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## The spectre of terrorism and the stock market

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THE SPECTRE OF TERRORISM  
AND THE STOCK MARKET

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Working Paper 22-10

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# The Spectre of Terrorism and the Stock Market

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## Abstract

Terrorism is a major issue in the 21st century. In this paper we examine the effect of terrorism on the stock market. We go beyond previous studies to explore the spectre of terrorism on the market rather than terrorist activities. Using a narrative-based approach à la Shiller (2019), we find that the spectre of terrorism during the Northern Ireland Troubles reduced returns and increased volatility on the UK stock market.

**JEL codes:** C00, E44, G12, G40, N24.

**Keywords:** terrorism, stock market, returns, volatility, narratives.

## Highlights

- The threat of terrorism affects stock market returns
- Media narratives can approximate the threat of terrorism
- Terrorism narratives reduce stock market returns and increase volatility
- The effect of terrorism narratives persists when controlling for terrorism events

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## 1. Introduction

Terrorism has become a major concern for societies across the globe over the past two decades. As a result, there is a growing literature on the effect of terrorism on stock markets (Eldor and Melnick, 2004; Karolyi and Martell, 2006; Arin et al., 2008; Nikkinen and Vähämaa, 2010; Chesney et al., 2011; Markoulis and Katsikides, 2020). This literature uses one of two methods to explore the relationship between terrorism and the stock market. Some studies take an event-study approach and analyse the effect of major terrorist atrocities, such as 9/11, on abnormal returns, whilst others examine the effect of terrorist events (small and large) on a time series of various stock market indices. But an absence of major terrorist atrocities and events does not imply an absence of terror. Such measures do not capture protests, riots by terrorist supporters, political talks to address a conflict, breakdown of talks, boycotts, and prison protests by terrorists. They also miss the spectre of terrorism. In other words, there can be no terrorist events, but a real sense of heightened fear.

In this paper, inspired by Shiller (2019), we propose a way of capturing terror or the spectre of terrorism: narratives. Narratives are human constructs that contain fact, emotions, and human interest that form an impression on how we think and act (Shiller, 2019). In this paper, we use quantitative narrative analysis of newspaper reporting to measure terror. In particular, we use the *Financial Times*' narratives on the Northern Ireland Troubles (NIT) which affected the UK from 1969 until 1998. During this conflict, there were 3,720 fatalities, over 47,000 people injured, nearly 37,000 shootings, and over 16,000 bombings. No other OECD economy has experienced such a prolonged period of domestic terrorism in the past 70 years.

We analyze the effect of these narratives on the NIT on the daily returns and volatility of the UK stock market. We find on days where opinion articles have a strong terror narrative, returns are 11.91 basis points lower than average on the stock market, and that terror narratives

increase conditional volatility in the stock market nearly twice as much as terrorist activities. These results are consistent with an emotional reaction to the terror narrative (Wang and Young, 2020).

## 2. Terror narratives

We capture the terror narrative presented to investors by using the opinion sections of the *Financial Times* (FT). The use of opinion sections allows us to better separate narratives from events. The first step in generating a measure of narrative was to pre-process the articles for machine reading. This entailed removing irrelevant information such as numbers, punctuation, special characters, words two letters and under, stop words, and words that appear less than 25 times. The next stage of the pre-processing was to transform words to lowercase and remove hyphens. Words were stemmed using Porter's algorithm (Van Rijsbergen et al., 1980). The final stage was to engage in concatenation using commonly occurring bigrams and trigrams to capture socioeconomic meaning, e.g., "per cent" and "European monetary system".

The second step was to filter all 94,984 opinion articles published in the FT from 1969 to 1998 for references to Ireland. We searched for *Ireland*, *Irish*, *Eire*, *Northern Ireland*, *Belfast*, and the 4 provinces and the 32 counties of Ireland.<sup>2</sup> This filtering process identifies 33,543 references to Ireland in 13,162 different opinion articles.

