ANL/DIS-11-2

Impact of Post-Event Avoidance Behavior on Commercial Facilities Sector Venues – Literature Review

Decision and Information Sciences Division

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by
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Contents

Contents (Cont.)

Figures

Tables

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Impact of Post-Event Behaviors on Commercial Facilities Sector Venues – Literature Review

ES 1 Executive Summary

ES 1.1 Introduction

The terrorist attacks of September 11, 2001 (9/11), focused a great deal of interest and concern on how individual and social perceptions of risk change behavior and subsequently affect commercial sector venues.

Argonne conducted a review of the literature to identify studies that quantify the direct and indirect economic consequences of avoidance behaviors that result from terrorist attacks. Despite a growing amount of literature addressing terrorism impacts, relatively little is known about the causal relationships between risk perception, human avoidance behaviors, and the economic effects on commercial venues. Nevertheless, the technical and academic literature does provide some evidence, both directly and by inference, of the level and duration of post-event avoidance behaviors on commercial venues. Key findings are summarized in this Executive Summary. Also included as an appendix is a more detailed summary table of literature findings reproduced from the full report.

ES 1.2 Commercial Real Estate

After the attacks of 9/11, vacancies increased by 10–15 percent and rental values decreased by 25–30 percent for properties surrounding trophy buildings similar to those targeted in the attacks.

After 9/11, areas within a 0.3-mile "shadow radius" of the Sears Tower (now Willis Tower), the Aon Center, and the Hancock Center in Chicago experienced a much more pronounced increase in vacancy rates than other areas of the city. During the first quarter of 2001, the average vacancy rate was approximately 9 percent in shadow areas and 7 percent in non-shadow areas. By the first quarter of 2006, average vacancy rates had increased to 17 percent in shadow areas and 12 percent in non-shadow areas.

Between the third quarters of 2001 and 2002, vacancy rates for high-profile buildings, such as the Empire State Building and the Sears Tower, increased from 7 percent to 13 percent, and rental rates dropped 33 percent from $45 to about $30 per square foot. The appraised value of the Sears Tower dropped 9 percent, from $911 million in 2001 to $826 million in 2002, and some

high-profile tenants moved out of the building. Local real estate analysts reported that Sears Tower rents dropped 25 percent compared to a 10 percent drop for Chicago office space overall.

ES 1.3 Domestic Airline and Highway Travel

After the attacks of 9/11, airline travel declined by 30–40 percent and did not recover until 3 years later. Substitution of automobile travel led to an estimated 1,200–1,600 more highway fatalities.

Time-series analysis of commercial airline ridership revealed a 30 percent reduction in air travel attributable to public fear of flying, followed by an additional 7–8 percent reduction attributable to more rigorous passenger screening at the airports. The analysis isolated the effects of avoidance behavior from the effects of the economic downturn following the 9/11 attacks. Results of similar analyses suggest that airline revenue passenger miles did not recover to the pre-9/11 levels until 3 years after the attacks.

Avoidance of airline travel has also been blamed for an increase in interstate highway travel that resulted in an additional 1,200 to 1,600 estimated highway deaths during the year following the 9/11 attacks as driving was substituted for flying.

ES 1.4 Tourism – Domestic and International

Studies of Mediterranean and Middle Eastern countries indicate that following the commencement of terrorist attacks, discretionary travel by international visitors initially declined by 60–80 percent, and discretionary domestic travel declined by 5–30 percent. Domestic travelers tended to resume their normal patterns quickly, despite ongoing terrorist activity.

Overnight stays in Israel by international tourists dropped almost 60 percent, and overnight stays by domestic travelers dropped 10 percent at the start of terrorist activities in the wake of the Second Intifada terrorist attacks in October 2000. After the initial decrease, overnight hotel stays by domestic tourists rebounded and even increased, while overnight stays by foreign tourists continued to decrease to 80 percent below pre-terrorist levels. The swift recovery of domestic tourism may reflect the adaptation of Israeli society to chronic and sustained terrorism.

On December 27, 1985, terrorists attacked El Al ticket counters in the Rome and Vienna airports using machine guns and hand grenades, killing 19 civilians. Following those attacks, a disproportionately high number of Americans changed their foreign travel plans despite the extremely low probability (1 in 172,000) of an American tourist being injured or killed in a terrorist incident while traveling abroad.

Terrorism activity in Spain in 1970–1988 reduced international tourism by one-third, and fear of a terrorist incident frightened away 140,000 potential tourists. A similar study of Greece, Israel, and Turkey indicated that in 1991–2000, each terrorist incident reduced a country's base tourism market by 4–7 percent.

ES 1.5 Theme Parks

A terrorist attack on a single U.S. theme park could result in as much as $23 billion in losses across the theme park industry, regardless of the range of losses experienced by the targeted venue.

A simulation model was used to estimate the business interruption costs of a terrorist attack on a U.S. theme park. Assuming that the impacts are contained to the theme park attacked, the economic impacts range from $0.5 billion to $11.3 billion. If the attack results in "spillover" effects on other theme parks, the economic impact of an attack would range from $19 billion to $23 billion.

Assuming that theme park patrons substitute visits to national parks for visits to theme parks, the net loss would be $8.3 billion, with major losses in Florida and California offset by geographically distributed gains in states such as Arizona, Utah, and Wyoming.

ES 1.6 Other Avoidance Behavior

People initially avoid terrorist-targeted venues or adapt normal daily activities to avoid locations perceived to be vulnerable to subsequent attacks. It is not atypical for a 25–40 percent decline in venue use to immediately follow an incident. The rate at which normal activity resumes depends on the situation.

Two weeks after the July 7, 2005, terrorist attacks on the London Tube, 32 percent of commuters surveyed intended to travel less often by mass transportation into central London. This percentage declined to 19 percent by 7 months after the attack, with a corresponding reduction in the level of fear. By comparison, after the 2004 Madrid attacks, the corresponding decline in train travel was of shorter duration, lasting about 2 months.

During the 2003 sniper shootings in the Washington, D.C., metropolitan area, over one third of residents surveyed reported leaving their household less often than usual because of concerns about the sniper, with 16 percent reporting that they sheltered in their residence for 1 or more days because of the shootings. Among residents who reported employment outside the home, more than 5 percent reported having missed one or more days of work because of the sniper shootings.

ES 1.7 Macroeconomic Impacts

Sustained terrorist activity constrains investment and leads to a long-term decline in gross domestic product (GDP) of 10–15 percent.

During the period of heightened terrorism during the Second Intifada, Israeli output per capita was 10–15 percent less than in the preceding period as a result of the terrorist attacks. It has been estimated that the outbreak of terrorism in the Basque region of Spain in the late 1960s resulted in a 10 percent decline in per-capita GDP over a 20-year period relative to a synthetic control region without terrorism.

ES 1.8 Psychological Impacts

Ten to twenty percent of terrorist attack victims may be affected by chronic Post-Traumatic Stress Disorder (PTSD) over a long period of time and often engage in various avoidance behaviors as a coping method.

An analysis of more than 100 quantitative studies of the behavioral health effects of terrorist incidents found that the prevalence rate of PTSD dropped from 16 percent to 14 percent to 12 percent for studies conducted 2 months, 6 months, and 1 year, respectively, after an event. All but two of the studies involved explosions or armed attacks; the other two were biological incidents.

Some victims of the sarin attack in Tokyo in 1995 continued to suffer physical and emotional symptoms as many as 5 years after the terrorist incident.

Seven months after the attacks, 14 percent of respondents in one of the Pentagon commands displayed symptoms consistent with probable PTSD, and 13 percent reported using more alcohol than intended.

Other studies conclude that denial, self-distraction through activity, and avoidance of television and radio broadcasts were frequently employed as PTSD coping mechanisms.

ES 1.9 References

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Neumayer, E. (2004) "The Impact of Political Violence on Tourism: Dynamic Cross-National Estimation," *The Journal of Conflict Resolution* 48(2): 259–281.

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Rubin, G.J., C.R. Brewin, N. Greenberg, J. Simpson, and S. Wessely (2005) "Psychological and Behavioural Reactions to the Bombings in London on 7 July 2005: Cross Sectional Survey of a Representative Sample of Londoners," *British Medical Journal*, September 17; 331(7517): 606.

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Sönmez, S.F., Y. Apostolopoulos, and P. Tarlow (1999) "Tourism in Crisis: Managing the Effects of Terrorism," *Journal of Travel Research* 38(1): 13–18.

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ES 1.10 Appendix

Table 1: Summary of Citations Containing Quantitative Evidence of Post-Event Behavioral Impacts

Venue or Discipline/ Cited Reference	Description	Findings
Commercial Real Estate Abadie, A., and S. Dermisi (2008) "Is Terrorism Eroding Agglomeration Economies in Central Business Districts? Lessons from the Office Real Estate Market in Downtown Chicago," *Journal of Urban Economics* 64(2): 451–463. *See full report page 29; Figure 5 (page 30).*	Uses vacancy rates as a proxy for behavioral change in downtown Chicago office buildings to examine the impact of increased risk perception after 9/11.	Concludes that after 9/11, areas within a 0.3-mile radius ("shadow area") of the Sears (Willis) Tower, Aon Center, and Hancock Center in Chicago experienced a much more pronounced increase in vacancy rates than did other areas of the city. In the first quarter of 2001 (1Q 2001), the average vacancy rate was approximately 9 percent in shadow areas and 7 percent in non-shadow areas. In 1Q 2006, average vacancy rates had increased to 17.4 percent in shadow areas and 12.3 percent in non-shadow areas.
Commercial Real Estate Miller, N.G., A. Florance, and B. Stevenson (2003) "The 9/11/2001 Impact on Trophy and Tall Office Property," *Journal of Real Estate Portfolio Management* 9(2): 107–125. *See full report page 29; Figure 4 (page 29).*	Empirically examines post-9/11 behavior and the impact it had on occupancy rates and the value of tall and trophy buildings.	Concludes that there is little evidence of any significant departure from general market trends for tall buildings or most "trophy" property. However, for a small subset of truly famous buildings in both New York City and Chicago, such as the Empire State Building and the Sears (Willis), there were significant rental and value losses. Vacancy rates for these buildings increased from 7 percent to 13 percent, and the rental rated dropped from $45 to about $30 per square foot between 3Q 2001 and 3Q 2002. (See Figure 4 in the full report.)
Commercial Real Estate Lyne, J. (2002) "Continuing 9/11 Concerns Stall REIT's Scheduled Sears Tower Buy," *The Site* Selection Online Insider, Week of November 11, available at http://www.siteselection.com/ssinsider/pwatch/pw021111.htm, accessed September 7, 2010. *See full report pages 15, 31.*	Periodic industry analysis/news account.	In 1997, Trizec Properties, which controlled the leasing and management of the Sears Tower, invested U.S.$70 million in the Sears Tower, and in the process, acquired an option to buy the skyscraper. In 3Q 2002, Trizec wrote down $48.3 million of the $70 million it invested. Prompting that write-down were persistent post-9/11 concerns over signature properties' diminished appeal and lower rents. Also, the 110-story Sears Tower had been appraised at $826 million in 2002, a sharp drop from the appraisal of $911 million in 2001. Moreover, some high-profile tenants were defecting, countering earlier reports that the 9/11 attacks were having no impact on the Sears Tower's occupancy. Chicago commercial market analysts reported that Sears Tower rents dropped by 25 percent, a drop that was 15 percent steeper than the overall reduction in the Chicago office market.

Table 1: (Cont.)

Venue or Discipline/ Cited Reference	Description	Findings
Theme Parks Gordon, P., J.E. Moore II, S.J. Kim, J. Park, Q. Pan, and H.W. Richardson (2008) "Tourism and Terrorism: The National and Interregional Economic Impacts of Attacks on Major U.S. Theme Parks," in H.W. Richardson, P. Gordon, and J.E. Moore II (editors), *The Economic Costs and Consequences of Terrorism,* Cheltenham: Edward Elgar Publishing. *See full report page 25.*	Uses a simulation model to assess the business interruption costs of a terrorist event on U.S. theme parks.	Assuming that impacts would be constrained to the theme parks attacked, the economic impacts would range from $0.5 billion to $11.3 billion. If the attack resulted in spillover effects on other theme parks, its economic impact would range from $19 billion to $23 billion. Assuming that theme park patrons would substitute visits to national parks for visits to theme parks, the net loss would be $8.3 billion, with major losses in Florida and California offset by geographically spread-out gains in states such as Arizona, Utah, and Wyoming.
Tourism Enders, W., and T. Sandler (1991) "Causality between Transnational Terrorism and Tourism: The Case of Spain," *Terrorism* 14:49–58. *See full report page 25.*	The study uses monthly data for 1970–1988 to relate terrorism and tourism for Spain. A causality test establishes that terrorism affects tourism, but not the reverse. The study uses the vector auto-regression (VAR) method.	Spain would have had 50 percent more tourists in the study period. A typical terrorist incident is estimated to frighten 140,000 tourists away from Spain when all impacts are combined.
Tourism Enders, W., T. Sandler, and G.F. Parise (1992) "An Econometric Analysis of the Impact of Terrorism on Tourism," *Kyklos* 45: 531–554. *See full report page 26.*	Relates share of tourist receipts to lagged shares of tourist receipts and lagged terrorist attacks. Focuses on Austria, Spain, and Italy for 1974–1988. Other continental countries are included to investigate out-of-region losses. Uses autoregressive integrated moving-average (ARIMA) model with transfer function.	During the sample period, tourist losses varied: Austria lost 3.37 billion special drawing rights (SDRs); Italy lost 861 million SDRs; and Greece lost 472 million SDRs. The sample of European countries lost 12.6 billion SDRs of tourist receipts to North America.

Venue or Discipline/ Cited Reference	Description	Findings
Tourism Drakos, K., and A.M. Kutan (2001) "Regional Effects of Terrorism on Tourism: Evidence from Three Mediterranean Countries," in *Understanding Terrorism, Second Edition*, Gus Martin (Ed.), Sage Publications, available at http://www.sagepub.com/Martin2Study/pdfs/Chapter%208/Drakos%20&%20Kutan%20article.pdf, accessed January 2011. *See full report page 26; Table 1 (page 27).*	Using monthly data for 1991–2000, the study relates a country's share of tourist receipts to terrorism. Focuses on Greece, Israel, and Turkey. Allows for terrorist-induced substitutions within and among regions. Uses autoregressive integrated moving-average (ARIMA) model with transfer function.	Each terrorist incident in Greece results in a loss of 6.8 percent of Greece's base tourism market share. For Israel, the impact is 8.1 percent of its base share. Turkey experiences an average loss of 4.4 percent of its base share. For Greece, a 6.8 percent decline in its base market share results in the loss of $35 million per month in tourism revenues. About 89 percent of lost tourism from Europe flowed to safer regions.
Tourism Yechiam, E., G. Barron, and I. Erev (2005) "The Role of Personal Experience in Contributing to Different Patterns of Response to Rare Terrorist Attacks," *Journal of Conflict Resolution* 49: 430–439. *See full report page 23; Figure 2 (page 24).*	Studies the effect of terrorist attacks on local residents and international tourists as a result of the Al-Aqsa Intifada (also known as the Second Intifada).	Attacks caused an initial drop in overnight stays of almost 60 percent for international tourists and 10 percent for domestic visitors in October 2000, the start of terrorist activities. After the initial decrease, domestic tourists' overnight stays in hotels rebounded and even increased, while the overnight stays of inbound tourists continued to decrease. A comparison of October 2000 with October 2001 shows an 80 percent decrease for international tourists and a 20 percent increase for domestic tourists.
Tourism Sönmez, S. F., Y. Apostolopoulos, and P. Tarlow (1999) "Tourism in Crisis: Managing the Effects of Terrorism," *Journal of Travel Research* 38(1): 13–18. *See full report page 44.*	Argues that tourist destinations, especially those vulnerable to politically motivated violence, should incorporate crisis management planning into their overall sustainable development and marketing strategies.	In 1985, the empirical probability of an American tourist being injured or killed in a terrorist incident while travelling abroad was approximately 1 in 172,000 (0.0000057). In spite of this extremely low probability, about "2 million Americans changed their foreign travel plans in 1986 as a result of the previous year's events."
Tourism Neumayer, E. (2004) "The Impact of Political Violence on Tourism: Dynamic Cross-National Estimation," *The Journal of Conflict Resolution* 48(2): 259–281. *See full report page 44.*	Estimates the impact of various forms of political violence, human rights violations, conflict, and other politically motivated violent events on tourist arrivals. For a large number of countries, tourism demand is measured as the number of tourist arrivals in a given country. Two estimation techniques – a fixed-effects panel estimator with contemporaneous effects only, and a dynamic generalized method of moments estimator – are used to test the impact of political violence on tourism.	An increase in the number of terrorist events by one standard deviation results in a contemporaneous (short-term) change in tourist arrivals of –8.8 percent in the short term and a decline of 14.8 percent in the long term. A similar increase in violent events results in a –5.7 percent short-term change and a –8.4 percent long-term change. A conflict intensity measure increase of one standard deviation results in a much larger change – more than –22 percent in the short term and –26.1 percent in the long term.

