in uncertainty from terrorist attacks does affect GDP growth. On the supply side, it leads to a postponement of investment decisions by firms (Bloom, 2009) and to a higher risk premium on financial assets and less credit supply (Gilchrist et al., 2014). On the demand side, it leads to higher precautionary household savings and thus lower consumption today (Carroll, 1996), but the effect is greater on production than on consumption (Carrière-Swallow and Céspedes, 2013). To quantify the impact on GDP, the findings by De Wind and Grabska (2014) and Veenendaal et al. (2014) can be used. They recently simulated the effect of uncertainty shocks on industrial production for the Netherlands by using a structural vector autoregression model comparable to the model devised by Bloom (2009).[21] They estimated an impulse response function for an

[19] To simultaneously simulate the impact of confidence and uncertainty on growth is challenging. It requires identifying shocks and restrictions in an extension of De Wind and Grabska (2014) SVAR model.

[20] Reduced financial capital and dividend rents lead to less consumption. Reduced share prices lead to higher capital cost; combined with lower demand, this leads to a decrease in investments by firms. This effect may diminish within a few quarters as wages, production costs and export prices adjust.

[21] The SVAR models allow for interdependencies between variables. This makes it possible to introduce an exogenous shock to the uncertainty equation and follow its contribution to other variables over time, while it is dependent on its own and other variables' past values.

uncertainty shock similar in size to 9/11. The deviation of industrial production from its trend reaches its lowest point after five months and then recovers. This averages to -0.45% in the first year.[22] They assume that the whole market sector (around 70% of GDP) faces this negative effect. This gives a negative effect on GDP from a surge in uncertainty similar to 9/11 of approximately -0.3% in the first year.

To provide an indication of the GDP effect caused by lower consumer confidence due to terrorism, a recent analysis by the Dutch Central Bank on the influx of refugees can be used (DNB, 2015).[23] Evidence from past influxes of refugees show a small, temporary effect on consumer confidence. The exact decrease in consumer confidence is not provided, but it is assumed to be comparable to the effect of terrorist attacks on consumer confidence.[24] This effect been simulated with their macroeconomic model, which includes confidence in line with the findings of Berben and Stokman (2015). They report an expected fall of GDP of -0.06% and -0.02% in the first and second year respectively. Therefore, it can be safely concluded that the impact of a terrorist attack on consumer confidence has limited effects on GDP.

Further research should be done to translate the effects of consumption and uncertainty on GDP. However, according to the results of this study, only a few terrorist attacks had an impact on stock returns, uncertainty and confidence, and according to a back-of-the-envelope calculation, these channels have not had large GDP effects. While economic forecasting agencies should carefully monitor these indicators, they do not have to reassess future investment and consumption levels immediately after a terrorist attack.

[22]The shape of impulse response functions are proportional to the shock magnitude.

[23]In the short term, consumer confidence has an effect on private consumption and residential investments (Berben and Stokman, 2015). This provides evidence of the presence of 'animal spirits' as explained in Section 2.3. This confirms earlier findings (Neisingh and Stokman, 2013; ECB, 2015) and the Granger causality test presented in Appendix Figure A.3.

[24]Special thanks to Ad Stokman, researcher at the Dutch Central Bank, for confirming this.

A Tables and figures

A.1 Additional regression output

Table A.1: Full GTD dataset approach by region: effect on returns and uncertainty

Dependent variable: ER_t				
Coefficients reflect excess return in log percentages per fatality per day.				
Daily fatalities in:	AEX '83-'14	S&P '70-'14	VAEX '00-'14	VIX '90-'14
Netherlands	0.117	-0.101	-0.747	-0.380
Western Europe	-0.004	-0.001	0.095***	0.044*
US and Canada	-0.002***	-0.000	0.012***	0.024
Australasia, Oceania	-0.026	-0.013	4.041**	-0.456
Middle East, North Africa	0.000	-0.000	0.008**	0.003
U.S fatalities	-0.021**	-0.019	0.001	-0.004
Russia, Eastern Europe	-0.000	-0.001	0.003	0.023**
U.S fatalities	-0.038	-0.061	3.379	4.130***
Asia	-0.002***	-0.000	0.019***	0.016***
U.S fatalities	-0.025	-0.004	0.200	-0.174
Latin America	-0.000	0.002**	0.019	0.003
U.S fatalities	0.022	-0.034	1.256	0.027
Sub-Saharan Africa	-0.000	0.000	0.010***	0.005
U.S fatalities	0.016	-0.063	0.608	-0.035
Constant	-0.001	-0.004	-0.178	-0.007
Observations	7,573	11,028	3,758	5,971
Adjusted R^2	0.027	0.013	0.036	0.047
*p<0.1 **p<0.05 ***p<0.01				

