The Consequences of Terrorism for Financial Markets: What Do We Know?[★]

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Abstract

The objective of this article is to outline what we, as researchers, know and, more importantly, what we do not yet know about the consequences of terrorism for financial markets. I argue that a number of the efforts used to assess quantitatively the risk of terrorist attacks are limited in scope and are hampered by the limits of the databases used to operationalize such models. I also describe some of the most recent research that has sought to measure the magnitude of the impact of terrorist attacks on financial markets. Most of them have focused on the events surrounding the September 11, 2001 attacks, though a few have broadened the perspective over time and for countries beyond the U.S.

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" The war on terror is a different kind of war, waged capture by capture, cell by cell, and victory by victory. Our security is assured by our perseverance and by our sure belief in the success of liberty. And the United States of America will not relent until this war is won."

President George W. Bush
on 14 December 2003
following the capture of Saddam Hussein

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On January 12, 2006, four Royal Dutch Shell workers in the Baylesa province of the Niger Delta region were kidnapped by members of a militia group, Movement for the Emancipation of the Niger Delta (MEND), who called for the release of a former governor currently indicted for money laundering. Four days later, a major pipeline in the region was bombed suspending the daily flow of 226,000 barrels of oil, about 10% of Nigeria's average daily output of 2.6 million barrels. MEND claimed to have detonated the bomb. The hostages were released on January 27. Three weeks later, on February 17, another nine Shell oil workers were kidnapped by masked militants of the MEND group. They released their demands to the media[1] which included a payment of $1.5 million by Shell for damages due to pollution from oil production in the Bayelsa province. They were released within three weeks. On the day of the pipeline bombing, oil prices jumped $2 to over $65 per barrel. Royal Dutch Shell's share price declined by 0.52% on that same day, another 1.94% on the day of the second hostage taking and cumulatively declined by 6% over the five-week period.

Such events remind us that terrorism is an important geopolitical risk that affects the global economy and financial markets. The immediate impact of terrorist attacks on financial and commodity markets are predictable in that they lead to increases in investors' risk aversion. The market reactions are also consistent with the expected economic impact of terrorism in the intermediate and longer term: by reducing confidence and increasing the risk aversion of consumers and firms, by lowering consumption and real investment activity, by triggering economic slowdown if not outright recession, and by spilling over to other stock markets, fixed income market yields, currency and even other commodity markets. There is also the potential impact of psychological fear of terrorism on economic behavior.

For investors, corporations and government policymakers, it is critical to understand the magnitude of the effects of terrorist acts. It matters for whether and how investors might choose to incorporate the risk of a terrorist attack into the value of the shares of publicly-traded companies so exposed. It matters for corporations in their decision to seek out terrorism risk insurance and for the insurance companies is providing and pricing such products. Finally, it matters for governments charged with the task of supporting an insurance industry that may hesitate to furnish such insurance programs at reasonable premiums or for monetary and fiscal policymakers who may have to react to broad-based attacks like those of September 11, 2001.

The objective of this article is to outline what we, as researchers, know and, more importantly, what we do not yet know about the consequences of terrorism for financial markets. I outline a number of the efforts to assess the risk of terrorist attacks using quantitative techniques that are limited in scope as well as the limits of the databases used to operationalize such models. I also describe some of the research studies that have sought to measure the magnitude of the impact of terrorist attacks on financial markets. Most of them have focused on the events surrounding the September 11, 2001 attacks, though a few have broadened the perspective over time and for countries beyond the U.S.

[1] "Nigerian Militants Show Off U.S. Hostage," by Edward Harris, AP Newswire, February 24, 2006, 3:09pm.

The Dynamics of Terrorist Activity

Terrorism is not a recent phenomenon. Although terrorism is presumably a complex and multi-causal phenomenon lying between the nexus of war and peace, scholarly research on the causes of international terrorism has always been hampered by a clear, objective definition of the event and the absence of databases chronicling such events over time in a detailed, reliable and consistent manner**.** In fact, in an article, entitled "Conceptualizing Political Terrorism," in an edited volume by Charles Kegley, International Terrorism (1990, St. Martin's Publishers), Professor Richard Shultz pronounced the existing terrorism literature at the time to be "descriptive, prescriptive and obliquely emotive in form."