Venue or Discipline/ Cited Reference	Description	Findings
Tourism Reisinger, Y., and F. Mavondo (2005) "Travel Anxiety and Intentions to Travel Internationally: Implications of Travel Risk Perception," *Journal of Travel Research* 43: 212–225. *See full report page 45.*	Cites World Trade Organization (2002): "Tourism between 'Moderate Optimism' and 'Structural Changes,' WTO Tourism Recovery Committee says." (This is a news account of The WTO Tourism Recovery Committee at the World Travel Market in London on November 12, 2002.)	This quotes the Minister for Culture and Tourism of the Republic of Indonesia, H.E. Mr. Gede Ardika: "We suspect that we will confront the fall of income from the tourism sector. The earnings from international tourists will plunge by U.S.$1.8 billion, as the income from domestic tourists will be reduced at least in an equivalent of U.S.$2 billion. These figures will trigger a 6.6 percent drop in our gross domestic products. …It is predicted that by the first 6 months there will be at least 2.7 million people unemployed all over Indonesia due to this incident."
Tourism Ito, H., and D. Lee (2005), "Assessing the Impact of the September 11 Terrorist Attacks on U.S. Airline Demand," *Journal of Economics and Business* 57(1): 75–95. *See full report page 27; Figure 3 (page 28).*	Studies the impact of 9/11 by using monthly time-series data to analyze the impact on the airline industry attributable to the attacks on 9/11. The analysis and model attempts to isolate behavioral effects by correcting for the economic downturn and other factors that influenced airline passenger travel following 9/11.	9/11 resulted in both a negative transitory shock in excess of 30 percent due to a fear of flying and an ongoing negative demand shock amounting to roughly 7.4 percent due to more rigorous passenger screening procedures and perceived risk of flying. The study ended with data from November 2003, prior to full recovery of airline travel to pre-9/11 levels. *Author's note: Information based on a confidential analysis by the Boeing Company, obtained through personal communications, suggests that airline revenue passenger miles did not recover to the pre-9/11 trend until 3 years after the attacks, a year after the Ito and Lee data series ends.*
Transportation Blalock, G., V. Kadiyali, and D.H. Simon (2005) "The Impact of 9/11 on Road Fatalities: The Other Lives Lost to Terrorism," Feb. 10, *Chronicle Online: Daily News from Cornell University*, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=677549, accessed January 2011. *See full report page 28.*	Analyzes the impacts of increased interstate highway travel that was substituted for air travel by Americans after 9/11, correcting for weather, road conditions, and other factors.	This study concludes that this suboptimal choice weakened over time but led to about 1,200 additional driving fatalities attributable to the effect of 9/11.
Transportation Gigerenzer, G. (2006) "Out of the Frying Pan into the Fire: Behavioral Reactions to Terrorist Attacks," *Risk Analysis* 26(2): 347–351. *See full report pages 15, 28, 44.*	Explores avoidance behavior as a potential cause for the indirect damages from terrorism by analyzing the impacts of increased interstate highway travel that was substituted for air travel by Americans after 9/11.	Estimates that after 9/11, public avoidance of airline travel resulted in 1,595 additional highway deaths because driving was substituted for flying. The analysis indicates that this increase lasted for approximately 12 months. By comparison, after the 2004 Madrid attacks, there was a corresponding decline in train travel that was of shorter duration, lasting about 2 months.

Venue or Discipline/ Cited Reference	Description	Findings
Transportation Stecklov, G., and J.R. Goldstein (2004) "Terror Attacks Influence Driving Behavior in Israel," in *Proceedings of the National Academy of Sciences of the United States of America*. *See full report page 40; Figure 6 (page 41).*	Analyzes traffic flow statistics and daily time-series data on automobile accidents in Israel from January 2001 through June 2002, an 18-month period that included a large number of terrorist attacks.	Discovers a lull in the light accident rate on the day after an attack, followed by a spike in traffic accident fatalities 3 days after an attack. Also finds that the effects on accidents are proportional to the severity of the attack. Authors interpret these results to suggest that terror attacks in Israel have broad, short-term behavioral effects on the general population. They conclude that the "third-day spike in traffic fatalities suggests that terror attacks have indirect effects as well as immediate casualties. Some portion of this increase in traffic fatalities may be terror-induced suicides. However, the increase may also reveal a more general delayed reaction to violence and stress."
Transportation Rubin, G.J., C.R. Brewin, N. Greenberg, J. Simpson, and S. Wessely (2005) "Psychological and Behavioural Reactions to the Bombings in London on 7 July 2005: Cross-Sectional Survey of a Representative Sample of Londoners," *British Medical Journal,* September 17, 331(7517): 606. Rubin, G.J., C.R. Brewin, N. Greenberg, J. Hacker Hughes, J. Simpson, and S. Wessely (2007) "Enduring Consequences of Terrorism: 7-Month Follow-Up Survey of Reactions to the Bombings in London on 7 July 2005," *British Journal of Psychiatry* 190: 350–356. *See full report page 40; Table 4 (page 40).*	Survey undertaken in the second week following the July 7, 2005, terrorist attacks on the central London transportation network (Rubin et al. 2005). Seven months later, a follow-up survey was undertaken to assess the endurance of the earlier reactions (Rubin et al. 2007).	The results of the first survey indicate that two weeks after the attack, 32 percent of respondents "intended to travel less often by one or more of tube, train, [or] bus or [go] into Central London." This number dropped to 19 percent by 7 months after the attack. The reduction in avoidance behavior coincided with a reduction in fear (i.e., "feeling very unsafe when traveling" by these means) from 19 percent two weeks after the attack to 12 percent after 7 months. Ninety percent of respondents to both surveys believed another attack on London was likely in the near future.

Venue or Discipline/ Cited Reference	Description	Findings
Multiple Venues – Avoidance Behavior Schulden, J., J. Chen, M.-J. Kresnow, I. Arias, A. Crosby, J. Mercy, T. Simon, P. Thomas, J. Davies-Cole, and D. Blythe (2006) "Psychological Responses to the Sniper Attacks Washington DC Area, October 2002," *American Journal of Preventive Medicine* 31(4): 324–327. *See full report page 42; Table 5 (page 43).*	Assesses the psychological and behavioral responses of residents of the Washington, D.C., metropolitan area to the October 2002 sniper shootings, as well as the association between measures of exposure to the shootings and elevated traumatic stress. A cross-sectional survey was conducted through random digit dialing (RDD) telephone interviews during May 2003. Survey data were collected from a random sample (n = 1205) of adult residents living in Washington, D.C., and Montgomery County and Prince Georges County, Maryland, during any portion of the period when the sniper shootings occurred. The response rate for the survey was 56.4 percent. Main outcome measures include self-reports regarding traumatic stress symptoms, perceptions of safety, behavioral responses, and exposures to incidents.	More than 50 percent of residents reported feeling less safe in their neighborhood; 66 percent reported feeling less safe at other public areas, such as shopping centers and parks; and 45 percent of respondents reported going to public spaces, such as parks and shopping centers, less often than usual. More than 33 percent of residents reported leaving their household less often than usual due to concerns about the sniper, with 16.4 percent reporting that they sheltered in their residence for 1 or more days because of the shootings. Among residents who reported employment outside the home, 5.5 percent reported having missed 1 or more days of work because of the sniper shootings. Women who reported living within 5 miles of any shooting incident were significantly more likely to report elevated traumatic stress symptoms – consistent with a probable diagnosis of PTSD – than women who reported living farther from incidents. Among men, there was no significant association between reported residential proximity and elevated traumatic stress symptoms.
Labor Force / Work Hours Hotchkiss, J.L., and O. Pavlova (2009) "The Impact of 9/11 on Hours of Work and Labour Force Participation in the U.S.," *Applied Economics Letters* 16: 999–1003. *See full report page 42.*	Uses observed changes in hours of work and labor force participation to draw inferences regarding behavioral responses to the 9/11 terrorist attacks. The analysis is based on the Current Population Survey. It controlled for differences in demographics and labor market conditions.	For most sub-samples, there was no change in labor force participation or in hours of work after 9/11 relative to before the attacks. Exceptions were women, who increased their labor force participation, and workers living in the proximity of one of the 9/11 events, who increased their hours of work. These results are consistent with a precautionary increase in labor supply during an uncertain time, and with others' documentation of women responding more dramatically to external stressors.
Macroeconomic Abadie, A., and J. Gardeazabal (2003) "The Economic Costs of Conflict: A Case Study of the Basque Country," *American Economic Review* 93(1): 113–132. *See full report page 32.*	Case study for Spain contrasts the Basque region in Spain that has terrorism with a "synthetic" region without terrorism. The latter is based on a weighted composite of other peaceful regions in Spain.	Finds that after the outbreak of terrorism in the Basque in the late 1960s, the per-capita GDP declined by 10 percent over a 20-year period relative to a synthetic control region without terrorism. Concludes that a higher risk of terrorism can be associated with a decline in per-capital GDP.

Venue or Discipline/ Cited Reference	Description	Findings
Macroeconomic Eckstein, Z., and D. Tsiddon (2004) "Macroeconomic Consequences of Terror : Theory and the Case of Israel," Centre for Economic Policy Research Discussion Paper 4427, London. *See full report page 32.*	Develops a theoretical model to estimate the impact of terror on GDP, demonstrate the costs and benefits of defense expenditures, and analyze the optimal response of a government to certain levels of terror. It then uses a case example in the Israeli economy to test the model by using a vector autoregression (VAR) methodology.	Shows that per-capita output of Israel in March 2003 was 10–15 percent lower than it otherwise would have been as a result of the terrorist attacks that occurred in the period leading up to March 2003.
Psychological - Avoidance Conejero, S., and I. Etxebarria (2007) "The Impact of the Madrid Bombings on Personal Emotions, Emotional Atmosphere and Emotional Climate," *Journal of Social Issues* 63(2): 273–287. *See full report page 39.*	Examined consequences of the March 11, 2004, Madrid bombing 1 week and 2 months after the incident by using a regression model that employed the analysis of data from a sample of 1,807 subjects from Spain's seven autonomous regions. The objective was to model the influence of personal emotions (individual level) and the country's emotional climate (aggregate level) on certain avoidance behaviors. It relates emotional dimensions with certain behaviors, such as avoiding "going out" and "catching a plane." With regard specifically to intergroup avoidance, respondents were asked if, in the light of March 11 events, "they avoided dealings with either Muslims or Basques."	Personal emotions and emotional climate showed significant improvement between 1 week and 2 months after the attack. These variables also contributed to the model's ability to predict a number of individual behaviors, including both types of avoidance behaviors. The regression model resulted in statistically significant results, but with relatively low explanatory power. The analysis revealed that "personal negative emotional response" could account for 5 percent of the variance in avoidance behaviors. By introducing the "negative atmosphere" variable, explanatory power increased to 5.6 percent. The addition of "emotional climate" raised it to 6.4 percent of the variance in avoidance behaviors.
Psychological – Avoidance Bleich, A., M. Gelkopf, and Z. Solomon (2003) "Exposure to Terrorism, Stress-Related Mental Health Symptoms and Coping Behaviors among a Nationally Representative Sample in Israel," *Journal of the American Medical Association* 290(5): 612–620. *See full report page 41.*	Examines coping mechanisms, including avoidance behaviors, of a nationally representative sample of people in Israel approximately 19 months after the beginning of the Second Intifada in late September 2000.	The study concludes that denial, self-distraction through activity, and avoidance of television and radio broadcasts were frequently employed, ranging from 46 percent to 32 percent for individuals who "ever" used these modes. Those who "always" used these coping mechanisms represented less than 10 percent of respondents.

Venue or Discipline/ Cited Reference	Description	Findings
Psychological – Avoidance Huddy, L., S. Feldman, T. Capelos, and C. Provost (2002) "The Consequences of Terrorism: Disentangling the Effects of Personal and National Threat," *Political Psychology* 23(3): 485–509. *See full report page 51; Table 6 (page 52).*	Uses data collected through an RDD survey conducted in the immediate aftermath of 9/11 to study differences in attitudes based on personal and national threat perceptions. The respondents were New York residents living in Long Island and Queens.	The results show that there is a negative correlation between the dependent variable of threat perception and independent variables, such as future predictions of national economic conditions and individual-level behaviors like travel into Manhattan. Moreover, the strength of the negative correlation depends on the nature of the independent variable. (See body of report for explanation of quantitative results.)
Psychological – PTSD DiMaggio, C., and S. Galea (2006) "The Behavioral Consequences of Terrorism: A Meta-analysis," *Academic Emergency Medicine* 13: 559–566. *See full report page 38.*	Meta-analysis of 113 post-1980 quantitative studies of the behavioral health effects of terrorist incidents, focusing primarily on the prevalence and correlates of PTSD. All but two of the studies involved explosions or armed attacks; the other two were biological incidents.	Found the prevalence rate of PTSD for studies conducted 2 month, 6 months, and 1 year after the event dropped from 16 percent to 14 percent to 12 percent, respectively.
Psychological – PTSD Stein, B.D., T.L. Tanielian, D.P. Eisenman, D.J. Keyser, M.A. Burnam, and H.A. Pincus (2004) "Emotional and Behavioral Consequences of Bioterrorism: Planning a Public Health Response," *The Milbank Quarterly* 82(3): 413–455. *See full report pages 37, 38; Table 3 (page 37).*	Cites results from a number of various other studies. See full text for details on cited references.	A majority of hostage victims in Israel in 1996 continued to experience stress symptoms as many as 17 years later (p. 421). Seven months following the attacks of 9/11, 14 percent of respondents in one of the Pentagon commands displayed symptoms consistent with probable PTSD, and 13 percent reported using more alcohol "than intended" (p. 422). Some victims of the sarin attack in Tokyo in 1995 continued to suffer physical and emotional symptoms as many as 5 years after the terrorist incident (p. 423). Of the U S. population outside New York City, 17 percent experienced PTSD symptoms following the 9/11 attacks. It was estimated that about 24 percent of rescue workers in New York would meet the requirements for having PTSD and need treatment (p. 433).

1 Risk Perception Literature

Despite the robust and growing amount of literature on risk perception, little is known about the causative relationship between perceptions of risk and changes in behavior. This situation is largely the result of the void in empirical research and consequent lack of data that correlate perceptions of exposure to risk with behavioral changes that then alter that exposure. This lack is particularly true with regard to perceptions about the risk of terrorism and population-level choices that alter exposure to the threat. Gigerenzer (2006) estimates that after the attacks of September 11, 2001, public avoidance of airline travel in favor of more automobile travel resulted in 1,595 additional highway deaths (six times the number of deaths that occurred on the four fatal flights), as driving offset flying. Also, the commercial value of symbolic buildings remained depressed for more than a year, as evidenced by the lack of buyer interest in completing the January 2003 transfer of ownership of the Chicago Sears Tower (Lyne 2002). With these notable exceptions, there are essentially no quantitative estimates in the risk perception literature that reveal the extent to which or the time over which behavior is altered by perceptions of the risk posed by terrorist threats. This conclusion is reinforced by Burns (2007), who says that future research on terrorism risk perception needs to emphasize, among other considerations, "the tracking of perceptions and risk-related behaviors over time." There are, however, several theoretical perspectives that support the intuitive understanding that, for a period of time, people would be less likely to go to work in prominent high-rise office buildings, attend high-profile sporting or entertainment events, ride mass transit systems, patronize densely populated shopping malls, or engage in similar activities after one or more attacks killed and injured a large number of people in one of these venues. The most salient of these theoretical perspectives are summarized below.

1.1 Social Amplification/Attenuation of Risk

In their seminal work, Kasperson et al. (1988) set forth a conceptual framework that seeks to link technical risk assessment with the psychological, sociological, and cultural perspectives of behavior related to risk perception. They posit that physical hazards are interpreted in psychological, social, institutional, and cultural ways that amplify or attenuate public responses to the risk or risk event. Amplification occurs both in the transfer of information about the risk and in society's response. Signals about risk are processed by the individual on the basis of information provided by experts, the news media, cultural groups, interpersonal networks, and others. According to this theory, the amplified risk leads to behavioral responses, which, in turn, result in secondary responses or impacts.