Figure A.1: The results from Equation 2 presented graphically for excess returns in crude Brent oil. The 70 black and red dots correspond to the estimated effect of the terrorist attacks on excess returns. The red dots display attacks where the effect is statistically different from zero (at the 95% confidence level). The x-axis corresponds to the amount of fatalities. Bootstrapped standard errors are used.

1) 12-10-2000: Oil prices rose following the attack on the USS Cole in the Yemeni port of Aden.

2) 01-12-2001: The Ben Yehuda suicide bombing in Israel: but there is no strong evidence available of any relationship with the spike in oil prices on the following Monday.

3) 20-09-2008: The suicide bombing in the Marriott Hotel, Islamabad. But the surge in the oil price was caused by news on the Wall Street bailout plan and its effect on the dollar.

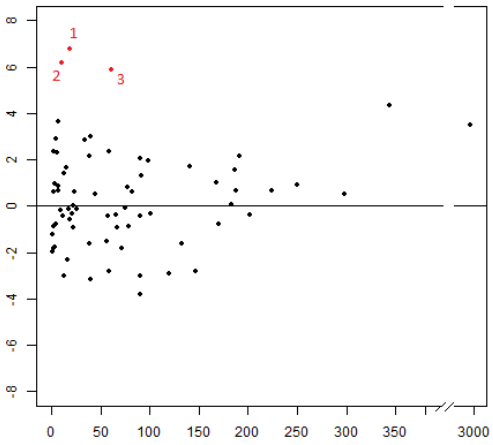


Table A.2: Robustness analysis: results for monthly dummies

		AEX ER_t	S&P ER_t	VAEX ER_t	VIX ER_t
USS Cole	10-2000	-	-0.06% (-0.4)	-	-
New York	09-2001	-0.39% (-3.5)***	-0.18% (-1.2)	+0.30% (0.45)	+0.27% (1.15)
Madrid	03-2004	+0.25% (2.3)**	-	+0.13% (0.37)	-
London	07-2005	-	-	+0.21% (0.56)	-
Boston	04-2013	-	-0.05% (-0.3)	-	-0.18% (0.46)
Observations		375	531	171	291
Note: t-statistic in parentheses					*p<0.1 **p<0.05 ***p<0.01

A.2 Data

Table A.3: 'GTD' dataset - Terrorism index description: number of weekdays per range of fatalities. Period: 1970-1992, 1994-2014 (11,082)

Region / Fatalities	**0**	**1**	**2-5**	**6-20**	**21-100**	**>100**
Netherlands	11,070	7[25]	2	3[26]	-	-
Western Europe incl. Netherlands	9,052	1,807	725	86	10[27]	2[28]
US and Canada	10,907	120	48	4	-	3[29]
Australasia, Oceania	11,047	18	12	4	1	-
Middle East, North Africa	6,612	857	1,427	1,280	820	86
U.S fatalities	10,999	42	36	4[30]	-	1[31]
Eastern Europe, Russia	10,213	395	331	111	26	6
US fatalities	11,075	6	1	-	-	-
Asia	5,977	683	1,397	2,008	925	47
US fatalities	10,994	24	10	-	-	-
Latin America	7,641	907	1,251	979	272	18
US fatalities	11,037	31	13	1	-	-
Sub-Saharan Africa	8,502	513	818	795	372	64
US fatalities	11,059	15	6	2[32]	-	-

[25]Fortuyn 2002, Van Gogh 2004.

[26]Moluccan hostage taking 1977, Turkish family in The Hague 1997, Apeldoorn 2009.

[27]Aircrafts 1973, -74, -85, Dublin 1974, Birmingham 1974, Bologna 1980, London 1980, Northern Ireland 1998, London 2005, Utoya 2011.

