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Terrorism, institutional environment, and corporate cash holdings

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ABSTRACT

Using a sample of firms from 35 countries from 2002 to 2019, we investigate the effect of terrorism on corporate cash holdings. We find a significant positive relationship between terrorism and corporate cash holdings. This effect is more pronounced for firms operating in countries with weaker institutional environments and less risk-oriented cultures. Further analysis suggests that increased informational opacity, high earnings and cash flow volatility, higher cost of debt, and lower payout ratio are plausible channels through which terrorism influences firms' cash holdings. Finally, we show that higher cash holdings help mitigate the negative effects of terrorism on investment. This finding supports the precautionary savings theory, highlighting how firms maintain financial flexibility to enhance organizational resilience in the face of terrorism-related risks.

1. Introduction

Terrorism, defined as threatened or actual use of illegal force and violence by a non-state actor to achieve a political, economic, religious, or social objective through fear, coercion, or intimidation (Institute for Economics and Peace [IEP], 2019), has long represented a significant global threat. Due to its growing prevalence worldwide, academic literature has extensively examined its economic implications. Several studies document negative effects of terrorism on economic activity (Abadie and Gardeazabal, 2003, 2008; Abrahms et al., 2019; Czinkota et al., 2010; Li et al., 2022; Liu and Li, 2020). Specifically, terrorism has been linked to reduced corporate social responsibility investments (Abrahms et al., 2019), lower R&D expenditures (Li et al., 2022), and diminished merger and acquisition (M&A) activity (Ouyang and Rajan, 2017). These findings suggest that terrorism disrupts firms' investment decisions, thereby exerting unfavourable long-term economic consequences for businesses, investors, and overall market stability. Despite the well-documented economic repercussions of terrorism, there remains a dearth of research on how companies around the world adjust their financial policies in response to heightened terrorism risk. In a recent study, Kim et al. (2022) examine and find that terrorist attacks influence corporate cash policies, using data from US-based firms. However, their finding may not be universally applicable to other countries due to varying institutional frameworks across countries that shape firms' cash management strategies. Besides,

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terrorism is a global concern and cash management policies are critical not only in the US but also across diverse economic landscapes. In particular, liquidity management plays a vital role in countries where capital markets are either underdeveloped or prone to instability.

This study advances our understanding of the impact of terrorism on firms' cash policies around the globe. Specifically, we investigate whether companies alter their cash holdings policies as a precautionary response to increased terrorism risk or the likelihood of future attacks in an international setting. We then examine the role of country-level institutional environments (formal and informal institutional environments) in shaping the relationship between terrorism and corporate cash holdings. We also assess whether changes in cash holdings mitigate the detrimental impact of terrorism on firms' real economic activities.

Corporate cash holdings play a critical role in enhancing financial flexibility and mitigating transaction costs (Campello et al., 2010; Graham and Harvey, 2001). More importantly, cash holdings are of paramount importance in financing investments and innovation, which are vital for long-term firm value and growth (Duchin et al., 2010; Fresard and Salva, 2010). Understanding how firms adjust their cash holdings in response to terrorism risk not only contributes to the literature on the economic consequences of terrorism but also provides valuable insights into corporate risk management and financial decision-making in uncertain environments.

To examine the relationship between terrorism and cash holdings, we focus on the precautionary savings motive theory, which indicates that firms increase their cash reserves to hedge against potential adverse shocks in internal financing and costly external capital constraints. Heightened financing frictions and increased cash flow risks during uncertain periods can restrict firms' access to external funding, necessitating higher cash reserves to support valuable investment opportunities (Almeida et al., 2004; Duchin et al., 2010).[1] Consistent with this perspective, prior research finds a positive relationship between economic policy uncertainty and corporate cash holdings (Li, 2019), while survey evidence suggests that firms maintain excess cash reserves to absorb unexpected financial shocks during downturns (Lins et al., 2010).

Drawing on the precautionary savings theory of cash holdings, we expect a positive relationship between terrorism and corporate cash holdings, driven by the increased risk and uncertainty that terrorism imposes on firms (Abadie and Gardeazabal, 2008; Kuang et al., 2023; Li et al., 2022). Terrorism disrupts business operations by destabilizing global supply chains (Czinkota et al., 2010), reducing market demand (Becker and Rubinstein, 2004), and raising the cost of financing (Abadie and Gardeazabal, 2008). Heightened firm-level uncertainty and performance volatility are a few economic consequences of terrorist attacks (Abadie and Gardeazabal, 2008; Joint Economic Committee of US Congress, 2002). According to the Joint Economic Committee of the US Congress' 2002 report on the economic costs of terrorism, "an immediate effect of terrorist attack, after all, was a dramatic increase in uncertainty and market volatility." To the extent that terrorism increases risks and uncertainty for businesses (Abadie and Gardeazabal, 2008; Kuang et al., 2023; Li et al., 2022), firms are likely to strengthen their precautionary savings motive by holding larger cash balances.

We further consider the country's institutional environment's role in the link between terrorism and corporate cash holdings. First, we consider the role of the formal institutional environment. Previous studies (La Porta et al., 1998; Leuz et al., 2003) document that strong country-level formal institutions help provide better protection to shareholders and creditors and reduce self-interested managers' tendency to waste internal free cash flow, such as investing in negative NPV projects for their own interests. Along this line, firms from countries with stronger (weaker) institutional environments may be less (more) prone to the free cash flow problem by Jensen and Meckling (1976) and Jensen (1986), and hence less (more) vulnerable during a high uncertainty period because of the availability (shortage) of internal savings. Besides, prior research also suggests that country-level external governance mechanisms and institutions are generally characterized by a significant public equity market development, which in turn facilitates firms' access to external financing (La Porta et al., 1998). Applying insights from these studies in our setting, we expect a weaker (stronger) precautionary saving motive for firms from countries with stronger (weaker) institutional environments and hence a lower (higher) propensity to increase cash holdings. Consistent with this view, Dittmar et al. (2003) show that firms in countries with weaker shareholder protection tend to hold more cash. Therefore, we expect quality formal institutions to moderate the positive relationship between terrorism and cash holdings.

Second, we consider the role of the informal institutional environment. Specifically, we focus on the country's cultural values of uncertainty avoidance, long-term orientation, and individualism in the relationship between terrorism and cash holdings. Cultures high on uncertainty avoidance typically experience more anxiety about the future and emphasize acting more cautiously relative to cultures low on uncertainty avoidance. Cultures high on long-term orientation are characterized by patience, perseverance, and high uncertainty avoidance. Cultures high on individualism emphasize individual freedom and achievement and exhibit high confidence about the future, hence underestimating the impact of future events. Intuitively, cultures high on uncertainty avoidance, long-term orientation, and low on individualism are more likely to put greater emphasis on the precautionary saving motives because they are less tolerant of risks and feel more anxious about future uncertainty, and as a result, increase their cash holdings in response to terrorism risk. Consistent with this view, prior studies show that uncertainty avoidance and long-term orientation positively correlate with cash holdings (Chang & Noorbakhsh, 2009; Chen et al., 2015), while individualism negatively correlates with corporate cash

[1] Anecdotal evidence underscores the role of precautionary savings during periods of heightened uncertainty. For example, following the September 11, 2001, terrorist attacks, American Airlines and other major carriers significantly increased their cash reserves. The attacks triggered a sharp decline in air travel demand, escalated security-related expenses, and introduced substantial operational uncertainty. In response, airlines accessed credit lines and bolstered liquidity buffers to navigate the financial shock and safeguard against future disruptions. This behavior aligns with the theory of precautionary cash hoarding, wherein firms accumulate excess cash to mitigate the risks posed by unforeseen events—such as those related to terrorism.

holdings (Chen et al., 2015). Accordingly, we expect to observe a greater effect of terrorism on cash holdings in countries with high uncertainty avoidance and long-term orientation cultures and a reduced effect in countries with high individualistic cultures.

We examine the effect of terrorism on corporate cash holdings and the moderating role of institutional environment in such a relationship using a comprehensive sample of 224,732 firm-year observations across 35 countries from 2002 to 2019. We follow previous work (e.g., Abadie and Gardeazabal, 2003; Moser, 2020) and use the IEP's Global Terrorism Index (GTI) to operationalize the risk of terrorism. This index is the most comprehensive and incorporates both the social and economic aspects of terrorism. Following the cash literature (Dittmar et al., 2003; Opler et al., 1999), we measure a firm's cash holdings using the ratio of cash and cash equivalents to net assets. We find a significant positive relationship between terrorism and corporate cash holdings. This finding is robust to a battery of sensitivity tests, including using alternative measures of cash holdings, alternative samples, change analysis, and difference-in-differences (DiD) analysis. Collectively, the results support the argument that firms adopt conservative financial policies in the face of uncertainty induced by terrorism, and they are consistent with the precautionary savings motive of cash holdings.