1.2 Dread Risk

Another seminal construct is the taxonomy evolved from the work of Slovic (1987), which posits that there are two factors derived from the multiple dimensions that people associate with risk. The first, dread, represents events that are unthinkable and catastrophic. The second is associated with whether the process is known or unknown, which includes a consideration of whether the

risk (1) is taken voluntarily, (2) viewed as controllable, (3) poses hazards for future generations, (4) is easily reduced, and (5) falls on the individual or society as a whole (see Figure 1). This paradigm has been used to help explain why the public's perception and acceptability of certain hazards differ markedly from those of expert risk analysts (Fischhoff et al. 1978; Slovic 1987).

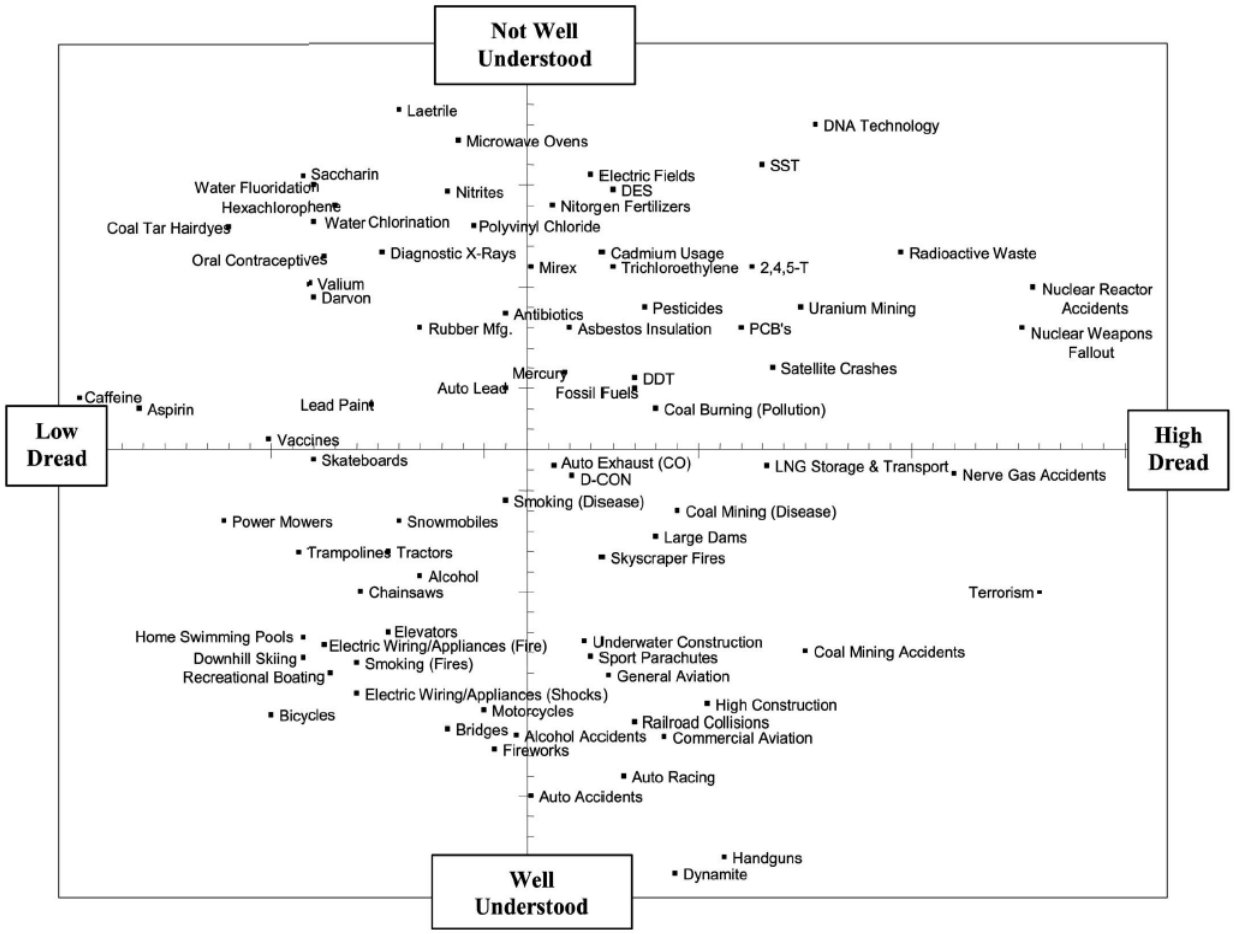

Figure 1: Risk Perception Space[1]

1.3 Probability Neglect

Probability neglect posits that people are often far more concerned about low-probability risks than they are about statistically greater risks that confront them in ordinary daily life. Sunstein (2003) considered probability neglect in relation to risks analogous to terrorism (i.e., risks in which people's attention is focused on the bad outcome itself, and they are inattentive to the fact that it is unlikely to occur, or, if it does, to affect them personally). Sunstein argues that "it is predictable that in the aftermath of a terrorist attack, the public will alter its behavior and demand a substantial governmental response – even if the magnitude of the risk does not warrant that

[1] Redrawn by Thompson and Bank (2007), with permission from Slovic (1987) and Slovic et al. (2004).

response, and even if the danger is far less than that presented by other hazards that do not greatly concern people. Hence an act of terrorism will have a large number of 'ripple effects,' including a demand for legal interventions that might not reduce risks and that might in fact make things worse." In laboratory research dealing with people's willingness to pay to avoid electric shocks, it was found that many people will pay a significant amount to avoid a low-probability hazard, and that when strong emotions are involved, the amount that they will pay does not vary greatly with changes in probability. Regarding terrorist attacks, Sunstein argues that they trigger strong emotions associated with bad outcomes, resulting in public willingness to pay to avoid the risk that is far in excess of the actual risk. When law students were asked to describe their maximum willingness to pay to reduce cancer risk by reducing levels of arsenic in drinking water, a more emotional description of cancer effects produced a greater willingness to pay than did a portrayal of the risk. In short, probability of harm will be neglected when strong emotions are activated. According to Sunstein, the implications of probability neglect for public policy is that the government should avoid the impulse to enact laws and implement regulations in response to popular demands for protection against small risks of catastrophic attacks.

1.4 Mediated Fear

Breckenridge and Zimbardo (2007) argue that terrorists understand the psychological mechanisms that amplify the perception of risk and vulnerability out of proportion to actual probabilities. Citing the results of post-9/11 national surveys, the authors conclude that mass-mediated fear (i.e., perceptions of terrorism that were shaped by media accounts of the recent attacks) strengthens popular support for assertive actions. Although terrorism creates visceral reactions to the experience of an attack, these reactions are more complicated than reactions to natural disasters. Lerner and Keltner (2001) conclude that people who project fear in response to an attack tend to have a more pessimistic estimate of risk, whereas those people who project anger have a more optimistic risk outlook.

1.5 Conclusion

The risk perception literature is prolific, and a growing volume of it deals with the perceived risk of terrorism. This body of work focuses on how risk is perceived, communicated, amplified, interpreted, and grouped or classed. Although empirical research that documents a correlation between perceptions of the risk of exposure to a terrorist attack and changes in behavior to avoid that risk is broadly and widely alluded to, that research is limited. There are two aspects to the risk perception equation that merit further consideration. The first question to explore, which has been addressed by the preponderance of theory developed to date, is: How does people's level or intensity of the perception of terrorism risk increase their avoidance of exposure, thereby decreasing consumer activities? The second is: How does terrorism risk perception affect the decisions of owners/operators of commercial venues to mitigate the exposure of their customers to attack? Additional research is needed to address the cause/effect relationship between risk perceptions and behavior.

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2 Bounded Rationality and Collective Behavior Literature

2.1 Bounded Rationality

The decisions of those (henceforth called the actors) affected by a terrorist attack on a commercial venue will determine the economic impact of the attack. The actors may be employees, employers, customers, suppliers, distributors, the public, and other stakeholders. If they make rational decisions on the basis of the nature, scale, and scope of the attack, they can minimize the economic impact; if they make nonrational or irrational decisions, they can increase it. Rational decisions require the actors to systematically collect extensive information about the attack and its effects and process it before making their decision(s). After a terrorist attack, in a crisis atmosphere, it is difficult to do that. The actors are under pressure to act. Moreover, their cognitive information-processing capacity is intrinsically limited – it is insufficient to process the large volume of information in the time available. The rationality of the decisions is thus limited – bounded – by the availability of information and the ability of the actors to process the information (Busenberg 2001; Wang and Kapucu 2008); hence, the term "bounded rationality."

While the concept of bounded rationality was originally proposed with regard to individuals, it is also applicable to groups, organizations, and other actors. Many research articles allude to how bounded rationality can have an adverse effect on the actors' decisions, policies, and strategies (Pan et al. 2006). Some suggest how the boundaries can be expanded (Sayegh et al. 2004). However, these articles do not trace a direct relationship between such rationality and economic impacts. Although one can surmise the potential adverse economic impacts of policies, decisions, and actions arising from bounded rationality, there is little empirical evidence for the same.

2.2 Collective Behavior

The collective behavior of actors after a terrorist event on a commercial venue will affect the economic impact of the attack. Collective actors may be groups of individuals or organizations. They may include employees, employers, customers, the public, suppliers, lenders, competitors, distributors, governments, unions, rescue and recovery teams, and others. Collectively, the actors may exhibit a range of behaviors. At one extreme, their behavior may be pro-social – helping the rescue, recovery, and repair of the commercial venue (Quarantelli 2001; Mawson 2005; Rodríguez et al. 2006). For example, employees may continue to work despite the damage to the venue; suppliers may continue to supply despite the possibility of delayed payments. Such behavior can reduce the economic impact. At the other extreme, the actors' behavior may be antisocial (Quarantelli 2001; Mawson 2005; Rodríguez et al. 2006). For example, crowds may loot the venue because of reduced security; competitors may take advantage of the situation to increase their market share and revenues. Antisocial behavior will likely have a net negative economic impact. Between these two extremes, the actors may (a) simply continue their normal behavior as it was prior to the attack or (b) avoid the venue but exhibit neither pro-social nor antisocial behavior. Normal behavior, such as customers patronizing the venue despite access

difficulties (behavior that, post-crisis, might actually be considered pro-social), is likely to have a positive economic impact. Avoidance behavior, on the other hand, is likely to have an adverse economic impact.

While post-event antisocial and avoidance behaviors have been given a lot of attention, there is significant anecdotal evidence of pro-social and normal behavior in these situations. Looting, panic, and unethical competition occur but are not universal. Pro-social and normal behaviors are common, too. However, the frequency and intensity of the four types of post-event behavior are difficult to surmise from the literature. The net economic impact will be the sum of the positive and negative impacts of the four types of collective behavior. There have been many instances where the economic impact of business disruption (not necessarily due to a terrorist attack) has been very low, possibly zero, despite early post-event expectations to the contrary (Knight and Pretty 1996; Rose and Lim 2002; Morag 2006). Although it is difficult to compute the economic impact (Handmer 2003), it can be argued that catalyzing pro-social behavior, supporting normal behavior, and inhibiting avoidance and antisocial behavior will minimize the economic impact by enhancing resilience (Rose 2007, 2009).

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3 Behavioral Economics and Macroeconomics Literature

3.1 Behavioral Economics

Behavioral economists use psychology to explain agents' bounded rationality relative to making economic decisions after a terrorist event. Although the economics of terrorism is a growing and developing field, very few studies are done from a behaviorist's standpoint. At a fundamental level, understanding about risk exposure perceptions and how they translate into behavioral changes is very limited, making it inherently difficult to frame this topic from a behavioral economics perspective. Nevertheless, because a goal of terrorism is to provoke uncertainty and fear, it is very important to understand how emotions induced by a terrorist event influence the framework by which individuals make decisions, and, in turn, how this process affects the economy at different levels.

To start framing relevant literature from a behavioral economics standpoint, it is useful to categorize the impacts as direct and indirect. More traditional economic measurement approaches are useful in quantifying the direct costs and impacts of destroying physical assets and lives. That being said, behavioral economics provides a potentially important framework for understanding how bounded rationality affects decision making, and, in turn, for measuring indirect costs and impacts associated with an event. Studies of indirect costs that are documented in the literature typically include "tourism, foreign investment, insurance and security firms, the capital markets, airlines, the public sector, and planning and relocating people and businesses" (Valino et al. 2010). Even though the amount of literature is generally scarce, for the purpose of this review, tourism and transportation choices (insomuch as they are behaviors) are inherently incorporated into the economic analysis. Finally, a summary of the literature that is particularly relevant to building facilities is presented.

3.1.1 Tourism

Largely because of the optional nature of tourism, this sector is commonly considered to be one of the most seriously impacted by the fear and uncertainty caused by terrorism. As such, a number of methodologies, locations, and types of terrorism have been studied. Given the fact that there has been no attack directly on a U.S. tourist attraction and there are thus virtually no empirical data, the majority of the literature in this category uses a time-series approach and focuses on European or Mediterranean regions with available data.

Focusing on the role that personal experience plays in individual patterns of response to rare terrorist attacks, Yechiam et al. (2005) studied the effect of terrorist attacks on local residents and international tourists. Their empirical research focused on the wave of terrorist attacks in Israel, known as the Al-Aqsa Intifada (also known as the Second Intifada). The Al-Aqsa Intifada had three properties that suited it well for their empirical study. First, the Intifada had a well-defined beginning (September 2000, marked by Ariel Sharon's visit to the Temple Mount and the first surge of terrorism in the city of Hadera). Second, terrorism within the State of Israel (not including the West Bank and Gaza Strip) was targeted toward specific civilian targets, including

hotels, restaurants, cafés, and clubhouses. Third, the terrorist activity was continuous: between September 2000 and October 2003, in each month, there were terrorist attacks on the civilian targets mentioned that led to fatalities. Therefore, during this period, there was a small probability of being a victim of terrorism as a result of taking part in several relatively well-defined leisure activities.

To evaluate the effect of the Intifada on tourism, the Israeli Central Bureau of Statistics calculated the number of bed nights in Israeli hotels by population type, inbound (international) or domestic tourists, prior to and following the outbreak of the Intifada. "Bed nights" denotes the number of beds occupied overnight by accommodation establishments. The examination included hotels that were either certified by the Ministry of Tourism as tourist hotels or had issued a petition for certification. Overnight stays in these hotels represent more than 80 percent of the total overnight stays in Israeli hotels.

The results shown in Figure 2 (from the author's original manuscript) show an initial drop in overnight stays by both inbound (international) tourists and domestic visitors in October 2000, during the initial terrorist activities. The drop was almost 60 percent for inbound tourists and about 10 percent for domestic visitors. The difference between stays by inbound and domestic tourists increased in the following months. After the initial decrease, the overnights of domestic tourists in hotels rebounded and even increased, while the overnights of inbound tourists

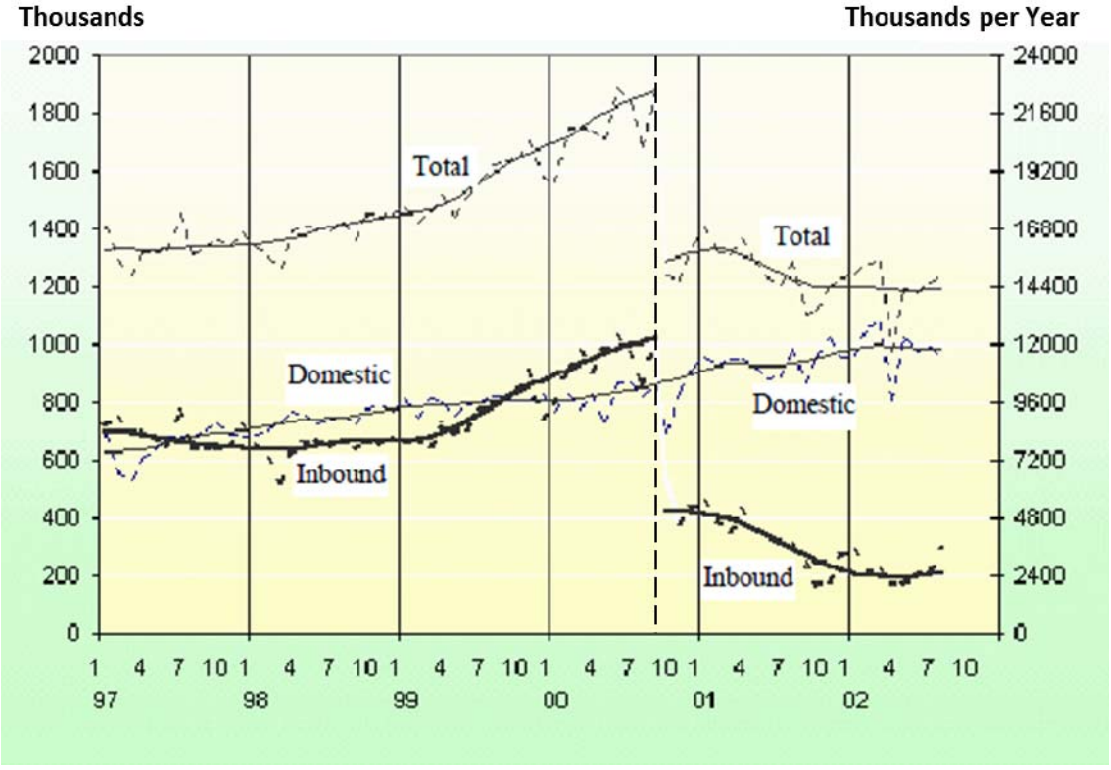

Figure 2: Monthly Bed Nights of Domestic and Inbound (International) Tourists in Israeli Tourist Hotels (seasonally adjusted and trend lines)

continued to decrease. For example, a comparison of October 2000 with October 2001 shows an 80 percent decrease for inbound tourists and a 20 percent increase for domestic tourists.

