

# Hindsight-Choice Bias in Combating Terrorism

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## ABSTRACT

Survey respondents assessed the risks of terrorist attacks and their consequences, and were asked how their assessments changed after 9/11/2001. This paper analyzes those risk assessments, and then uses respondents' patterns of risk assessments to explain their willingness to sacrifice civil liberties to combat terrorism.

More than half of the respondents exhibited hindsight bias; i.e., reported that risk assessments did not rise after 9/11. Estimates should have risen given that a major attack was an event with a low and highly uncertain probability. Equivalent numbers showed hindsight bias surrounding space shuttle risks and the Challenger accident.

There is general willingness to support airplane passenger profiling if the time costs of alternative policies are great, and there is support for surveillance policies to address terrorism risks as well. However, individuals suffering from hindsight bias are much less supportive. Interestingly, people exhibiting hindsight bias with respect to space shuttle accidents are also less supportive of these anti-terrorism policies. We explain these results as the phenomenon we label *hindsight-choice bias*: People assessing past decisions in which they are invested -- such as the protective decisions the government made on behalf of its citizens -- do not favor a change in policy after an unlikely event if they believe their risk estimates have not changed. Despite claiming that risks were not above their pre-9/11 levels, individuals exhibiting hindsight-choice bias do not have significantly lower terrorism risk beliefs than others. Yet, they are less supportive of anti-terrorism policies, which is consistent with continuing to favor policies that were previously desirable.

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## **1. Introduction**

The 9/11/2001 terrorist attack imposed devastating costs on the United States and dramatically changed policymakers' beliefs about the likelihood and magnitude of future terrorist attacks. A series of significant policy measures—such as the creation of the Department of Homeland Security, beefed up airport inspections, and a war that deposed the Taliban in Afghanistan—were taken to combat these risks. The nature of terrorist risks—low probability, high consequence, man-made, hard to estimate—makes decisions on how to respond particularly prone to non-rational biases. Unlike many risks, such as automobile accidents, we do not have a large data source telling us how the risk of a terrorist attack would change with some change in policy. The 9/11/2001 attack marked a shift in the type of risks we recognized.

Many of the difficulties in developing sound anti-terrorism policies can be traced to the nature of the probabilities involved. Sound policies should be based on subjective estimates of initial risks and how those risks respond to various measures. Unfortunately, we have very little information to help us answer questions such as: If we seek to reduce terrorism risks through a variety of screening efforts with different levels of stringency, how will this change the expected number of fatalities? Policymakers implicitly must make such subjective judgments to formulate policies. Their policies will also be influenced by the public's support, which in turn will depend on its perceptions of risks and the effectiveness of measures to control them.

Given these requirements for sound policy, this paper addresses two major questions. First, how well do people do in formulating judgments of the terrorism risk? Second, for whatever judgments they form, what tradeoffs will people make when balancing the risk of terrorism against the cost of measures to combat the risk?

This analysis addresses the risk perceptions and policy preferences of a group of relatively sophisticated citizens, Harvard Law School students and students at Harvard's Kennedy School of Government, as revealed in surveys conducted in 2002 and 2003. We examine their patterns of response and search for biases and irrational judgments. The policy tradeoffs involved in combating terrorism are more subtle than in most policy choice contexts. While most policy tradeoffs balance money and some policy goal, combating terrorism often creates conflicts between the fundamental attributes of safety and civil liberties. Advocates on each side claim that the goal they favor cannot be compromised, yet these claims frequently cannot be satisfied simultaneously.

The underlying central question we asked was: How, if at all, should our long-established civil liberties protections be altered to combat terrorism? We wished to learn what changes in terrorism risks respondents perceived after 9/11. We are confident that very few people anticipated an attack as severe as the 9/11 catastrophe, in part because responsible professionals did not anticipate such an attack<sup>1</sup>.

Remarkably, many of our respondents reported that they believe the risks did not increase from what they thought they were before this attack. Such individuals have fallen prey to hindsight bias—the tendency of people who learn of an event to exaggerate the extent to which they had foreseen its likelihood of happening (Fischhoff, 1975). We focus on how hindsight bias affects risk beliefs and attitudes towards anti-terrorism policies.