The final step in generating a measure of terror narrative was to use the Correlated Topic Model (CTM) of Blei and Lafferty (2006). CTM requires the modeller to select the number of topics to be identified. While the NIT was the main Irish issue commented upon by the FT from 1969-1998, it was not the only one. We find that setting the number of topics at three best identifies coverage of the NIT. Whereas increasing the number of topics from two to three improves the semantic cohesion of the model by 13.48%, increasing the number of

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<sup>2</sup> Search terms are also stemmed. "County Down" is used rather than "Down" and both *Derry* and *Londonderry* are included.

topics to four reduces the semantic cohesion by 12.20%. A manual reading of model output confirms this, with the terror topic becoming more focused on the NIT as we increase the number of topics to three with no improvement thereafter. Table 1 shows the most frequent topic-specific words for the three identified topics. We have labelled the topics *Economy*, *Terror* and *Europe* based on their content.

CTM measures the proportion of each article relating to each topic. We use the average daily proportion of coverage about the terror topic to approximate the terror narrative in the subsequent regression analysis. For illustrative purposes and in the descriptive statistics, we identify articles within the top quartile of terror topic scores (articles with 76.8% or more related to the terror topic).

In our analysis, we also use data on terrorist acts associated with NIT as a control and point of comparison with the terror narrative presented in the FT. Terrorism data is sourced from the Global Terrorism Database. Data is available 1970 to 1998 excluding 1993. We identify events, injuries and fatalities in the UK and Ireland from 1969 to 1998 attributable to terrorist organizations linked to the NIT. There is little correlation between our terror narrative and terrorism activity. Of the 10 most fatal days during the NIT, on only three occasions was an opinion article published the next day referencing Ireland. Two of those articles had strong terror narratives with 88% of the article relating to the terror topic. The other article was mainly about Europe, with only 1% of the article relating to the terror topic. The terror narrative peaks in 1972, the fourth-year of the NIT, with 35 opinion articles published in the top quartile of terror topic scores. Thereafter the number of articles decreases until the mid-1990s with the last year of the NIT having 25 opinion articles which was the third-largest annual number.

### 3. Empirical results

To assess the effect of the terror narratives on the stock market, we use the FT30, the United Kingdom's oldest daily stock index. We calculate the conditional volatility of returns using a GARCH(1,1) of the series. Table 2 shows that the average return for the index over the 7,340 trading days from 1969 to 1998 was 2.48 basis points. On the 266 trading days where there was an FT article in the top quartile of the terror topic, the average return for the FT30 was -9.43 basis points. On the 242 trading days in the bottom quartile of the terror topic, the average return was 1.29 basis points. This contrasts with the market response to deaths associated with NIT: the average return is 5.25 basis points on the day of deaths and 4.40 basis points the next day. Consistent with previous literature, the conditional volatility of returns is higher on days with terrorist activity. However, it is only marginally higher on days with FT narrative on the terror topic.

Table 2 shows the relationship between the terror narrative and subsequent market performance. Panel A reports  $\beta$  coefficients and *t-stats* from the model

$$R_t = \alpha + \beta(T_{t-1}) + \eta R_{t-1} + \psi \text{Jan} + \epsilon_t \quad (1)$$

where  $R_t$  is FT30 log returns, Jan is a month-of-the-year dummy which equals one during January and zero otherwise,  $T_{t-1}$  is our terror measures. The Terror Narrative is the daily average proportion of coverage about the NIT as identified using the CTM. Following García (2013) and Hanna et al. (2020), we date our narrative measures to the day written rather than the day published because the content of the morning paper is written the day before. The Long-Run Terror Narrative is a 120-day moving average of the Terror Narrative variable. Following Arin, Ciferri and Spagnolo (2008), the Terrorism Activity Index is the natural log of  $(e + \text{number of events} + \text{number of wounded} + \text{number of fatalities})$ .

Panel A of Table 3 shows that the terrorist acts associated with the NIT did not affect stock returns. Although unreported, no correlation is found between any component of the

index and either today's or tomorrow's return. While terrorism did not affect returns, the spectre of terrorism did. Both the previous day's Terror Narrative and the Long-Run Terror Narrative are negatively correlated with subsequent market returns: a one standard deviation change is associated with a 0.027 and 0.024 basis point reduction in returns respectively. Notably, these effects persist after controlling for the Terrorism Activity Index.