To elucidate the underlying mechanism in the positive relationship between terrorism and cash holdings, we examine and find that terrorism is positively associated with lower accrual quality, higher earnings and cash flow volatility, and higher cost of debt. These results suggest that higher informational opacity, increased earnings and cash flow risks, and higher cost of capital are plausible channels through which terrorism affects cash holdings. In addition, firms reduce payouts to increase their cash reserves to cushion against the adverse effects of terrorism on their business operations.

For the moderating role of a country's institutional environment, we find that the positive relationship between terrorism and cash holdings is less pronounced for firms in countries with stronger formal institutions. Additionally, we find the effect is more pronounced in countries with high uncertainty avoidance and long-term-oriented cultures, but less pronounced in countries with highly individualistic-oriented cultures. These findings are consistent with our conjecture that the positive relation between terrorism and cash holdings is greatly shaped by firms' ability to access external finance, hence the precautionary saving demand.

Finally, we examine whether increased cash holdings moderate the dampening effect of terrorism on R&D investment as documented by Li et al. (2022). We find that higher cash holdings mitigate the negative impact of terrorism on firms' R&D investment. This finding is consistent with the strategic motive underlying firms' conservative cash holdings policy, which suggests that larger cash accumulations allow firms to fund valuable investment opportunities (Duchin et al., 2010).

This study adds to the growing body of knowledge about terrorism in global business (Abrahms et al., 2019; Czinkota et al., 2010; Li et al., 2022). Terrorism poses a challenge to businesses and the economy's smooth operation because it has the potential to upset global value chains (Czinkota et al., 2010), increase worker stress and anxiety (Bader and Schuster, 2015), reduce market demand (Becker and Rubinstein, 2004), and raise the cost of external financing (Abadie and Gardeazabal, 2008; Procasky and Ujah, 2016). In fact, prior studies document a negative impact of terrorism on various economic and business activities, such as firms' R&D investment (Li et al., 2022), foreign direct investment (Abadie and Gardeazabal, 2008), M&A activities (Ouyang and Rajan, 2017), and corporate social responsibility investment (Abrahms et al., 2019). We contribute to the terrorism literature by demonstrating the role of cash holdings in mitigating the adverse effects of terrorism on firms' operations.

This study also contributes to the literature on the determinants of corporate cash holdings. While firm- and industry-level determinants of firms' cash have been extensively examined (Duchin et al., 2010; Le et al., 2023; Pinkowitz et al., 2016; Tran et al., 2024), the importance of the macro environment has received less attention. We introduce terrorism to the cash holdings literature and show that it is an important macro-level factor influencing corporate cash policy. More importantly, our study highlights the importance of considering terrorism as an important risk factor in firms' financial management decisions.

2. Related literature and hypotheses

Terrorism has been a significant global threat for decades, causing both direct and indirect harm to individuals, businesses, and countries. The psychological and physical impact of terrorism is well documented, but the economic impact can be equally severe. For instance, Abadie and Gardeazabal (2003) report a 10 % decline in per-capita GDP in regions plagued by terrorism relative to regions unaffected by terrorism. Similarly, the Institute for Economics and Peace (IEP) estimates that terrorism cost the global economy $33 billion in 2018 (IEP, 2019). A burgeoning literature examines the business and economic impacts of terrorism (Abadie & Gardeazabal, 2003; Abrahms et al., 2019; Li et al., 2022; Liu & Li, 2020). For instance, research by Abrahms et al. (2019) shows that investments in corporate social responsibility are negatively impacted by terrorism. Li et al. (2022) report that terrorism reduces R&D investment. According to Liu & Li (2020), terrorism accelerates MNC withdrawals and divestitures. Furthermore, M&A activities are found to have a negative correlation with terrorism by Ouyang and Rajan (2017). We contribute to this burgeoning literature on terrorism by examining the relationship between terrorism and firms' cash policy, to shed light on the resilience of firms, and hence economies to the adverse effects of terrorism.

We develop hypotheses on the relationship between terrorism and cash holdings through the precautionary savings motive for holding cash, according to which firms hold higher cash balances to insure against future adverse shocks in internal funds and/or costly external capital. Getting outside financing can be difficult during uncertain times due to increased financial frictions and higher cash flow concerns. As a result, businesses must retain more cash on hand in order to finance worthwhile investment possibilities in the future. Both theoretical and empirical studies provide results consistent with the precautionary savings motive (Almeida et al., 2004; Bates et al., 2009; Harford et al., 2014; Minton & Schrand, 1999; Pinkowitz et al., 2016). According to Graham and Leary (2018), the secular rise in cash holdings globally can be explained by macro factors that impact cash flow volatility. In a similar vein, Li (2019) finds a positive relationship between cash holdings and economic policy uncertainty. Lins et al. (2010) note in their survey report that businesses keep cash on hand above what they require for operations to cover unforeseen cash demands during difficult times. In short,

the precautionary motive theory of cash holdings suggests that firms hold higher levels of cash in environments where there are higher levels of perceived risk or uncertainty.

Terrorism can be characterized as a form of risk or uncertainty, as it is challenging to foresee the timing and location of terrorist attacks. Indeed, increased levels of uncertainty in business operations and performance are one of the economic effects of terrorist attacks (Abadie & Gardeazabal, 2008; Joint Economic Committee of US Congress 2002). In 2002, the US Congress Joint Economic Committee conducted a report titled "The Economic Costs of Terrorism" which said that "a dramatic increase in uncertainty and market volatility was an immediate effect of terrorist attack". By impeding global value chains (Czinkota et al., 2010), lowering market demand (Becker & Rubinstein, 2004), and increasing financing costs (Abadie & Gardeazabal, 2008), terrorism can increase the uncertainties surrounding corporate operations. Furthermore, studies show that terrorism harms national security and raises transaction costs and uncertainty for businesses (Abadie & Gardeazabal, 2008; Abrahms et al., 2019; Czinkota, et al., 2010; Li et al., 2022; Liu & Li, 2020; Ouyang & Rajan, 2017). Thus, all else being equal, to the extent that terrorism increases risks and uncertainty for businesses, it should increase firms' precautionary savings motive for holding larger cash balances.,[23] We therefore hypothesize that terrorism or the risk of future terrorism prompts firms to increase their cash holdings to cushion potential liquidity shortfalls induced by terrorism.

Hypothesis 1: Terrorism has a positive relationship with corporate cash holdings.

We consider the role of the country-level formal institutions in the relationship between terrorism and cash holdings. The extant literature shows that strong (weak) institutions at the country level decrease (exacerbate) agency problems and are associated with cheaper (costlier) external finance (La Porta et al., 1997; 1998; Leuz et al., 2003). Strong country-level formal institutions can also increase managers' diversion cost and reduce the free cash flow problem by Jensen and Meckling (1976). Further, country-level external governance mechanisms and institutions promote equity market development, which in turn facilitates firms' access to external financing (La Porta et al., 1998). Consistent with quality institutions reducing agency problems and facilitating firms' access to external financing, prior research links strong institutions to reduced agency-driven cash holding (Dittmar et al., 2003; Pinkowitz et al., 2006; Kalcheva & Lins, 2007). To the extent that financing constraints are decreasing with the quality of formal institutions, we expect weaker (stronger) precautionary saving motives for firms from countries with stronger (weaker) institutional environments and hence a lower (higher) propensity to increase cash holdings. Providing support, Dittmar et al. (2003) and Kalcheva & Lins (2007) show that firms in countries with weaker shareholder protection tend to hold more cash. To the extent that strong institutions allow firms' easier access to external finance and thereby reduce the precautionary savings motive, the positive impact of terrorism on cash holdings should be less pronounced for firms in countries with quality formal institutions. Thus, we state our second hypothesis:

Hypothesis 2: The positive impact of terrorism on cash holdings is more pronounced in countries with quality institutions.

We also explore the impact of culture—an informal institution—on the relationship between terrorism and corporate cash holdings. Prior studies (e.g., Li et al., 2013; Chen et al., 2015) have emphasized the role of national culture in shaping managerial preferences and strategic decisions. Cultural values significantly influence how managers interpret and respond to risk and uncertainty. For instance, Li et al. (2013) show that cultural dimensions such as individualism and uncertainty avoidance affect corporate risk-taking. To the extent that culture influences managers' disposition towards risks, we expect it to shape the response to the risk of terrorism and thus moderate the relationship between terrorism and cash holdings. We explore how country differences in adherence to cultural values of uncertainty avoidance, long-term orientation, and individualism affect the terrorism-cash holdings relation.