There is a second way that individuals can believe their pre-9/11 and post-9/11 beliefs were the same. The 9/11 attack may not have changed their views, despite the occurrence of such an extreme outcome on an event with such a low and hard-to-estimate probability. Such

events provide us with an enormous amount of information. Thus, rationally computed risk beliefs should have shifted significantly.<sup>2</sup> We call the people whose risk beliefs did not change “resistant learners;”<sup>3</sup> effectively, they ignore information. Resistant learners, like those who are hindsight-choice biased, have no reason to change policies from what they were. The distinction between the two groups is that the former maintains their ex ante beliefs as their ex post beliefs, whereas the latter raises their remembered ex ante beliefs to their current ex post beliefs.

We use respondents’ risk beliefs to distinguish between those who exhibit traditional hindsight bias and resistant learners. If their risk estimates are below those of their peers, we will view them as resistant learners. If they are the same as the risk beliefs of people who report that they have updated their risk beliefs, we will view them as subject to hindsight bias.

Our analysis of this problem posits that risks have increased dramatically since 9/11, despite sustained efforts against Al Qaeda and sister organizations. How can we be confident that updated and upgraded probabilities swamp diminished terror capacity? We rely on market information and the estimates implicit in the choice of vigorous and extremely expensive government antiterrorist policies. Terror risks were excluded from many new insurance policies after 9/11. Difficulties in securing such coverage, and dramatic escalation in proposed rates, eventually led to a three-year government reinsurance program.<sup>4</sup> In 2004, the U.S. government is spending many tens of billions of dollars, and implementing some unappealing policies, to

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<sup>1</sup> The dramatic effect this attack had on tightening up (less coverage at higher prices) insurance markets is documented by Brown, Cummins, Lewis, and Wei (2003), Cummins and Lewis (2003), and Doherty, Lamm-Tennant, and Starks (2003).

<sup>2</sup> A hard-to-estimate risk will have a broad prior distribution, implying that an occurrence will significantly raise its probability.

<sup>3</sup> Resistant learning could result from cognitive dissonance, not wishing to change their prior beliefs.

<sup>4</sup> The government pays 90% above the insurance companies’ deductible, which is 10% of a company’s premiums in 2004. Brown, Cummins, Lewis, and Wei (2003) provide an excellent discussion of the legislation pertaining to

fight terrorism—implying that the returns to such measures are far greater post 9/11 than before. In addition, an attack that cost 3,000 lives and perhaps \$100 billion in damage was beyond the expectation of virtually all observers; this highly unlikely outcome greatly increases the expected damages from subsequent successful attacks.

We are particularly interested in how hindsight bias affects the choices individuals would make. Traditional hindsight bias posits that people's risk beliefs would have increased after the World Trade Center attack, but that they fail to recognize this. If hindsight bias-afflicted individuals make different choices than other people with the same current risk beliefs, we say they exhibit hindsight-choice bias.

The paper proceeds as follows: Section 2 begins with a brief discussion of hindsight bias, and employs a model that analyzes how it might reduce support for antiterrorism risk policies, in particular the tradeoff between risk and civil liberties. In particular, individuals who do not recognize that we are living in more dangerous times than we understood on 9/10/2001 will underweight the relative importance of safety. If that does happen, we say that hindsight bias generates hindsight-choice bias.

Section 3 details our assessment of individuals' beliefs about terror risk, and examines the determinants of such beliefs. It pays particular attention to the possible influence of hindsight bias.

Section 4 focuses on the key tradeoff issues in combating terrorism. Our main case study addresses respondents' willingness to support targeted passenger screening at airports, where the tradeoff is between additional waiting time for all passengers and targeting passengers according to some demographic profile of potential terrorists. It focuses on hindsight bias as an

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insurance involving terrorism. Other possible policy responses are explored by Keohane and Zeckhauser (2003) and Kunreuther and Heal (2003).

explanatory variable. Individuals who couple such bias with the belief that pre 9/11 policies were optimal for that time will feel that it is undesirable to compromise civil liberties now to promote safety. This constellation of perceptions and beliefs produces hindsight-choice bias.