Panel B reports  $\beta$  coefficients and p-values from the model

$$\sigma_t = \alpha + \beta(T_t) + \epsilon_t \quad (2)$$

where  $\sigma_t$  is the conditional variance of daily FT30 log returns as calculated by a GARCH (1,1) model.

Panel B of Table 3 shows that both terrorist activity and the spectre of terror increased market volatility. A one standard deviation increase in the Terrorism Activity Index is associated with a 0.044 increase in conditional variance of FT30 returns whereas the associated effect for an increase in the Long-Run Terror Narrative is a 0.074 increase. When both are included in the model, their effects persist, suggesting that the spectre of terror is not a proxy for terrorist activity, but that another factor that affects the market.

Given the relative sparse nature of FT commentary on the NIT, as an additional robustness test, we limit regression analysis to days with non-zero coverage of the Troubles. Results presented in Appendix Table 1 show that our terror narrative is negatively correlated with subsequent returns and positively correlated with conditional volatility even when controlling for terrorism activity. Results are also robust to the exclusion of outlier days with the findings qualitatively unchanged if the terror narratives are winsorized at the 95 quantiles.



#### **4. Conclusion**

Using newspaper narratives on terrorism during the NIT, we find that the spectre of terrorism decreases returns on the UK stock market and increases volatility. Even when we control for terrorist activity, this effect remains. Our findings are consistent with an emotional reaction by investors to the terror narrative (Wang and Young, 2020). One of the main implications of our results is that the spectre of terror can have just as large an effect on the economy as actual terrorist events.

**TABLE 1. Irish Topics in the *Financial Times* 1969-1998**

Topic as identified through a Correlated Topic Model of Blei and Lafferty (2006) of *Financial Times* articles that reference Ireland during the period 1969–1998. Words are ranked by their importance in defining topics.

<b>Topic 1</b>	<b>Topic 2</b>	<b>Topic 3</b>
<b>Economy</b>	<b>Terror</b>	<b>Europe</b>
profit	IRA	fair
earn	unionist	country
index	violence	unemployment
share price	catholic	European
shareholder	peace	EEC
sale	ulster	Europe
bid	protest	commission
bank	Northern Ireland	budget
dividend	party	nation
column	province	franc
cash	terrorist	economy
pre-tax	Dublin	community
company	ceasefire	Germany
yield	Belfast	Brussels
stock	constitution	region
investor	talk	world
quarter	lynch	EMU
acquisition	police	French
pre-tax profit	elect	German

**TABLE 2: Descriptive Statistics**

Based on 10,956 days between 1 Jan 1969 and 31 Dec 1998. Terror Articles are opinion articles published in *The Financial Times* that reference Ireland and the content of which is in the top quartile for the terror topic as identified through a Correlated Topic Model of Blei and Lafferty (2006). NIT deaths are sourced from Global Terrorism Database and attributable to terrorist organisations linked to the Northern Ireland Troubles or occurred in Northern Ireland. Returns are daily log close to close of the FT30 and Volatility is based on a GARCH (1,1) of those returns.

		Obs.	Mean	Median	St. Dev	Min	Max
Panel A: All Days (10,956 days)							
Returns	Basis Points	7,340	2.48	2.79	120.46	-1,240.02	961.86
Volatility		7,340	1.44	1.00	1.67	0.35	20.66
Terror Articles	No.	278	1.05	1	0.25	1	4
NIT Deaths	No.	1,781	1.67	1	1.80	1	33
Panel B: Terror Article Days (278 days)							
Returns		266	-9.43	-13.76	135.65	-692.58	412.47
Volatility		266	1.48	1.04	1.43	0.35	11.90
Panel C: NIT Deaths Days (1,781 days)							
Returns		1,250	5.25	4.04	131.63	-629.81	717.41
Next-Day Returns		1,199	4.40	0.00	142.34	-736.98	717.41
Volatility		1,250	1.81	1.17	2.04	0.39	19.13
Next-Day Volatility		1,199	1.85	1.18	2.07	0.37	19.28

