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Are the effects of terrorism short-lived?

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Abstract

Terrorism elicits strong public reactions immediately after the attack, with important implications for democratic institutions and individual well-being. Are these effects short-lived? We answer this question using a natural experiment design and combining data on terrorist attacks in the United Kingdom with a Continuous Monitoring Survey. We find that heightened risk perceptions and emotional reactions in the wake of deadly attacks do not dissipate in the very short run but are sustained over time and up to 120 days after the attacks. Whereas large-scale attacks cause a long-lasting shift in risk assessments and emotions, the corresponding effect of smaller-scale terrorism incidents appears to subside within one month. Overall, the impact of terrorism does not fade away easily.

Keywords: terrorism; risk perceptions; emotions; quasi-experimental design

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1 Introduction

Terrorist violence has considerable effects on key attitudes such as trust in government, migration preferences and commitment to civil liberties (Davis & Silver, 2004; Huddy et al., 2005; Legewie, 2013; Dinesen & Jæger, 2013; Balcells & Torrats-Espinosa, 2018; Falcó-Gimeno et al., 2022; Godefroidt, 2023). Terrorist acts also result in a “complex state of negative emotional arousal” (Godefroidt, 2023, p.5), making ordinary people feel vulnerable and helpless and eliciting negative emotions such as anxiety, anger and sadness (Hansen et al., 2016, 2017; Nussio et al., 2019; Sønderskov et al., 2021).

In this paper we depart from the magnitude of the terrorism effects and focus instead on their duration. We contribute specifically to recent studies that identify the causal impact of terrorism on public sentiments by exploiting the unexpected occurrence of a terrorist attack during the fieldwork of a public opinion survey, where the timing of the event assigns survey respondents into treatment and control groups as good as randomly (Muñoz et al., 2020). Given the nature of the research question and because of data limitations, these studies usually track public reactions to terrorism only for a few days after an attack, with the corresponding time frames ranging from 3 to 30 days (Balcells & Torrats-Espinosa, 2018; Ferrín et al., 2020; Van Hauwaert & Huber, 2020; Nussio et al., 2021; Bove et al., 2022; Holman et al., 2022; Breton & Eady, 2022; Germann et al., 2022; Godefroidt, 2023; Pickard et al., 2023).

Overall, existing evidence suggests that terrorism does shape citizens’ attitudes and emotions in important ways. As of yet, however, much less is known about the duration of such effects.1 To address this puzzle, we rely on uninterrupted series of individual-level observations with a large N, which allows us to retain the statistical power of our analysis across all time frames considered. Using survey items that are designed to capture atti-

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1 Two exceptions are Bozzoli & Müller (2011) and Giani et al. (2021) who focus on the effects of the 2005 London bombing over a longer time period but rely on relatively small samples.
tudes and feelings elicited by terrorism greatly reduces the risk of bias due to other events. In addition, we move beyond the focus on a single emblematic event, and instead exploit the timing of six terrorism incidents (three deadly and three foiled attacks) to shed light on the heterogeneity of the resulting effects and enhance the generalizability of the findings. Perhaps more crucially, we explore first-order effects, the perceptions of terrorism risk and the emotions that are stimulated by the attack itself. Risk assessments and negative emotions following terrorist episodes shape cognition and policy preferences (Huddy et al., 2005; Epifanio, 2016; Helbling & Meierrieks, 2022), with wider implications for individual well-being and mental health (Sønderskov et al., 2021). We thus consider risk perceptions and the negative emotions stimulated by terrorism as highly consequential variables.2

What explains the temporal dynamics of attention to terrorism, and in particular the duration of its effects? We can isolate two contrasting ex ante predictions. One might expect risk perceptions and emotional reactions to be short-lived and subject to a swift ‘return to homeostasis’ or baseline values (Brandon & Silke, 2006; Maguen et al., 2008). This is underwritten by the general tendency of perturbations to subside as individuals habituate psychologically and return to baseline arousal levels. Breton & Eady (2022), for example, find that indices of anxiety towards refugees rise sharply, then diminish quickly (within ten days) after a terrorist incident. Yet, the impacts of terrorism could also have a more lasting duration, given its unpredictable nature and the dramatic way in which it forces the public to revise its beliefs about risk (Bux & Coyne, 2009). An initial ‘emergency stage’ of intense emotional reaction tends to last for one month and is then followed by a ‘plateau’ period of another month, wherein mental rumination is maintained at high levels (Pennebaker & Harber, 1993). Given the theoretical ambiguity, we consider the duration of the emotional and cognitive effects of terrorism as an empirical question. Appendix A.1