We begin with the culture dimension of uncertainty avoidance, as conceptualized by Hofstede (2001), which captures the extent to which members of a culture feel uneasy in ambiguous or unpredictable situations. Hofstede notes that low uncertainty-avoidance cultures generally tolerate ambiguity and show less urgency in unfamiliar situations. In contrast, high uncertainty-avoidance cultures tend to experience heightened anxiety and seek quick resolutions to reduce uncertainty. Griffin et al. (2009) further describe high uncertainty-avoidance cultures as favoring strict rules and predictability, while low uncertainty-avoidance cultures embrace novelty and diversity. Given this, we expect that firms in cultures characterized by high uncertainty avoidance will perceive terrorism as an acute and destabilizing threat. This perception motivates financial conservatism, including the accumulation of precautionary cash reserves. Compared to firms in low uncertainty-avoidance societies, those in high uncertainty-avoidance environments are more likely to bolster their cash holdings in anticipation of financial disruptions linked to terrorism. Such firms interpret terrorism as a serious risk to economic stability and future cash flows, prompting defensive financial strategies. Supporting this view, Chen et al. (2015) find a positive link between uncertainty avoidance and corporate cash holdings. Their research suggests that managers in high uncertainty-avoidance cultures prefer maintaining liquidity as a buffer against future cash flow shortfalls. Thus, we posit that a culture of

[2] As mentioned, our study focuses on the precautionary savings motive to examine the link between terrorism and corporate cash holdings. We concur that the agency motive is also an important determinant of corporate cash holdings (Jensen and Meckling, 1976; Harford et al., 2008). The agency motives suggest that managers are inclined to keep cash on hand because substantial cash allows them with higher discretion and avoids monitoring by investors. From the agency perspective, when firms are affected by terrorist attacks, poorly governed managers may increase their holdings to enjoy a "quiet life" as propounded by Bertrand and Mullainathan (2003). Prior studies suggest that robust institutional environments help mitigate agency-related issues and improve firms' ability to secure external financing. In such settings, firms are less inclined to engage in excessive cash retention driven by managerial self-interest (Dittmar et al., 2003; Pinkowitz et al., 2006; Kalcheva & Lins, 2007). Therefore, to address the agency motive, we account for several corporate governance reforms, including board reforms (Post-board reforms) (Fauver et al., 2017), and takeover laws (Post-take-over laws) (Lel & Miller,2015), in our baseline specification. By incorporating these governance-related controls that have been shown to reduce agency problem, we aim to mitigate concerns regarding managerial self-interest and ensure that our results are not driven by governance deficiencies. We also conduct several supplementary robustness checks.

[3] We thank an anonymous referee for this excellent suggestion.

uncertainty avoidance strengthens the positive relationship between terrorism risk and the level of cash holdings.

Next, we consider the role of long-term orientation culture. Societies characterized by a strong long-term orientation tend to emphasize patience, resilience, and financial discipline. These cultural attributes encourage a forward-thinking approach to financial management, where firms prioritize sustainability and proactive risk mitigation. In such contexts, external threats like terrorism are seen as enduring challenges, prompting organizations to adopt precautionary savings strategies to shield operations from potential disruptions. In essence, financial conservatism becomes a strategic response, reinforcing the observed positive link between terrorism exposure and corporate cash reserves (Chang & Noorbakhsh, 2009; Chen et al., 2015). All else being equal, we anticipate that firms operating in long-term oriented cultures will exhibit a heightened sensitivity to terrorism-related uncertainty by holding larger precautionary cash balances, suggesting a more pronounced effect of terrorism on cash holdings in long-term oriented cultures.

Finally, we consider the culture dimension of individualism, which reflects the extent to which people define themselves as independent rather than part of a collective (Hofstede, 2001). Highly individualistic societies prioritize personal autonomy, while collectivist cultures emphasize group cohesion and shared responsibility (Griffin et al., 2009). In business settings, individualism fosters self-reliance, confidence in long-term economic prospects, and diminished sensitivity to external threats. Managers operating within individualistic cultures often express greater confidence in their firm's financial outlook and are thus less inclined to emphasize precautionary cash holdings. Instead, they tend to prioritize growth-oriented initiatives such as innovation and investment. In contrast, managers in collectivist cultures may value reputational signals, viewing high cash reserves as a mark of sound management and organizational resilience. Consequently, firms in individualistic environments are less likely to adjust their liquidity strategy in response to terrorism-related uncertainty, potentially downplaying its long-term financial impact. This behavior contrasts with firms in collectivist or risk-averse settings, which are more likely to increase cash buffers as a protective measure. Supporting this view, Chen et al. (2015) report a negative relationship between individualism and corporate cash holdings. To the extent that individualistic values amplify managerial overconfidence and reduce perceived need for financial safeguards, we expect the relationship between terrorism risk and cash holdings to be weaker in such cultures.

Based on the above discussion, we proposed the following additional hypotheses.

Hypothesis 3a: The positive impact of terrorism on cash holdings is more pronounced in countries with high uncertainty-avoidance cultures

Hypothesis 3b: The positive impact of terrorism on cash holdings is more pronounced in countries with long-term orientation culture

Hypothesis 3c: The positive impact of terrorism on cash holdings is less pronounced in countries with a high individualism culture

3. Research methodology

3.1. Data and sample selection

We construct our sample by merging multiple data sets. We obtain firm-level financial data from Compustat (Global and North America), terrorism data from the IEP, and country-year macroeconomic data from the World Bank. We report all other data sources, as stated in the Appendix. To be included in our sample, observations must have non-missing values for all the variables specified in the model. We also drop financial firms (SIC codes 6000–6999) and utility firms (SIC codes 4900–4999) as they may hold cash for non-economic reasons (e.g., capital requirements or regulation), which may distort the analysis if included. These procedures generate a sample of 224,732 firm-year observations from 2002 to 2019, which includes 29,109 firms from 35 countries. The sample starts in 2002 because the values of the Global Terrorism Index are available for each country for each year starting with 2002. The sample ends in 2019 to avoid the potential impact of the COVID-19 pandemic.

Table 1 presents the sample distributions by country and the country-level terrorism score. We observe that the US is the country with the greatest number of firm-year observations (58,140 firm-year observations) while Hungary is the country with the least (110 firm-year observations). To provide confidence that our findings are generalizable and not driven by the US, we report results for both the full sample and the sample excluding the US in a parallel manner. Regarding the terrorism score, we find that Pakistan has the highest score of 7.805.[4]

3.2. Variable definitions

3.2.1. Cash holdings

Following prior cash literature (e.g., Bates et al., 2009; Dittmar et al., 2003; Kalcheva and Lins, 2007; Opler et al., 1999), our main measure of cash holdings (CASH_HOLD) is the ratio of cash and cash equivalents to net assets, where net assets refer to the difference between total assets and cash and cash equivalents. We test the robustness of our results to other measures of cash holdings in the literature, including the ratio of cash and cash equivalents to total assets, the ratio of cash and cash equivalents to sales and an industry-adjusted measure of cash holdings (captured by the difference between a firm's cash holdings and its industry median) (Harford et al.,

[4] Although Finland and Singapore have terrorism score of zero, we include them in our sample to serve as benchmark countries. We verify that our results are robust to excluding them in the analysis.

Table 1
Sample distribution by country.

	Country	No. of Firms	No. of Firm-years	TerrScore
1	Argentina	60	655	0.916
2	Australia	1,742	12,190	0.939
3	Brazil	260	2,157	1.001
4	Canada	158	651	0.770
5	China	3,380	27,829	4.503
6	Chile	140	1,453	2.104
7	Colombia	32	218	5.864
8	Egypt	132	706	6.318
9	Finland	106	282	0.000
10	France	565	2,190	3.686
11	Germany	741	6,847	2.382
12	Greece	158	191	4.270
13	Hungary	21	110	0.248
14	India	2,572	16,101	7.535
15	Indonesia	372	2,503	4.320
16	Israel	116	302	6.561
17	Italy	208	772	1.893
18	Japan	3,619	40,826	0.920
19	Korea, Rep.	1,491	10,439	0.366
20	Malaysia	995	9,103	1.471
21	Mexico	111	1,236	2.811
22	Netherlands	149	1,051	1.048
23	Norway	194	830	0.149
24	Pakistan	189	948	7.805
25	Peru	80	767	3.000
26	Philippines	163	1,543	6.505
27	Poland	578	3,155	0.190
28	Singapore	637	5,814	0.000
29	Spain	123	966	3.146
30	Sweden	218	398	0.070
31	Switzerland	206	1,229	0.434
32	Thailand	500	3,870	6.673
33	Turkey	299	1,890	6.030
34	United Kingdom	1,584	7,370	4.531
35	United States	7,210	58,140	5.060
Total/Average		29,109	224,732	3.372

This table provides a breakdown of sample firms by country and the average terrorism score for each country.

2008; Gao et al., 2013; Chen et al., 2018).[5]

3.2.2. Terrorism

Our explanatory variable, *TerrScore* is the GTI developed annually by the IEP. It is constructed based on the weighted average of four factors associated with terrorism: (1) total number of terrorist incidences, with a weight of 1; (2) total number of fatalities caused by terrorists, with a weight of 3; (3) total number of injuries caused by terrorists, with a weight of 0.5; and (4) total property damage from terrorist incidences, with a weight from 0 to 3 depending on the severity. A high value of the GTI indicates a higher terrorism risk. We use the GTI as our measure of terrorism risk because of its capability to systematically track important global trends and patterns in terrorism and because it has been used in previous academic studies (Abadie and Gardeazabal, 2003; Moser, 2020; Procasky and Ujah, 2016).