[28]Lockerbie 1988, Madrid 2004.

[29]Toronto 1985, Oklahoma 1995, New York 2001.

[30]US Embassy Lebanon 1983.

[31]Algeria 1998.

[32]US embassies in Kenya and Tanzania 1998.

Table A.4: 'Events' dataset - 81 terrorist attacks used for event-study analysis

Date	Location	Fatalities	Date	Location	Fatalities	Date	Location	Fatalities
18.04.1983	Beirut	63	16.05.2003	Casablanca	45	30-4-2009	Apeldoorn	7
23.09.1983	Jebel Ali	111	05.08.2003	Jakarta	15	8-12-2009	Baghdad	132
23.06.1985	Toronto	329	19.08.2003	Jerusalem	19	8-1-2010	Cabinda	2
23.11.1985	Athens	60	04.10.2003	Haifa	23	29-3-2010	Moscow	40
21.12.1988	Lockerbie	270	06.02.2004	Zamoskvorechye	40	28-5-2010	Midnapore	115
19.09.1989	Niger	171	11.03.2004	Madrid	191	31-10-2010	Baghdad	58
26.02.1993	New York	6	29.05.2004	Khobar	22	1-1-2011	Alexandria	23
25.02.1994	Hebron	48	24.08.2004	Rostov-on-Don	90	24-1-2011	Domodedovo	38
18.07.1994	Buenos Aires	85	01.09.2004	Beslan	344	11-4-2011	Minsk	13
20.03.1995	Tokyo	13	07.10.2004	Taba	38	13-5-2011	Shabqadar	82
19.04.1995	Oklahoma	168	02.11.2004	Amsterdam	1	22-7-2011	Utoya	77
25.07.1995	Paris	7	19.03.2005	Doha	2	13-12-2011	Luik	6
25.02.1996	Jerusalem	26	07.07.2005	London	56	20-1-2012	Kano	188
17.11.1997	Luxor	58	23.07.2005	Sharm el-Sheikh	91	19-3-2012	Toulouse	4
07.08.1998	Nairobi	224	02.03.2006	Karachi	5	10-5-2012	Damascus	57
09.09.1999	Pechatniki	90	07.04.2006	Baghdad	90	5-8-2012	Oak Creek	7
12.10.2000	Adan	19	24.04.2006	Dahab	18	17-12-2012	Jamrud	21
01.06.2001	Tel Aviv	22	12.07.2006	Mumbai	187	15-4-2013	Boston	3
09.08.2001	Jerusalem	16	30.12.2006	Madrid	2	21-9-2013	Nairobi	72
11.09.2001	New York	2996	19.02.2007	Deewana	66	5-10-2013	Baghdad	75
01.12.2001	Jerusalem	10	06.03.2007	Hillah	99	24-5-2014	Brussels	4
11.04.2002	Er Riadh	21	19.06.2007	Baghdad	79	15-12-2014	Sydney	3
06.05.2002	Hilversum	1	14.08.2007	Qahtaniya	250	7-1-2015	Paris	12
12.10.2002	Kuta	202	18.10.2007	Karachi	141	17-7-2014	Ukraine	298
23.10.2002	Yuzhnoportovy	170	01.02.2008	Baghdad	90	14-2-2015	Copenhagen	2
05.01.2003	Tel Aviv	22	17.02.2008	Kandahar	101	2-4-2015	Garissa	147
12.05.2003	Riyadh	34	26.11.2008	Mumbai	183	26-6-2015	Lyon, Tunisia	67

Table A.5: 'Google' dataset - Overview monthly dummies used for consumer confidence

Terrorism dummies:	9/11 (Oct & Nov 2001), Fortuyn (Jun 2002), Madrid (Apr & May 2004) Van Gogh (Dec 2004), London (Aug 2005), Apeldoorn (Jun 2009), Utoya (Sep 2011) Boston (Jun 2013), Charlie Hebdo (Feb 2015), Lyon (Aug 2015)
Terrorism index:	9/11 (9), Fortuyn (1), Madrid (3), Van Gogh (1), London (4) Apeldoorn (7), Utoya (3), Boston (3), Charlie Hebdo (9), Lyon (3)
War dummies:	1^{st} Gulf war (Aug 1990 - Feb 1991), Yugoslavian war (Jun 1992 - Feb 1994), Desert Fox (Dec 1998), Kosovo (Mar 1999 - Jun 1999), 2^{nd} Gulf war (Mar 2003 - Apr 2003), Sirian war (Mar 2011 - Aug 2015)

