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# **TERROR ATTACKS AND INDIVIDUAL INVESTOR BEHAVIOR: EVIDENCE FROM THE 2015-2017 EUROPEAN TERROR ATTACKS**

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## **Abstract**

We study how terrorism impacts individual investor behavior. We utilize international brokerage data to study how individual investors react in the immediate aftermath of a terror attack. We focus on seven major terror attacks that occurred during the European terror attacks of 2015-2017. We find that investors lower their trading activity, use less leverage, and engage in less short selling. This effect is observed on a worldwide basis, with the effects being stronger in the country of attack. The changes in investor behavior can be explained by increased risk aversion and personal loss experiences. The decrease in trading activity leads to an increase in investors' return on investments.

Keywords: terrorism, investor behavior, risk aversion

JEL classifications: D10, G40

\*Both authors contributed equally, author order is the result of randomization

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## 1. INTRODUCTION

Over the last decade, developed countries and especially Europe have witnessed an increasing number of terror attacks. These terror attacks have a tremendous impact on the population, causing strong emotional responses of individuals such as fear and anger (Lerner, Gonzalez, Small, & Fischhoff, 2003). As emotions play a significant role in explaining investor behavior (Kamstra, Kramer, Levi, & Wermers, 2017; Saurabh & Dey, 2020; Taffler, 2018), and terrorism is associated with distinct emotions such as fear and anger, many academics have tried to understand the impact of terrorism on capital markets and the economy. While the macroeconomic effect of terrorism on the economies in general, and financial markets, in particular, has been well documented (Arin, Ciferri, & Spagnolo, 2008; Drakos, 2010; Kollias, Manou, Papadamou, & Stagiannis, 2011), much less is known about how individual investors behave in the immediate aftermath of a terror attack on the micro-level (Levy & Galili, 2006; Wang & Young, 2020).

This paper contributes to this research by focusing on the individuals that make up the capital markets. We utilise international brokerage data to investigate how investors behave after a terror attack. We proxy investors' trading activities with their trading intensity (number of trades), their leverage-usage, which is a pure measure of risk-taking, and their propensity to engage in short-selling. Given that there are many factors impacting investor behavior, the empirical challenge to analyzing the marginal impact of terror attacks on investor behavior is to net out investors' normal trading activities. We rely on a difference-in-differences approach to overcome this challenge and directly compare the behavior of investors in a country that has experienced a terror attack to the behavior of investors in countries that have not experienced a terror attack. We focus on the 2015-2017 terror attacks in Europe and find that terror attacks in general lead to reduced risk-taking. Specifically, we find that immediately after a terror attack has occurred, investors execute less trades, utilise less leverage when

trading, and are less likely to engage in short selling. These effects are observed across all investors, with the effects being stronger in the country of attack. We find that gender and age can explain some variation in investor behavior. We find that men and older people decrease their trading intensity to a larger extent as compared to their counterparts. We study several channels through which terrorist activity may influence investor behavior and find evidence suggesting that the impact of terror attacks on trading behavior is driven by changes in investors' risk aversion and through personal experiences, i.e., trading losses. Finally, we also observe a slight increase in returns following terror attacks for those investors who reduce their trading activities.

We contribute to the literature on the impact of terror attacks on financial markets. This literature documents that investor behavior in the aftermath of terrorist activity is associated with more risk-averse choices, such as a reduced trading intensity and a reduced flow to risky assets (Levy & Galili, 2006; Luo, Chen, & Lin, 2020; Wann & Lobo, 2010). We contribute to this literature by showing that investors reduce their risk-taking, in particular, if they experienced losses during the month of the attack. The decrease in risk-taking does not seem to be driven by negative market expectations, as investors significantly reduce their short-selling activities. Considering previous evidence by Kelley and Tetlock (2016), who show that retail short selling has predictive ability for future (negative) stock returns, this observation provides important insights on investor perceptions of terror attacks in Europe. We also show that the decrease in trading is not driven by a change in investor attention. Providing additional insights, we find that particularly male and older investors reduce their trading activities. We believe that this result can be attributed to the impact of age and gender on emotional regulation (Zimmermann & Iwanski, 2014). Finally, we show that investors with a high cultural distance to the country of the attack increase their trading and risk-taking in the aftermath of terrorist activity.

The remainder of our paper proceeds as follows. In section 2, we present our dataset. Section 3 discusses our identification strategy. We present our findings in section 4. The final section concludes.

## **2. DATA AND VARIABLES**

Our analysis is based on transaction-level brokerage data obtained from an online brokerage service operating under a UK brokerage license. The broker allows its clients to trade CFDs on a variety of underlying instruments, such as stocks, currency pairs, and commodities, among others. The broker does not provide its clients with any professional investment advice. CFDs are derivative contracts designed such that their prices mirror those of the underlying securities (Brown, Dark, & Davis, 2010). CFD trading represents a substantial fraction of the overall trading activity in Europe and Asia. The majority of CFD trading activity is caused by retail investors (Stafford & Murphy, 2018). The practice of CFD trading is growing rapidly across the world. For example, the value of CFD transactions amounted to 35% of the value of London Stock Exchange equity transactions in 2007, according to the Financial Services Authority. In Germany, the CFD trading volume in 2018 was approximately equal to the total transaction volume of the Deutsche Börse AG (CFD Verband e.V.).

CFD based trading allows investors to select the leverage of each individual CFD trade. As leverage allows investors to increase the scope for extreme returns (Heimer & Simsek, 2019), it is a key dimension of risk-taking. Second, investors have considerable flexibility to engage in short positions, which adds an important dimension to our study. In particular, it allows investors to trade on pessimistic expectations, without restricting them to positions they previously held in their portfolios.

The data contain investors' basic demographics characteristics, i.e., gender and age, several additional items supplied in response to a questionnaire issued by the broker when investors create their brokerage account, and detailed information on their transactions. The transaction data contain the exact time-stamp of each trade, information on the specific underlying, an indicator for long or short positions, the execution price, the leverage, and the investment. Lastly, the data contain information when investors accessed information pages on the broker's website that provide information on stock prices, key financial variables, and the latest news on the company.

In total, our data contain an international clientele from across 83 countries (country classified by primary citizenship), with 67% of investors being from Europe. We start with a sample of full trading histories of 668,067 investors spanning the period of January 1, 2014 to December 31, 2017. Data on investors research activities is only available from June 2015 onwards. The majority of investors in our sample are males and between 25 and 44 years of age (see Table 1), which is in line with previous studies on active investors (e.g., Barber & Odean, 2013; Linnainmaa, 2003). About one-third of the investors in our sample had a certain level of trading experience when they created the brokerage account; about 23% of investors had never traded before creating the account. Table 1 also provides information on investors net annual income and their liquid assets.