3.2.3. Control variables

We control for several country-level and firm-level variables that shape firms' cash policy, according to recent studies (Dittmar et al., 2003; Kalcheva and Lins, 2007; Pinkowitz et al., 2006). For the country-level characteristics, first, we include as control GDP per capita growth (*GDPPG*), foreign direct investment (*FDI*), *Stocks traded*, *Market capitalization*, and *Openness* to proxy for the extent of economic and capital market development in a country. Second, we control for the legal and political environment, using the principal component of the six institutional quality components developed by the World Bank (*WGI_PCA*), an index on *Checks and balances* from the Database of Political Institution. Moreover, we control the extent of uncertainty in a country using *Political stability* and World

[5] Our main results are statistically unchanged when we use the logarithmic transformation of these cash holdings measures instead of the log values.

Uncertainty Index (*WUI*) to rule out the concern that country uncertainty attributed to other risk factors, rather than terrorism affects firms' cash holding.[6] Third, we control for the prevailing culture in a country using *Societal trust* because Dudley and Zhang (2016) document a positive effect of trust on cash holdings. Finally, we control for recent government regulations, including board reforms (*Post-board reforms*) and takeover laws (*Post-takeover laws*), to rule out their potential confounding effect on the analysis of the relationship between terrorism and cash holdings.

For the firm-level characteristics, we include *Firm size* (log of the book value of assets); *Leverage* (total debt over lagged total assets); *Sales growth* (represented by the annual sales growth); *Profitability* (return on assets is measured as income before extraordinary items divided by lag total assets return on assets); Cash flow (operating cash flows scaled by lagged total assets); *Cash flow volatility* (standard deviation of cash flows over 5-year period); net working capital (*NWC*) (current assets minus current liabilities minus cash and equivalents scaled by assets); *Payer* (an indicator variable that is equal to one if a firm pays dividend in a year, zero otherwise); *CAPEX* (capital expenditure divided by lagged total asset); *R&D* (research and development expenditure divided by lagged total asset); *ACQ* (acquisition expenditure divided by lagged total asset) and *External financing* (sum of equity and debt issue). See the Appendix for detailed descriptions of the variables. We winsorize all continuous variables at the 1 % and 99 % levels to minimize the influence of extreme observations.

3.3. Descriptive statistics

Table 2 presents the descriptive statistics of the key variables. The mean value for *CASH_HOLD* is 0.335. The mean value of *TerrScore* is 3.372, which is comparable to the value reported in prior studies (e.g., Li et al., 2022; Moser, 2020). The mean value for *Firm size* is 5.471, suggesting that the sample covers both large and small firms. The descriptive statistics for the other variables are comparable to those provided in prior literature (Chen et al., 2020; Dudley et al., 2016).[7][8]

4. Empirical results

4.1. Model specification

We examine the relationship between terrorism and cash holdings using the following pooled multivariate regression model:

$$CASH\_HOLD_{i,c,t+1} = \alpha_0 + \beta_1 TerrScore_{c,t} + \gamma Controls_{i,c,t} + Firm\&YearFixedEffects + \varepsilon_{i,c,t+1} \quad (1)$$

where i, c, and t denote firm, country, and year, respectively. The dependent variable CASH_HOLD is a firm's cash holdings as defined above. The main explanatory variable, TerrScore is the Global Terrorism Index (GTI) developed annually by the IEP. Controls is a vector of country-level and firm-level variables defined above. We include firm and year fixed effects to account for within-firm and within-year changes in firms' cash holdings. Alternatively, we include country, industry, and year fixed effects to control for characteristics that are invariant within the country, industry, and year. The standard errors are heteroskedasticity-robust and corrected for country-level clustering.[9]

4.2. Baseline results

Table 3 reports the results for the relationship between terrorism and cash holdings using a set of nested models. Columns (1) to (3) report the results for the full sample. Column (1) reports the results with firm and year-fixed effects but without control variables, and column (2) reports the results of the fully specified baseline model in equation (1) with both economy-wide and firm-level control variables included. Column (3) reports the results when we estimate equation (1) after replacing firm fixed effects with industry and country fixed effects. Columns (4) to (6), respectively, report the results after excluding the US. Across the six columns, the coefficient on TerrScore is positive and statistically significant, consistent with hypothesis 1 that there is a positive relation between terrorism and cash holdings across countries. The effect is also economically significant, with the estimated coefficients in column (2) suggesting that a one-standard-deviation increase in *TerrScore* leads to an increase of 0.029 (= 2.613 × 0.011) in cash holdings, equivalent to approximately 9 % of the sample mean value of cash holdings and 4 % of its standard deviation. Collectively, the results support the argument that firms adopt conservative financial policies in the face of uncertainty induced by terrorism, and they are consistent with the precautionary savings motive of cash holdings.

The coefficients of the control variables are generally consistent with prior studies (Chen et al., 2020; Dudley and Zhang, 2016;

[6] Li (2019) investigates the influences of economic policy uncertainty on corporate cash policy and documents a positive relationship between economic policy uncertainty and cash holdings. Our main results remain intact after we control for economic policy uncertainty from Baker et al. (2016). Because including this variable reduce our sample drastically, we do not include it in our baseline regression.

[7] Untabulated analysis shows that the Pearson correlation coefficient between *CASH* and *TerrScore* is 0.022, andit is significant at the 5% level.

[8] To check for multicollinearity among the independent variables, we conduct a variance inflation factor (VIF) analysis and find that the average VIF among the independent variables is 5.37 which is below the threshold of 10, implying that multicollinearity is unlikely to pose an issue (O'brien, 2007).

[9] In untabulated results, we also cluster standard errors at the firm, country-year, and industry-year levels. Our results remain qualitatively unchanged.

Table 2
Descriptive statistics.

Variable	N	Mean	SD	P25	Median	P75
Measure of cash holdings						
CASH_HOLD	224,732	0.335	0.666	0.052	0.135	0.313
Measure of terrorism						
TerrScore	224,732	3.372	2.613	0.496	3.321	5.527
Country-level controls						
GDPPG	224,732	2.697	3.114	1.015	1.981	4.173
FDI	224,732	2.539	3.422	0.931	1.749	2.938
Stocks traded	224,732	114.597	77.849	53.780	98.330	156.407
Market capitalization	224,732	95.482	43.303	65.170	90.260	126.762
Openness	224,732	57.305	59.360	28.058	39.464	56.421
WGI_PCA	224,732	2.002	1.882	−0.372	3.076	3.328
Political stability	224,732	0.127	0.262	0.000	0.000	0.250
WUI	224,732	0.171	0.108	0.089	0.151	0.241
Checks and balances	224,732	3.576	2.081	3.000	4.000	4.000
Societal trust	224,732	0.369	0.143	0.302	0.388	0.410
Post-board reforms	224,732	0.970	0.170	1.000	1.000	1.000
Post-takeover laws	224,732	0.565	0.496	0.000	1.000	1.000
Firm-level controls						
Firm size	224,732	5.471	2.057	4.143	5.458	6.783
Leverage	224,732	0.228	0.223	0.037	0.186	0.346
Sales growth	224,732	0.140	0.520	−0.045	0.057	0.191
Profitability	224,732	−0.014	0.226	−0.012	0.028	0.070
NWC	224,732	0.005	0.224	−0.084	0.019	0.131
Cash flow	224,732	0.041	0.178	0.006	0.062	0.118
Cash flow volatility	224,732	0.095	0.162	0.029	0.051	0.092
Payer	224,732	0.460	0.498	0.000	0.000	1.000
CAPEX	224,732	0.055	0.072	0.013	0.031	0.066
R&D	224,732	0.070	0.329	0.000	0.000	0.017
ACQ	224,732	0.013	0.051	0.000	0.000	0.000
External financing	224,732	0.085	0.288	−0.014	0.004	0.068

This table reports descriptive statistics for the key variables. CASH_HOLD is the ratio of cash and cash equivalents to net assets. TerrScore is the Global Terrorism Index (*GTI*) developed annually by the IEP. All variables have been defined in the Appendix.

Hoberg et al., 2014). For example, we find that *Firm size and Leverage* are negatively associated with cash holdings, while *Cash flow* and *Cash flow volatility* are positively associated with cash holdings.

4.3. Robustness tests

We carry out an array of sensitivity tests to assess the robustness of our baseline results and report the results in Table 4.[10]

4.3.1. Alternative measures of cash holdings

We assess whether the results are robust to alternative measures of cash holdings. We use as alternative measures of cash holdings, such as the ratio of cash and cash equivalents to total assets (Cash/Total assets), the ratio of cash and cash equivalents to sales (Cash/sales) and an industry-adjusted measure of cash holdings (Industry adjusted CASH_HOLD) (captured by the difference between a firm's cash holdings and its industry median) (Harford et al., 2008; Gao et al., 2013; Chen et al., 2018). As shown in Panel A of Table 4, the coefficient of *TerrScore* continues to be positive and statistically significant (5 out of 6 columns). These results suggest that the positive relationship between terrorism and corporate cash holdings is robust to the different measures for cash holdings used in the literature.