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2In Appendix A.1 we discuss the relation between risk perceptions and emotional reactions and how they shape policy preferences.
offers additional theoretical insights on our expectations with regards to the duration of these (first-order) effects.

2 Data and Empirical Strategy

We use individual-level data on public opinion and emotions from the Continuous Monitoring Survey (CMS) – a set of monthly internet surveys of the British electorate (with around 1.3K respondents participating in each survey) that were conducted as part of the British Election Study over the period 2004-2014. The CMS has component questions that are asked every month, and, as such, it offers uninterrupted series of individual-level observations.

To capture individuals’ perceptions about the risk of terrorism, we explore their answer to the following statement: “Do you think the risk of terrorism to British citizens these days is...”; with possible responses being: a lot better, a little better, the same, a little worse, and a lot worse. To capture emotions, we rely on their answer to the question: “Which, if any, of the following words describe your feelings about the risk of terrorism to British citizens (please tick up to four)?”, with possible responses being: angry, happy, disgusted, hopeful, uneasy, confident, afraid, proud. Among negative feelings, the four stated ones – anger, fear, disgust and unease (or anxiety) – are the most prevalent in the context of terrorism, with important psychological and cognitive consequences.

Using the CMS data, we create the main outcome variables for our regression analysis. We first construct the variable Risk of terror, a binary indicator taking value 1 if people report that the risk of terrorism these days is either a little worse or a lot worse (and 0 otherwise). We then construct four binary indicators Anger, Disgust, Unease and Fear, each taking value 1 if people choose the corresponding word to describe their feelings about the risk of terrorism (and 0 otherwise), as well as a ‘negative emotions index’ using the
average value of the four aforementioned variables.

Comparing individual responses before and after terrorist attacks enables us to examine the causal effect of terrorism on people’s responses. Our identification strategy relies on the assumption that the timing of attacks is exogenous (unexpected) and largely randomly assigned relative to that of the interviews, and thus individuals interviewed after the attack can be defined as the ‘treatment’ group whereas those interviewed before the attack can be defined as the ‘control’ group (Muñoz et al., 2020). We consider three of the four ‘major’ terrorist attacks that occurred between 2004 and 2013: the London bombings (7 July 2005), the Glasgow airport attack (30 June 2007) and the Lee Rigby murder (22 May 2013). All three attacks received widespread media coverage and resulted in deaths, which makes them particularly impactful and relevant. Moreover, all three attacks were motivated by Islamic extremism, which ensures that the reactions to terrorism are homogeneous with respect to the characteristics of the perpetrators (Pickard et al., 2023).

Our empirical model specification takes the following form:

\[ y_{irw} = \alpha + \beta T_{irw} + \lambda_{rw} + \varepsilon_{irw} \]  

where \( y_{irw} \) is one of the outcome variables for individual \( i \), living in region \( r \), and interviewed around the time of terrorist attack \( w \); \( T_{irw} \) is a binary indicator that takes value 1 if the individual was interviewed after the day of the attack, and 0 before the day of the attack; \( \lambda_{rw} \) represents attack-by-region fixed effects; and, \( \varepsilon_{irw} \) is an error term, clustered at the attack-by-region level. We compare answers between the control group, interviewed 30 days before the attack, and three different treatment groups, interviewed at three dis-

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3 Appendix A.2 offers background material on the three attacks.

4 England, Scotland and Wales are divided into 11 regions.

5 To avoid measurement errors, we drop individuals who were interviewed on the same day of the attack.
tinct time frames: (i) one week after the attack (very short run), when the threat is the most salient and emotions are potentially very high; (ii) the first month minus the first week after the attack (short run), which represents the short period following the initial emotional reaction; and (iii) the first four months minus the first month after the attack (medium run), which allows us to assess whether any reaction is short-lived or yields a more permanent shift in attitudes or emotions (see also Giani et al., 2021).