Please place Table 1 about here

We create several variables to proxy for investors' trading activities. First, we estimate the number of *trades* investors execute during a particular time period. We set the variable equal to zero if investors do not execute any trades during that time period. *Leverage* denotes the leverage of a trade; *short sale* is a dummy variable that takes a value of one if the trade takes a short position, and zero otherwise; a trade's *return on investment (ROI)* is the return on investment net of the transaction cost charged by the broker. We proxy for investors'

*attention* with their number of visits to the research pages provided by the broker in a given time period. Finally, we create two dummy variables considering gender and age (two groups of 18-44 years old, and 45+ years old).

Table 2 provides summary statistics of the trading variables in our dataset. Trading intensity is highly skewed, with a mean of .961 trades per week and a median of zero. The trading intensity of investors in our sample is comparable to previous studies (see, e.g., Nicolosi et al. 2009). Attention shows a similar skew, with 9.508 page visits per week, on average, and a median of zero. Note that we show summary statistics for investor attention only for those investors who make use of the research pages at least once during our sample period, thereby excluding several investors who never make use of this service of the broker.

Please place Table 2 about here

We use the Global Terrorism Database to establish our sample of terror events during our sample period. For this purpose, we select all major terror attacks in Europe in our sample period (where the number of casualties is at least ten, excluding the attackers). This results in a sample of seven events that are listed in Table 3.

Please place Table 3 about here

### **3. METHODOLOGY**

We use a standard difference-in-differences technique to investigate the impact of terror attacks on trading behavior. We compare investor behavior in a country that has experienced the terror attack to investors outside the country of attack. The underlying rationale is that the impact of the terror attack should be more pronounced in the country of attack. Using the full trading histories, we identify investors that were active in the immediate before- and aftermath of each terror event (14 days prior and 14 days after). We focus on a

14-day window before and after the attack for our estimation to mitigate the impact of potential time-variation in investors' trading activities. Formally, we estimate

$$Y_{it} = \beta_1 \cdot \text{Post attack}_{it} + \beta_2 \cdot \text{Attacked country}_i + \beta_3 \cdot \text{Post attack}_{it} \cdot \text{Attacked country}_i + \text{Controls}_{it} + e_{it}, \quad (1)$$

where Post attack is a dummy variable that equals one after the terror attack has occurred, regardless of whether investor  $i$  is in the country that has been attacked, and zero otherwise. The variable captures all effects that are relevant for both types of investors after the attack (treatment). Attacked country is a dummy variable equal to one for investors from the country of attack. It controls for time-invariant differences between the two types of investors. The interaction term between Post attack and Attacked country is the central term as its coefficient captures the change in behavior of treated investors that is related to being in a country that has experienced a terror attack. Our dependent variables are trades (number of equity trades executed in the 14-day window), leverage (average leverage used for trades in the 14-day window), short sales (the percent of equity transactions in the 14-day window that were short sales), and return on investment (ROI).

In additional specifications, we make use of three-way interactions in the spirit of Gruber (1994) and Puri, Rocholl, and Steffen (2011) to identify investors whose behavior is particularly affected by terrorist activity and the channels through which terrorist activity affects investor behavior.

## **4. RESULTS**

### **4.1. The impact of terrorist activity on investor behavior**

We begin our analysis by considering the central focus of our study, the overarching effects of terror attacks on investor behavior. We report these results in Table 4. To ease the



visualization, we show only the coefficients that are relevant for interpretation in the regression tables. We find that investors in our sample execute fewer trades, use less leverage, and engage in less short selling in the immediate aftermath of a terror attack. In particular, investors reduce their trading intensity by .46 trades over the 14-day window, with the lower end of the two standard deviation confidence interval indicating a reduction of .40 trades. Considering the average trading intensity of .961 trades per week (see Table 2), the effect size of the trading reduction in the two standard deviation confidence interval is between 20.8% and 27.5%, which is economically highly important. As the median number of trades for an investor in a given week is equal to zero, we additionally explore the variation in the effect of terror attacks on the trading intensity across investors by estimating quantile regressions. We visualize the results in Figure 1. The figure illustrates that particularly investors who trade frequently prior to the attacks reduce their trading intensity, while, mechanically, investors who were inactive prior to the event do not reduce their trading.

Table 4 also indicates that investors reduce their leverage-usage by 3.69. Here, the lower end of the two standard deviation confidence interval is just below 3, at 2.986. Finally, investors reduce their propensity to engage in short sales by 2.5%. The two standard deviation confidence interval ranges from -2.2% to -2.8%.

Please place Table 4 and Figure 1 about here

We investigate the parallel trend assumption of the difference-in-differences approach in Figure 2. We plot the average trading intensity, leverage-usage, and short sale propensity for all investors around the terror attacks. While we observe differences in levels between investors in our treatment and control group, the trends in trading activities prior to the attacks are parallel. Note that we capture pre-event differences by including *attacked country* in our difference-in-differences approach. Beyond providing insights into the parallel trends assumption, Figure 2 also indicates that all investors display a decrease in trading intensity,

leverage-usage, short sale propensity, and that these effects are stronger for investors in the country of attack. In particular, Panel a indicates that both, investors in the attacked country and in other countries reduce their trading intensity following terrorist activity; however, the reduction is larger in the country of attack, as also indicated by the negative loadings on the interaction term between Post attack and Attacked country in our main specification. While the trading intensity (Panel a) declines only over the days following the attack, the leverage-usage of investors in the attacked country immediately declines at the time of the attack (Panel b). Two weeks after the attack, the leverage-usage of treated and control investors follows a parallel trend, again. Panel c shows the evolution of short sales. Here, we observe a sharp decline in short sales for treated investors immediately following the attack, followed by an increase, before the treated and control investors follow a parallel trend again after approximately three weeks. Figure 2 also shows investors' average ROI around the terror attacks (Panel d). We further investigate investors' ROI in section 4.4.

Please place Figure 2 about here

As literature provides convincing evidence on gender differences in financial asset market behavior (see, e.g., Barber & Odean, 2001; Eckel & Füllbrunn, 2015; Wann & Lobo, 2010), we continue by exploring how gender moderates the investor response to terror attacks. In addition to the literature on gender differences in investor behavior there is significant literature showing that men and women differ with respect to their emotional regulation (Zimmermann & Iwanski, 2014), and thus would be expected to behave differently when experiencing an event that causes intense emotions such as fear or anger that are often associated with terror attacks (Lerner et al., 2003). We find that men in the country of attack decrease the number of executed trades to a larger extent as compared to women (coefficient of -0.309 on Attacked \* Post-attack \* Male). We do not observe statistically significant differences in leverage-usage and short sale propensity for male and female investors,

however. To ease interpretation, we provide additional graphs in Figure 3 that present the linear predictions based on the regression output (at the mean).