The earliest studies (for example, Sandler, Tschirhart and Cauley, 1983; Cauley and Im, 1988) employed the only publicly-available chronology of international terrorist events compiled by Edward Mickolus (1980). He computed monthly totals of skyjackings, barricade and hostage-taking events and all terrorist acts directed against diplomats. The development of the ITERATE (International Terrorism: Attributes of Terrorist Events) and International Crisis Behavior (ICB) databases represented the catalyst for a number of more disciplined studies of the dynamics of terrorist activity from a quantitative analysis perspective (such as, Enders and Sandler, 1993, 2000). ITERATE and ICB arose from a cooperative venture between Mickolus' team of researchers and the Inter-University Consortium for Political and Social Research (a unit based at the University of Michigan). They strung together hundreds of events coding incident dates, location, type, number of people killed and wounded, and other variables. In spite of efforts to maintain coding consistency over various updates, the reliance on newspaper and other media sources may have created unevenness and potential selection biases from inclusion/exclusion of small incidents.

The most recent initiative, arguably the most detailed and consistent yet, began in 1995 when annual reports had to be submitted in compliance with Title 22 of the United States Code, Section 2656(f), by the Department of State to Congress with a full and complete annual report on terrorism for those countries and groups meeting some objective criteria. These "Patterns of Global Terrorism" reports define terrorism to mean "premeditated, politically-motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents, usually intended to influence an audience." Each year, the annual report contains a list of "Designated Foreign Terrorist Organizations" (see Table 1 for the 2003 list) and a chronology appendix of acts of terrorism, including politically-motivated, religious-based and non-attributed acts. Consider the following two examples of terrorist events.

8-Apr-97	*Colombia*	*FARC guerrillas bombed a rail line at a mining complex in El Cerrejon, derailing 27 railcars, spilling 2,700 tons of coal and 3,700 gallons of diesel fuel, and damaging 550 yards of rail line. The mine is operated under concession by Intercor, a subsidiary of Exxon Corp.*
3-Feb-98	*Greece*	*Bombs detonated at two McDonald's restaurants in the Halandri and Vrilissia suburbs of Athens, causing extensive damage. Authorities suspect anarchists carried out the attacks in retaliation for the arrest of the alleged leader of the Fighting Guerrilla Formation (MAS).*

What does the data say? Figure 1 shows the total number of international terrorist attacks over 1982 to 2003 documented by the U.S. Department of State's Counterterrorism Office (the unit that compiles the annual report for Congress). The number of incidents has dropped remarkably over time from around 650 in

the mid-1980s to between 200 and 400 in the past five years. Enders and Sandler (2000) acknowledged this decreasing trend in the post-Cold War period which they attributed to reduced state sponsorship, increased efforts to thwart terrorism and the demise of many leftist groups. As noted in the examples above, the attacks are coded by geographic location; Figure 2 shows that the vast majority of attacks have taken place most recently (during 1998 to 2003) in Latin America (602 attacks, 34% of the total), followed by Asia (26%), Western Europe (13%), and the Middle East (12%). While North America records only 6 terrorist attacks during that period, it represents one of the largest target regions in terms of casualties. Figure 3 demonstrates that the 4,465 casualties (all stemming from three attacks in 2001) in North America are surpassed only by those in Africa (5,899) and Asia (5,590). Finally, Figure 4 shows that, among facilities struck by terrorist attacks, incorporated businesses are by far the greatest target (1,534 attacks, 64% of the total) with military, government and diplomatic facilities far behind in number.

What have we learned about the patterns of international terrorist activity? Hamilton and Hamilton (1983) were among the first to study these dynamics from a formal perspective applying stochastic models for social contagion. Not surprisingly, they find that more open societies have a harder time responding effectively to terrorism and weakening the tendency of terrorist acts to incite further violent acts. Cauley and Im (1988) use intervention analysis to study the effectiveness of increased security measures in airports and embassies and find that only the former were effective in deterring terrorist attacks. Enders and Sandler (1993) take this analysis one step further using vector autoregressive (VAR) models to find evidence of substitutes and complements among the attacks. In a more recent paper, Enders and Sandler (2000) study the time series properties of these terrorist attacks, distinguishing the stochastic from the deterministic components. Spectral analysis is used to investigate the presence of cycles, and the VAR framework is used to look for, among other things, structural shifts. Interestingly, they document a shift from politically-motivated terrorism to religious-motivated terrorism, based on changes in the number of casualties, around the takeover of the U.S. Embassy in Tehran. Krueger and Laitin (2003) conduct a study to determine which countries are more susceptible to develop terrorists and which countries these terrorists more likely to attack. They find that the origins of terrorism are in countries that suffer from political oppression; the targets are countries that enjoy economic well-being. Krueger and Maleckova (2003) continue the research initiated in the previous paper uncovering those variables that could reduce the creation of terrorists within a country. They do not find evidence that reductions in poverty or increases in education reduce significantly the export of terrorist activity. Further, on the relation between poverty and terrorism activity, they claim that 'any connection is complicated and weak.'