**TABLE 3: Spectre of Terror, Terrorist Activity and the Stock Market**

The Terror Narrative is the daily average proportion of *Financial Times* opinion coverage about the NIT as identified using the Correlated Topic Model of Blei and Lafferty (2006). The Long-Run Terror Narrative is a 120-day moving average of the Terror Narrative. The Terrorism Activity Index is based on deaths, injuries and events from Global Terrorism Database and attributable to terrorist organizations linked to the Northern Ireland Troubles or occurred in Northern Ireland. Results are reported based on robust standard errors. Returns are based on daily log close to close of the FT30, 1969-1998. Volatility is based on a GARCH(1,1) of the FT30. Based on 7,588 observations.

<i>Panel A: Returns</i>					
	(1)	(2)	(3)	(4)	(5)
<i>Terror Narrative</i>	-0.027** (-2.09)			-0.028** (-2.11)	
<i>Long-Run Terror Narrative</i>		-0.024** (-2.03)			-0.024** (-2.06)
<i>Terrorism Activity Index</i>			-0.001 (-0.46)	0.011 (0.82)	0.011 (0.82)
<i>Constant</i>	Yes	Yes	Yes	Yes	Yes
<i>AR(1)</i>	Yes	Yes	Yes	Yes	Yes
<i>Jan Dummy</i>	Yes	Yes	Yes	Yes	Yes
<i>Panel B: Volatility</i>					
	(6)	(7)	(8)	(9)	(10)
<i>Terror Narrative</i>	-0.001 (-0.13)			-0.003 (-0.34)	
<i>Long-Run Terror Narrative</i>		0.074*** (7.79)			0.073*** (7.66)
<i>Terrorism Activity Index</i>			0.044*** (3.98)	0.044*** (3.98)	0.042*** (3.83)
<i>Constant</i>	Yes	Yes	Yes	Yes	Yes
<i>AR(1)</i>	No	No	No	No	No
<i>Jan Dummy</i>	No	No	No	No	No

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## Appendix

**Appendix Table 1: Spectre of Terror, Terrorist Activity and the Stock Market: Days with Coverage About the Northern Ireland Troubles**

The Terror Narrative is the daily average proportion of *Financial Times* opinion coverage about the NIT as identified using the Correlated Topic Model of Blei and Lafferty (2006). The Long-Run Terror Narrative is a 120-day moving average of the Terror Narrative. The Terrorism Activity Index is based on deaths, injuries and events from Global Terrorism Database and attributable to terrorist organizations linked to the Northern Ireland Troubles or occurred in Northern Ireland. Results are reported based on robust standard errors. Returns are based on daily log close to close of the FT30, 1969-1998. Volatility is based on a GARCH(1,1) of the FT30. Results are reported based on robust standard errors. Based on 1,006 observations.

	<i>Panel A: Returns</i>				
	(1)	(2)	(3)	(4)	(5)
<i>Terror Narrative</i>	-0.070** (-2.09)			-0.070** (-2.10)	
<i>Long-Run Terror Narrative</i>		-0.031 (-0.99)			-0.032 (-1.03)
<i>Terrorism Activity Index</i>			0.045 (0.18)	0.024 (0.52)	0.024 (0.52)
<i>Constant</i>	Yes	Yes	Yes	Yes	Yes
<i>AR(1)</i>	Yes	Yes	Yes	Yes	Yes
<i>Jan Dummy</i>	Yes	Yes	Yes	Yes	Yes
	<i>Panel B: Volatility</i>				
	(6)	(7)	(8)	(9)	(10)
<i>Terror Narrative</i>	0.010 (0.35)				0.009 (0.30)
<i>Long-Run Terror Narrative</i>		0.063*** (2.96)		0.057*** (2.62)	
<i>Terrorism Activity Index</i>			0.126*** (3.21)	0.123*** (3.13)	0.126*** (3.19)
<i>Constant</i>	Yes	Yes	Yes	Yes	Yes
<i>AR(1)</i>	No	No	No	No	No
<i>Jan Dummy</i>	No	No	No	No	No