Please place Figure 3 about here

Next, we explore how age impacts the investor response to terror attacks as it has been shown that age is also an important factor in explaining investor behavior (Barber & Odean, 2001), and similarly to gender age also impacts individuals emotional regulation and thus could be hypothesized to impact how they respond to terror attacks (Zimmermann & Iwanski, 2014). Here, we find that older people in the country of attack are more likely to decrease their trading intensity (coefficient of -1.463 on Attacked \* Post-attack \* Age 45+).

Additionally, we explore if the number of deaths can explain the variation in findings. In other words, we ask whether a larger number of fatalities in a terror attack invokes a stronger emotional response by investors. We base this question on the recent work of Luo et al. (2020), who find that the effects of terror attacks on investor productivity are dependent on the fatality levels. We include a measure of fatalities as an additional interaction term in our model; however, the results (untabulated) show that fatalities do not explain variation among investors.

#### **4.2. Through which channel does terrorist activity influence investor behavior?**

In the following section, we discuss several channels through which terrorist activity may influence investor behavior. In particular, we investigate whether the impact of terror attacks on trading behavior may be explained through changes in investors' risk aversion, through changes in investors' expectations, through changes in investors' attention, or through personal experiences, i.e., trading losses.

##### **Risk aversion**

Terrorism has been found to cause strong emotional responses, such as fear and anger and these are associated with risk aversion (Lerner et al., 2003). Consequently, a potential explanation for our finding could be that exposure to terrorism increases investors' risk aversion, thereby driving the decrease in their trading activity. We address this channel by investigating the risk-taking of investors in the aftermath of terrorist activity. We have already provided evidence that investors take less risk following terror attacks in our main results. In particular, the leverage-usage provides a direct measure of risk-taking. The results in Table 4 indicate that investors use less leverage following terror attacks, thereby providing support to the argument that terrorist activity increases risk aversion.

We provide additional support for our argument by additionally studying investors' propensity to open new positions. By opening new positions, investors increase their market exposure. The increase in market exposure can be interpreted as a secondary measure for risk-taking, adding to the primary risk-taking measure leverage. We expect that an investor who is driven by fear should be less likely to open new positions.

Table 5 summarizes the results of our additional analysis. We again make use of equation 1 and use the opening of new positions as our dependent variable. The coefficient of interest on  $\text{Attacked} * \text{Post-attack}$  is negative (-0.233, t-statistic of 7.27), providing strong evidence that investors decrease their propensity to open new positions in the aftermath of terrorist activity. Taken together with our result on leverage-usage, these findings provide support for the increased risk aversion-channel.

Please place Table 5 about here

### **Market expectations**

Our main result is that investors decrease their trading activity in the immediate aftermath of a terror attack. It could be reasoned that the decrease in trading activity is rational

if investors have pessimistic market expectations, thus leading them to exit the market and decreasing their trading activity. However, as our results also show that investors decrease their propensity to engage in short selling (see Table 4), the market expectation explanation argument does not hold.

Table 6 separately studies investors' trading intensity for new long and new short positions. If investors reduce their trading activities due to negative market expectations, we should observe a negative coefficient for new long positions, indicating that investors decrease their propensity to open new long positions, and a positive coefficient for new short positions, indicating that investors increase their propensity to open new short positions. However, the results in Table 6 indicate the opposite. We show that investors' propensity to open long positions increases slightly (coefficient of 0.011, t-statistic of 1.79), while their short-selling intensity decreases significantly (coefficient of -0.09, t-statistic of 8.74).

In general, retail short selling has predictive ability for future (negative) stock returns (Kelley & Tetlock, 2016). Consequently, our observation that short selling decreases indicates positive market expectations. Thus, we cannot explain the decrease in trading activities and leverage-usage with negative market expectations.

Please place Table 6 about here

### **The attention channel**

One potential explanation for our results could be that investors are not necessarily more risk-averse but instead are distracted by the terror attack and as a result not focused on the stock market (Barber & Odean, 2013; Dellavigna & Pollet, 2009; Hirshleifer, Lim, & Teoh, 2009; Huang, Huang, & Lin, 2019). If investors pay less attention to the stock market, then we would expect them to naturally decrease their trading activity. To investigate whether reduced attention is driving their behavior, we follow several recent studies that proxy

investor attention at the individual level using data on investors' research activity on stock-related information (e.g., Gargano and Rossi, 2018). Specifically, the broker offers clients the ability to access research pages, where clients can browse research and market-related insights. We posit that if our effects are driven by decreased attention, then we should also see a decrease in their visits to these research pages. Consequently, we study investors' research activities, i.e., the investor attention at the individual level in a difference-in-difference approach analogous to our main analysis (see equation 1). Unfortunately, data on investors' research activities is only available from June 2015. Thus, we can only investigate the attention channel for six of our seven terror attacks. Several investors in our data never make use of the research pages, likely obtaining their information from different sources such as yahoo finance and others. Consequently, we restrict our analysis to investors who access the research pages of the broker at least once during our sample period to ensure that the investor is an active consumer of research.

The results of our analysis are summarized in Table 7. Model 1 indicates that investors do not meaningfully decrease their financial attention after a terror attack, as the coefficient of interest on *attacked* \* *post-attack* is statistically not different from zero (t-statistic of 1.45).

Nonetheless, some investors may be distracted by terrorist activities and, as a result, decrease their trading activities. To account for this possibility, we estimate the change in attention at the individual investor level and include the change in investor attention in the aftermath of the terror attack in a three-way interaction with *attacked* and *post-attack*. The coefficient on the three-way interaction term is statistically not different from zero (Model 2, t-statistic of 0.03), allowing us to draw the conclusion that our results are not driven by the attention channel.

Please place Table 7 about here

### **The personal experience channel**

Another potential explanation for our findings could be that the decrease in trading activity could be attributed to negative personal experiences. Specifically, investors may be less active because they have experienced losses and, as a result, actively shy away from risk (Andersen, Hanspal, & Nielsen, 2019). Given that the personal losses are large, they could also be considered a wealth effect. To consider this personal experience channel, we take the losses of investors following the attack, as this provides us with a proxy for investors' personal investment experiences. Then, we include the trading losses as an additional interaction term in our main specification.

The results of our analysis are summarized in Table 8. Note that we define trading losses as positive values and trading gains as negative values to simplify the interpretation of our regression results. The coefficient of interest on our three-way interaction is negative (-0.041) and statistically different from zero (t-statistic 2.28), lending support to the personal experience channel. Investors from the attacked country who make negative personal experiences at the time of the attack particularly decrease their trading activities.