Terrorism and Stock Prices

Prices of individual stocks reflect investors' hopes and fears about the future, and taken in aggregate, stock price movements can generate a tidal wave of activity. Because of their liquidity, terrorist attacks and other unforeseen disastrous occurrences can have serious implications for stocks and bonds. Decisions to buy and sell can quickly, easily and inexpensively, be reversed. When information becomes available about a cataclysmic event, like a terrorist attack, investors often flee the market in search of safer financial instruments and panel selling can ensue. So, it seems logical to investigate the response of global capital markets to terrorist attacks and a number of studies have done so. One remarkable feature of these studies is that they have been published or completed in working paper form in only the past 2 or 3 years. Almost all of them employ standard statistical methodology to uncover abnormal returns (after adjusting for 'normal' using risk-return factor models) timed to occur around the terrorist events though they occur in different points of calendar time. But, they differ dramatically in terms of the types of events considered as well as the targets of the attacks. Some focus on the September 11, 2001 period, others broaden the focus to other terrorist or military attacks.

One question that each of these studies asks is whether the terrorist attacks are associated with significant negative abnormal returns and, if so, how large are the reactions? The answer is resoundingly yes and it depends. Chen and Seims (2004) study the impact of six major events (e.g., 1941 Pearl Harbor attack, 1990 Iraqi attack on Kuwait) on national market index returns over six-day windows surround the events and uncovered negative returns ranging from -2.75% around Pearl Harbor, -3.34% around the Korean Air bombing in November 1987, to as large as -7.14% around September 11, 2001. Berrebi and Klor (2005) focus only on attacks on Israeli companies during 1998-2000 Palestinian-Israel conflict. The innovative aspect of the study is that the Israeli companies are those cross-listed for trading in the U.S. and the benchmark sample constitutes other similar U.S. firms. They find large negative reactions of -0.77% overall, but for non-defense-related companies the reactions are more dramatic at -4.58%. Defense-related companies actually experience positive net reactions of +3.89%. Abadie and Gardeazabal (2003) study the costs of the Basque Country conflict in terms of economic growth and lost market capitalization of public firms. They report a 10% gap in the per capita growth of the Basque Country and that of a synthetic benchmark and they also find that Basque firms did significantly worse than non-Basque firms during the 1998-2000 period. Guidolin and La Ferrara (2005) looks at the effect on national stock market indices of 112 internal conflicts (civil wars) from 1974 to 2004 and find that a large number of those conflicts had a significant impact on stock indices and on commodity prices. Finally, Karolyi and Martell (2006), in the most broad-based, firm-level experiment to date, find a large negative stock price reaction of -0.83% around the day of a terrorist attack for 75 such events for publicly-traded companies domiciled in 11 different developed and emerging market countries.

One of the key factors that determine the magnitude of the impact is how closely related the firms are to the terrorism attack. The events surrounding September 11, 2001 (hereafter, “9/11”) prompted a number of studies of share-price reactions focused not just on the target companies, but also on those with different stakes in the tragedy, including insurance and real-estate companies. Cummins and Lewis (2003) analyze the returns of 43 property-casualty insurers and also find evidence of strong negative reactions. Doherty, Lamm-Tennant and Starks (2003) develop testable hypotheses about the cross-sectional variation in the price reaction of the stock of insurance companies following 9/11 from the capacity constraint, post-loss investment, and a variety of implicit insurance contracts models and find results in support. Kallberg, Liu and Pasquariello (2005) analyze the behavior of New York real estate investment trusts (REITs) to the 9/11 attack and report an initial positive reaction followed by downward revisions of expectations a couple of weeks after the attacks. Brown, Cummins, Lewis and Wei (2004) explain how the U.S. government, by providing ‘free’ reinsurance to domestic insurers via the 2002 Terrorism Risk Insurance Act (TRIA), may have involuntarily delayed or prevented the reemergence of private insurance following September 11, 2001. They conduct an analysis of the financial response to different stages of the passage of the Act from firms in different sectors of the economy and find negative reactions for those most likely to be affected by TRIA (banking, construction, REITs, transportation, utilities), but neutral reactions at best for property-casualty insurers.