A concern that may arise when one considers outcomes that are measured a long time after the treatment occurred is that this might lead to bias due to the occurrence of other unrelated events (Muñoz et al., 2020). As such, many researchers choose to rely on short time intervals around the event date as a way to reduce the probability of other factors driving the estimated effects. An important reason why this concern is much less acute in our context is that we focus on the first-order effects of terrorism and exploit information from survey items that are designed to capture attitudes and feelings elicited by terrorism – as opposed to general attitudes or the emotional state which may depend on a wide range of factors and can be influenced by multiple events. This, together with the fact that no other major terrorist incidents occurred within 120 days after the sampled attacks, maximizes the probability that the pre-post-attack changes in our outcomes are caused by these attacks, and allows us to credibly estimate the duration of the resulting effects.

Another possible threat to our identification strategy is that individuals with specific characteristics may respond to the survey at different points in time, and these characteristics may be predictive of the outcome. In Appendix B.1, we show that there is a strong balance in observed characteristics across treatment and control units, and that the reported estimates do not change when we augment Eq. (1) with a wide set of individual-level controls. In the same appendix, we also show that our results persist when we use entropy

\[ \text{The first (national or international) major attack that occurred after the three sampled attacks is the Westgate shopping mall attack in Kenya (21 September 2013); i.e., 123 days after the Lee Rigby murder.} \]
weighting or coarsened exact matching as a way to correct for possible imbalances.

3 Empirical Results

3.1 Dynamics of risk perceptions and negative feelings

We start by providing a graphical representation of the conditional relationship between the treatment indicator (in bins) and the mean of the variable Risk of terror, using a ‘binned scatterplot’. Relative to the standard approach of reporting results – i.e., plots of fitted values – the binned scatterplot depicts the non-parametric relationship of interest and allows the quick detection of non-linearities, outliers and distributional differences (Hainmueller et al., 2019; Starr & Goldfarb, 2020).7

As shown in Figure 1, exposure to new terrorist attacks leads to strong post-attack reactions: the public’s perceived risk of terrorism increases from around 0.52 (on a 0-1 scale) to more than 0.75 in the first few days following the attacks. We can also see that the mean estimate of Risk of terror declines in the medium run but remains significantly higher than that of the control group. In fact, the temporal dynamics reveal a level shift upwards that is sustained over time and up to 120 days after the attacks.8

We continue by estimating the treatment effect across three pre-determined time frames: the very short run, the short run, and the medium run. The results are displayed in the left panel of Figure 2. In line with the patterns of Figure 1, we can observe a large and highly statistically significant change of perceptions in the very short run, which persists in the short run. Substantively, the point estimates imply that the perceived risk of terrorism

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7Confidence intervals around a single point may be misleading since each point in a binned scatterplot represents the data from an entire interval of data (Starr & Goldfarb, 2020). As such, we report both confidence intervals (at the mean within the bin) and confidence bands (across the whole bin).

8Appendix C.1 provides the binned scatterplots for both risk perceptions and negative emotions based on a 120-day bandwidth.
Figure 1: Risk of terror: non-parametric estimates

Notes: The upper panel shows the binned scatterplot and the corresponding confidence intervals and confidence bands (Cattaneo et al., 2019), implemented using the \texttt{binsreg} package. The lower panel shows the frequency of observations.
increases by about 50% relative to the pre-treatment mean. In the medium run, we can observe a decline in risk assessments compared to the short run; yet, the treatment effect retains its statistical significance and is way above the pre-treatment levels, suggesting that people continue to feel that another attack is possible for a quite long time after the attack. To ensure that the reported estimates are unlikely to be observed by chance, we perform permutation tests that randomly shuffle the data 1,000 times and estimate a treatment effect for each random draw and each time frame. The resulting distributions are displayed in the right panel of Figure 2. As can be seen, there is 0% probability that the observed treatment effects are observed by chance.