Please place Table 8 about here

### **4.3. The impact of terrorist activity on foreign investors**

In our main results, we observe a change in investor behavior both in the country of attack as well as in our control group, with the effect being stronger in the country of attack (see Figure 3). We now attempt to extend our findings and consider the role of cultural distance to explain variation among investors in countries that were not attacked. We posit that the effects may be stronger in countries that are culturally closer to the country of attack and weaker in countries that are culturally distant. To measure cultural distance, we use the

approach of Kogut and Singh (1988). We calculate the distance using Hofstede's six cultural dimensions and estimate the square root of the sum of the squared distances of all six cultural dimensions between the investor country and the country where the attack occurred. Based on this, we form a *high cultural distance* dummy variable that takes the value of one if the cultural distance is above the median. We report these results in Table 9.

Please place Table 9 about here

The coefficient of interest in our three-way interaction is positive for all three models, indicating that there is a relationship between cultural distance and how investors behave in the aftermath of a terror attack. In essence, we find that investors who are from countries that are culturally distant to the country of attack have higher trading intensity, use more leverage, and engage in more short-selling as compared to investors in countries that are culturally close to the country of attack. In other words, investors who are from a country that is culturally close to the country of attack are more likely to behave as investors who are from the attacked country.

#### **4.4. Performance implications of investors' reduced trading activities**

Finally, we investigate the potential performance implications of investors' reduction in trading in response to terrorist activity. To this end, we estimate the reduction in the trading intensity of investors in the aftermath of a terror attack and include this estimate in a three-way interaction with *attacked* and *post-attack*. Note that we define a trading reduction as positive values and an increase in trading as negative values to simplify the interpretation of our regression results. We report the results of our analysis in Table 10. While the coefficient on *Attacked \* Post-attack* is statistically not different from zero (Model 1, t-statistic 0.78), we find a positive coefficient on *Attacked \* Post-attack \* Trading reduction* (0.0001, t-statistic of 2.10). This indicates that, while we do not observe changes in investors' profitability in



general, investors in the attacked country who reduce their trading activities realize a larger ROI in the aftermath of an attack. In other words, the decrease in trading activity leads to an increase in investors' return on investments. Models (2) through (5) indicate that this increase is particularly pronounced for female and younger investors.

Please place Table 10 about here

Panel d of Figure 2 shows investors' average ROI around the terror attacks. We observe a clear parallel trend before the terrorist activity. However, following the terror attacks, we find that investors in the treatment group realize, on average, higher returns.

## **5. CONCLUSION**

In this paper, we explored how terror attacks impact individual investor behavior. As such, we contribute to previous research around the effects of terrorism on financial markets, where previous work has been dominated by studies focusing on the impact on stock markets as a whole instead of individuals. The limited evidence on individual behavior was generally focused on national data or using broad proxies of risk, such as aggregate mutual fund flows (Levy & Galili, 2006; Wang & Young, 2020). We found that terror attacks have a significant impact on individual investor behavior, as investors decrease their trading activity and use less leverage in the immediate aftermath of a terror attack, consistent with the negative stock market returns following terror attacks documented in the literature (Drakos, 2010). Additionally, our findings are consistent with Wang and Young (2020), who find that terrorist attacks are associated with decreases in aggregate equity fund flows.

Our findings are observed for investors across the world, with effects being stronger for those in the country of attack. The decrease in trading activity has a slightly positive impact on the returns of investors. Furthermore, we find that men and older people display stronger effects than women and young people when it comes to decreases in trading activity.

As we found that risk aversion and personal experiences appear to drive this reduction, the gender results may be most likely attributed to documented differences in emotional regulation (Zimmermann & Iwanski, 2014). Our results with respect to age may also be explained through an emotional regulation lens, as it impacts how individuals respond to emotional events. Additionally, the stronger response of older investors could also be linked to criminology literature that shows the level of fear to be different across age groups, with older people generally being more fearful (Koeber & Oberwittler, 2019).

In our attempt to understand why there is a change in investor behavior, we explored a number of potential channels through which the effect may be explained. We found support for the effect being driven by risk aversion, as investors not only decrease their leverage-usage but are also less likely to open new positions. On the other hand, we did not find any evidence to support that negative market expectations explains our findings. The propensity to engage in short-sales decreased, whereas the opposite effect is found for long positions, both indicating that investors have positive market expectations. Furthermore, we also did not find any evidence of investors trading less because they paid less attention to trading, as we found they accessed research on the brokerage to the same extent as prior to the terror-attacks. In contrast, we found support for the change in behavior being partially driven by personal experience, as investors who experience trading losses in the month of the attack decrease their trading activities to a larger extent. However, it is important to note that we are not necessarily able to conclude that risk aversion and personal experience are two non-overlapping channels, as the negative personal experience may increase risk aversion in general.

Our study suffers from several limitations. The use of brokerage data means that our sample suffers from self-selection. However, it would be almost impossible to provide representative data on individual investor behavior on a large international scale, and even

experimental work would be difficult and still suffer from issues surrounding external validity. Additionally, it could be argued that our sample period is selected at random. We focus on the period of 2015 to 2017, as this was a period with an unusually high number of terror attacks in European countries, and because it fell within the period of time that we had available data for. Furthermore, our classification of nationality is based on primary citizenship, as this is verified as a part of the account opening process, and we are not able to compare our results to the country of residence due to data availability. However, we believe that using citizenship data is a better test for our purposes as most first-generation immigrants and expatriates have strong ties to their country of origin. The treatment group in our study consists of developed nations that could be argued to have effects on the global economy. Consequently, our results cannot be used to infer the effects of a terror attack in a developing nation. We hope future researchers can explore this issue. Finally, our data does not contain the dollar value of each trade. Thus, while we observe a decrease in trading intensity, it is unlikely but still possible that investors may be trading more, in terms of absolute dollar value. Notwithstanding our limitations, we believe that we provide a significant contribution to the literature on emotions in investment behavior, and specifically the effects of terror attacks on investor behavior, and provide initial insights that may inform future research that attempts to explore this topic further.