Table A.6: Summary statistics of daily excess returns of stock index and implied volatility

Index	Obs.	Mean	Median	Min	Max	Std.dev	Skewness	Kurtosis
AEX	8,284	-0.003	0.013	-9.324	10.695	1.332	0.152	10.263
S&P	11,481	0.001	0.003	-9.166	10.789	1.061	0.019	10.410
VAEX	3,961	0.008	-0.276	-27.215	35.190	5.850	0.459	5.843
VIX	6,424	0.005	-0.272	-35.423	49.507	6.303	0.602	7.173

Table A.7: The effects of changes in the exchange and interest rate on stock returns

Dependent variable: Excess returns AEX

Sample: 05-01-1999 - 01-10-2015 (observations: 4,282)

Adjusted R^2: -0.0004

	coefficient	t-statistic
Constant	-0.007	-0.303
Log return dollar/euro exchange rate	0.015	0.440
Log return 3 month Euribor rate	-0.001	-0.079

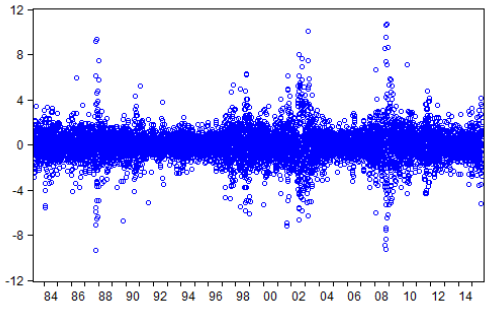
Table A.8: Augmented Dicky Fuller Unit Root tests - t-statistics

Daily data	**Source**	**Period**	**Level**		**Exc. Ln % return**	
			drift	**+trend**	**drift**	**+trend**
AEX	Datastream	1983 - 2015	-1.59	-1.68	-15.82***	-15.82***
S&P	Datastream	1970 - 2015	0.27	-2.14*	-19.05***	-19.06***
VAEX	Datastream	2000 - 2015	-3.89***	-3.96**	-12.03***	-12.03***
VIX	Datastream	1990 - 2015	-4.02***	-4.04***	-15.52***	-15.52***
Crude Brent	Datastream	1994 - 2015	-1.42	-0.87	-76.83***	-76.84***
3 month Euribor	DNB	1999 - 2015	-0.36	-1.66	-12.04***	-12.08***
Dollar / euro exchange rate	DNB	1999 - 2015	-1.20	-1.28	-65.57***	-65.56***
Confidence	**Source**	**Period**	**Level**		**First difference**	
			drift	**+trend**	**drift**	**+trend**
consumer confidence	CBS	1986m4 - 2015m8	-2.79*	-3.07	-8.33***	-8.34***
willingness-to-buy	CBS	1986m4 - 2015m8	-2.08	-2.41	-6.23***	-6.22**
change unemployment rate	CBS/CPB	1986m4 - 2015m8	-2.94**	-2.95	-12.63***	-12.61***
y-o-y growth real - private consumption	CBS/CPB	1986m4 - 2015m8	-2.64*	-3.01	-6.20***	-6.20***
y-o-y growth real - disposable income	CBS/CPB	1986m4 - 2015m8	-3.04**	-3.91**	-6.40***	-6.39***
y-o-y growth real - house prices	CBS/CPB	1986m4 - 2015m8	-1.43	-2.00	-4.16***	-4.15***
y-o-y inflation rate	CBS	1986m4 - 2015m8	-3.34**	-3.36*	-6.15***	-6.33***
perceived inflation	CBS	1986m4 - 2015m8	-2.37	-2.29	-11.38***	-11.39***
stock index (2010=100)	OECD	1986m4 - 2015m8	-1.79	-2.20	-5.31***	-5.30***
yield spread	OECD	1986m4 - 2015m8	-2.91**	-2.91	-11.71***	-11.70***
Greece-Germany spread	OECD	2002m1 - 2015m8	-1.95	-2.85	-4.63***	-4.64***
coverage rate shortage	DNB	2007m1 - 2015m8	-2.83*	-3.26*	-8.92***	-8.91***
poll seats populism	Ipsos	1997m3 - 2015m8	-1.26	-2.81	-7.41***	-7.41***
temperature	KNMI	1986m4 - 2015m8	-5.14***	-5.26***	-7.98***	-7.98***