The authors cite three factors that contribute to the observed patterns. One is economic considerations. The cost of avoiding a risky area is much higher for local residents than potential visitors. For example, to avoid Israeli venues, local residents have to stop using them or travel abroad. International tourists, on the other hand, can simply select a different destination for their vacation. A second contributing factor involves cultural and/or ideological differences and value systems. For example, in some cultures, solidarity is important, and personal risk may be underweighted. The third factor is known as the "personal experience" hypothesis. As local residents are exposed to risk but do not suffer bad outcomes, they are more likely to base future decisions on this "positive" experience. As a result, the typical experience of locals – going out without being harmed – results in a relatively quick recovery in venue use and reduces the effect of the terrorist attacks. International tourists, of course, have similar positive experiences that form the basis of their decisions to avoid the conflict area, and thus they may continue to do so until the conflict subsides and they are again relatively assured of their safety.

With regard to the United States, Gordon et al. (2008) simulate the business interruption, rather than immediate damages, caused by a terrorist event on theme parks, while accounting for spillover and diversion scenarios. By "spillover," they mean that an attack on one theme park in a given geographic cluster or even in the nation would affect other theme parks not directly attacked. "Diversion" refers to the actor substituting one activity for another. The simulation uses the National Interstate Economic Model to examine a conventional bomb attack on 11 individual theme parks plus two clusters (multiple theme parks in the same metropolitan area) in eight states. They suggest that the economic impacts on theme parks from a single attack would be nationwide in scope, although perhaps greater in a geographic cluster. They assume (1) that theme parks have a role in shaping the American psyche; (2) that people are inclined to protect children, who are, perhaps, a majority of theme park visitors; (3) the probability neglect; and (4) the displacement effect. They run their simulation under three different scenarios: (1) gross losses with nationwide spillovers, (2) gross losses with no spillovers and only local impacts, and (3) net losses, incorporating diversion, in which visits to national parks are substituted for visits to theme parks. They conclude that with spillovers, the economic impacts of an attack would range from $19 billion to $23 billion. Without spillovers, the economic impacts would range from $0.5 billion to $11.3 billion. In the diversion scenario, in which people substitute national parks for theme parks, the net loss would be $8.3 billion, with major losses in Florida and California offset by geographically spread-out gains, often in states such as Arizona, Utah, and Wyoming.

As noted above, a number of studies also examine the effects of terrorism on tourism based on European regions with ongoing terrorist events. In a prominent piece, Enders and Sandler (1991) use a vector autoregression (VAR)[2] method to determine that without terrorism, Spain would have had 50 percent more tourists in the study period of 1970–1988. A typical terrorist incident is estimated to frighten away 140,000 tourists when all impacts are combined. In an important conclusion, they suggest that terrorism affects tourism, but not vice versa. Note that the time

[2] VAR is an econometric model used to capture the evolution and the interdependencies between multiple time series.

period studied by Enders and Sandler was nearly a decade before the Al-Aqsa Intifada period studied by Yechiam et al. (2005).

Enders et al. (1992) use an autoregressive integrated moving average model to show that from 1974 to 1988, tourist losses varied among three European countries: Austria lost 3.37 billion special drawing rights (SDRs)[3]; Italy lost 861 million SDRs; and Greece lost 472 million. The sample of Europe countries lost 12.6 billion SDRs of tourist receipts to North America.

Similarly, Drakos and Kutan (2001) build on the consumer choice model developed by Enders et al. (1992) and use a regression model to show significant substitution and regional contagion effects of terrorism in Greece, Israel, and Turkey. They "explore the impacts of terrorism, measured by the number of terrorist attacks, on the dynamics of the relative market share of each of the countries" (p. 624). In addition to the number of attacks, they assess the intensity of attacks measured by the number of fatal casualties distributed into three categories (0, 1–3, and >3). They also examine geographic location, defined as rural or urban, again in terms of the country involved.

Empirical data consist of the "number of tourist visits for the period from January 1991 to December 2000, with 120 data points for each country" (p. 631). Data were provided by national tourism organizations for Israel and Greece, the Central Bank of Turkey, and the National Statistical Institute for Italy. Terrorist attack data were drawn from the International Terrorism Database (ITD) of the International Policy Institute (http://www.ict.org.il/) (p. 632). The hypotheses tested explored the relationship of terrorist attacks and market shares within a country, as well as the corresponding substitution impacts on other countries (p. 634). The authors conclude that "risk-averse" decision makers (tourists) shift their demand away from risky destinations and toward safer ones (p. 634).

Each terrorist incident in Greece results, on average, in a decline of 1.07 percentage point in its relative market share (6.8 percent of Greece's base share). In Israel, the impact is, on average, a decline of 0.44 percentage point (8.1 percent of Israel's base share), and Turkey experiences an average drop of 0.78 percentage point (4.4 percent of Turkey's base share) (Table 2). The analysis of the effects of cross-country terrorism reveals that all but one of the relevant estimated coefficients attained a positive sign, which is consistent with the substitutability of tourism services in the region. Although all of the paired substitution coefficients are shown in Table 2, the only statistically significant relationships are those between Greece and Israel and between Turkey and Israel (underlined). In particular, a higher frequency of terrorist incidents in Greece is associated with an increase in the relative market share of Israel. In other words, each terrorist event in Greece results in an increase of 1.01 percentage point in Israel's market share. Similarly, an increase of one terrorist incident in Israel results in a gain of 0.7 percentage point in market share for Turkey.

[3] The SDR is an international reserve asset, created by the International Monetary Fund (IMF) in 1969 to supplement its member countries' official reserves. Its value is based on a basket of four key international currencies, and SDRs can be exchanged for freely usable currencies.

Table 2: Market Share and Change Due to Terrorist Events (Source: Drakos and Kutan 2001)

Country	Market Share (Percentage Points)	Change in Market Share Due to a Single Terrorist Event	Change Due to a Single Terrorist Event in Country Shown in Column 1		
			Israel	Turkey	Greece
Israel	5.40	–0.44	-	+0.70[b]	+0.59
Turkey	17.78	–0.78	–0.10	-	+0.70
Greece	15.66	–1.07	+1.01[b]	+0.56	-
Italy[a]	61.16	control variable			

[a] Italy is used as a control variable in estimations, acting as a proxy for tourist activities in the rest of the Mediterranean region and providing an additional destination for tourists to visit.

[b] The only statistically significant relationships are those between Greece and Israel and between Turkey and Israel (underlined).

Drakos and Kutan (2001) also provide an estimate of the economic impact due to terrorism-induced changes in the tourism market share. Note that in the case of Greece and Israel, a terrorist incident in Greece results in a decrease of about 1 percent in its own relative market share and increases Israel's share by the same amount. They go on to state that "given that the average number of tourists entering the four-country market per month is about 4.5 million people, we can deduce that on average a terrorist incident in Greece results in 45 thousand tourists switching to Israel. We can further provide some monetary cost figures of terrorism based on 1999 figures. Given that in 1999 Greece had 8.8 billion in US dollars tourist income and about 12 million tourists, then the average tourist expenditure was about 733 U.S. dollars. The number of tourists who visited the four countries was almost 58 million in 1999 and a 1 percent market share of this would be equivalent to 580 thousand tourists. Thus, the loss for Greece in pecuniary terms would approximately be 425 million in U.S. dollars (580,000 tourists * 733 U.S. dollars) per annum or $35 million per month."

3.1.2 Transportation

Similarly, actors may increase or reduce the use of certain types of transportation in response to an event. For instance, Ito and Lee (2005) study the impact of 9/11 on the airline industry by using monthly time-series data to demonstrate a transitory and ongoing shock to the airline industry, which they attribute to the effects of the attacks on 9/11. Their analysis and model attempt to isolate behavioral effects by correcting for the economic downturn and other factors that influenced airline passenger travel following 9/11. They conclude (see Figure 3 taken from the author's original paper) that 9/11 resulted in "both a negative transitory shock of over 30 percent and an ongoing negative demand shock amounting to roughly 7.4 percent of pre-September 11 demand" (p. 75). In other words, immediately after 9/11, fear of flying significantly decreased demand for airline travel, and there was also an ongoing decrease in demand due to the more rigorous passenger screening procedures and perceived risk of flying. It

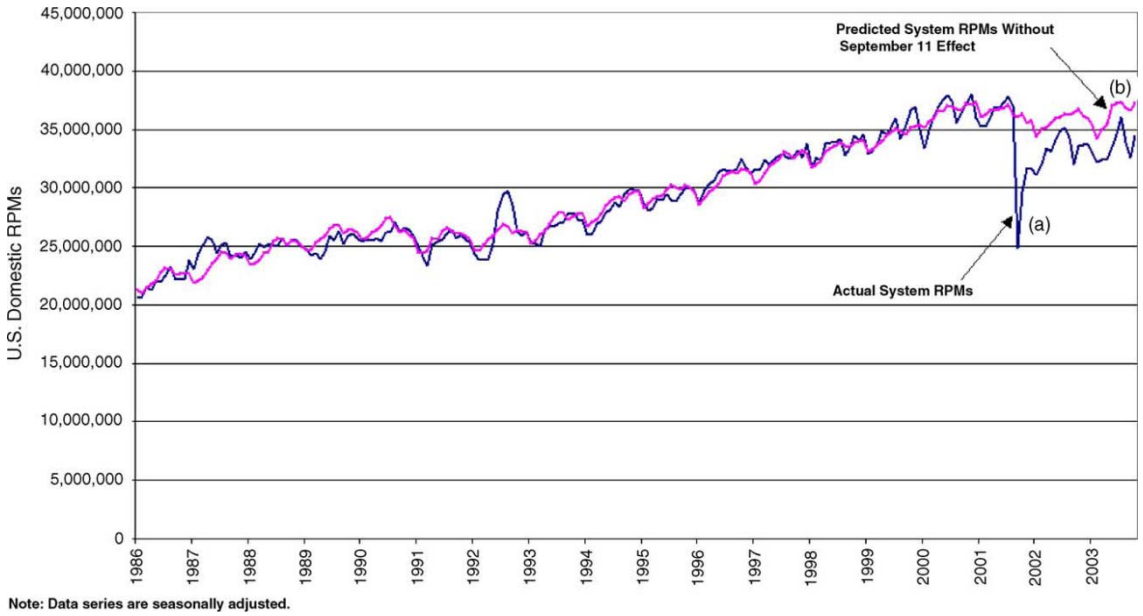

Figure 3: Revenue Passenger Miles (RPMs) vs. Model Predictions without 9/11

should be noted that the Ito and Lee (2005) study ended with data from November 2003, prior to full recovery of airline travel to pre-9/11 levels.[4]

Alternatively, Becker and Rubenstein (2009) specifically point to "fear" as a factor that can generate substantial economic effects. However, on the basis of a rational choice model and empirical data, they argue that fear can be managed like other forms of human capital, and, in turn, those who stand to benefit will invest in overcoming fear. For instance, they examine the impact of fear on behavior by comparing the effect of terror on people who face a similar probability of being harmed but have different incentives for overcoming fear. They conclude that "persons who are more likely to benefit from engaging in what had turned into a 'risky' activity will invest and overcome their fears. Others will substitute to other consumption or production activities" (p. 3). To illustrate this conclusion, they suggest that suicide attacks on buses will decrease the likelihood that drivers in general will specifically become bus drivers, but existing bus drivers will not be more likely to quit their jobs because they will ultimately invest in overcoming their fear.

With regard to ground transportation, Blalock et al. (2005) find that even when there was a very small probability of a terrorist attack, there was a substitution of driving for flying. Post-9/11, this suboptimal choice weakened over time, but it did lead to about 1,200 additional driving fatalities that are attributable to the effect of 9/11 after correcting for weather, road conditions, and other factors. Gigerenzer (2006) estimates that after 9/11, public avoidance of airline travel resulted in 1,595 additional highway deaths as driving was substituted for flying. His analysis

[4] Analysts at the Boeing Company have also attempted to isolate post-9/11 airline passenger behavioral effects from other factors. From their analysis, the details of which are confidential, they conclude that revenue passenger miles did not recover to the pre-9/11 trend until 3 years after the attacks, a year after the Ito and Lee data series ends (personal communications).

indicates that this increase lasted for approximately 12 months. By comparison, after the 2004 Madrid attacks, there was a corresponding decline in train travel that was of shorter duration; it lasted about 2 months (p. 350).

3.1.3 Commercial Buildings

Addressing buildings more specifically, Miller et al. (2003) examines post 9/11 behavior and the impact it had on tall and trophy buildings with regard to occupancy and value. Their empirical study concludes that "there is little evidence of any significant departure from general market trends for tall buildings or most 'trophy' property, yet for a small subset of truly famous buildings in both New York City and Chicago, such as the Empire State Building and the Sears Tower (now the Willis Tower), there are significant rental and value losses" (see Figure 4 taken from the original work).

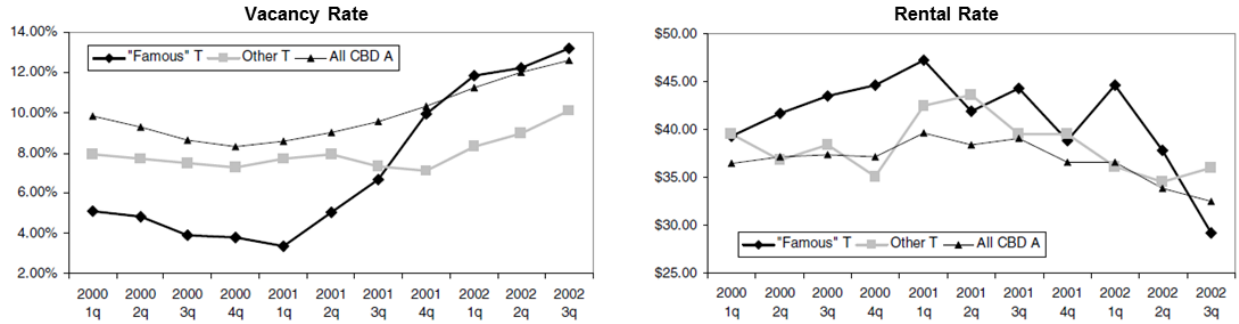

Figure 4: Famous Trophy Properties vs. Other Trophy Properties vs. All Central Business District Class A Properties

They suggest that sublease activity was an indicator of future occupancy trends, and, as such, there is little evidence of tenant flight away from most buildings, the exception being the above-stated buildings. However, it is important to point out that while significant flight was not predicted, property managers expected significant design changes and security measures to result from 9/11, which would lead to an increase in the overall costs of building occupancy. They also note that "tenants are now more concerned with co-tenants and wish to avoid high profile commercial firms or government agencies likely to be higher priority targets for terrorists. Some are also more concerned with evacuation procedures and escape routes." Thompson and Bank (2007) also characterize the increased risk perceived by occupants of tall buildings and how that impacts design changes and acceptable risk versus cost.