## REFERENCES

- Andersen, S., Hanspal, T., & Nielsen, K. M. (2019). Once bitten, twice shy: The power of personal experiences in risk taking. *Journal of Financial Economics*, 132(3), 97-117. doi:<https://doi.org/10.1016/j.jfineco.2018.10.018>
- Arin, K. P., Ciferri, D., & Spagnolo, N. (2008). The price of terror: The effects of terrorism on stock market returns and volatility. *Economics Letters*, 101(3), 164-167. doi:<https://doi.org/10.1016/j.econlet.2008.07.007>
- Barber, B. M., & Odean, T. (2001). Boys will be Boys: Gender, Overconfidence, and Common Stock Investment\*. *The Quarterly Journal of Economics*, 116(1), 261-292. doi:10.1162/003355301556400
- Barber, B. M., & Odean, T. (2013). The behavior of individual investors. In *Handbook of the Economics of Finance* (Vol. 2, pp. 1533-1570): Elsevier.
- Brown, C., Dark, J., & Davis, K. (2010). Exchange traded contracts for difference: Design, pricing, and effects. *Journal of Futures Markets*, 30(12), 1108-1149. doi:10.1002/fut.20475
- Dellavigna, S., & Pollet, J. M. (2009). Investor Inattention and Friday Earnings Announcements. *The Journal of Finance*, 64(2), 709-749. doi:10.1111/j.1540-6261.2009.01447.x
- Drakos, K. (2010). Terrorism activity, investor sentiment, and stock returns. *Review of Financial Economics*, 19(3), 128-135. doi:<https://doi.org/10.1016/j.rfe.2010.01.001>
- Eckel, C. C., & Füllbrunn, S. C. (2015). Thar SHE Blows? Gender, Competition, and Bubbles in Experimental Asset Markets. *American Economic Review*, 105(2), 906-920. doi:10.1257/aer.20130683
- Gruber, J. (1994). The Incidence of Mandated Maternity Benefits. *The American Economic Review*, 84(3), 622-641.

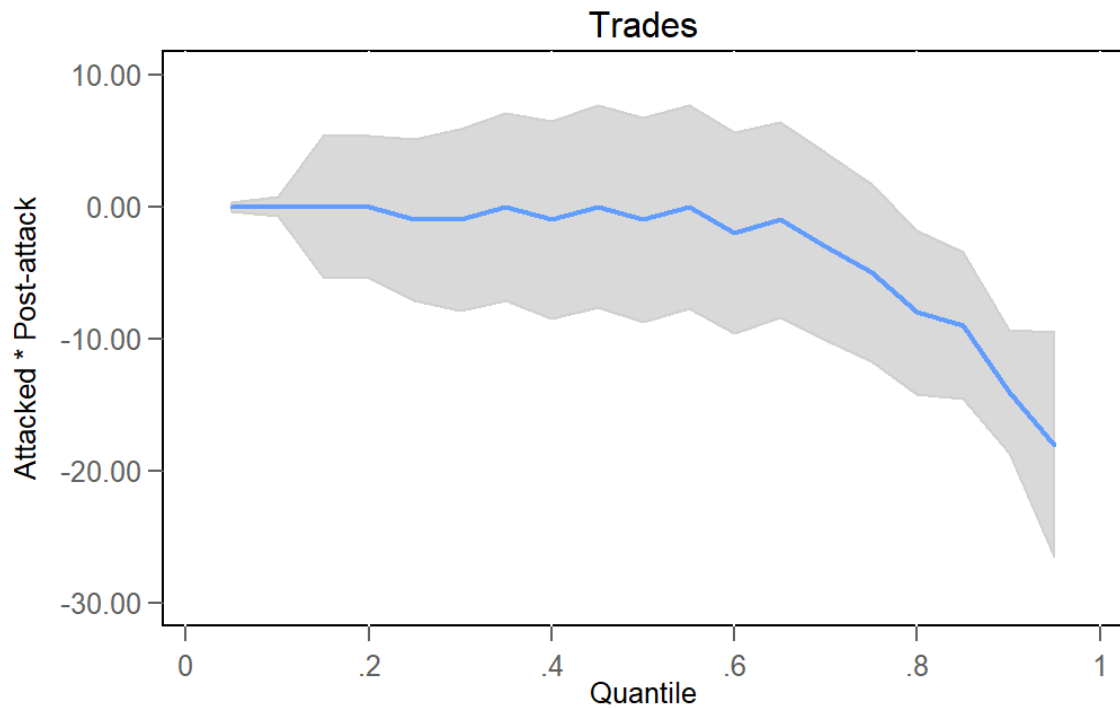
- Heimer, R., & Simsek, A. (2019). Should retail investors' leverage be limited? *Journal of Financial Economics*, 132(3), 1-21. doi:<https://doi.org/10.1016/j.jfineco.2018.10.017>
- Hirshleifer, D., Lim, S. S., & Teoh, S. H. (2009). Driven to Distraction: Extraneous Events and Underreaction to Earnings News. *The Journal of Finance*, 64(5), 2289-2325. doi:10.1111/j.1540-6261.2009.01501.x
- Huang, S., Huang, Y., & Lin, T.-C. (2019). Attention allocation and return co-movement: Evidence from repeated natural experiments. *Journal of Financial Economics*, 132(2), 369-383. doi:<https://doi.org/10.1016/j.jfineco.2018.10.006>
- Kamstra, M. J., Kramer, L. A., Levi, M. D., & Wermers, R. (2017). Seasonal Asset Allocation: Evidence from Mutual Fund Flows. *Journal of Financial and Quantitative Analysis*, 52(1), 71-109. doi:10.1017/S002210901600082X
- Kelley, E. K., & Tetlock, P. C. (2016). Retail Short Selling and Stock Prices. *The Review of Financial Studies*, 30(3), 801-834. doi:10.1093/rfs/hhw089
- Koerber, G., & Oberwittler, D. (2019). How older people became less afraid of crime—An age-period-cohort analysis using repeated cross-sectional survey data. *Social Science Research*, 79, 211-225. doi:<https://doi.org/10.1016/j.ssresearch.2018.10.010>
- Kogut, B., & Singh, H. (1988). The Effect of National Culture on the Choice of Entry Mode. *Journal of International Business Studies*, 19(3), 411-432. doi:10.1057/palgrave.jibs.8490394
- Kollias, C., Manou, E., Papadamou, S., & Stagiannis, A. (2011). Stock markets and terrorist attacks: Comparative evidence from a large and a small capitalization market. *European Journal of Political Economy*, 27, S64-S77. doi:<https://doi.org/10.1016/j.ejpoleco.2011.05.002>