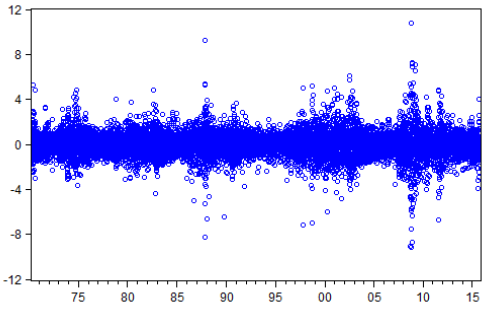
Crit. values with drift: -3.43 (1%***) -2.86 (5%**) -2.57 (10%*)

Crit. values with trend: -3.96 (1%***) -3.41 (5%**) -3.12 (10%*)

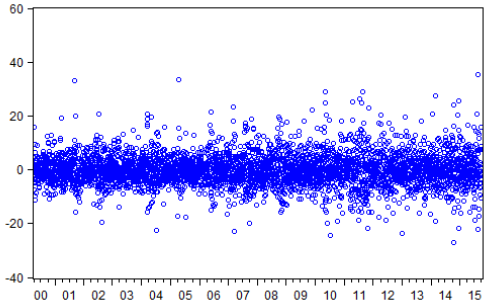
Figure A.2: Scatterplots of ER_t



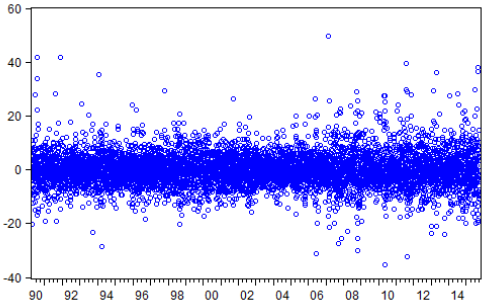
(a) AEX



(b) S&P 500



(c) VAEX



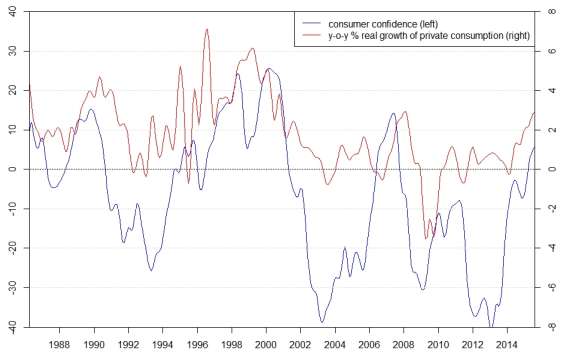
(d) VIX

Figure A.3: Consumer confidence Granger causes change in consumption

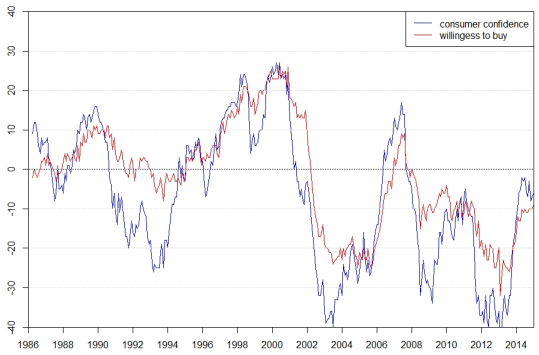
Pairwise Granger Causality Tests
Date: 09/29/15 Time: 12:56
Sample: 1986M04 2015M08
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CONSUMPTION does not Granger Cause CONFIDENCE	351	0.86056	0.4238
CONFIDENCE does not Granger Cause CONSUMPTION		11.6066	1.E-05