Figure 3 shows the results for emotions of negative valence, based on the same regression set-up as in Figure 2. The evolution of negative feelings, as captured by the overall index, is consistent with the dynamics of risk assessments: there is a sharp increase in the first 7 days after the attacks, which persists for one month and is then followed by a noticeable decline (in the next 90 days). Still, even in the medium run, the treatment effect remains substantively and statistically significant. Turning now to the four components, we can see that anger, and to some extent disgust, prevail over the other negative feelings in the very short run and short run, and can largely explain the more intense emotional reaction to terrorism in the immediate aftermath of the attacks.9

### 3.2 Results for individual attacks

One would expect the results to be stronger and longer-lasting for attacks that are considered to be more consequential and threatening to the general population; as proxied, for example, by the number of victims or the extent of national media coverage. To test for this, we run the same analysis as in Figures 2 and 3 for each sampled attack separately, and

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9Evidence of increased negative feelings in the wake of the 2013 Lee Rigby murder is also provided in Appendix A.3, based on a sentiment analysis of Twitter data.
Figure 2: Risk of terror: main results

Notes: The left panel shows the treatment effect on public’s perceptions about the risk of terrorism across the three time frames. Standard errors are clustered at the attack-by-region level. Fat (thin) lines signify the 90% (95%) confidence interval. The sample sizes are: \( N \) (very short run) = 4,186; \( N \) (short run) = 6,397; and \( N \) (medium run) = 13,870. The right panel shows the results from permutation tests that randomly shuffle the data 1,000 times, stratified by attack-by-region, and estimate a treatment effect for each random draw and each time frame. The reference lines show the observed effects, with labels reporting the proportion of times that the treatment effects under the permuted data are at least as extreme as under the observed data.
Notes: The figure shows the treatment effect on the outcome listed on the horizontal axis across the three time frames. Standard errors are clustered at the attack-by-region level. Fat (thin) lines signify the 90% (95%) confidence interval. The sample sizes are: $N$ (very short run) = 4,350; $N$ (short run) = 6,615; and $N$ (medium run) = 14,314.
report the results in Figure 4. For the 2005 London bombings (attack 1) – a highly shock-
ing and sensational event with a large number of victims and a quite long media cycle –
the effects seem to persist over a long period of time: both risk perceptions and negative
feelings increase in the very short run, become more pronounced in the short run, and
stabilise (at the initial post-attack levels) in the medium run.\textsuperscript{10} On the other hand, for the
2007 Glasgow airport attack and the 2013 Lee Rigby murder (attacks 2 and 3, respectively)
– two less severe terrorist incidents with a small number of victims and a short media cycle
– the effects appear to be transitory: while there is a large increase in risk assessments and
negative emotions in the very short run (similar to that of the 2005 London bombings),
both reactions become weaker in the short run and return to baseline levels (or remain
marginally above them) in the medium run.

Two conclusions emerge from this analysis. First, large-scale attacks can cause a large
and long-lasting shift in public reactions; and second, smaller-scale attacks can still trigger
sizable changes in attitudes and emotions, which however tend to dissipate within one
month – in line with the media cycle of these events. Appendix A.4 provides a discussion
about the role of media coverage in shaping terrorist effects and provides evidence about
the extent and duration of coverage for each of the three attacks.

3.3 Comparison with foiled attacks

We perform a benchmarking exercise where we compare our results with those for three
foiled airplane hijackings, whose timing coincides with the CMS data-collection period
(taking place on the 9th of August 2006, the 25th of December 2009 and the 9th of Octo-
ber 2010). Each event was covered extensively by national media, including articles in the
Guardian, the Telegraph, and the BBC News. The left panel of Figure 5 presents the treat-

\textsuperscript{10} Appendix C.2 provides suggestive evidence that this particular attack caused a more permanent shift
in risk perceptions and negative emotions.
Figure 4: Risk of terror and negative emotions: results for each attack