- Lerner, J. S., Gonzalez, R. M., Small, D. A., & Fischhoff, B. (2003). Effects of Fear and Anger on Perceived Risks of Terrorism: A National Field Experiment. *Psychological Science*, 14(2), 144-150. doi:10.1111/1467-9280.01433
- Levy, O., & Galili, I. (2006). Terror and trade of individual investors. *The Journal of Socio-Economics*, 35(6), 980-991. doi:<https://doi.org/10.1016/j.socec.2005.11.019>
- Linnainmaa, J. T. (2003). *The anatomy of day traders*. Paper presented at the AFA 2004 San Diego Meetings.
- Luo, Y., Chen, Y., & Lin, J.-C. (2020). *Shocks and Inventor Productivity: Evidence from Terrorist Attacks*. Working Paper.
- Nicolosi, G., Peng, L., & Zhu, N. (2009). Do individual investors learn from their trading experience? *Journal of Financial Markets*, 12(2), 317-336.  
doi:<https://doi.org/10.1016/j.finmar.2008.07.001>
- Puri, M., Rocholl, J., & Steffen, S. (2011). Global retail lending in the aftermath of the US financial crisis: Distinguishing between supply and demand effects. *Journal of Financial Economics*, 100(3), 556-578.  
doi:<https://doi.org/10.1016/j.jfineco.2010.12.001>
- Saurabh, S., & Dey, K. (2020). Unraveling the relationship between social moods and the stock market: Evidence from the United Kingdom. *Journal of Behavioral and Experimental Finance*, 26, 100300. doi:<https://doi.org/10.1016/j.jbef.2020.100300>
- Taffler, R. (2018). Emotional finance: investment and the unconscious. *The European Journal of Finance*, 24(7-8), 630-653. doi:10.1080/1351847X.2017.1369445
- Wang, A. Y., & Young, M. (2020). Terrorist attacks and investor risk preference: Evidence from mutual fund flows. *Journal of Financial Economics*.  
doi:<https://doi.org/10.1016/j.jfineco.2020.02.008>

Wann, C. R., & Lobo, B. J. (2010). Gender-based trading: evidence from a classroom experiment. *Journal of Economics and Finance Education*, 9(2), 54-61.

Zimmermann, P., & Iwanski, A. (2014). Emotion regulation from early adolescence to emerging adulthood and middle adulthood: Age differences, gender differences, and emotion-specific developmental variations. *International Journal of Behavioral Development*, 38(2), 182-194. doi:10.1177/0165025413515405

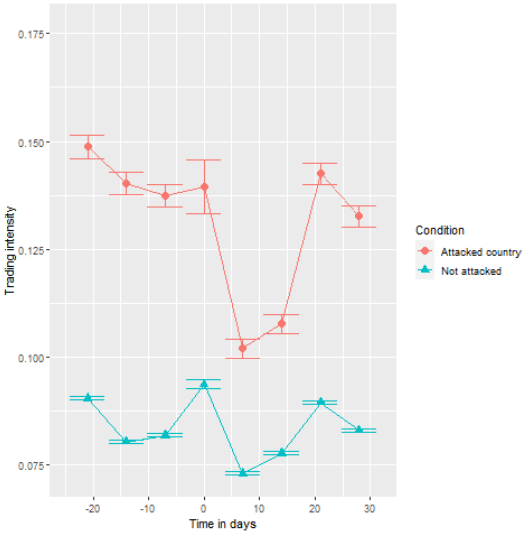
**Figure 1. Quantile regressions on investors' trading intensity**



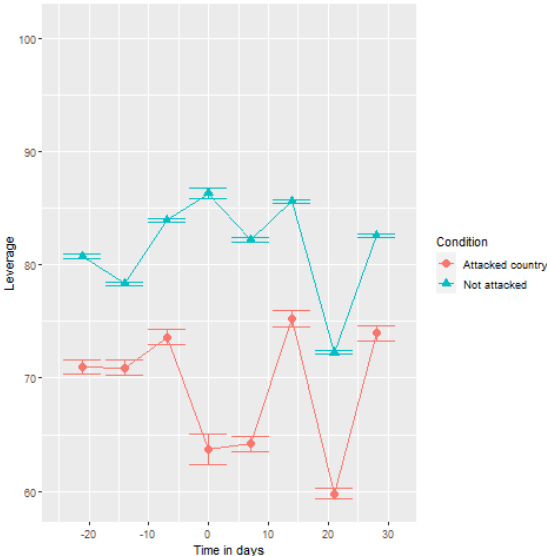
Note: This figure shows regression results of quantile regressions for the effect of terror attacks on the trading intensity of investors. The figure visualizes the coefficient of interest (attacked \* post-attack) for each quantile together with the confidence interval. Trades is the number of trades investors execute.



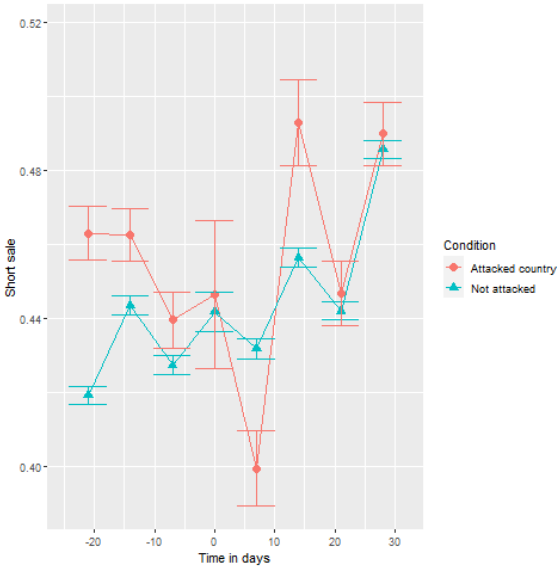
**Figure 2. Trading behavior around terror attacks**