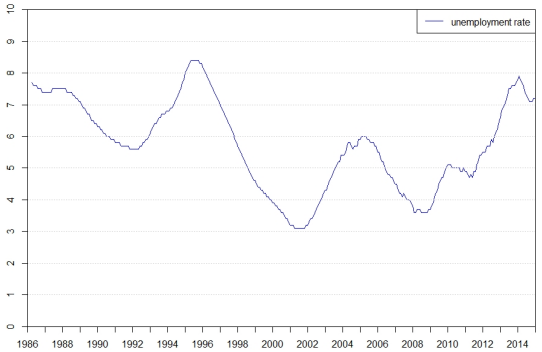
Figure A.4: Consumer confidence and its determinants



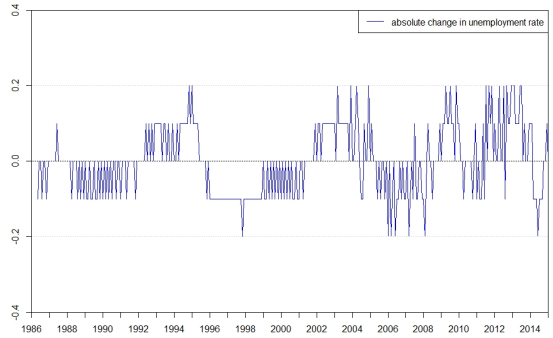
(a) Confidence & Consumption



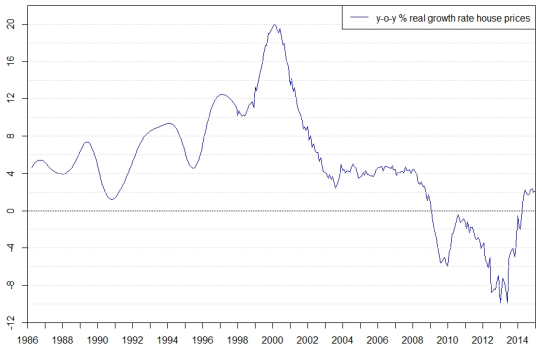
(b) Total CC index and sub-index



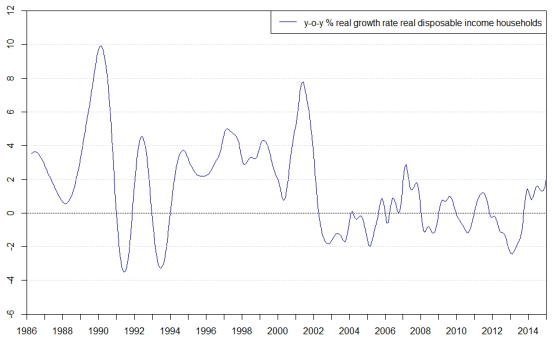
(c) Unemployment rate



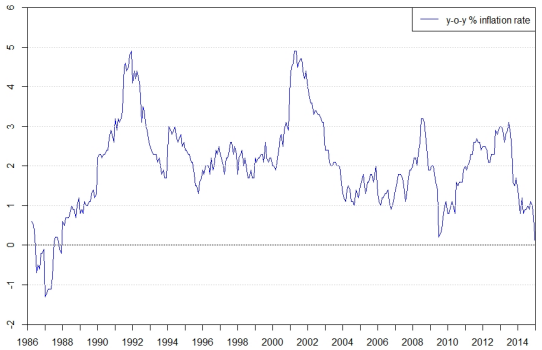
(d) Change in unemployment rate



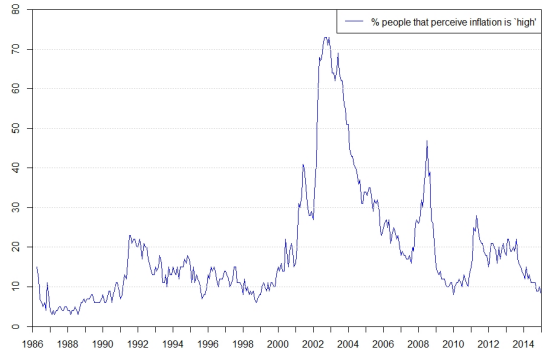
(e) House prices



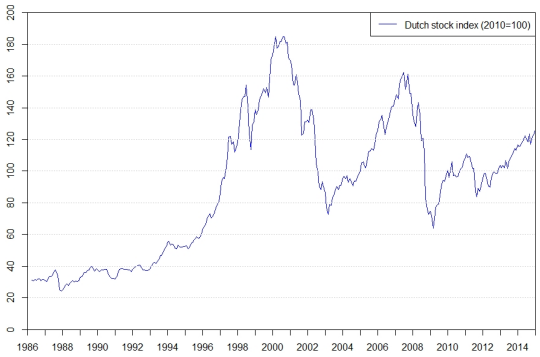
(f) Income



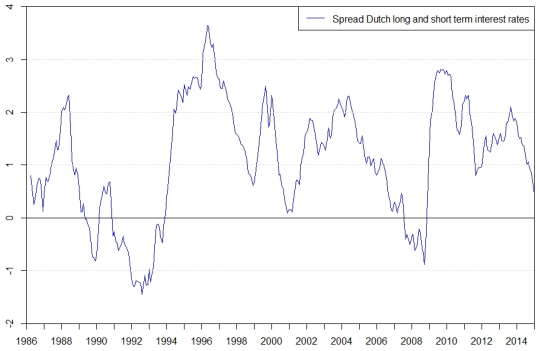
(g) Inflation



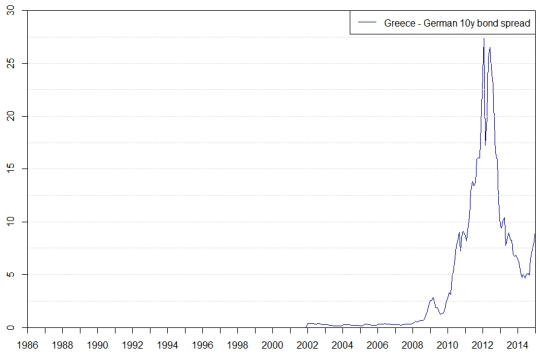
(h) Perceived inflation



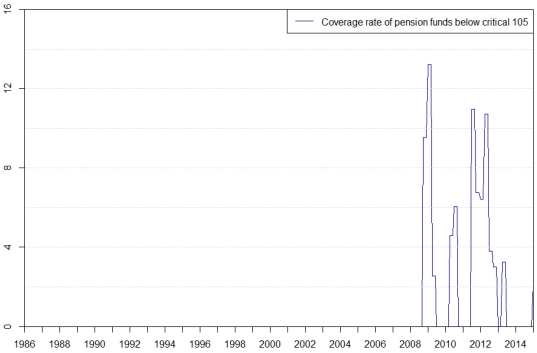
(i) Capital market



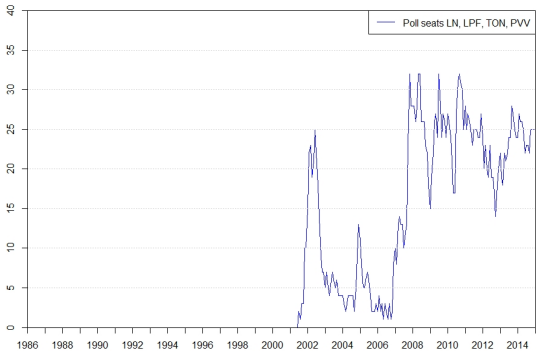
(j) Interest spread