This line of inquiry on “spillover effects” of terrorist attacks is critical as it helps portfolio managers to gauge how broad-based or “systematic” a potential terrorism risk factor might be. A proper investigation of this question mandates an analysis of “higher order” effects of terrorist attacks, however, including, say, on market- or individual stock-return volatility or market covariance (beta) risks in the context of an asset pricing model, like the CAPM. Only a few such studies have been attempted and with limited scope. Hon, Strauss and Yong (2003) showed that September 11, 2001 resulted in a significant increase in correlations across global financial markets, which they associate with financial market contagion. The effects were stronger among European and U.S. markets, than among those in Asia or Latin America. Choudhry (2003) evaluated whether the market betas of 20 U.S. firms in a variety of different industries experienced a significant shift after September 11, 2001. He finds very mixed results and with no obvious pattern by type of firm.

What Do We Still Need to Know?

We still know relatively little of the economic and financial consequences of terrorism, though it is clear that the level of terrorist activity will likely not slow for the foreseeable future. Corporations with global operations in countries that have abnormally-high risks of terrorist attacks need to understand it better, as do investors with holdings in such corporations and policy-makers with a mandate to respond to the immediate aftermath of attacks or those with a medium- to longer-term focus for regulatory, trade, monetary and fiscal policy.

We do know that financial markets react negatively to terrorist attacks by selling down shares of targeted firms, but we do not know whether these price changes reflect the consequences of direct asset losses, or changes in market beliefs that the attacks might change the firm's operations or its investment programs. We also do not know whether the share price reactions are permanent or transitory, perhaps reflecting some kind of psychological over-reaction to the terrorist event (Becker and Rubinstein, 2004). We know that there are measurable consequences of such attacks for shares of other firms that are economically related to the target of the attack, but these "spillover" effects vary in magnitude and in ways that are unrelated to any economic fundamentals. There are undoubtedly many avenues through which firms are connected to the attacks that are difficult to measure. For example, positive price reactions to a terrorist attack could reflect *competitive* effects in which investors adjust to improved cash flow expectations from the decreased capacity of a competitor firm and negative price reactions could reflect *contagion* effects as investors adjust discount rate expectations higher for increased terrorist risk exposures or for higher security costs. Ultimately, we need to know whether there exists a pervasive terrorism-related risk factor that is priced in the markets and how the premium for such a risk factor might vary over time.