Notes: See notes of Figures 2 and 3. Attack 1 = 2005 London bombings; Attack 2 = 2007 Glasgow airport attack; Attack 3 = 2013 Lee Rigby murder. The sample sizes for the left panel are: $N_1$ (very short run) = 1,211; $N_1$ (short run) = 2,511; $N_1$ (medium run) = 5,138; $N_2$ (very short run) = 1,156; $N_2$ (short run) = 2,237; $N_2$ (medium run) = 5,172; $N_3$ (very short run) = 1,819; $N_3$ (short run) = 1,649; $N_3$ (medium run) = 3,560. Similar sample sizes are used in the right panel.
ment effect of these foiled attacks on Risk of terror across the three time frames. Overall, we can observe an increase in risk assessments, which quickly decays back to baseline levels. Substantively, the effect is about 40% smaller in the very short run, and about four times as small in the short run, compared to the deadly attacks. Turning now to the evolution of negative feelings after these foiled attacks (right panel of Figure 5), we can detect a very small increase in Anger and Disgust in the very short run and short run – which is 50%-75% smaller than for deadly attacks – but no effects in the medium run (and no effects at all for the other two feelings).

Overall, our results support the argument that foiled terrorist attacks, when they are largely reported in the media, can produce a “strong alarming effect on a wide audience” (Shoshani & Slone, 2008, p.637), which can lead to increased threat perceptions and anger in the first few weeks after the attacks. However, as memories of such ‘near-miss’ terrorist incidents fade and evaluations of how close the events came to being fatal diminish, the resulting effects quickly return to normal levels.

### 3.4 Further analyses and robustness tests

In Appendices B.2 to B.10, we carry out additional analyses and robustness checks. Specifically, we perform validity tests to strengthen our identification assumptions, including testing for pre-existing trends (Section B.2); check sensitivity to using quintile-based time frames (Section B.3); conduct placebo tests on alternative unrelated outcomes (Section B.4); examine the treatment effect on positive emotions about the risk of terrorism (Section B.5); test for heterogeneity in the terrorism effects across individuals (Section B.6); compare the results between attacked and non-attacked regions (Section B.7); check robustness to using a probit model (Section B.8); and consider the effects of a foiled and low-reported attack (Section B.9). Taken together, the results lend credibility to our causal claims and provide strong support to our key findings. Finally, in Section B.10, we test for
Figure 5: Risk of terror and negative emotions: foiled attacks

Notes: See notes of Figures 2 and 3. The sample sizes for the left panel are: $N$ (very short run) = 3,139; $N$ (short run) = 5,834; and $N$ (medium run) = 10,971. Similar sample sizes are used in the right panel.
a ‘second-order echo effect’ of terrorism: its influence on migration attitudes. We find that terrorism can also lead to a long-lasting shift in such attitudes, with people perceiving the number of asylum-seekers as a more important problem after the attacks compared to before the attacks.

4 Conclusions

Are the emotional and cognitive effects of terrorism short-lived? To address this question, we rely on uninterrupted series of individual-level observations and employ a natural experiment design. Specifically, we compare survey responses before and after three deadly and three foiled attacks in the United Kingdom and track public opinion dynamics across three time periods: the first week after the attacks, the first month (minus the first week), and the next three months. We find that the impact of terrorism lasts well beyond the few days after the attacks, particularly for deadly attacks with a long media cycle.

The deleterious consequences attached to these heightened risk perceptions and emotional reactions are likely to confront policymakers long after the attacks occur. Increased risk perceptions and fear of terrorism can lead to stronger public support for policies that prioritise security and surveillance at the expense of civil liberties. Similarly, by priming ‘mortality salience’, terrorism can contribute to the prevalence of prejudiced attitudes towards out-groups and the marginalisation of vulnerable communities, with downstream effects on individual well-being and mental health. Yet, terrorism can also result in actions spilling over across the border, as high levels of anger towards terrorists can lead to calls for more aggressive military actions which seek to retaliate against an identifiable target. As such, disentangling the quantitative effects of terrorism over the short and long run is a crucial task for policymakers, public institutions, and scholars alike.
Supplementary Material. Online appendices are available at ***

Data Availability Statement. Replication data for this article can be found in Harvard Dataverse at: https://doi.org/10.7910/DVN/FXYJZH

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Conflicts of Interest. None.

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