The concluding section 5 highlights a major finding: attitudes towards policies to combat terrorism do not depend on current assessments of terror risks. Rather, individuals' policy preferences are strongly influenced by whether they perceive that there has been a shift in the level of the risk. If yes, more aggressive policies are supported; if no, they are not.

## **2. Hindsight Bias, Risk Beliefs, and Policy Preferences**

Several kinds of hindsight bias can be distinguished; for example, people may claim that they were able to foretell a particular event.<sup>5</sup> Our interest is in hindsight bias involving probabilities. For example, after the event people might claim that they knew all along that there was a substantial probability of such an attack, or they might not even increase their assessment of risk, arguing that we do not adjust our probability that a coin will come up heads just because the last flip was a heads. Such logic applies to known risks, but is simply wrong with risks whose probabilities are not known, such as the risk of a terrorist attack, particularly when those risks are initially given a very low value. When such a risk occurs, if other factors do not change, the estimate of risk should rise substantially.<sup>6</sup>

How risk perceptions might influence preferences on civil rights and anti-terror policies can be illustrated with the aid of Figure 1. The original set of tradeoffs between civil liberties and expected terrorism losses is characterized by the curve xx. As the level of civil liberties

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<sup>5</sup> For a review of the effect of hindsight bias in a variety of contexts, see Kelman et al. (1998), Fischhoff (1975), Hastie, Schkade and Payne (1999), Rachlinski (1998), Viscusi (1999), and Sunstein et al. (2002).

increases one would expect higher expected terrorism losses because screening of passengers and other anti-terrorism efforts will be less vigorous in such a world. Individuals have indifference curves with respect to combinations of civil liberties and terrorism losses, which are indicated by  $I_1$ ,  $I_2$ ,  $I_3$ , and  $I_4$  in the diagram. All individuals prefer lower levels of terrorism losses and higher levels of civil liberties, so that preferences take on a higher value moving in the southeasterly direction of the figure. The indifference curves are vertical offsets of each other. This relationship implies, as would seem reasonable though not inevitable, that the tradeoff between lives and liberties does not depend on the number of lives already lost. Given the preferences indicated, the optimal choice before the 9/11 attack is at point A, offering expected losses of a.

After the terrorist attack on 9/11/2001, the tradeoff curve between expected terrorism losses and civil liberties is characterized by  $yy$ . For any given level of civil liberties, the expected terrorism losses have increased because we have raised our assessed risks from a terrorist attack. This curve is twisted upward: for any civil liberties level, the  $yy$  tradeoff curve is steeper than  $xx$ . This tilting reflects our assumption that a reduction in civil liberties, like any expensive safety measure, reduces losses more when risks are high. Similarly, it makes more sense to drive slowly on a rainy night. If we were to keep civil liberties at their optimal pre-9/11 level at point A, we would land at point C. Instead, the new optimal combination of civil liberties and expected terrorism losses is at D. It provides for a lower level of civil liberties than before; nevertheless, there are increased expected terrorism losses, namely to d.

What if individuals do not shift their risk estimates? We mentioned two situations where individuals have or believe they have the same ex ante and ex post beliefs. In one, resistant

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<sup>6</sup> Some commentators might believe that America's aggressive war on terrorism reduces risk more than the information gained on 9/11 raised it. Contrary indicators are that insurance rates are up dramatically, and the government is spending much more to contain/eliminate terrorism.

beliefs, they do not update their beliefs from 9/11, and will set risk estimates well below those of the rest of the population. They would wish to operate at A, as before 9/11.

Traditional hindsight bias, the second situation, is our focus. In it, though a person's risk beliefs may not differ from those of the rest of the population, remembered ex ante beliefs are raised to current beliefs. Let risk beliefs  $R_A$  and  $R_P$  represent ex ante and ex post beliefs, with  $R_A(i)$  being perceptions of ex ante views at time  $i$ , where  $i = A, P$ , and similarly for  $R_P(i)$ . Traditional hindsight bias has  $R_A(P) = R_P(P)$ ; that is, the remembered ex ante probability is adjusted to equal the ex post probability.