In a similar study, Abadie and Dermisi (2008) use vacancy rates as a proxy for behavioral change in downtown Chicago office buildings to examine the impact of a perception of increased risk after 9/11. They conclude that post-9/11, the three most distinctive Chicago buildings (Sear Tower, Aon Center, and Hancock Center) and the buildings within a 0.3-mile-radius surrounding each of these buildings ("shadow area") experienced a much more pronounced increase in vacancy rates than did those in other areas of the city of Chicago. More specifically, "in the first

quarter of 2001 the average vacancy rate was approximately 9 percent in shadow areas and 7 percent in nonshadow areas. However, the difference between these two vacancy rates was not significant at conventional test levels. In the first quarter of 2006, more than four years after 9/11, average vacancy rates had increased to 17.4 percent in shadow areas and 12.3 percent in nonshadow areas. The difference in average vacancy rates between shadow areas and nonshadow areas in the first quarter of 2006 was of about 5 percentage points and statistically significant at the 5 percent level" (p. 11). (See Figure 5 taken from the original work.) They interpret these results to suggest economic activity in the central business districts, especially in the three iconic buildings, can be significantly affected by risk perceptions and, in turn, by behavioral changes.

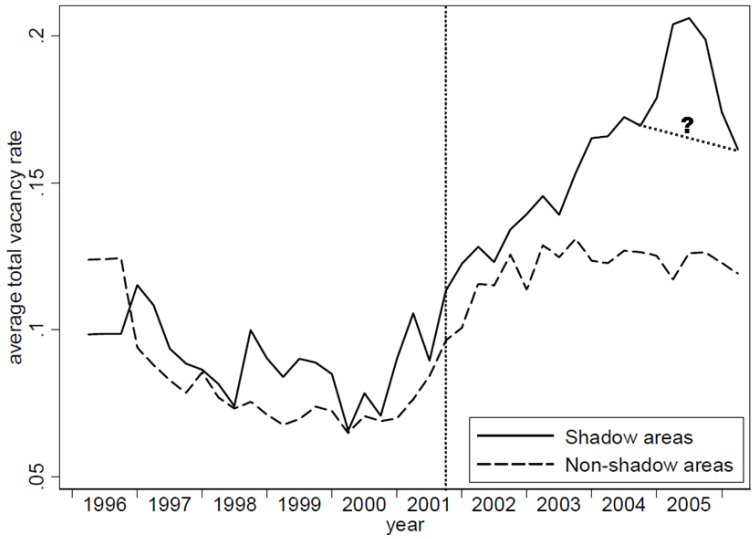

Figure 5 Average Vacancy Rates in Shadow and Nonshadow Areas

However, the Abadie and Dermisi analysis excludes new building floor space added between 2001 and 2006. Because significant new floor space was added to the shadow areas during this time, the observed increase in the vacancy rate of buildings that existed in 2001 could easily have resulted in tenants moving from a pre-2001 building to a new building within the shadow area. Since buildings built after 2001 were excluded from the analysis, such movement would count as an increase in vacancy but not a corresponding increase in occupancy within the shadow area.

Drennan (2007) also conducts an empirical analysis at a micro level by studying post-9/11 firm relocation and rent in the immediate New York area. He concludes that agglomeration economies are difficult to destroy because "firms that had occupied half the destroyed space of all large tenants (i.e., tenant-occupied buildings) chose to relocate elsewhere downtown despite the fact that they could have paid much lower rents by relocating across the river in urban New Jersey" (p. 180). Similarly, Redfearn (2007) attempts to understand consumers' perception of risk by studying homebuyer and real estate data from areas in proximity to potential terror targets after 9/11. He wanted an answer to the question "Do individuals act the same way when they buy houses as they do when they answer surveys?" (p. 167). Redfearn's data and

subsequent analysis indicate that despite what homebuyers reveal in surveys, their post-9/11 perception of risk is unchanged.

Lyne (2002) reports that in 1997, Trizec Properties, which controlled the leasing and management of the Sears Tower, invested U.S.$70 million in the Sears Tower, and in that process, it acquired an option to buy the skyscraper. In the third quarter of 2002, Trizec wrote down $48.3 million of the $70 million it invested. Prompting that write-down were persistent post-9/11 concerns about the diminished appeal and lower rents of signature properties. Also, the 110-story Sears Tower had been appraised at $826 million in 2002, a sharp drop from the appraisal of $911 million in 2001. Moreover, some high-profile tenants are defecting, countering earlier reports that the 9/11 attacks were having no impact on occupancy of the Sears Tower. Chicago commercial market analysts report that rents at the Sears Tower dropped by 25 percent, a drop that was 15 percent steeper than the overall reduction in the Chicago office market.

3.2 Macroeconomics

From surveying the economics literature on terrorism, it becomes apparent that a number of issues are addressed by using a variety of methodologies. The issues addressed under the broadly defined banner of "economics of terrorism" include a number of common economic measurements applied to terror events (e.g., reductions in gross domestic product [GDP] in afflicted countries, game theory and hostages, sources of terrorist funding, counter-terrorism cost/benefit analyses, and foreign direct investment growth modeling). Although a variety of methodologies are used in the literature, panel estimates covering large cross sections of countries and time-series estimates tend to be the two basic approaches (Sandler and Enders 2005). For the purposes of this literature review, we surveyed the macroeconomic literature and categorized the approaches as empirical or theoretical. The majority of literature in this field tends to be empirical, drawing on a limited number of data sets, and it presents findings at a macroeconomic level. While the microeconomic literature is helpful in understanding the consequences of attacks, it generally focuses on sector-specific studies (such as the tourism sector), which are incorporated into the behavioral economics portion of this review.

3.2.1 Empirical Studies

To evaluate the macroeconomic consequences of terrorism, Blomberg et al. (2004a) use a panel dataset and employ a structural VAR model, cross-sectional, and panel growth regression analysis. They draw two important conclusions from their work. First, they argue that a terrorist event is associated with a redirection of economic activity toward government spending and away from investment spending. Second, they conclude that although terrorist events are more common in Organization for Economic Cooperation and Development (OECD) economies, their negative influence on economic growth is smaller there than it is in developing countries. They show that the negative effect of terrorism is statistically significant in developing countries and not statistically significant in OECD economies.

Similarly, Sandler and Enders (2005) highlight the important finding that because most terrorist campaigns are low in intensity, the macroeconomic impact is short lived and very modest, if there is one at all, depending on the country. They state that "an economy as rich and diverse as that of the United States is anticipated to withstand most terrorist events with little macroeconomic consequences" (p. 9). They attribute this conclusion to the ability of developed countries to respond to a terrorist event by shifting economic activity to sectors not affected by it. That being said, while they expect that a modest number of terrorist events will not significantly affect these countries' growth in income, at a more microeconomic level, sectors (such as the tourism sector) are likely to be influenced by terrorism. These findings can be contrasted to those associated with small economies that experience ongoing terrorism, such as the Basque region in Spain, where "terrorism can reduce GDP and curb development" (p. 10).

Abadie and Gardeazabal (2003) produce an important case example on the Basque region in Spain to illustrate a key finding: namely, that a higher risk of terrorism can be associated with a decline in per-capital GDP. More specifically, they use a two-country endogenous growth model and show "that after the outbreak of terrorism in the late 1960s, per capita GDP in the Basque Country declined about 10 percentage points relative to a synthetic control region without terrorism" (p. 1). They also incorporate the 1998–1999 truce to show "that stocks of firms with a significant part of their business in the Basque Country showed a positive relative performance when truce became credible and a negative relative performance at the end of the cease fire" (p. 1).

3.2.2 Theoretical Studies

Blomberg et al. (2004b) offer a theoretical approach to link economic variables with terrorist events, and they ultimately support their theory with empirical evidence. They are careful to point out that their simple theoretical model relates only to the economic explanations of terrorist activity and not to the political or social motivators that we understand to be motivating factors, among many. The model suggests a simple result: namely, that "groups with limited access to opportunity rationally engage in terrorist activities while policy-making elites find it rational not to engage in opening access to these groups. The result is a pattern of reduced economic activity and increased terrorism" (p. 477). By testing their theoretical framework with empirical evidence, they conclude that economic activity and terrorism are not independent of one another, and that terrorism appears to be linked with the economic business cycle.

Eckstein and Tsiddon (2004) also develop a theoretical model to estimate the impacts of terrorism at the macroeconomic level. In short, they suggest that because of a rise in terrorist activity, investment goes down, and, in the long run, income and consumption go down as well. They base their model on the Blanchard-Yaari Model, demonstrate the costs and benefits of defense expenditures, and analyze the optimal response of a government to certain levels of terrorism. They then use a case example to test their theoretical model by using the VAR methodology in the Israeli economy, showing that the output per capita in March 2003 was 10–15 percent lower as a result of the terrorist attacks that occurred in the period leading up to March 2003.

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4 Psychosocial and Related Literature

4.1 Introduction

The authors of a Homeland Security Institute pilot study (Carlson et al. 2008) recognize that risk assessments generally address economic consequences and direct human casualties (i.e., injuries and deaths). They expand on these, however, by indicating that the impacts on public confidence and morale suggest that there is an additional "category of consequences – psychosocial impacts" (p. 5). More explicitly, they define psychosocial impacts as "an event's effect on the public's attitudes and behaviors" that may "have significant long-term political and economic consequences, as well as effect(s) (on) the health and well-being of individuals" (p. 5).

Their suggestion of multidimensional impacts confirms the complexity and thus the difficulty of assessing the risks associated with a terrorist attack. An examination of the literature also confirms that part of the complexity stems from the variation in the types of events represented (e.g., mechanisms for delivery can differ: explosives; chemical, biological, radiological, nuclear [CBRN], etc.) and in the immediate impacts. Stein et al. (2004) provide a conceptual example that addresses the differences between bioterrorism and other forms of terrorism (Table 3).

Table 3: Difference between Bioterrorism and Other Forms of Terrorism

Factor	Bioterrorism	Other Forms of Terrorism
Speed at which attack results in effect	Delayed and/or prolonged	Immediate
Site of attack	Usually unknown	Specific
Knowledge of attack boundaries or scope	Scope or boundaries unknown	Usually well understood
Distribution of affected patients	Geographically dispersed	Usually in concentrated area
First responders	Physicians, nurses, public health	Police, fire, emergency management services (EMS)
Decontamination efforts	Geographically dispersed	Confined environment
Isolation/quarantine	For transmittable diseases	Not usually necessary

These differences can also be reflected in the units of analysis that are used to assess possible outcomes. The differences may reflect levels from micro to macro that represent disciplinary approaches from the psychological (individual) level to the sociological and economic (social and societal) levels. Between these extremes lie many hybrid approaches that address the problem from a social-psychological orientation. These approaches can focus on risk perception, risk assessment, behavioral economics, decision analysis, bounded rationality, and so on.

In many ways, this framework has been an implicit part of the empirical studies that are seen in the literature reported on here. Carlson et al. (2008) state in a footnote to the introduction that they employ the term "psychosocial impact" for several reasons, because it incorporates both

"psychological changes ... as well as follow-on changes in social behavior" (p. 5). It is the behavioral changes that may prove most useful from a policy perspective, especially when they relate to avoidance behaviors resulting from fear and rational decision making in the aftermath of a terrorist attack.

4.2 Micro Level/Psychological

Many early studies looked at the psychological consequences of attacks by the application and assessment of clinical constructs such as PTSD, for which there is an established clinical description and diagnostic protocol. Although these studies often neglect actual avoidance behaviors, they are seen as assessing behavioral consequences because of the increased demand for medical services.

DiMaggio and Galea (2006), in a meta-analysis of the behavioral consequences of terrorism, reviewed post-1980 "quantitative studies of the behavioral health effects of terrorist incidents, focusing primarily on the prevalence and correlates of PTSD" (p. 559). Other eligible effects included "depression, substance abuse and potentially related somatic signs and symptoms, such as asthma and cardiovascular disease" (p. 560). Of the 113 studies reviewed, all but two (biologic incidents) involved explosions or armed attacks.

This study is significant because of the number of other studies it reviews. It clearly would have been more useful had it dealt directly with explicit avoidance behaviors, but it does make a contribution in addressing the variation by time in the post-terrorism prevalence of PTSD. This overall global measure "included all studies of victims, rescuers, occupational groups and general population samples" (p. 561). The authors found that the rate of prevalence of PTSD found in studies conducted 2 months, 6 months, and 1 year after a terrorist event dropped from 16 percent to 14 percent to 12 percent, respectively (p. 561).

Citing Desivilya et al. (1996), Stein et al. (2004) provide information on the psychological consequences of a number of violent events. In examining the direct victims, they found that traumatic stress symptoms could linger far longer than the times reported in the previous meta analysis. For example, a majority of adolescent survivors of a hostage situation in Israel in 1996 continued to experience stress symptoms as much as 17 years later (p. 421). Further, referring to the work of Grieger et al. (2003), Stein et al. (2004) state that "seven months following the attack (of 9/11) 14 percent of respondents in one of the Pentagon commands displayed symptoms consistent with probable PTSD and 13 percent reported using more alcohol than intended" (p. 422). Some victims of the sarin attack in Tokyo in 1995 continued to suffer physical and emotional symptoms as many as 5 years after the terrorist incident (Okumura et al. 1998, as cited in Stein et al. 2004, p. 423).

It seems logical that direct victims of the attacks would be prone to stress-related symptoms from them. Studies of the general population reveal that the events also have indirect consequences. Seventeen percent of the U.S. population outside of New York City experienced posttraumatic stress symptoms following the 9/11 attacks (Silver et al. 2002, as reported in Stein et al. 2004). In addition to the direct victims and general population, first responders and vulnerable

populations are also at risk. In New York, it was estimated that about 24 percent of rescue workers would meet requirements for PTSD and require treatment (Herman et al. 2002, as cited in Stein et al. 2004, p. 433).

4.3 Psychological and Behavioral: Linking the Individual Level with the Social Level

The importance of the previous section in addressing issues of broader consequences or impacts of terrorist attacks may lie in the ability to link psychological consequences, such as PTSD and other stress-related responses, to behavioral consequences, especially avoidance behaviors. The Lee et al. (2009) analysis, for example, demonstrates that there is a tendency for "actual avoidance behaviors to be associated with heightened psychological stress" (p. 69).

Vázquez et al. (2006) report on stress reactions following the Madrid bombings of March 11, 2004. Using criteria established by Schuster et al. (2001) after 9/11, they assessed levels of stress in the population of Madrid 13 to 18 days following the attacks. The only discussion of avoidance in their study involves a component of the DSM-IV-TR (i.e., the 4th edition of *Diagnostic and Statistical Manual of Mental Disorders* [American Psychiatric Association 2004]; it is a revision of an earlier version, DSM-IV [American Psychiatric Association 1994]). Under the designation of Diagnostic Criteria for PTSD (p. 66), Criterion C (of the DSM-IV-TR) includes "Persistent Avoidance" with such items as "1. Efforts to avoid thoughts, feelings, or conversations associated with the trauma, 2. Efforts to avoid activities, places or people that arouse recollections of the trauma, and 3. Diminished interest to participate in significant activities" (Vázquez et al. 2006). These criteria do not however, relate behaviors specifically identified by Vázquez et al., such as not taking the train or not travelling to central Madrid.

Conejero and Etxebarria (2007) also examined consequences of the Madrid bombing 1 week and 2 months after the March 11 bombings. They related the emotional dimensions with certain behaviors, including avoiding "going out," and "catching a plane" (p. 278). In addition, two items related specifically to "intergroup avoidance." Specifically, respondents were asked if, in light of the March 11 events, "they avoided dealings with either Muslims or Basques." The thrust of their research was to model the influence of personal emotions (at the individual level) and the country's emotional climate (at an aggregate level) on the avoidance behaviors mentioned above (p. 278).

Both personal emotions and the emotional climate showed significant improvement between 1 week and 2 months after the attack. These variables also contributed to the model's ability to predict a number of individual behaviors, including both types of avoidance behaviors. If the measurement of the independent variables could be improved, perhaps a better surrogate measure for avoidance behavior could also be developed. The regression model that was employed to analyze the data from a sample of size 1,807 from Spain's seven autonomous regions resulted in statistically significant results, but they had relatively low explanatory power.

The analysis revealed that "personal negative emotional response could account for 5 percent of the variance in avoidance behaviors, multiple R = 0.228, F (1,1192) = 65.12, p <0.001" (p. 282). By introducing the "negative atmosphere" variable, explanatory power increased to 5.6 percent. The addition of "emotional climate" raised it to 6.4 percent of the variance in avoidance behaviors. Using both the "negative emotional response" and "emotional climate" variables explained 4.3 percent of the variance in intergroup avoidance.