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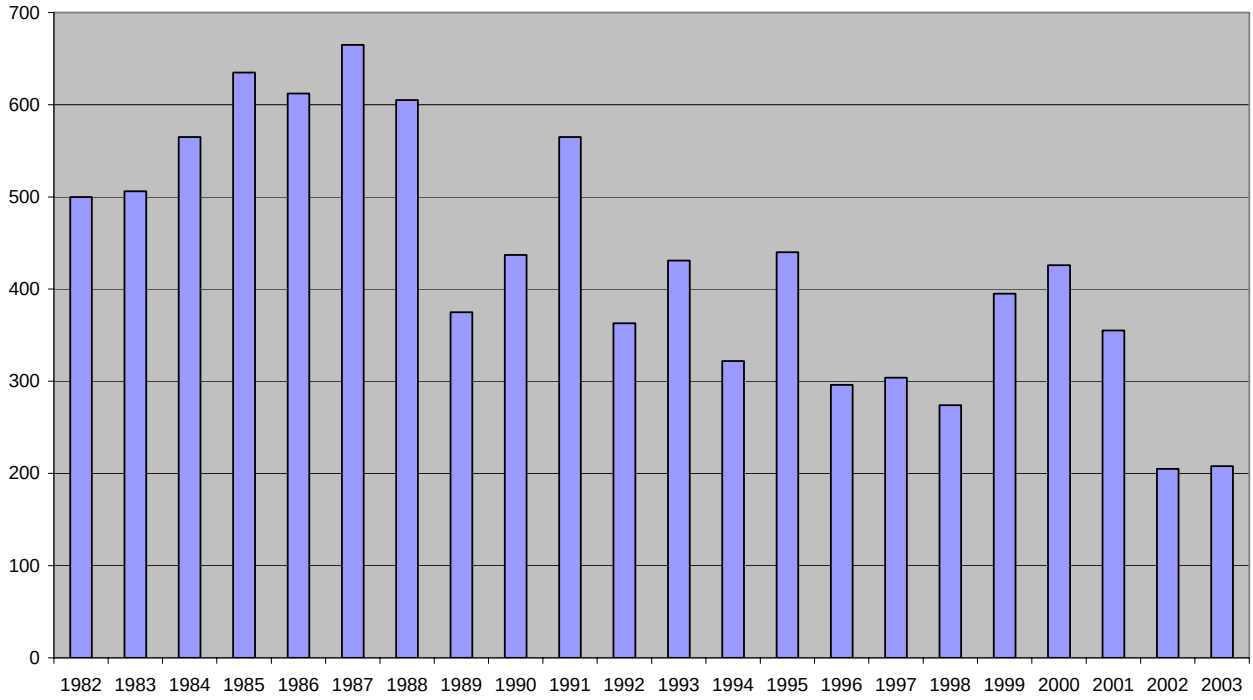
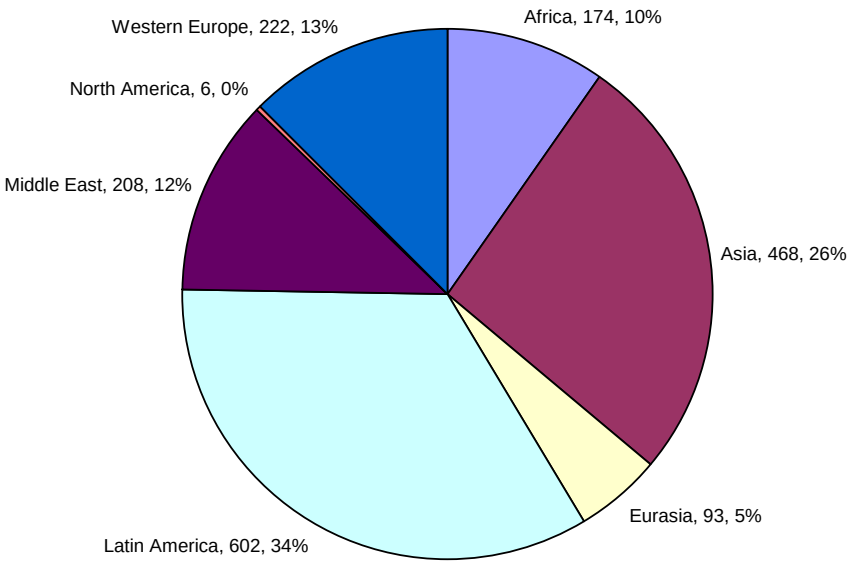
Figure 1
Total Number of International Terrorist Attacks, 1982-2003
U.S. Department of State Counterterrorism Office



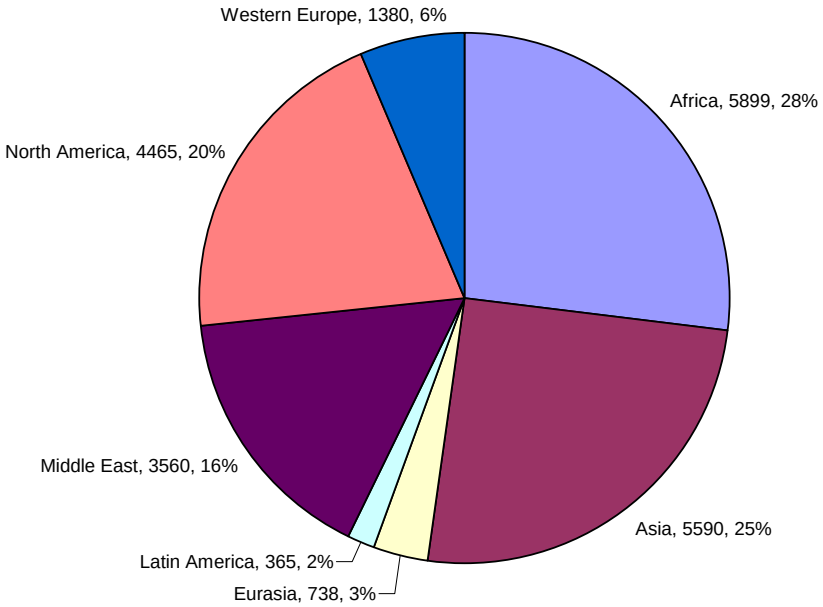
Source: Appendix G, Patterns of Global Terrorism, 2003 Report, Released by the Office of the Coordinator for Counterterrorism, June 22, 2004 (http://www.state.gov/s/ct/rls/crt/2003).