4.3.2. Alternative samples

We check the sensitivity of our findings to alternative sample compositions and report the results in Panel B of Table 4. To address the concern that a few countries with many firms drive the results, we dropped the top three countries with the largest number of observations, excluding the US, such as Japan, China, and India.[11] We also estimate the baseline results after dropping countries with less than 1000 observations to further mitigate the concern of large sample bias. Next, we drop data from the years 2007 and 2008 to mitigate the concern that uncertainty from the financial crisis drives the results. Finally, we address the concern that our results may be driven by country and industry heterogeneities by splitting our sample into 1) developed versus developing countries using the classification of International Monetary Fund (IMF) and 2) manufacturing and non-manufacturing industries. Using these alternative sample compositions, we continue to find a positive relationship between terrorism and cash holdings.

[10] We thank the referees for suggesting some of these tests.

[11] We check in untabulated analyses that our inferences are robust to the exclusion of any individual country as well as using the weighted least squares (WLS) regression that helps mitigate concerns of uneven sample composition.

Table 3
Terrorism and corporate cash holdings: Baseline results.

Dep. var.=	CASH_HOLD					
Sample=	Full sample			Excluding USA		
	(1)	(2)	(3)	(4)	(5)	(6)
TerrScore	**0.013*** **	**0.011*** **	**0.007*** **	**0.005*** **	**0.006*** **	**0.009*** **
	(3.429)	**(4.793)**	**(3.305)**	**(2.810)**	**(2.991)**	**(4.169)**
GDPPG		−0.002	−0.002		−0.002	−0.001
		(−1.160)	(−0.899)		(−1.371)	(−0.471)
FDI		−0.002	0.000		−0.001	−0.000
		(−1.372)	(0.229)		(−0.874)	(−0.047)
Stocks traded		0.000	0.000		0.000	−0.000
		(0.159)	(0.338)		(1.026)	(−0.911)
Market capitalisation		0.000*	0.000		0.000**	0.000
		(1.702)	(1.207)		(2.093)	(1.654)
Openness		−0.001**	−0.000		−0.001	−0.000
		(−2.081)	(−0.472)		(−1.545)	(−0.392)
WGI_PCA		0.042***	0.045**		0.017	0.038
		(3.019)	(2.516)		(1.681)	(1.684)
Political stability		−0.004	−0.005		0.001	−0.006
		(−0.899)	(−1.449)		(0.250)	(−1.242)
Checks and balance		−0.001	0.004***		0.001	0.004***
		(−0.836)	(4.144)		(0.570)	(3.112)
WUI		−0.037***	−0.058**		−0.027**	−0.046**
		(−2.812)	(−2.332)		(−2.570)	(−2.220)
Societal trust		0.053	−0.019		0.015	−0.036
		(0.787)	(−0.249)		(0.234)	(−0.429)
Post-board reforms		0.020	0.020		0.035	0.011
		(1.245)	(1.404)		(0.935)	(0.786)
Post-takeover laws		0.017	−0.021		0.027	−0.007
		(1.019)	(−0.928)		(1.494)	(−0.321)
Firm size		−0.085***	−0.029***		−0.079***	−0.029***
		(−5.098)	(−7.294)		(−3.173)	(−4.142)
Leverage		−0.243***	−0.660***		−0.245***	−0.646***
		(−17.899)	(−15.250)		(−9.412)	(−10.632)
Sales growth		−0.010**	0.003		−0.012***	−0.011**
		(−2.601)	(0.228)		(−3.737)	(−2.363)
Profitability		0.033	0.146		0.018	−0.077
		(1.315)	(1.066)		(0.378)	(−0.550)
NWC		−0.156***	−0.371***		−0.142***	−0.347***
		(−10.989)	(−16.787)		(−7.539)	(−12.792)
Cash flow		0.172***	0.106		0.142***	0.078
		(6.438)	(1.232)		(3.677)	(0.536)
Cash flow volatility		0.142***	0.308***		0.115**	0.373***
		(4.100)	(7.804)		(2.218)	(7.931)
Payer		0.009**	−0.025		0.011**	0.020
		(2.231)	(−0.846)		(2.384)	(1.143)
CAPEX		−0.487***	−1.052***		−0.436***	−0.817***
		(−8.018)	(−6.179)		(−5.877)	(−7.935)
R&D		0.222***	0.718***		0.185***	0.564***
		(16.708)	(10.104)		(4.887)	(6.985)
ACQ		−0.496***	−1.049***		−0.399***	−0.916***
		(−10.735)	(−17.487)		(−7.116)	(−10.068)
External financing		0.160***	0.309***		0.123***	0.252***
		(7.054)	(10.240)		(6.085)	(7.270)
Constant	0.297***	0.695***	0.493***	0.266***	0.671***	0.457***
	(23.793)	(9.363)	(8.637)	(58.185)	(6.102)	(6.697)
Firm FE	Yes	Yes	No	Yes	Yes	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	No	No	Yes
Industry FE	No	No	Yes	No	No	Yes
Observations	224,732	224,732	224,732	166,592	166,592	166,592
Adjusted R-squared	0.674	0.685	0.338	0.625	0.636	0.236

This table reports the baseline regression results for the relationship between terrorism and corporate cash holdings. In all columns, the dependent variable is CASH_HOLD, which is measured as the ratio of cash and cash equivalents to net assets. Columns (1) to (3) report the results for the full sample. Columns (4) to (6) report the results after excluding the US. Our explanatory variable, *TerrScore*, is the Global Terrorism Index (GTI), which is developed annually by the IEP. Definitions of all the other variables are reported in Table 1. All regressions include fixed effects as indicated, and t-statistics are calculated based on standard errors clustered at the country level and reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

Table 4
Terrorism and corporate cash holdings: Robustness tests.

Panel A: Alternative measures of cash holdings

Dep. var.=	Full sample Cash/Total assets	Cash/sales	Industry_adjusted CASH_HOLD	Excluding USA Cash/Total assets	Cash/sales	Industry_adjusted CASH_HOLD
	(1)	(2)	(3)	(4)	(5)	(6)
TerrScore	**0.004*** **	**0.031** **	**0.011*** **	**0.002*** **	**0.015**	**0.007*** **
	(5.180)	**(2.538)**	**(4.706)**	**(3.762)**	**(1.142)**	**(3.172)**
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	224,732	224,732	224,732	166,592	166,592	166,592
Adjusted R-squared	0.742	0.648	0.670	0.716	0.649	0.623

Panel B: Alternative samples

Dep. var.=	CASH_HOLD								
Sample=	Exclude Japan	Exclude China	Exclude India	Exclude countries with <1000 observations	Exclude financial crisis periods	Developed countries	Developing countries	Manufacturing industries	Non-manufacturing industries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TerrScore	**0.011*** **	**0.009*** **	**0.011*** **	**0.012*** **	**0.011*** **	**0.010*** **	**0.010*** **	**0.012*** **	**0.011*** **
	(4.400)	**(3.247)**	**(5.290)**	**(5.398)**	**(4.254)**	**(3.290)**	**(6.618)**	**(3.540)**	**(3.479)**
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	183,906	196,903	208,631	216,936	195,147	150,488	74,244	124,262	100,470
Observations	0.677	0.690	0.685	0.685	0.689	0.689	0.633	0.732	0.620
Adjusted R-squared	0.677	0.690	0.685	0.685	0.689	0.689	0.636	0.732	0.620

Panel C: First difference change analysis

Dep. var.=	ΔCASH_HOLD Full sample		Excluding USA	
	(1)	(2)	(3)	(4)
ΔTerrScore	**0.006*** **	**0.009*** **	**0.005***	**0.008** **
	(2.841)	**(3.806)**	**(2.016)**	**(2.436)**
Controls	No	Yes	No	Yes
Country FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	193,703	193,703	143,154	143,154
Adjusted R-squared	0.003	0.013	0.001	0.011

Panel D: DiD approach

Dep. var.=	CASH_HOLD Full sample Main DiD results		Dynamic effect	Excluding USA Main DiD results		Dynamic effect
	(1)	(2)	(3)	(4)	(5)	(6)
Terr_Shock	**0.044** **	**0.025*** **		**0.019*** **	**0.014***	
	(2.654)	**(3.131)**		**(3.103)**	**(1.973)**	
Terr_Shock T-5			0.017			0.010
			(1.574)			(1.445)
Terr_Shock T-4			0.021*			0.012

(*continued on next page*)

Table 4 (*continued*)

Panel D: DiD approach						
Dep. var.=	CASH_HOLD					
	Full sample			Excluding USA		
	Main DiD results		Dynamic effect	Main DiD results		Dynamic effect
	(1)	(2)	(3)	(4)	(5)	(6)
			(1.760)			(1.449)
Terr_Shock T-3			0.012			0.005
			(0.882)			(0.464)
Terr_Shock T-2			−0.001			−0.014
			(−0.113)			(−1.173)
Terr_Shock T			**0.021*****			0.011
			(3.091)			(1.279)
Terr_Shock T+1			**0.034*****			**0.020****
			(3.231)			**(2.052)**
Terr_Shock T+2			**0.027****			**0.007**
			(2.096)			**(0.742)**
Terr_Shock T≥3			**0.055*****			**0.024***
			(3.243)			**(1.929)**
Controls	No	Yes	Yes	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	224,732	224,732	224,732	166,592	166,592	166,592
Adjusted R-squared	0.674	0.686	0.686	0.627	0.637	0.637