A similar study was undertaken in the second week following the July 7, 2005, terrorist attacks on the central London transportation network (Rubin et al. 2005). Then 7 months later, a follow-up survey was undertaken to assess the endurance of the earlier reactions (Rubin et al. 2007). In 2005, 71 percent of respondents indicated that they had talked with someone else about what happened "a great deal" or "a fair amount" (p. 3), although only 1 percent indicated they had seen a mental health professional (p. 3). Unfortunately, this question was not repeated in the follow-up survey. The results of the first survey indicated that 2 weeks after the attack, 32 percent of respondents "intended to travel less often by one or more of tube, train, bus or into Central London." This number dropped to 19 percent in 2006 (7 months after the attack). This reduction in avoidance behavior coincided with a reduction in fear (i.e., "feeling very unsafe when traveling" by these means), from 19 percent in 2005 to 12 percent in 2006. It is interesting that this reduction occurred in spite of the fact that 90 percent of the respondents to both surveys believed another attack on London was likely in the near future (p. 353). The authors conclude that although there is usually a decline in stress symptoms over time, "other psychosocial responses may be more persistent" (p. 353).

Table 4: Expressed Behavioral and Emotional Response to London Tube Bombings (Rubin et al. 2005, 2007)

Time of Survey after July 7, 2005, Tube Bombings	Percent Who Intend to Travel Less Often by Tube, Train, or Bus or into Central London	Percent Who Feel Very Unsafe When Traveling by These Means	Percent Who Believe Another Attack on London Is Likely in the Near Future
2 weeks	32	19	90
7 months	19	12	90

Stecklov and Goldstein (2004) analyzed traffic flow statistics and daily time-series data on automobile accidents in Israel for an 18-month period that included a large number of terrorist attacks (Figure 6). They discovered that there was a lull in the light accident rate the day after an attack, followed by a spike in traffic accident fatalities 3 days after an attack, and that the effects on accidents were proportional to the severity of the attack. They interpret these results to suggest that terror attacks in Israel have broad, short-term behavioral effects on the general population. In their concluding discussion, Stecklov and Goldstein suggest that the third-day spike in traffic fatalities indicates that terrorist attacks may not only reflect an immediate increase in traffic fatalities due to terror-induced suicides but may also reveal a more general delayed reaction to violence and stress. Hence, there is a need to look at other indicators of aggregate population reaction to terrorist attacks, such as changes in the incidence of domestic

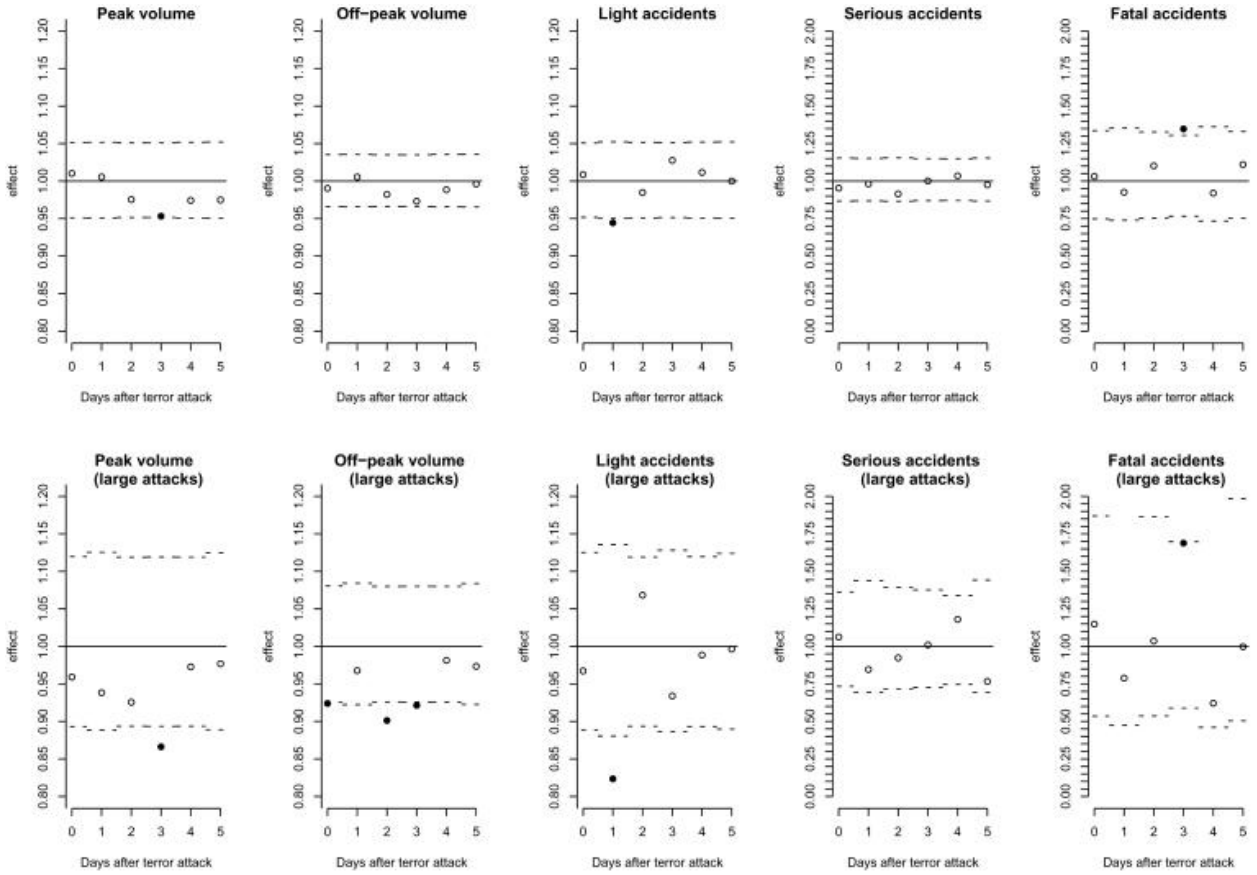

Figure 6: Proportional Effects of Terror Attacks on Israeli Traffic Volume and Traffic Accident Injury or Fatality Rates for the Indicated Lag

violence, or increased cigarette consumption, to help determine the breadth of the terrorist attack's impact on society. They also point out that there is little observational evidence of broad, societal responses to terrorist attacks.

Public reports of declines in murders in New York City as reported in local newspapers after the 9/11 attacks are an interesting example of a possible societal response, but, in the context of several years of declining crime levels and huge increases in security operations in the area after the attacks, these changes are difficult to attribute to the attacks themselves.

The results from Stecklov and Goldstein (2004) in Figure 6 show the proportional effects of terrorist attacks on traffic volume and accident rates by number of days after attack. The upper row is for all attacks; the lower row is for large attacks only. Open circles indicate effects that are not statistically significant, and filled circles indicate effects that are significant at the 5 percent level. Circles that lie outside the dashed interval are statistically significant at the 10 percent level.

Bleich, Gelkopf, and Solomon (2003) examined a nationally representative sample in Israel approximately 19 months after the beginning of the Second Intifada in late September 2000. Unlike the situations discussed in many of the reports thus far, which deal with what might be

called acute terrorism episodes, Israeli society was subjected to chronic terrorism. The authors speculate that a relatively moderate psychological impact may have resulted from a kind of habituation process and the development of coping mechanisms. Most of the outcome measures relate to psychological impacts, except in cases where coping mechanisms and behaviors were involved. In terms of avoidance behaviors, the study concludes that denial, self-distraction through activity, and avoidance of television and radio broadcasts were frequently employed; use ranged from 46 percent to 32 percent for individuals who "ever" used the coping mode. Those who "always" used these coping modes represented under 10 percent of respondents. The use of tranquilizers, alcohol, or cigarettes was reported by fewer respondents than the use of other modes.

Hotchkiss and Pavlova (2009) used observed changes in hours of work and labor force participation to draw inferences about behavioral responses to the 9/11 terrorist attacks. They used data from the current population survey and controlled for differences in demographics and labor market conditions. They determined that for most sub-samples, there was no change in labor force participation or in hours of work after the 9/11 attacks relative to before them. The exceptions to this finding were women, who increased their labor force participation, and workers living in the proximity of one of the 9/11 events, who increased their hours of work. They note that their results are consistent with a precautionary increase in labor supply during an uncertain time, and with others' documentation of women responding more dramatically to external stressors.

4.4 Avoidance Behaviors

"The estimation of personal risk and vulnerability to terrorism may act as a key motivator to behavioral adaptations, including avoidance of usual activities or increased adoption of protective behaviors" (Eisenman et al. 2009). Thus, studies that explicitly link perceived risk or terrorism-related fear to particular behaviors, including avoidance behaviors, may allow for the most helpful public-policy-related insights on the potential impacts of terrorist attacks.

Schulden et al. (2006) assessed the psychological and behavioral responses of residents of the Washington, D.C., metropolitan area to the October 2002 sniper shootings, as well as the association between measures of exposure to the shootings and elevated traumatic stress. A cross-sectional survey was conducted through random digit dialing (RDD) telephone interviews during May 2003. Survey data were collected from a random sample (n = 1,205) of adult residents living in Washington, D.C., and Montgomery County and Prince Georges County, Maryland, during any portion of the period when the sniper shootings occurred. The response rate for the survey was 56.4 percent. Main outcome measures included self-reports regarding traumatic stress symptoms, perceptions of safety, behavioral responses, and exposures to incidents (see Table 5).

Forty-five percent of residents reported going to public spaces, such as parks and shopping centers, less often than usual, and 5.5 percent reported missing at least 1 day of work because of the sniper attacks. Women who reported living within 5 miles of any shooting incident were significantly more likely to report elevated traumatic stress symptoms – consistent with a

probable diagnosis of PTSD – than were women who reported living farther from incidents (odds ratio 4.2, 95 percent confidence interval 1.9–9.3). Among men, there was no significant association between reported residential proximity and elevated traumatic stress symptoms.

Table 5: Perceived Safety in Community Settings during Washington, D.C., Sniper Shootings

Degree of Safety	In Neighborhood (%)	At Workplace and in Surrounding Area (%)	At Other Public Places (%)	At Gas Stations (%)
A lot less safe	21.5	22.7	30.6	38.6
A little less safe	35.7	31.5	35.3	31.1
As safe as usual	42.4	45.6	32.0	26.8
Don't know or refusals	0.5	0.2	2.1	3.5

More than half of the residents reported feeling less safe in their neighborhood (Table 5). More than one-third of residents reported leaving their household less often than usual because of concerns about the sniper, with 16.4 percent reporting that they sheltered in their residence for one or more days because of the shootings. Sixty-six percent reported feeling less safe at other public areas, such as shopping centers and parks. Almost half reported going to these public spaces less often than usual. Among residents who reported employment outside the home, 5.5 percent reported having missed one or more days of work because of the sniper shootings.

Utilizing awareness of the Homeland Security Advisory System (HSAS) level (at the time of the survey) as a measure of "perceived population-level risk," Eisenman et al. (2009) analyzed data from the Public Health Response to Emergent Threats Survey, which used an RDD method and was conducted in Los Angeles County from October 28, 2004, through January 7, 2005 (p. 169). The purpose of the study was to "determine whether groups traditionally most vulnerable to disasters would be more likely than would be others to perceive population level risk as high ... would worry more about terrorism, and would avoid activities because of terrorism concerns" (p. 168). The vulnerable populations included racial and ethnic minorities, those with probable serious mental illness, and those with physical disabilities or mental or emotional problems (p. 169).

One significant finding was that members of vulnerable populations were more likely to overestimate the HSAS level (estimating it was red or orange when, in fact, it was yellow throughout the survey). The survey also revealed that "vulnerable groups were more likely to fear terrorism and avoid activities because of terrorism fears." For example, "26.1 percent of Latinos reported worrying very often or often about terrorism compared with 14.1 percent of whites, and 7.9 percent of Latinos reported avoidance behavior very often or often compared with 1.1 percent of whites" (p. 170).

Since urban populations may have a higher proportion of multiethnic and other vulnerable groups, it may prove useful to explore policy-related implications for such areas, where mitigation may require an understanding of cultural and language differences. As Eisenman et al. (2009, p. 173) state in their conclusion:

Terrorism-related fears and avoidant behavior can be considered part of the "disaster burden" – the amount of adverse health effects ranging from loss of well-being or security to injury, illness, or death caused by a disaster – associated with terrorism and national terrorism policies. The disaster burden associated with terrorism and consequent policies may fall disproportionately on the vulnerable groups we studied. Further studies should investigate the specific behaviors affected and further elucidate disparities in the disaster burden associated with terrorism and terrorism policies.

Avoidant behaviors, as a consequence of terrorist attack, can pose a threat of indirect damage, which Gigerenzer (2006) suggests is mediated through risk perception. He further states that "in the case of September 11, known indirect damages include the financial damages in the aviation industry fueled by many people's anxiety about flying, the job loss in the tourism industry…." (p. 347). As noted earlier,[5] his research suggests that avoiding air travel resulted in more driving as an alternative means of travel, resulting in an increase in the number of driving-related fatalities of 1,595 (p. 349). His analysis indicates that this increase lasted for approximately 12 months. By comparison, after the 2004 Madrid attacks, there was a corresponding decline in train travel that was of shorter duration, lasting about 2 months (p. 350).

As suggested by Gigerenzer (2006), tourism is an additional area that can experience direct and indirect damages from terrorist attacks. Incidents such as the Bali night club attack and the attacks on hotels in Indonesia, Mumbai, and others indicate the disruptive nature (social and economic) of such attacks. As Sönmez et al. (1999) state, "Persistent terrorism ... can tarnish a destination's image of safety and attractiveness and jeopardize its entire tourism industry." In 1985, the empirical probability of an American tourist being injured or killed in a terrorist incident while travelling abroad was approximately 1 in 172,000 (0.0000057). In spite of this extremely low probability, about "2 million Americans changed their foreign travel plans in 1986 as a result of the previous year's events" (Sönmez et al. 1999, p. 15). The economic significance is apparent when it is recognized that the "tourism industry … has become the world's preeminent industry, contributing about $3.6 trillion to the global GDP" (p. 13).

Also noted previously,[6] Drakos and Kutan (2003) used a consumer-choice model and a regression model to explore the impacts of terrorism on substitution and regional contagion effects related to tourism in Greece, Israel, and Turkey. The authors conclude that "risk-averse decision makers (tourists) shift their demand away from risky destinations and toward safer ones" (p. 634). "Such decisions resulted in a change of market share (for within-country terrorist attacks) of –9.02 percent for Greece, –0.67 percent for Israel, and –5.21 percent for Turkey" (p. 633). The lower number for Israel may be a function of the previously mentioned chronic nature of terrorism in the Israeli experience.

The hypothesis that political violence deters tourism is mainly based on case study evidence and a few quantitative studies confined to a small sample of countries. Neumayer (2004) extended some of the earlier analyses in an attempt to estimate or "test the impact of various forms of political violence" showing "strong evidence that human rights violations, conflict and other

[5] See the Behavioral Economics, Transportation section of this report.
[6] See the Behavioral Economics, Tourism section of this report.

politically motivated violent events negatively affect tourist arrivals" (p. 59). To measure tourism demand, Neumayer examines the number of tourist arrivals in a given country, over a large number of countries. He uses two estimation techniques – a fixed-effects panel estimator with contemporaneous effects only, and a dynamic generalized method of moments estimator – to test the impacts of various forms of political violence on tourism. Both models show strong evidence that human rights violations, conflict, and other politically motivated violent events negatively affect tourist arrivals. He chooses arrivals over receipts in the interest of greater precision. He notes, however, that there is a high correlation (0.91, n = 3,116) between these receipts and arrivals (p. 267). Data for tourist arrivals were taken from the Compendium of Tourism Statistics (WTO) and covered the period from 1977 to 2000 (p. 267).

In this study, the independent variable drew on a variety of sources that provide data on terrorist events, violent events, conflict variables, and human rights violations. The results of the analysis indicate that an increase of one standard deviation in terrorist-events count accounts for a contemporaneous decline of 8.8 percent in tourist arrivals. A similar increase in the violent-events count results in a –5.7 percent change. Finally, an increase of one standard deviation in the conflict-intensity count results in a much larger change of more than –22 percent (p. 277). With regard to the long-term impacts on tourist arrivals, the changes associated with the same increases in the explanatory variable are 14.8 percent – 8.4 percent, and –26.1 percent.

Reisinger and Mavondo (2005) conducted a path analysis of the data from samples of 246 Australian and 336 foreign respondents surveyed in Australia during the period between October and December 2001 to test the hypothesis that "travel anxiety is associated with the perception of safety and intentions to travel" (p. 216). One important aspect of this study to the overall review is that it brings together varied dimensions from the micro/psychological level (travel anxiety); the social-psychological level (perception of travel risk/safety), and the sociological/cultural level (cultural orientation), along with the behavioral manifestation of suppression of international travel.