Let us posit, as we find with our respondents, that these individuals' risk beliefs are like those of the broader population, implying that traditional hindsight bias is at play. Thus, though expected terrorism losses are higher than before, respondents claim inaccurately that they knew the risk was so high all along. Given traditional hindsight bias, we distinguish two possibilities, which depend on individuals' relation to pre-event decisions. If individuals were external to those decisions, if they never approved of them or were in no way invested in them, they will be termed "external." In making normative judgments, they will be judging others. This is what Kelman et al. (1998) refer to as third-party hindsight bias in the risk perception context. When such external judgments pertain to decisions, we label it hindsight-judgment bias. Hindsight judgment bias applies when judging the past decisions of others.

Hindsight-judgment bias plays a prominent role in many Monday-morning quarterbacking situations, such as jury decisions in negligence cases.<sup>7</sup> After catastrophic accidents have occurred, jurors often indicate that they believe that the risk levels were apparent

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<sup>7</sup> The potentially powerful role of hindsight bias with respect to assessments of liability and punitive damages is documented by Rachlinski (1998), Hastie, Schkade, and Payne (1999), Viscusi (1999), and Sunstein et al. (2002).

to the defendant before the accident. Moreover, given the preventive actions then available to the defendant, he should have taken appropriate efforts to reduce these risks.

When individuals are judging their own past decisions, or past decisions of which they approved, we say they are internal, or invested. Our respondents comprised a well-informed audience on government-citizen relations. Virtually all of them were familiar with the broad sweep of American civil liberties policies prior to 9/11, and we suspect that virtually all of them approved of the protections then in place. Thus, we think of our respondents' decisions as being internal.

When decisions are internal, people with hindsight bias presumably judge past policies as optimal. Thus, they will tend to favor the same policies that were in effect in the past. We employ the term "hindsight-choice bias" to refer to the tendency of hindsight-biased individuals, who are invested in past decisions, to make the same choices now despite a severe adverse event.<sup>8</sup>

To review, hindsight-judgment bias is backward looking and external. By contrast, hindsight-choice bias is forward looking and internal; it addresses the decisions individuals would like to make themselves, or have made on their behalf. Let us illustrate hindsight-choice bias for the terrorism case. Respondents believe that the expected terrorism losses are at a risk level higher than a, indeed at d. However, in this instance they believe that we were at point B before the attack and that the anti-terrorism efforts had already been optimized. Thus, the 9/11 attack does not warrant a policy shift in antiterrorism actions. In their view, the opportunities locus did not shift from xx to yy but simply remained at zz. Given that society is assumed to

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<sup>8</sup> There is the possibility that respondents' policy preferences influenced their stated risk beliefs. If they do not wish to allow new curbs on civil liberties, they convince themselves or state that current risk levels are no higher than those before the salient event. They adjust remembered ex ante levels upward to achieve this equality. However, the survey questions were not framed in a manner that would foster such an effect.

have behaved optimally before the attack, and there is no change in the risk after the attack, then there is no reason to move from point B.<sup>9</sup> We find that individuals with hindsight-choice bias come to conclusions as if they believed the opportunities locus was always  $zz$ .

Hindsight-choice bias leads people to believe that there is no need to undertake more vigorous anti-terrorism policies than before the attack. By analyzing the relationship of risk beliefs, evidence of hindsight bias, involvement in past policies, and attitudes toward future anti-terrorism policies, it will be possible to determine how hindsight bias, hindsight judgment bias, and hindsight-choice bias influence policy choice. To the best of our knowledge, there is no discussion of hindsight-choice bias in the existing literature. The common element between judgment and choice biases is that pre- and post-event estimates are the same. This is also true for resistant learners. However, these three phenomena make disparate predictions in other areas, as Table 1 shows. Our analysis below seeks to which of these explanations applies for respondents who did not raise their risk estimates.

Our base case involves individuals who did learn, who set higher ex post than ex ante probabilities, and recognized that fact. We would expect such individuals to disproportionately favor tightening civil liberties from their pre-9/11 levels to protect safety. Before proceeding, we should note that—though it is not often done—it is useful to distinguish between the probability of an attack and the size of an attack, should it come.