This table reports the results for robustness tests. Panel A reports the results using the alternative measures of cash holdings. Panel B reports the results using the alternative samples. Panel C reports the results using first difference change analysis. Panel B reports the results of analyses of the DiD approach. Columns (1) and (2) report the main DiD results, without and with control variables, respectively. Column (3) reports results assessing the validity of the parallel trend assumption underlying the DiD estimation. Columns (4) to (6), respectively, report the results after excluding the US. TerrScore is the Global Terrorism Index (GTI), which is developed annually by the IEP. ΔTerrScore is the first difference change in terrorism score. ΔCASH is the change in cash holdings from year t to year t+1. Terr_Shock is an indicator variable that equals 1 for years after a firm's country experienced a large increase in terrorism score and 0 otherwise. Definitions of all variables are reported in Table 1. The regressions include year and firm fixed effects, and t-statistics are calculated based on standard errors clustered at the country level and reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

4.3.3. First difference change analysis

Endogeneity does not appear to be a big threat to our study because the core explanatory variable terrorism (*TerrScore*) is largely exogenous to individual firms' actions. Nonetheless, we use a change regression to address reverse causality concerns per Lin et al. (2013). We regress changes in cash holdings (*ΔCASH)* on changes in the terrorism index (*ΔTerrScore)*. Control variables are also included in their change form. As shown in Table 4 Panel C, using the change analysis, we continue to find that terrorism is positively associated with cash holdings. This finding corroborates our main results, which use level forms for all variables.

4.3.4. DiD approach

We validate our findings using a DiD approach. We draw inspiration from recent studies (Huang et al., 2017; Rezaee et al., 2024; Ryou et al., 2022; Tsang et al., 2024) to design a quasi-natural experiment using the most significant increase in a country's terrorism score in our sample period as the shock year. Specifically, we identify countries that experienced a large increase in terrorism scores (an increase that is at least three times the sample median) during our sample period as the treatment group (Huang et al., 2017; Ryou et al., 2022). We assume the year when the treatment country experienced a significant change in terrorism score for the first time as the event year. We then define Terr_Shock as an indicator variable that equals 1 for years after a firm's country experienced a large increase in terrorism score and 0 otherwise. Thus, countries that did not experience such an increase during our sample period served as the benchmark group. We used the same model as in equation (1) except for replacing TerrScore with Terr_Shock. Table 4 Panel D reports the results of the DiD analysis.

As shown in columns (1), (2), (4), and (5) of Table 4 Panel D, we document results consistent with the finding in the main regression. The coefficient on Terr_Shock is positive and significant at the 5 percent level, suggesting higher cash holdings by firms in response to a significant increase in terrorism in a country. The results are robust to both excluding and including the control variables. The results also hold when excluding US firms. In terms of economic magnitudes, the coefficient on Terr_Shock in column (2) suggests that firms increase corporate cash holdings by 2.5 % following the shock of terrorism.

A critical assumption underlying a DiD analysis is the parallel trend assumption. To test the validity of the parallel trend assumption, we conduct a dynamic analysis of the effect of terrorism on cash holdings. In particular, we follow Bertrand and Mullainathan (2003) and replace Terr_Shock with eight indicators indicating whether a given year is 5 years (Terr_Shock T-5), 4 years (Terr_Shock T-4), 3 years (Terr_Shock T-3) or 2 years (Terr_Shock T-2) before the shock, the year of the shock (Terr_Shock T), or the first year (Terr_Shock T + 1), second year (Terr_Shock T + 2), or third year or more (Terr_Shock T $\geq$ 3) after the shock. Based on the recommendation of Armstrong et al. (2022), we consider observations from one year before the shock (Terr_Shock T-1) as the baseline group and exclude them from the regression. If the parallel trends assumption holds, we expect the positive impact on cash holdings to be only observed in the post-time indicators.

As shown in columns (3) and (6) of Table 4 Panel D, the pre-reform indicators are generally insignificant. In line with the parallel trends assumption of our DiD design, we observe a significant increase in cash holdings after the shock as manifested by the significant coefficients on the year of the shock (Terr_Shock T) and the post-time indicators (Terr_Shock T + 1, Terr_Shock T + 2, and Terr_Shock T $\geq$ 3). These results corroborate our findings that terrorism positively impacts corporate cash holdings.

Overall, the results in Table 4 show that the main findings are robust in using alternative measures of cash holdings, sample compositions, change analysis, and the DiD approach.

4.4. Channel analysis

4.4.1. The effect of terrorism on accrual quality, earnings and cash flow volatility, and cost of debt

Our analysis is based on the assertion that terrorism increases uncertainty and market volatility, which in turn increases firms' precautionary saving motive of cash holdings, hence the higher cash holdings. Periods of heightened uncertainty often complicate access to external financing due to increased financial friction and concerns over cash flow stability. A sustained rise in corporate cash holdings is largely attributed to macroeconomic factors that drive cash flow volatility (Graham & Leary, 2018). This is further supported by a positive correlation between cash reserves and economic policy uncertainty (Li, 2019). According to Lins et al. (2010), companies typically maintain cash beyond operational needs to buffer against unexpected financial demands during turbulent times. This aligns with the precautionary motive theory, which posits that firms accumulate more cash in response to elevated risk and uncertainty. Terrorism exacerbates such uncertainty by disrupting global supply chains (Czinkota et al., 2010), lowering market demand (Becker & Rubinstein, 2004), increasing volatility of earnings, and raising financing costs (Abadie & Gardeazabal, 2008). Consequently, as terrorism increases operational risk, it strengthens the precautionary rationale for holding larger cash reserves. To support the reasoning that terrorism increases cash holdings through the escalation of uncertainty and business risk, we examine the impact of terrorism on accrual quality (measured as the absolute value of discretionary accruals from the modified Jones model), earnings volatility (the standard deviation of earnings over five-year rolling window), cash flow volatility (standard deviation of cash flows from operations over five-year rolling window) and cost of debt (*Cost_debt*), measured as the ratio of a firm's annual interest expense scaled by the firm's total debt (Chaney et al., 2011).[12]

The results are presented in Table 5. We observe that terrorism is positively associated with lower-quality accruals, higher earnings and cash flow volatility, and higher cost of debt. To the extent that lower accruals quality, earnings and cash flow volatility and higher

[12] We test the sensitivity of our results to measuring earnings volatility and cash flow volatility using four- and three-years rolling window and obtain consistent results.

Table 5
Terrorism and corporate cash holdings: Channel analysis.

Dep. var.=	Accruals	Earnings volatility	Cash flow volatility	Cost_debt	Dividend	Repurchases	Total payout
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TerrScore	**0.192*** **	**0.188***	**0.095****	**0.262***	**−0.037***	**−0.037***	**−0.078***
	(2.789)	**(2.026)**	**(2.718)**	**(1.716)**	**(−1.736)**	**(−1.991)**	**(−2.030)**
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	194,680	224,732	224,730	190,160	224,732	224,732	224,732
Adjusted R-squared	0.426	0.795	0.849	0.339	0.622	0.457	0.540

This table reports the regression results of the impact of terrorism on firms' operating environment and payout policies. TerrScore is the Global Terrorism Index (*GTI*) developed annually by the IEP. Definitions of all variables are reported in Table 1. Accruals is the absolute value of discretionary accruals from the modified Jones model. Earnings volatility is the standard deviation of earnings over five-year rolling window. Cost of debt is the ratio of a firm's annual interest expense to the firm's total debt. The regressions include year and firm fixed effects, and t-statistics are calculated based on standard errors clustered at the country level and reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

debt cost increase firms' business risk, which subsequently increase firms' precautionary savings motives, we interpret these results as suggesting that increased informational opacity, high earnings and cash flow risk and high cost of debt associated with terrorism are plausible channels through which terrorism influences cash holdings.

4.4.2. The effect of terrorism on payout policy

To further elucidate the mechanisms through which terrorism affects firms' cash holdings, we examine the impacts of terrorism on payout policy (dividend payouts, share repurchases). A stable environment conducive to dividend payouts is less likely when firms suffer escalated operating uncertainty due to high risk of terrorism (Hoberg et al., 2014). Accordingly, we expect that to the extent that terrorism increases operating uncertainty, threatens the stability of companies' future cash flows, and increases firms' financing frictions, it should lead to lower payout policy. We examine this issue and present the results in columns (5) to (7) of Table 5. We find that terrorism decreases firms' propensity to make payouts, suggesting that firms decrease payouts to increase their cash reserves to cushion against the adverse effects of terrorism on their business operations.