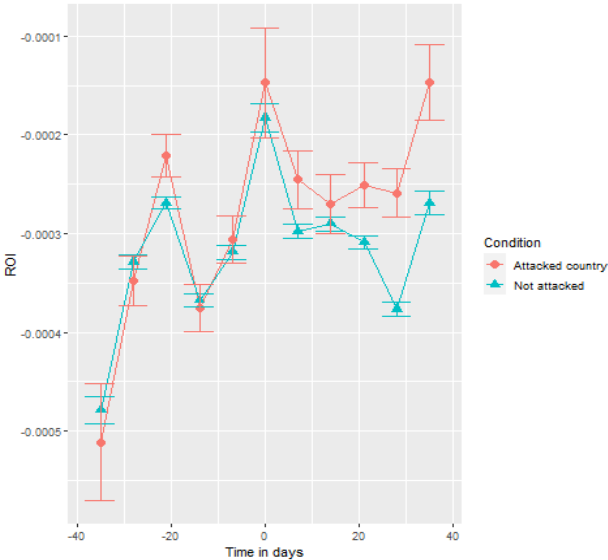
(a) Trades



(b) Leverage



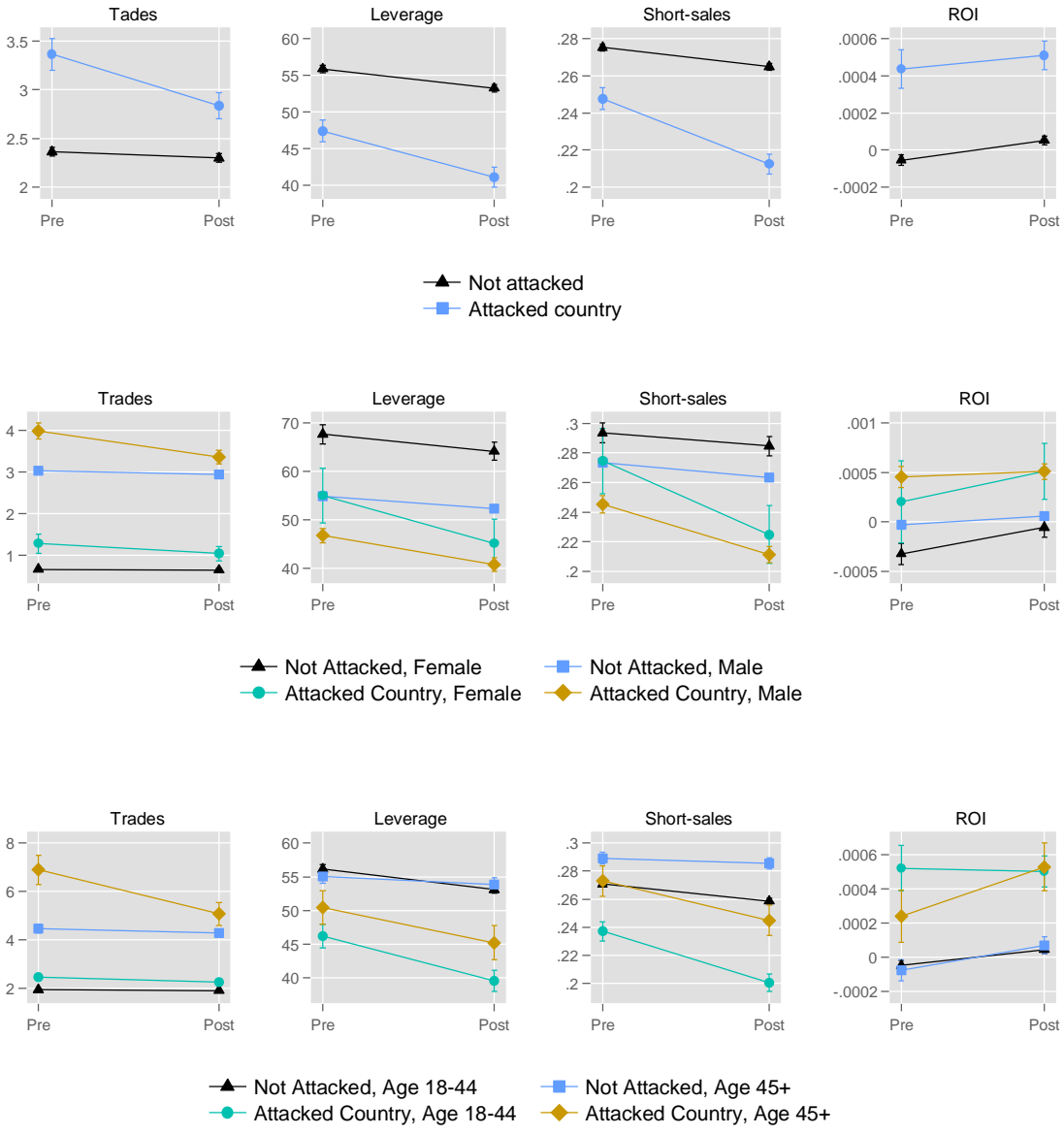
(c) Short sales



(d) ROI

Note: This figure presents the average trading intensity (number of trades), the average leverage-usage, the average fraction of short positions, and the average ROI for investors around the terror attacks, together with 95% confidence intervals. The data are from a discount brokerage firm that offers a trading platform to retail investors under a UK broker license.

**Figure 3. Effects of Terrorism on Investor Behavior**



Note: This figure illustrates linear predictions (at the mean), together with 95% confidence intervals. Linear predictions are based on the results of OLS regressions in Table 4. Pre- and post-periods both relate to 14-day windows prior and after a terror attack. Trades is the number of trades investors execute. We set the variable equal to zero if investors do not execute any trades during the time period. Leverage denotes the average leverage of a trade. Short sale is the proportion of trades that are short sales. Return on investment (ROI) is the return on investment net of the transaction cost charged by the broker.

**Table 1. Demographic information**

<b>Variable</b>	<b>Categories</b>						
<b>Gender</b>	<b>Male</b>	<b>Female</b>	<b>Missing</b>				
	82.47%	9.47%	8.07%				
<b>Age</b>	<b>18-24</b>	<b>25-34</b>	<b>35-44</b>	<b>45-54</b>	<b>55-64</b>	<b>65&gt;</b>	<b>Missing</b>
	6.86%	38.50%	26.88%	12.16%	5.25%	1.95%	8.40%
<b>Income (thousands \$)</b>	<b>10&lt;</b>	<b>10-50</b>	<b>50-200</b>	<b>200-1000</b>	<b>1000&gt;</b>	<b>Missing</b>	
	17.46%	49.32%	23.52%	0.82%	0.94%	7.96%	
<b>Liquid assets (thousands \$)</b>	<b>10&lt;</b>	<b>10-50</b>	<b>50-200</b>	<b>200-1000</b>	<b>1000&gt;</b>	<b>Missing</b>	
	37.92%	37.63%	11.93%	1.14%	1.06%	10.32%	
<b>Trading experience (years)</b>	<b>None</b>	<b>1&lt;</b>	<b>1</b>	<b>1-3</b>	<b>3&gt;</b>	<b>Missing</b>	
	23%	16%	24%	20%	13%	4%	

Note: The table reports an overview of the demographic distribution of investors in our data. In total, our sample contains trading data from 668,067 investors.

**Table 2. Summary statistics**

	<b>N</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min</b>	<b>P25</b>	<b>Median</b>	<b>P75</b>	<b>Max</b>
<b>Trading intensity</b>								
Trades per week	57,429,581	0.961	4.783	0	0	0	0	37
<b>Trading characteristics</b>								
Leverage	42,896,634	88.366	115.650	1	10	50	100	400
Short sale	42,896,634	0.364	0.481	0	0	0	1	1
Return on investment	41,527,314	-0.0002	0.004	-0.016	-0.001	0.0002	0.001	0.012
<b>Investor attention</b>								
Page visits per week	10,163,436	9.508	38.254	0	0	0	0	278

Note: The table reports summary statistic for the variables in our dataset. Trades is the number of trades investors execute in a given week. Leverage denotes the leverage of a trade. Short sale is a dummy variable that takes a value of one if the trade takes a short position, and zero otherwise. Return on investment (ROI) is the return on investment net of the transaction cost charged by the broker. Page visits is the number of times the investor visits the research pages provided by the broker in a given week.