Figure 2
All International Terrorist Attacks, By Geographic Location, 1998-2003
US Department of State Counterterrorism Office



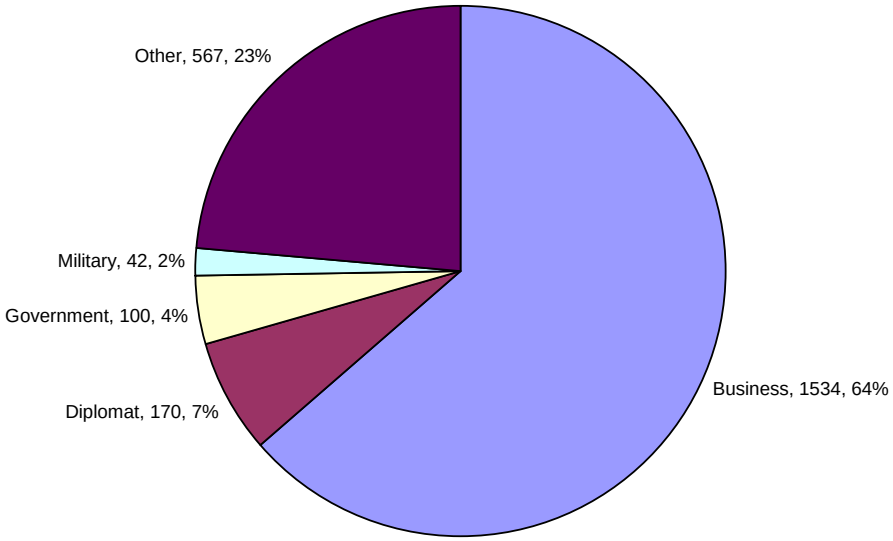
Source: Appendix G, Patterns of Global Terrorism, 2003 Report, Released by the Office of the Coordinator for Counterterrorism, June 22, 2004 (http://www.state.gov/s/ct/rls/crt/2003).

Figure 3
Casualties in International Terrorist Attacks, 1998-2003
US Department of State, Counterterrorism Office



Source: Appendix G, Patterns of Global Terrorism, 2003 Report, Released by the Office of the Coordinator for Counterterrorism, June 22, 2004 (http://www.state.gov/s/ct/rls/crt/2003).

Figure 4
Facilities Struck by Terrorist Attacks, By Type, 1998-2003
US Department of State, Counterterrorism Office



Source: Appendix G, Patterns of Global Terrorism, 2003 Report, Released by the Office of the Coordinator for Counterterrorism, June 22, 2004 (http://www.state.gov/s/ct/rls/crt/2003).

Table 1
Appendix B -- Background Information on Designated Foreign Terrorist Organizations

Abu Nidal organization (ANO)
Abu Sayyaf Group (ASG)
Al-Aqsa Martyrs Brigade
Ansar al-Islam (AI)
Armed Islamic Group (GIA)
'Asbat al-Ansar
Aum Supreme Truth (Aum) Aum Shinrikyo
Basque Fatherland and Liberty (ETA)
Communist Party of Philippines (CPP)
Al-Gama'a al-Islamiyya (Islamic Group, IG)
HAMAS (Islamic Resistance Movement)
Harakat ul Mujahidin (HUM)
Hizballah (Party of God)
Islamic Movement of Uzbekistan (IMU)
Jaish-e-Mohammed (JEM)
Jemaah Islamiya (JI)
Al-Jihad (Egyptian Islamic Jihad, EIJ)
Kahane Chai (Kach)
Kongra-Gel (KGK, formerly Kurdistan Workers' Party)
Lashkar-e-Tayyiba (LT)
Lashkar I Jhangvi (LJ)
Liberation Tigers of Tamil Eelam (LTTE)
Mujahedin-e Khalq Organization (MEK or MKO)
National Liberation Army (ELN)—Colombia
Palestine Islamic Jihad (PIJ)
Palestine Liberation Front (PLF)
Popular Front for the Liberation of Palestine (PFLP)
Al-Qaida
Real IRA (RIRA)
Revolutionary Armed Forces of Colombia (FARC)
Revolutionary Nuclei (RN)
Revolutionary Organization 17 November (17 November)
Revolutionary People's Liberation Party/Front (DHKP/C)
Salafi st Group for Call and Combat (GSPC)
Sendero Luminoso (Shining Path or SL)
United Self-Defense Forces/Group of Colombia (AUC)

Source: Appendix B, Patterns of Global Terrorism, 2003 Report, Released by the Office of the Coordinator for Counterterrorism, June 22, 2004 (http://www.state.gov/s/ct/rls/crt/2003).