4.5. Tests of additional hypotheses

4.5.1. The role of the formal institutional environment

We examine Hypothesis 2, which states that stronger formal country-level institutions reduce the free cash flow problem and facilitate easy access to the external capital market to moderate the positive relationship between terrorism and cash holdings. To test this prediction, we follow prior literature and use three proxies for the quality of institutions in a country. The first proxy is Legal origin, which separates countries into common law countries and code law countries. Prior literature shows that common law countries typically have greater shareholder protections than civil law countries (La Porta et al., 1998). The second proxy is the public enforcement index (Enforcement) from Djankov et al. (2008). Finally, we use the creditor rights index (*Creditor rights*) from La Porta et al. (1998), which captures the extent of protection given to creditors. Higher *Enforcement* and *Creditor rights* values indicate better investor and creditor rights protection, hence stronger institutions in a country. We define Institution as equal to 1 if a country has a common law legal origin or has a value of Enforcement or Creditor rights above the sample median, and zero otherwise. We interact Institution with TerrScore and re-estimate equation (1).

The results are presented in Table 6. Consistent with Hypothesis 2, Table 6 shows that the terrorism–cash holdings relation is weaker for firms in countries with stronger institutions. The coefficient estimates on TerrScore × Institution enter negatively and significantly at the 5 % level or better. These findings suggest that firms in countries with sound institutions tend to increase their cash holdings less in response to the risk of terrorism because of a weaker precautionary saving motive, as they have less difficulty raising external finance. To illustrate the size of the impact, we consider a one-standard-deviation increase in TerrScore (2.613). From column 1 of Table 6, the estimated coefficients suggest that firms in countries with strong formal institutions experience increases in cash holdings that are 0.039 (= 2.613 x -0.015) smaller, on average, than those of other firms in countries with weak formal institutions. This effect is equivalent to 59 % of the sample standard deviation of cash holdings.

4.5.2. The role of the informal institutional environment

We next examine Hypothesis 3, which predicts a greater effect of terrorism on cash holdings in countries with high uncertainty-avoidance and long-term orientation cultures and a reduced effect in countries with high individualistic cultures. To assess this prediction, we use Hofstede's (2001) cultural dimensions of uncertainty-avoidance, long-term orientation and individualism. Higher values of these cultural measures indicate that countries are associated with high uncertainty-avoidance, long-term orientation, and individualism cultures. We define Culture as equal to 1 if a country has a value of uncertainty-avoidance index, long-term orientation index, and individualism index above the sample median, and 0 otherwise. We interact Culture with TerrScore and re-estimate

Table 6
Terrorism and corporate cash holdings: The role of institutional quality.

Dep. var.=	CASH_HOLD					
	Full sample			Excluding USA		
	Common law legal origin	Enforcement	Creditor rights	Common law legal origin	Enforcement	Creditor rights
	(1)	(2)	(3)	(4)	(5)	(6)
TerrScore	**0.039*** **	**0.012*** **	**0.013*** **	**0.008*** **	**0.008*** **	**0.008*** **
	(5.034)	**(5.967)**	**(6.113)**	**(3.089)**	**(4.525)**	**(4.166)**
TerrScore × Institution	**−0.015** **	**−0.012*** **	**−0.012*** **	**−0.010*** **	**−0.012*** **	**−0.010*** **
	(−2.715)	**(−4.161)**	**(−4.250)**	**(−2.745)**	**(−3.910)**	**(−3.037)**
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	224,732	224,541	224,541	166,592	166,401	166,401
Adjusted R-squared	0.735	0.686	0.686	0.636	0.636	0.636

This table presents the results of the moderating effect of country-level institutional quality in the relation between terrorism and cash holdings. As measures of institutional quality, we use legal origin in columns (1) and (4), the public enforcement index from Djankov et al. (2008) in columns (2) and (4), and the creditor rights index from La Porta et al. (1998) in columns (3) and (6). Institution is an indicator equal to 1 if a country has a common law legal origin or a value of Enforcement or Creditor rights above the sample median, and zero otherwise. CASH_HOLD is the ratio of cash and cash equivalents to net assets. TerrScore is the Global Terrorism Index (*GTI*) developed annually by the IEP. Definitions of all variables are reported in Table 1. The regressions include year and firm fixed effects, and t-statistics are calculated based on standard errors clustered at the country level and reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

equation (1).

The results are reported in Table 7. The interaction term, *TerrScore* × *Culture* enters positively for high uncertain avoidance, and long-term oriented cultures and enters negatively for high individualistic-oriented cultures. These results are consistent with Hypotheses 3a-3b, which state that the terrorism–cash nexus is stronger in countries with high uncertain avoidance, long-term orientation and low individualism cultures, that have a stronger precautionary saving motives because they are less tolerant of risks and feel more anxious about future uncertainty, and as a result, hold more cash in response to the risk of terrorism. To assess the estimated sizes of these effects, we consider a one-standard-deviation increase in TerrScore (2.613) and the regression estimates based on individualism culture value used in column 6. The estimated coefficient on *TerrScore* × *Culture* (− 0.043) indicates that firms in high individualism cultures experience increases in cash holdings that are 0.112 (= 2.613 x -0.043) smaller, on average, than those of other firms in countries with low individualism cultures. This effect is large and represents almost 17 % of the sample standard deviation of cash holdings.

4.6. Additional analysis: cash holdings, terrorism, and investment

Thus far, we have shown that terrorism positively impacts firms' cash holdings. As a corroborating test, we examine whether the increase in cash holdings is beneficial to firms business operations. Specifically, we investigate the possibility that cash holdings could function as a channel to lessen the detrimental impact of terrorism on firms' real activities. Since Li et al. (2022) document a negative

Table 7
Terrorism and corporate cash holdings: The role of culture.

Dep. var.=	CASH_HOLD					
	Full sample			Excluding USA		
	Uncertainty avoidance	Long-term orientation	Individualism	Uncertainty avoidance	Long-term orientation	Individualism
	(1)	(2)	(3)	(4)	(5)	(6)
TerrScore	**0.004*** **	**0.027*** **	**0.041*** **	**0.019*** **	**−0.001**	**0.030*** **
	(8.556)	**(5.791)**	**(11.537)**	**(4.161)**	**(−0.279)**	**(8.466)**
TerrScore × Culture	**0.001** **	**0.010***	**−0.020*** **	**0.006**	**0.009***	**−0.043*** **
	(2.295)	**(1.910)**	**(−3.950)**	**(0.820)**	**(1.794)**	**(−4.623)**
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	224,541	224,541	224,541	166,401	166,401	166,401
Adjusted R-squared	0.742	0.735	0.735	0.729	0.636	0.729

This table presents the results of the role of culture in the relationship between terrorism and cash holdings. We use Hofstede's (1980, 2001) cultural dimensions of uncertainty-avoidance (columns (1) and (4), long-term orientation (columns (2) and 5) and individualism (columns (3) and (6). If a country has a value of uncertainty-avoidance index, long-term orientation index and individualism index above the sample median, then we set Culture indicator equal to 1 and 0 otherwise. CASH_HOLD is the ratio of cash and cash equivalents to net assets. TerrScore is the Global Terrorism Index (*GTI*) developed annually by the IEP. Definitions of all variables are reported in Table 1. The regressions include year and firm fixed effects, and t-statistics are calculated based on standard errors clustered at the country level and reported in parentheses. Significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively.

impact of terrorism on R&D investment, we examine the effect of cash holdings and terrorism on R&D investment. We first replicate the finding of Li et al. (2022) in our setting by investigating the relationship between terrorism and R&D investment. We regress R&D expenditure (*R&D*) on terrorism risk (*TerrScore*) and our control variables.

As shown in Table 8, column 1, we find a significant negative impact of terrorism on firms' R&D investment, consistent with Li et al. (2022). Next, we examine the moderating role of cash by including cash holdings (*CASH_HOLD*) and the interaction of *CASH_HOLD* and *TerrScore*. Columns (2) and (3) report the results. In column (2), we estimate the results using firm and year fixed effects. In column (3), we estimate the results using country, industry, and year fixed effects. For both columns, we find that the coefficient on the interaction term, *TerrScore* × *CASH_HOLD,* is positive and significant, suggesting that cash holdings moderate the adverse effect of terrorism firms' R&D investment. Specifically, the results suggest that cash holdings serve as a financial buffer, moderating the adverse impact of terrorist attacks on R&D investment. That is, firms with higher cash holdings experience a less severe decline in R&D investment induced by terrorism, reinforcing the notion that liquidity plays a crucial role in preserving strategic investments under uncertain conditions.

5. Conclusion

We examine the impact of terrorism on corporate cash holdings and how this relationship is conditioned on a country's institutional environment. Using a large sample of 224,732 firm-year observations across 35 countries from 2002 to 2019, we find a significant positive relationship between terrorism and cash holdings. The effect is more pronounced for firms from countries with weaker institutional environments and cultural predisposition with less tolerance for risk. In additional analysis, we find that increased informational opacity, high cash flow risk, cost of debt, and lower payout associated with terrorism are possible channels through which terrorism affects cash holdings. Finally, we find that increasing cash holdings attenuates the dampening effect of terrorism on R&D investment.