The authors hypothesized a negative relationship between travel anxiety and perception of safety and between travel anxiety and intention to travel, and they expected a positive relationship between perception of safety and intention to travel. Results of the path analysis indicate a positive relationship between terrorism risk and anxiety, and also between sociocultural risk and anxiety, for both the Australian and the foreign group. For both groups, the data also revealed a negative relationship between health/financial risk and perception of safety. In addition, the data supported the hypothesis of a negative relationship for anxiety and safety and also for anxiety and intention to travel.

The quantitative results for these pairs are provided by the authors as standardized regression weights and were statically significant for the paths represented above. Although the regression weights are not directly convertible to percentages or other common numeric metrics, the authors note that "the perception of high risk associated with international travel can have a devastating effect on not only tourism but also the entire region. This was evident, for example, in Bali, where the bombings at two night clubs in Kuta cost U.S.$2 billion from international and domestic tourism earnings, leaving 2.7 million unemployed" (WTO 2002, as cited in Reisinger and Mavondo 2005, p. 222).

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5 Political Psychology Literature

Political psychology applies theories and research practices from the field of psychology to the political behavior of individuals. The field is a branch of social psychology that includes subfields such as memory and cognition, emotion and effect, group processes and decision making, and identity formation. Actors in political psychology include the general public, political elites, influence groups, political and bureaucratic institutions, and foreign entities.

Practitioners in the field rely on survey research results to gather data directly from population samples. They may also derive their hypotheses from data related to behavioral patterns of interest, such as information seeking, hoarding, communicating via social media, or crime – each of which may be interpreted as representative of acting out on emotions.

Because terrorist attacks are, by definition, political actions, the response of individuals to them will be, at least in part, political. The response domain at the center of political psychology is cognitive, and it affects an individual's values and beliefs related to the public sphere. Secondary effects of these cognitive processes may be manifested in behavioral changes that have economic implications as well as impacts on social stability. Political actors and government institutions have a vested interest in the impact of an event on society as a whole. They will act in response to the event on the basis of their need to control the situation from a political standpoint by affecting the public's perception of collective threats (Béland 2007). In the aftermath of 9/11, the government attempted to mitigate secondary impacts by reassuring the public of its safety, and it called for calm in order to prevent acts of violence against persons of Middle Eastern descent. The general call was to return to normalcy "so as not to let the terrorists win."

Studies in the field of political psychology that relate to the impact of terrorism date back to the early 1990s and are generally limited to how an event affects the internal belief structures of individuals, particularly in terms of how it relates to their perceptions of personal risk or in how an event results in more incidences of clinical conditions like PTSD or acute stress disorder (Koopman 1997). Since the terrorist attacks on 9/11, the field has expanded to include studies seeking to understand changes in behaviors such as information seeking, blame assignment, and economic activity/targeted marketplace engagement or withdrawal (Prior 2002; Béland 2007; Huddy et al. 2002).

5.1 Threat Perception

Perceptions and beliefs about the public sphere are central to political psychology.
Huddy et al. (2002) attempt to distinguish between individual and collective psychological beliefs following terrorist attacks. The authors call these variables "personal threat" and "national threat." Personal threat is related to feelings of vulnerability to harm at the individual level. This threat is very experiential and therefore of greater salience to individuals. National threat is very abstract in nature. It relates to concerns over the long-term existence of the collective. Béland (2007) defines national threat as collective insecurity that is the "product of processes by which groups and individuals learn to acquire or create interpretations of risk"

(p. 320). Risk mitigation policies are informed by the threat profile, which is defined by its frequency, distance, visibility and origin (natural or human caused). Huddy et al. (2002) illustrate the distinction between the risk types by example: Personal threat is represented by crime victimization, which is local in nature, and national threat is represented by a subpopulation within a collective that is subjected to external attack.

Individual and collective behavioral responses to the two types of stimuli are quite different. In response to personal-level threats, individuals are likely to engage in avoidance behaviors (also called "constrained behaviors"). These behaviors are believed to reduce the probability of exposure to the threat. Such behavioral choices might be as simple as avoiding certain neighborhoods deemed dangerous or purchasing a firearm (Smith and Uchida 1981). National threats trigger changes in beliefs, prompting xenophobia and a willingness to accept a reduction in civil liberties (Doty et al. 1991; Marcus et al. 1995) The theory is that the stress of perceived threats results in reduced cognitive abilities and a disparity between the perceived threat and actual threat.

Huddy et al. (2002) use data collected through an RDD survey conducted in the immediate aftermath of 9/11 to study differences in personal and national threat perceptions (Table 6). The respondents were New York residents living in Long Island and Queens. The results show that there is a negative correlation between the dependent variable (threat perception) and independent variables (e.g., future predictions of national economic conditions, individual-level behaviors such as travel into Manhattan). Moreover, the strength of the negative correlation depends on the nature of the independent variable. Global-level variables (such as economics) were more strongly correlated with national threat than with personal threat, while micro-level responses (such as transportation choice or increased family time) were more strongly linked with personal threat.

Table 6: Predictors of Personal Attitudes Based on Perceived Personal and National Threat

Predictors	Time of Improvement	Personal Threat[a]	National Threat[a]
Of national economic evaluations: business conditions[b]	In 1 year	0.00 (0.05)	–0.27[c] (0.05)
	In 5 years	–0.09 (0.05)	–0.20[c] (0.05)
Of stock market evaluations[b]	In 1 year	–0.06 (0.05)	–0.16[c] (0.04)
	In 5 years	–0.01 (0.03)	–0.07[d] (0.03)
Of personal economic evaluations[b]	Better off than 12 months ago	–0.04 (0.05)	–0.00 (0.07)
	Better off in 12 months	–0.03 (0.05)	–0.11 (0.05)
Of personal behaviors	More time spent with family	0.66[c] (0.18)	0.36 (0.20)
	Drive less often into Manhattan	0.28 (0.19)	0.62[c] (0.23)
	Take public transit into Manhattan	0.48[d] (0.21)	0.01 (0.23)

[a] Parameter regression coefficients with standard errors in parentheses.
[b] Regression coefficient, which is the slope of the linear model.
[c] $p < 0.01$.
[d] $p < 0.05$.

Source: Adapted from Huddy et al. (2002).

Perceptions of personal and national threat lead to changes in behavior related to marketplace interaction and political engagement. Prior (2002) uses knowledge metrics and self-reported levels of interest from national surveys to illustrate a marked increase in information-seeking behaviors resulting from the 9/11 terrorist attacks. In addition, respondents to the surveys demonstrated greater knowledge of political institutions and actors than was evident in sample populations from previous periods. Althaus (2002) reported similar findings in a study of Nielsen ratings. However, Althaus's study identified boundaries to the change in behavior. Data suggest that within weeks of the stimulating event, knowledge-seeking behavior returns to a point just above pre-event levels, and that within several months, it returns to pre-event levels.

5.2 Recovery

The political psychology literature provides some insight into the mechanisms that drive recovery from a traumatic event. The event itself triggers in individuals a cognitive shutdown that limits response to more emotive expressions. In the initial period after the attack, individuals may experience a shift from long-held political and social beliefs and a temporary re-ordering of value preferences, referred to as the "distraction hypothesis." These shifts would be toward the center of broadly accepted beliefs of the society. However, as time passes and memories of the event become less vivid, normal cognitive operation returns, and individuals revert to previous attitudes and beliefs. This progression is called the "bounce-back hypothesis" (Vertzberger 1997).

Vertzberger applies a qualitative research approach to illustrate these effects, using survey data of Israeli citizens in the months immediately following the assassination of Yitzhak Rabin. Survey data from the weeks immediately following the assassination showed that the respondents' ordering of national identity variables had changed from pre-event surveys. However, he found that within 6 months of the assassination, beliefs had reverted back to pre-event levels.

Because the political psychology field focuses on the belief systems and cognitive processes of individuals, it does not have much direct applicability to the problem of the vulnerability of commercial facilities to second-order and third-order effects in the aftermath of a terrorist event. This lack of applicability is a particular problem when the goal is to determine the impact on an entire sector of the economy. Study designs are often narrowly constructed to identify changes in beliefs and emotional responses but leave the behavioral expression of those changes open to conjecture.

Two topics that could help to bound understanding of the impact of terrorism on personal behavior are the salience of the threat to the individual and the duration of impacts following an event. First, as Huddy et al. (2002) research suggests, the extent to which individuals believe that they are personally at risk of becoming a victim will result in a change in their behavior, as expressed through public interaction. Events that are local in nature or attempted repeatedly within a particular geographic region seem unlikely to elicit a spillover response. Avoidance behaviors will occur locally, and it is likely that individuals from outside the targeted area will avoid the targeted area. Second, as suggested by Raviv et al. (2000), the time period of impact is

relatively short. Within 3 to 6 months, individuals have reverted back to their normal patterns of behavior.

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6 Social Networks

6.1 Background

Research on trying to quantify the economic consequences of terrorist attacks in different settings (including different types of buildings, such as shopping malls and stadiums) has been done. Work in this area seldom considers costs associated with behavioral responses of consumers as part of the relevant associated costs of threats and attacks. For example, Pinker (2007) identifies the total cost of terrorism as being composed of "damage from attacks and the cost of defensive measures taken" (p. 867). Although the Pinker (2007) analysis focuses on the short-term consequences of terrorism, no mention of behavioral consequences (even just short-term consequences) exists in his analysis or discussion. The identification of social networks as underlying mechanisms that influence behavior provides a good theoretical orientation for exploring such consequences.

Social networks research "has roots in many disciplines, including sociology, anthropology, psychology, and pure mathematics" (Krackhardt 2009, p. 47). In general, it is concerned with understanding the shape, processes, and mechanisms that link social elements (Wasserman and Faust 1994). Overall, social networks are identified as devices that allow information and influence to flow among members of the network (Burt 1992; Burt et al. 1994; Granovetter 1973, 1992; Wasserman and Faust 1994). Social network theory has been applied to several different domains, such as the diffusion of innovations (Rogers 1995), cultural change (Bikhchandani et al. 1992), cognition and social perception (Krackhardt 1987), social influence (Friedkin and Johnsen 1990, 1999; Ibarra and Andrews 1993; Marsden and Friedkin 1993), markets (Burt 1988, 1992), and, recently, consumer behavior (Iyengar et al. 2009). Notably relevant to this review is social networks research related to social influence, markets, and consumer behavior, because of its potential to explain "at least in part, the behavior of network elements" (Marsden and Friedkin 1993, p. 127) and, in particular, behavior responses after disruptive events such as acts of terrorism (Sheppard et al. 2006).

6.2 Social Network Influences

Burt (1992) uses social network theoretical arguments and tools to explore how to make markets profitable and how to identify areas of opportunity (termed structural holes) within them. Burt (1992) concludes that networks rich in structural holes (disconnections between social groups in large social networks) are rich in offering entrepreneurial opportunity (to exploit such holes) and "thus rich in information and control benefits" (p. 44). Structural holes, according to Burt (1992), are fertile grounds for intervention in markets, because the bridge built between these holes can control and influence the information that the different groups obtain. In this sense, the rationale of Burt (1992) expands and generalizes the conceptualization of Granovetter (1973, 1983) about the strength of weak ties in social networks. According to Granovetter (1973), "more novel information flows to individuals through weak ties than through strong ties" (p. 34), making the existence of weak ties (connections through acquaintances rather than through close friends, which are strong ties) crucial to learning about

opportunities and new alternatives in social interaction. Therefore, becoming a connection that bridges structural holes in markets has the potential of influencing consumer response to determined events.

Sheppard et al. (2006), in their study of terrorism and panic response, make the point that the preparation for terrorist attacks must include both physical response mechanisms and psychological measures, such as risk communication protocols and targeted information diffusion. The latter represents precisely what Granovetter (1983) and Burt (1992) also endorse: exploiting the use of structural holes to influence network participants' behavior. Social network participants' behavior is a function of how information is transmitted and internalized by network members. Although some evidence points to the fact that panic behavior rarely emerges as generalized public response after terrorist attacks (Sheppard et al. 2006), researchers have also found that mass behavior might be fragile as a result of informational cascade in social networks (Bikhchandani et al. 1992). According to Bikhchandani et al. (1992), "information cascade occurs when it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information" (p. 994). Therefore, informational cascade (or positive feedback information processes) has the potential to explain the emergence of both stable emergent behavior, consistent with the perspective that a panic-prone public is a myth (Sheppard et al. 2006), and fragile mass behavior with rapid spread of extreme behavior such as panic (Bikhchandani et al. 1992). Careful identification and management of the information needs of relevant social networks thus seem warranted. In the commercial buildings sector, in order to effectively and efficiently implement psychological measures designed to minimize short-term and long-term impacts on consumer behavior, it would make sense to try to understand the shape and composition of relevant social networks.

In addition, according to the analysis of Sheppard et al. (2006), changes in behavior experienced after terrorist attacks seem to be transient and depend on the type of event. For instance, after the anthrax attacks in October and November 2001 in the United States, although 57 percent of Americans modified their behavior in one form or another (avoiding public events, exercising caution when opening the mail, washing their hands, etc.), only an additional 0.13 percent of the population (relative to the same period the previous year) filled prescriptions for the three most recommended antibiotics (ciprofloxacin, doxycycline, and amoxicillin). Moreover, evidence suggests that in London, 3 months after the July 7, 2005, bombing that resulted in 56 deaths and about 700 people entering hospitals because of injuries, use of the tube returned to expected levels (Sheppard et al. 2006).

In complex social networks, the social structure (i.e., the influence that any given person has on another) can have important behavioral consequences (Granovetter 1978; Ibarra and Andrews 1993) and economic impacts, because the social networks affect the flow and quality of information, reward and punishment systems, and trust that others will comply with normative behavior (Granovetter 2005). Social influence networks have been characterized, studied, and analyzed both experimentally (Friedkin and Johnsen 1990, 1999) and empirically (Marsden and Friedkin 1993) to understand their effects on behavior across different domains. Both theoretical research and simulation-based research related to how to maximize the spread of influence in social networks have also been conducted (Kempe et al. 2003). Social influence is important in social networks because "individuals form their opinions in a complex social environment in

which influential opinions are [potentially] not only in disagreement but are also liable to change" (Friedkin and Johnsen 1990, p. 193). Social influence could thus link "the structure of social relations to attitudes and behaviors of actors who compose a network" (Marsden and Friedkin 1993, p. 127). An understanding of how individuals make judgments and of relevant social networks in which businesses operate – when it is paired with an understanding of the importance of information management in networks (structural holes and weak ties) – could clarify the sources of the behavioral responses of the public to terrorist attacks.

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7 Press and Other Accounts of Significant Events[7,8]

The limited information that we found in popular press about the public avoiding venues after a terrorist attack or another violent event is summarized in the following sections from most current to oldest. Within these accounts are a few anecdotal mentions of avoidance behaviors, but, in general, the popular press provided little additional evidence of such behavior.

7.1 Northern Illinois University Shooting – February 14, 2008

In this shooting on the campus of Northern Illinois University (NIU) in DeKalb, a gunman shot multiple people. The incident happened at Cole Hall at about 3:06 p.m. local time (a Thursday). The school placed the campus on lockdown; students and teachers were advised to head to a secure location, take cover, and avoid the scene and all buildings in the vicinity of the area. Six people died in the incident, including the perpetrator, making it the fourth-deadliest university shooting in U.S. history, after the Virginia Tech massacre, University of Texas Clock Tower shooting, and California State University, Fullerton, library massacre.

After the incident, the university administration cancelled all classes for the rest of the week and for the next week. Students were asked to contact their parents as soon as possible. All NIU sporting events, home and away, through Sunday, February 17, 2008, were canceled. Most students left campus for the weekend.

7.2 Westroads Mall Shooting – December 5, 2007

The Westroads Mall shooting was a murder-suicide at the Von Maur department store. Nineteen-year-old Robert A. Hawkins killed nine people (including himself) and wounded four, two of them critically. It was the deadliest shooting spree in Nebraska since the rampage of Charles Starkweather in 1958.

7.3 Virginia Tech Massacre – April 16, 2007

This shooting took place on the campus of Virginia Tech in Blacksburg. In two separate attacks about 2 hours apart, Seung-Hui Cho killed 32 people and wounded many others before committing suicide. This massacre is the deadliest peacetime shooting incident by a single gunman in U.S. history, on or off a school campus.

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[7] Selected incidents in English-speaking Anglo societies.

[8] Wikipedia, which was used as a principal Internet source, reflects the ongoing collaboration and interpretation of events by a broad network of contributors. References for each event are included at the end of this section, listed by event.