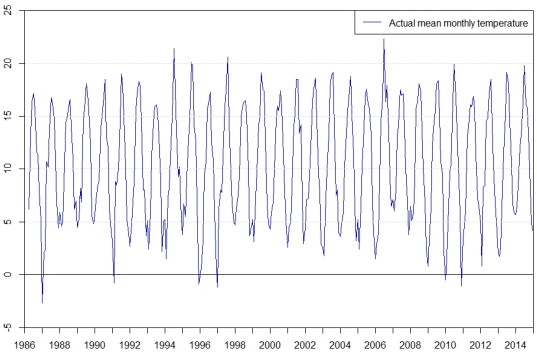
(k) Euro sovereign crisis



(l) Pension stress



(m) Political stress



(n) Temperature

B Additional literature review: other channels

Multiple studies have made an attempt to directly gauge the effect of terrorism on overall economic growth.[33] When facing a prolonged period (two decades in the Basque Country) or a very intense campaign (Israel during the 2001-03 Intifada) of terrorism, regions may experience a substantial decrease in GDP per capita. This has been estimated at 10 percentage points compared to a situation where there is no terrorism.[34] However, the consensus is that there are no significant, measurable effects on GDP from incidental attacks. Nevertheless, terrorism may also have a small impact on other specific channels:

Firstly, some early studies indicate a negative effect of terrorist attacks on transaction costs, international trade[35] and foreign direct investments,[36] but Egger and Gassebner (2014) recently showed that the estimated trade effects in these studies are biased because of the time aggregation and general equilibrium effects. Secondly, according to Netherlands Statistics (2013), €13 billion (€780 per capita) was spent on security in the Netherlands in 2013, of which 78% was financed by the government. The effects of increased government expenditure on security strongly depend on how it is financed.[37]

Thirdly, The Economist (2015) showed recently that the contribution of tourism to Northern African economies decreased for up to 12 months after an attack.[38] Fourthly, Gautier et al. (2009) find that housing prices in multicultural districts in Amsterdam decreased by 3% compared to other districts as an effect of the murder of Theo van Gogh in November 2004. Also, they find evidence for increased segregation. These effects are robust, but too small to have an impact on GDP.[39] Finally, Berrebi and Ostwald (2014) recently identified a causal relationship between terrorist attacks and decreased fertility, using a dataset of 170 countries from 1970-2007.

[33] Blomberg et al. (2004); Bird et al. (2008); Crain and Crain (2006); Gaibulloev and Sandler (2008); Gries et al. (2011); Gaibulloev et al. (2014).

[34] Abadie and Gardeazabal (2003); Eckstein and Tsiddon (2004).

[35] Nitsch and Schumacher (2004); Blomberg and Hess (2006); De Sousa et al. (2009, 2010); Bandyopadhyay and Sandler (2014).

[36] Abadie and Gardeazabal (2008); Powers and Choi (2012).

[37] Also see: Mueller and Stewart (2011).

[38] For European countries, see: Enders et al. (1992) and Drakos and Kutan (2003).

[39] Other studies on real estate include Abadie and Gardeazabal (2008) and Besley and Mueller (2012).

C Preliminary case study: Paris attacks (Nov. 2015)

The shocking attacks in Paris on the 13^{th} of November 2015 primarily had an impact on people's wellbeing as a consequence of heightened anxiety and fears. Assuming the attacks in Paris are of an once-off nature, the impact on economic growth is limited.

The results in this thesis show that past terrorist attacks affected the economy in the short term as a result of negative reactions on the financial markets and the lowering of confidence. This translates into a small first-year drop in GDP. The indicators available at this moment point in the direction of an even smaller effect. The attacks in Paris show similarities with the bombings in Madrid 2004 with regard to the region and number of fatalities. However, on the Monday after the attack, the financial markets showed resilience. Stock market indices opened -1% in France and the Netherlands, but closed the day without a loss. Volatility indices rose only by between 2 and 3%. This can be explained by the existing high levels of volatility and the abundance of liquidity in the market due to the ECB's unconventional monetary policies. Also, investors might have taken into account terrorism risks and that financial markets were closed during the weekend might have played a role.

The consumer confidence indicator is not available yet, but my findings show that the attacks in Paris are expected to have a negative effect on consumer confidence of 3 to 4 points.[40] In the long run, the economic effects on government expenditure and European integration are uncertain. French president François Hollande stated that security is more important to Europe than budget stability pacts, but the effect of increased government expenditure depends strongly on the method of financing. Finally, the attacks have put further pressure on open borders. The process could potentially lead to stricter security protocols and higher transaction costs, with resulting negative effects on trade. It is estimated that European integration increased Dutch GDP by about 6% (Straathof et al., 2008), which could potentially be reversed partially. However, such a reversal is highly unlikely.

Assuming the attacks in Paris are of an once-off nature, there is no impact on economic growth in 2015 and 2016. If the recent attacks are a start of an episode of long term terrorism threats, GDP effects might be significantly greater.[41]

[40] Current consumer confidence level (November 2015) is 9.

[41] Intense terrorism wars in the Basque Country and Israel depressed GDP by as much as 10%

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