**Table 3. List of terror attacks in the sample**

<b>Country</b>	<b>Day</b>	<b>Month</b>	<b>Year</b>	<b>Deaths</b>
France	7	January	2015	17
France	13-14	November	2015	130
Belgium	22	March	2016	32
France	14	July	2016	86
Germany	19	December	2016	12
United Kingdom	22	May	2017	22
Spain	16	August	2017	16

**Table 4. Effects of terrorism on investor behavior**

	Main effects			Gender effects			Age effects		
	(1) Trades	(2) Leverage	(3) Short sales	(4) Trades	(5) Leverage	(6) Short sales	(7) Trades	(8) Leverage	(9) Short sales
Attacked * Post-attack	-0.464*** (0.0642)	-3.691*** (0.705)	-0.0250*** (0.00314)	-0.222*** (0.0833)	-6.321** (2.961)	-0.0410*** (0.0116)	-0.162*** (0.0586)	-3.533*** (0.858)	-0.0245*** (0.00373)
Attacked * Post-attack * Male				-0.309*** (0.115)	2.861 (3.048)	0.0174 (0.0121)			
Attacked * Post-attack * Age 45+							-1.463*** (0.227)	-0.401 (1.490)	0.000233 (0.00695)
Observations	4,313,265	386,240	386,240	4,313,265	386,240	386,240	4,313,265	386,240	386,240
Adj. R2	0.1%	0.1%	0.2%	0.2%	0.3%	0.2%	0.2%	0.1%	0.3%

Note: The table shows regression results for the effect of terror attacks on the trading activity of investors. The dependent variable of each regression is stated in the header row. The time window is 14-days prior to and after each terror attack. Trades is the number of trades investors execute. We set the variable equal to zero if investors do not execute any trades during the time period. Leverage denotes the average leverage of executed trades. Short sale is the proportion of trades that are short sales. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. Trades regressions includes all investors in the sample (including non-trading), whereas leverage and short-sales regressions are conditional on trading. For interpretability, we show only the variables of interest; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5. The risk aversion channel**

	(1) Trading intensity New positions
Attacked * Post-attack	-0.233*** (0.032)
Observations	4,313,265
Adj. R2	0.1%

Note: The table shows regression results for the effect of terror attacks on the trading intensity for new positions of investors. The dependent variable is the number of new established positions. The time window is 14-days prior to and after each terror attack. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. For interpretability, we show only the variables of interest; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6. The expectations channel**

	(1)	(2)
	Trading intensity New long positions	Trading intensity New short positions
Attacked * Post-attack	0.011* (0.006)	-0.094*** (0.011)
Observations	3,499,384	1,132,366
Adj. R2	0.1%	0.1%

Note: The table shows regression results for the effect of terror attacks on the trading intensity for new long and short positions of investors. The dependent variables are the number of new positions that are long and short, respectively. The time window is 14-days prior to and after each terror attack. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. For interpretability, we show only the variables of interest; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$



**Table 7. The attention channel**

	(1)	(2)
	Attention	Trades
Attacked * Post-attack	0.804 (0.556)	-0.457*** (0.063)
Delta attention		-0.047*** (0.003)
Attacked * Post-attack * Delta attention		-0.000 (0.013)
Observations	916,733	4,313,265
Adj. R2	0.1%	0.6%

Note: The table shows regression results for the effect of terror attacks on the attention and trading intensity of investors. The dependent variables are attention and trades. The time window is 14-days prior to and after each terror attack. Attention is the number of times the investor visits the research pages provided by the broker. Delta attention is the change in the attention variable from one 14-day period to the next. Trades is the number of trades investors execute. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. For interpretability, we show only the variables of interest; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 8. The personal experience channel**

	(1) Trades
Attacked * Post-attack	-0.490*** (0.066)
Attacked * Post-attack * trading loss	-0.041** (0.018)
Observations	4,311,254
Adj. R2	0.1%

Note: The table shows regression results for the effect of terror attacks and the experience of trading loss on the trading intensity of investors. The time window is 14-days prior to and after each terror attack. Trades is the number of trades investors execute. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. Trading loss is the loss of the investor during the month of the attack; losses take positive values, while trading gains take negative values. We show only the variables of interest for interpretability; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 9. The effect of cultural distance**

	(1) Trades	(2) Leverage	(3) Short sales
Post-attack *	0.171***	2.521***	0.00530***
High cultural distance	(0.0259)	(0.434)	(0.00188)
Observations	3,950,135	359,728	359,728
Adj. R2	0.1%	0.1%	0.1%

Note: The table shows regression results for the effect cultural distance has on how investors behave after a terror attack. The dependent variable of each regression is stated in the header row. The time window is 14-days prior to and after each terror attack. Trades is the number of trades investors execute. Leverage denotes the average leverage of a trade. Short sale is the proportion of trades that are short sales. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. Trades includes all investors in the sample (including non-trading), whereas leverage and short-sales regressions are conditional on trading. High cultural distance is a dummy variable that takes the value of one if the cultural distance is above the median, and zero otherwise. We calculate the distance using Hofstede's six cultural dimensions and estimate the square root of the sum of the squared distances of all six cultural dimensions between the investor country and the country where the attack occurred. For interpretability, we show only the variables of interest; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 10. The impact on performance**

	(1)	(2)	(3)	(4)	(5)
	<b>ROI</b>	<b>ROI</b>	<b>ROI</b>	<b>ROI</b>	<b>ROI</b>
	<b>All</b>	<b>Male</b>	<b>Female</b>	<b>Young</b>	<b>Old</b>
	<b>investors</b>	<b>investors</b>	<b>investors</b>	<b>investors</b>	<b>investors</b>
Attacked * Post-attack	-0.0053 (0.0068)	-0.0059 (0.0071)	0.0033 (0.0259)	-0.0147* (0.0085)	0.0127 (0.0111)
Attacked * Post-attack * Trading reduction	0.0001** (0.0001)	0.0001* (0.0001)	0.0004** (0.0002)	0.0003** (0.0001)	0.0001 (0.0000)
Observations	382,132	351,499	29,940	287,177	93,169
Adj. R2	0.1%	0.1%	0.1%	0.1%	0.1%

Note: The table shows regression results for the effect of trading reduction on the return of investment. The time window is 14-days prior to and after each terror attack. The dependent variable is the return on investment (ROI) by net of the transaction cost charged by the broker. Attacked is a dummy variable that takes the value of one for investors from a country that has experienced a terror attack, and zero otherwise. Post-attack is a dummy variable that takes the value of one if the time-period is after the terror attack has occurred, and zero otherwise. Trading reduction is the change in the trades variable from one 14-day period to the next; positive values indicate a decrease in trading, while negative values indicate an increase. For interpretability, we show only the variables of interest; however, all main effects and interactions are included in the models. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1