These results show how firms in weak-institution countries might balance liquidity buffers against growth investments, and how policymakers could mitigate terrorism's financial spillovers. Understanding and addressing the economic effects of terrorism have been prominent in the policy agendas of several countries. In fact, the International Organization of Securities Commissions (IOSCO) introduced the multilateral memorandum of understanding (MMoU) in May 2002 to promote cross-border cooperation and facilitate information sharing among securities regulators in order to address terrorism related issues. Recent studies document negative impacts of terrorism on firms' investment activities. However, we have limited understanding of how firms reduce the adverse effects of terrorism on firms' real decisions, like firms' R&D investment, which has important implications for firm value and hence the economy. Our finding suggests that increasing cash holdings can mitigate the adverse effects of terrorism on firms' operations by providing financial flexibility to firms. Our study highlights the importance of considering terrorism as a risk factor in corporate financial management and how cash holdings can serve as a channel in cushioning the adverse effects of terrorism and other related external environmental factors on a firm's real economic activities. Our study thus offers crucial insights for businesses in terrorism-prone countries on how to moderate the dampening effect of terrorism on investment. Moreover, our finding on how country institutions affect the relationship between terrorism and cash holdings highlights the importance of country-level institutions in influencing the economic impacts of terrorism.

Our study comes with a few caveats that point to opportunities for future research. First, our analyses use IEP's GTI, a country-level measure of terrorism as opposed to firm-level terrorism measures. We urge further investigation into this area of inquiry by gathering more precise firm-level data. Second, while we perform multiple cross-sectional analyses and channel tests to elucidate the underlying mechanisms of our findings, these analyses may not be sufficient to substantiate definitive conclusions. Finally, although our regression specifications include extensive controls and fixed effects, they do not include the types of randomized controlled

Table 8
Terrorism, cash holdings, and R&D investment.

Dep. var.=	$R\&D_{t+1}$		
	(1)	(2)	(3)
TerrScore	**−0.037***	**−0.070*****	**−0.072***
	(−1.894)	**(−3.099)**	**(−1.998)**
CASH_HOLD		−0.016	−0.081
		(−0.738)	(−1.028)
TerrScore × CASH_HOLD		**0.066*****	**0.113*****
		(2.926)	**(4.172)**
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	224,732	224,732	224,732
Adjusted R-squared	0.516	0.517	0.040

This table reports the regression results of the effect of terrorism and cash holdings on firms' R&D investment. CASH_HOLD is the ratio of cash and cash equivalents to net assets. TerrScore is the Global Terrorism Index (*GTI*) developed annually by the IEP. $R\&D_{t+1}$ is R&D expenditure scaled by asset at year t + 1. Definitions of all variables are reported in Table 1. The regressions include year and firm fixed effects, and t-statistics are calculated based on standard errors clustered at the country level and reported in parentheses. Significance at the 10 %, 5 %, and 1 % level is indicated by *, **, and ***, respectively.

experiments that would address the remaining identification concerns. Therefore, we do not claim a causal link and interpret our results cautiously. Despite these limitations, this study indicates a positive connection between terrorism and corporate cash holdings that is consistent with the precautionary saving demand of firms. Terrorism causes earnings and cash flow volatility and increases the cost of external financing. As a result, firms may not have adequate cash inflows to support future investments and need to rely on internal cash reserves. This concern for cash flow shortfalls motivates firms to increase their cash holdings to mitigate the detrimental impact of terrorism on firms' real activities.

CRediT authorship contribution statement

Solomon Wise Dodzidenu Adza: Writing – review & editing, Writing – original draft, Supervision, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Adelaide Dak-Adzaklo:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Patrick Bimpong:** Writing – original draft, Formal analysis, Data curation, Conceptualization. **James Edudzi Kudoh:** Writing – review & editing, Validation, Formal analysis, Data curation. **Cephas Simon Peter Dak-Adzaklo:** Writing – review & editing, Validation, Supervision, Project administration.

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Availability of data and material

The data used in this study is available from the public sources or websites indicated in the paper.

Code availability

The code for obtaining the results in this paper is readily available.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix. Key variable definitions

Variable	Definition
CASH_HOLD	Cash and cash equivalents scaled by net assets. Source: Compustat NA and Global
TerrScore	The Global Terrorism Index (GTI) measured as the weighted average of four factors associated with terrorism: (1) total number of terrorist incidences, with a weight of 1; (2) total number of fatalities caused by terrorists, with a weight of 3; (3) total number of injuries caused by terrorists, with a weight of 0.5; and (4) total property damage from terrorist incidences, with a weight from 0 to 3 depending on the severity. A high value indicates high terrorism risk.
GDPPG	The annual growth in the gross domestic product (GDP) per capita. Source: World Bank
FDI	Total foreign direct investment scaled by gross domestic product. Source: World Bank
Stocks traded	Stocks trading volume as a percentage of GDP. Source: World Bank
Market capitalization	Stock-market capitalization scaled by gross domestic product. Source: World Bank
Openness	Ratio of the sum of exports and imports to a country's GDP. Source: World Bank
WGI_PCA	The first principal component of the six governance scores in the World Governance Indicators namely government effectiveness, regulatory quality, control of corruption, political stability, rule of law, and voice and accountability. Source: World Bank
Political stability	Level of political stability in a country from the Database of Political Institution (DPI)
WUI	An index measuring economic uncertainty for 143 countries from 1996 onwards using frequency counts of "uncertainty" (and its variants) in the quarterly Economist Intelligence Unit (EIU) country reports. Developed by Hites Ahir (International Monetary Fund), Nicholas Bloom (Stanford University), and Davide Furceri (International Monetary Fund).
Checks and balances	Level of checks and balances (assessment of the democratic stance of a country) from DPI
Societal trust	The percentage of people who responded that most people can be trusted in response to the WVS question: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" Source: World Value Survey.
Post-board reforms	An indicator that equals one if the country has adopted policies on board reform and zero otherwise (Fauver et al., 2017).
Post-takeover laws	An indicator that equals one if the country has adopted takeover laws and zero otherwise (Lel & Miller, 2015).
Firm size	The natural log of a company's total assets in US dollars. Source: Compustat NA and Global
Leverage	The ratio of the sum of short- and long-term debt to lag total assets. Source: Compustat NA and Global
Sales growth	Sales for this year minus sales for last year divided by sales for last year. Source: Compustat NA and Global
Profitability	Return on assets is measured as income before extraordinary items divided by lag total assets. Source: Compustat NA and Global
NWC	Current assets minus current liabilities minus cash and equivalents scaled by assets. Source: Compustat NA and Global

(*continued on next page*)

(*continued*)

Variable	Definition
Cash/Total assets	Ratio of cash and cash equivalents to total assets. Source: Compustat NA and Global
Cash/sales	Ratio of cash and cash equivalents to sales. Source: Compustat NA and Global
Industry_adjusted CASH_HOLD	Industry-adjusted measure of cash, captured by the difference between a firm's cash holdings and its industry median. Source: Compustat NA and Global
ΔCASH	Changes in cash holdings from year t to year t + 1. Source: Compustat NA and Global
Cash flow	Operating cash flows scaled by lag total assets. Source: Compustat NA and Global
Cash flow volatility	Standard deviation of cash flows over a five-year period. Source: Compustat NA and Global
Earnings volatility	Standard deviation of earnings over a five-year rolling window. Source: Compustat NA and Global
Accruals	The absolute value of total accruals, calculated as: (Δ [current assets] − Δ [current liabilities] −Δ [cash and short-term investment] + Δ [debt in current liabilities] − depreciation) / lag (total assets) (see Dechow et al., 1995).
Cost of debt	Ratio of a firm's annual interest expense scaled by the firm's total debt. Source: Compustat NA and Global
Dividend	Annual dividend payment scaled by total assets. Source: Compustat NA and Global
Repurchases	Annual share repurchases scaled by total assets. Source: Compustat NA and Global
Total payout	Total payout (sum of dividend payout and share repurchases) scaled by total assets. Source: Compustat NA and Global
Payer	An indicator variable equal to one if a firm pays a dividend in a year, zero otherwise
CAPEX	Capital expenditure scaled by lag total assets. Source: Compustat NA and Global
R&D	R&D expenditures scaled by lag total assets. Source: Compustat NA and Global
ACQ	Acquisition expenditure scaled by lag total assets. Source: Compustat NA and Global
External financing	Sum of equity issuance and debt issuance. Source: Compustat NA and Global
Enforcement	Country-level enforcement index from Djankov et al. (2008).
Creditor rights	Country-level Creditor rights index from La Porta et al. (1998).
Institution	An indicator that is equal to 1 if a country has a common law legal origin or has a value of Enforcement or Creditor rights above the sample median, and zero otherwise
Uncertainty-avoidance index	Hofstede (1980,2001) culture dimension of uncertainty avoidance
Long-term orientation	Hofstede (1980,2001) culture dimension of long-term orientation
Individualism	Hofstede (1980,2001) culture dimension of individualism
Culture	Equal to 1 if a country has a value of uncertainty-avoidance index, long-term orientation index, and individualism index (Hofstede, 2001) above the sample median, and 0 otherwise

Data availability

Data will be made available on request.

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