Cho, a senior English major at Virginia Tech, had previously been diagnosed with a severe anxiety disorder. During much of his middle school and high school years, he received therapy and special education support. When Cho enrolled at Virginia Tech, because of federal privacy laws, the school was not informed about his previous diagnosis or the accommodations he had been given. In 2005, Cho had been accused of stalking two female students, and, after an investigation, a Virginia special justice declared him mentally ill and ordered him to attend treatment sessions. Lucinda Roy, a professor and former chairwoman of the English department, had also asked Cho to seek counseling.

7.4 Amish School Shooting – October 2, 2006

This shooting took place at the West Nickel Mines School, an Amish one-room schoolhouse in the Old Order Amish community of Nickel Mines, a village in Bart Township, Lancaster County, Pennsylvania. Gunman Charles Carl Roberts IV took hostages and eventually shot 10 girls (aged 6–13), killing 5 of them, before committing suicide in the schoolhouse.

The emphasis on forgiveness and reconciliation in the response of the Amish community was widely discussed in the national media. The West Nickel Mines School was torn down, and a new one-room schoolhouse, the New Hope School, was built at another location.

On the day of the shooting, a grandfather of one of the murdered Amish girls was heard warning some young relatives not to hate the killer, saying, “We must not think evil of this man.” Another Amish father noted, “He had a mother and a wife and a soul and now he’s standing before a just God.” Jack Meyer, a member of the Brethren community living near the Amish in Lancaster County, explained: “I don’t think there’s anybody here that wants to do anything but forgive and not only reach out to those who have suffered a loss in that way but to reach out to the family of the man who committed these acts.”

The Amish do not normally accept charity, but because of the extreme nature of the tragedy, donations were accepted. Richie Lauer, director of the Anabaptist Foundation, said the Amish community, whose religious beliefs prohibit them from having health insurance, would likely use the donations to help pay for the medical costs of the hospitalized children.

Some commentators criticized the swift and complete forgiveness with which the Amish responded, arguing that forgiveness is inappropriate when no remorse has been expressed and that such an attitude runs the risk of denying the existence of evil. Others were supportive. Donald Kraybill and two other scholars of Amish life noted that “letting go of grudges” is a deeply rooted value in Amish culture, which remembers forgiving martyrs, including Dirk Willems and Jesus himself. They explained that the Amish willingness to forgo vengeance does not undo the tragedy or pardon the wrong; rather, it constitutes a first step toward a future that is more hopeful.

7.5 London Tube Bombings – July 7, 2005

The July 7, 2005, London bombings, also known as 7/7, were a series of coordinated suicide attacks on the city's public transport system during the morning rush hour. They were carried out by four Muslim men, three of British Pakistani descent and one of British Jamaican descent, who were motivated by Britain's involvement in the Iraq War.

At 8:50 a.m., three bombs exploded within 50 seconds of each other on three London underground trains; a fourth exploded an hour later at 9:47 on a double-decker bus in Tavistock Square. The explosions appeared to have been caused by home-made organic peroxide-based devices, packed into rucksacks and detonated by the bombers themselves, all four of whom died. Another 52 people were killed, and about 700 were injured.

An earlier post of November 17, 2004, on the *Newsweek* website had stated that fears of terrorist attacks "prompted FBI agents based in the U.S. Embassy in London to avoid travelling on London's popular underground railway (or tube) system" (which is used daily by millions of commuters), according to a U.S. government official. *Newsweek* learned that some U.S. law enforcement officers based in London became extremely concerned about evidence regarding possible active al Qaeda plots to attack targets in Britain. While Embassy-based officers of the U.S. Secret Service, Immigration and Customs Bureaus, and the Central Intelligence Agency were believed to still use the underground to do business, FBI agents were known be late to cross-town meetings because they insisted on using taxis in London's traffic-choked business center (MSNBC).

7.6 Beltway Sniper Attacks – October 4 to 22, 2002

The Washington sniper attacks took place during three weeks in October in Washington, D.C., Maryland, and Virginia. Ten people were killed and three others were critically injured in various locations throughout the Washington metropolitan area and along Interstate 95 in Virginia (Figure 7). It was widely speculated that a single sniper was using the Capital Beltway for travel, possibly in a white van or truck. It was later learned that the rampage was perpetrated by one man, John Allen Muhammad, and one minor, Lee Boyd Malvo, driving a blue 1990 Chevrolet Caprice sedan, and that it had apparently begun the month before with murders and robbery in Louisiana and Alabama that had resulted in three deaths.

Figure 7: Locations of the 15 Sniper Attacks, Numbered Chronologically

During the weeks that the attacks occurred, fear of the apparently random shootings generated a great deal of public apprehension, especially at gas stations and the parking lots of large stores. People pumping gas at gas

stations would walk around their cars quickly, hoping that they would be a harder target to hit. Some gas stations put up tarpaulins around the awnings over the gas pumps so people would feel safer. Also, many people attempted to fill their cars at the Naval Base of the National Naval Medical Center because they felt it was safer inside the guarded fence. Various government buildings, such as The White House, U.S. Capitol, and Supreme Court building, and memorial tourist attractions at The Mall in Washington also received heightened security.

After the specific threat against children was delivered, many school groups curtailed field trips and outdoor athletic activities because of safety concerns. At the height of public fear, after the Ponderosa shooting, some school districts, such as Henrico County Public Schools and Hanover County Public Schools, simply closed school for the day. Other schools, such as Melvin J. Berman Hebrew Academy, cancelled all outdoor activities after the shooting at the Connecticut and Aspen Hill intersection. Others changed after-school procedures for parents picking up their children to minimize the amount of time children spent in the open. Extra police officers were placed in schools because of this fear. In addition to this, Joel Schumacher's film *Phone Booth* was deemed potentially upsetting enough that its release was delayed for months.

7.7 Columbine High School Massacre, Colorado – April 20, 1999

This massacre occurred on a Tuesday at the high school in Columbine, an unincorporated area of Jefferson County, Colorado, near Denver and Littleton. Two senior students, Eric Harris and Dylan Klebold, killed 12 students and 1 teacher. They also injured 21 other students directly, and 3 people were injured while attempting to escape. The pair then committed suicide. It is the fourth-deadliest school massacre in U.S. history (after the 1927 Bath School disaster, 2007 Virginia Tech massacre, and 1966 University of Texas massacre) and the deadliest for an American high school.

The massacre provoked debate regarding gun control laws, the availability of firearms in the United States, and gun violence involving youths. Much discussion also centered on the nature of high school cliques, subcultures, and bullying, as well as on the role of violent movies and video games in American society. The shooting also resulted in an increased emphasis on school security, and a moral panic aimed at Goth culture, social outcasts, the gun culture, the use of pharmaceutical anti-depressants by teenagers, violent films and music, teenage Internet use, and violent video games.

7.8 Centennial Olympic Park Bombing, Atlanta – July 27, 1996

This bombing in Atlanta, Georgia, during the 1996 Summer Olympics was the first of four bombings by Eric Robert Rudolph, who, after more than 5 years on the run, was arrested on May 31, 2003, in Murphy, North Carolina. Two people died and 111 were injured in this bombing.

Centennial Olympic Park was designed as the "town square" of the Olympics, and thousands of spectators had gathered for a late band concert. Sometime after midnight, Rudolph planted a

green U.S. military ALICE (field) pack, containing three pipe bombs surrounded by nails, underneath a bench near the base of a concert sound tower and then left the area. The pack had a directed charge, and it has been estimated that the bomb could have done more damage if it had not tipped over at some point. This incident involved the use of the largest pipe bomb in U.S. history (more than 40 pounds) and a steel plate as a directional device. Investigators later tied some other of Rudolph's bombs to this first device, because all were propelled by nitroglycerin dynamite, used an alarm clock and Rubbermaid containers, and contained steel plates.

President Bill Clinton denounced the explosion as an "evil act of terror" and vowed to do everything possible to track down and punish those responsible. Despite this bombing, officials and athletes agreed that the games should continue as planned. The crash of TWA Flight 800 off Long Island (at the time, considered a possible terrorist attack), which had occurred just 10 days earlier on July 17, 1996, was likewise not considered a reason to postpone the games.

7.9 Oklahoma City Bombing – April 19, 1995

This bomb attack on the Alfred P. Murrah Federal Building in downtown Oklahoma City was perpetrated by Timothy McVeigh, an American militia movement sympathizer. He detonated an explosives-filled truck parked in front of the building. His co-conspirator, Terry Nichols, assisted in the bomb preparation. It was the most destructive act of terrorism on American soil until the September 11, 2001, attacks. The Oklahoma blast claimed 168 lives, including the lives of 19 children under the age of 6, and it injured more than 680 people. It destroyed or damaged 324 buildings within a 16-block radius, destroyed or burned 86 cars, and shattered glass in 258 buildings nearby. It was estimated to have caused at least $652 million worth of damage. It has been estimated that about 387,000 people in the Oklahoma City metropolitan area (a third of the population) knew someone who was directly affected by the bombing.

In the weeks following the bombing, the federal government ordered that all federal buildings in all major cities be surrounded with prefabricated Jersey barriers to prevent similar attacks. As part of a longer-term plan for U.S. federal building security, most of those temporary barriers have since been replaced with permanent security barriers, which look more attractive and are driven deep into the ground for sturdiness. Furthermore, all new federal buildings must now be constructed with truck-resistant barriers and with deep setbacks from surrounding streets to minimize their vulnerability to truck bombs. FBI buildings, for instance, must be set back 100 feet (30 meters) from traffic. The total cost of improving security in federal buildings across the country in response to the bombing reached over $600 million. The attack also led to engineering improvements that allow buildings to better withstand tremendous forces; these improvements were incorporated in the design of Oklahoma City's new federal building.

7.10 Sarin Gas Attack on the Tokyo Subway – March 20, 1995

This attack on the Tokyo subway, usually referred to in the Japanese media as the Subway Sarin Incident, was an act of domestic terrorism perpetrated by members of Aum Shinrikyo. In five coordinated attacks, the perpetrators released sarin on several lines of the Tokyo Metro, killing 13 people, severely injuring 50 people, and causing temporary vision problems for nearly 1,000 other people. The attack was directed against trains passing through Kasumigaseki and Nagatachō, home to the Japanese government. It was and remains the most serious attack to occur in Japan since the end of World War II. There were 13 deaths and over 6,200 injuries.

On the day of the attack, ambulances transported 688 patients. Nearly 5,000 people reached hospitals by other means. Hospitals saw 5,510 patients, 17 of whom were deemed critical, 37 who were deemed severe, and 984 who were moderately ill with vision problems. Most of those reporting to hospitals were the "worried well," who had to be distinguished from those that were ill.

Surveys taken in 1998 and 2001 showed that many of the victims were still suffering from PTSD. In one survey, 20 percent of 837 respondents complained that they felt insecure whenever they rode on a train, and 10 percent answered that they tried to avoid any nerve-attack–related news. More than 60 percent reported chronic eyestrain and said their vision had worsened.

7.11 1993 World Trade Center Bombing – February 26, 1993

This incident occurred when a truck bomb was detonated in the parking garage below the North Tower (Tower One) of the World Trade Center (WTC) in New York City. The 1,500-pound (680-kilogram) device enhanced with urea-nitrate-hydrogen gas was intended to knock the North Tower into the South Tower (Tower Two), bringing both down and killing thousands of people. It failed to do so, but it did kill 6 people and injure 1,042.

The attack was planned by a group of conspirators, including Ramzi Yousef, Mahmud Abouhalima, Mohammad Salameh, Nidal A. Ayyad, Abdul Rahman Yasin, and Ahmad Ajaj. They received financing from Khaled Shaikh Mohammed, Yousef's uncle. In March 1994, four men were convicted of carrying out the bombing: Abouhalima, Ajaj, Ayyad, and Salameh. The charges included conspiracy, explosive destruction of property, and interstate transportation of explosives. In November 1997, two more were convicted: Yousef, the mastermind behind the bombings, and Eyad Ismoil, who drove the truck carrying the bomb.

The victims of the 1993 WTC bombings sued the buildings' owner/operator, the Port Authority of New York and New Jersey, for damages. A decision was handed down in 2006, assigning liability for the bombings to the Port Authority. The decision declared that the agency was 68 percent responsible for the bombing, and the terrorists bore only 32 percent of the responsibility. In January 2008, the Port Authority asked a five-judge panel of the Appellate Division of the New York State Supreme Court in Manhattan to throw out the decision, describing the jury's verdict as "bizarre." On April 29, 2008, a New York State Appeals Court

unanimously upheld the jury's verdict. Under New York law, once a defendant is more than 50 percent at fault, he/she/it can be held fully financially liable.

It has been argued that the problem with the apportionment of responsibility in the case is not the jury's verdict but rather New York's tort-reform-produced state apportionment law. Traditionally, courts do not compare intentional and negligent fault.

7.12 Harrods Bombing, London – December 17, 1983

This was a car bombing at Harrods department store in London. The bomb was planted by members of the Provisional Irish Republican Army (IRA), although the IRA Army Council claimed that it had not authorized the attack. Six people were killed: three police officers and three civilians. A memorial that marks the spot where the police officers were killed is located on the side of Harrods at Hans Crescent. Philip Geddes, an Oxford graduate and journalist, was one of those killed. In his honor, annual prizes are awarded to aspiring journalists attending Oxford University. Also, every year, the Philip Geddes Memorial Lecture on the future of journalism is given by a leading journalist. The same store was the target of a much smaller IRA bomb in 1993.

7.13 Three Mile Island Accident – March 28, 1979

The Three Mile Island (TMI) accident was a partial core meltdown in Unit 2 (a pressurized water reactor manufactured by Babcock and Wilcox) of the TMI Nuclear Generating Station in Dauphin County, Pennsylvania, near Harrisburg. The plant was owned and operated by General Public Utilities and Metropolitan Edison Company (Met Ed). This accident was the most significant in the history of the American commercial nuclear power generating industry. It resulted in the release of up to 13 million curies of radioactive gases but less than 20 curies of the particularly dangerous iodine-131.

The accident began at 4 a.m. on Wednesday, March 28, with failures in the non-nuclear secondary system. Then a pilot-operated relief valve (PORV) in the primary system got stuck open and allowed large amounts of reactor coolant to escape. The mechanical failures were compounded by the initial failure of plant operators to recognize the situation as a loss-of-coolant accident as a result of inadequate training and by human factors, such as industrial design errors related to ambiguous control room indicators in the power plant's user interface. The scope and complexity of the accident became clear over the course of 5 days, as Met Ed employees, Pennsylvania state officials, and members of the U.S. Nuclear Regulatory Commission (NRC) tried to understand the problem, communicate the situation to the press and local community, decide whether the accident required an emergency evacuation, and ultimately end the crisis.

Public reaction to the event was probably influenced by the release of the movie *The China Syndrome* 12 days before the accident, depicting an accident at a nuclear reactor.

Communications from officials during the initial phases of the accident were felt to be confusing. The accident crystallized anti-nuclear safety concerns among activists and the general public, resulted in new regulations for the nuclear industry, and has been cited as a contributor to the decline of new reactor construction that had already been underway in the 1970s.

Twenty-eight hours after the accident began, William Scranton III, the lieutenant governor of Pennsylvania, appeared at a news briefing to say that Met Ed had assured the state that "everything is under control." Later that day, Scranton changed his statement, saying that the situation was "more complex than the company first led us to believe." There were conflicting statements about radiation releases. Schools were closed, and residents were urged to stay indoors. Farmers were told to keep their animals under cover and on stored feed.

Governor Dick Thornburgh, on the advice of NRC Chairman Joseph Hendrie, advised the evacuation of "pregnant women and pre-school age children ... within a five-mile radius of the Three Mile Island facility." Within days, 140,000 people had left the area.

Post-TMI surveys have shown that less than half of the American public were satisfied with the way the accident was handled by Pennsylvania State officials and the NRC, and the people surveyed were even less pleased with the utility (General Public Utilities) and plant designer. Extensive research has been conducted on the effects of nuclear power plant siting on real estate values, local taxes, and the quality of life. Most of it reinforces the perspective that industrial development has a net benefit to communities. Nevertheless, the TMI accident (along with financial risks attributed to regulatory impediments and construction delays) is widely viewed as being a principal reason that no new nuclear power generating units have been built in the past 30 years.

7.14 References

All of the reference sources for the general summaries here in Section 7 were taken from *Wikipedia,* except for one on the London tube bombings, which was taken from *Newsweek.* The URLs for the individual websites are listed. All the websites except the one for the Westroads Mall shooting were accessed on September 7, 2010.

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