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<sup>9</sup>There is an important distinction here with hindsight bias surrounding, say, a jury deliberation on negligence. In that case, the juror never made a judgment about the level of precautions taken. Hence, if he now believes the risk was higher than other felt before, he can blame the responsible party for laxity. Interestingly, jurors in experimental contexts have quite different attitudes to risk taking decisions they are asked to make ex ante and failed risky decisions others have made. See footnote 6 *supra*. In the terrorism case, we assume that respondents approved, as did virtually all Americans, of the levels of civil liberties pre 9/11. Loss aversion could also be at play. Given loss

### 3. The Determinants of Risk Beliefs

The discussion below draws on two different sets of surveys from students at Harvard Law School and Harvard's Kennedy School of Government. The first survey was run at Harvard Law School in April 2002 and had a sample size of 95. The second survey was taken by 56 Harvard Law School students and 61 Kennedy School students in November 2003, for a total sample of 117. Respondents considered a written survey instrument and were assured of the confidentiality of their responses.

#### A. Hindsight Bias Measures

Though actual risk beliefs are of interest, and are reported, our principal concern is hindsight bias. We developed two different measures for it. The first pertains to beliefs about terrorism risks, both before and after the 9/11 attack. In the 2003 survey, we also included hindsight bias questions about the risks of the space shuttle, providing a measure of hindsight bias from an arena quite different from terrorism. Presumably, individuals showing hindsight bias there should also exhibit distinctive risk beliefs about terrorism.<sup>10</sup>

The hindsight bias question with respect to terrorism was the following:

Take yourself back to the World Trade Center disaster. Do you believe that the risk of a terrorist attack over the next year on an airplane is higher or lower than you thought it was before the September 11<sup>th</sup> disaster?

Higher \_\_\_\_\_ The Same \_\_\_\_\_ Lower \_\_\_\_\_

The results reported in Table 2 are startling. A substantial fraction of respondents—just over 50% in the pooled sample—believed that the risk was lower or the same than what they

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aversion in a multi-attribute situation, it is far more costly to sacrifice on one dimension than it is beneficial to gain on another. Hence, there is a tendency to stick with the perceived status quo policy choice.

<sup>10</sup> The space shuttle hindsight bias question, based on that in Viscusi (1999), was updated to take into account the Columbia accident.

remember they thought it was before the attack.<sup>11</sup> In regressions reported below, the variable WTC hindsight bias will take on a value of 1 if the respondent believed the risks were the same or lower than they were before the attack, and a value of 0 otherwise.

We included a hindsight bias question about the space shuttle attempted to detect this bias more broadly, to avoid the possibility that individuals were blinded by the emotionally-charged terrorism issue. The question began with a description of the original Challenger disaster in 1996 and explained that before the disaster NASA engineers estimated the risk of a fatal accident at launch at 1/100,000, while Air Force engineers at Cape Kennedy estimated the fatal accident rate to be 1/35. This disparity certainly suggests substantial uncertainty about the probability, so that there should be significant updating after an accident. After receiving information about the pre-Challenger crash risk estimates, respondents considered the following two questions about the more recent risks made salient by the Columbia accident.

The 1986 *Challenger* accident was attributed to the failure of the O-ring seals in the solid-propellant engines. That problem was definitely fixed. Indicate what you believe to have been the best estimate of the fatal accident risk per space shuttle launch after the *Challenger* accident and design fix, but before the shuttle *Columbia* accident that killed all 7 crew members on February 1, 2003.

- Under 1/200,000
- 1/200,000 to 1/50,000
- 1/50,000 to 1/1,000
- 1/1,000 to 1/100
- 1/100 to 1/35
- 1/35 to 1/10
- Over 1/10

Finally, consider the situation today after both the *Challenger* and *Columbia* space shuttle accidents. Suppose that no new precautions were taken, e.g., we use the same spacecraft and procedures we would have if *Columbia* had landed safely. Indicate what you believe would be the best estimate of the fatal accident risk for the next launch.

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<sup>11</sup> It is somewhat surprising that the 2003 survey had fewer think the risk was lower than the 2002 survey. There was no terrorist attack in the United States between the two survey times, which should have lowered risk estimates.

- Under 1/200,000
- 1/200,000 to 1/50,000
- 1/50,000 to 1/1,000
- 1/1,000 to 1/100
- 1/100 to 1/35
- 1/35 to 1/10
- Over 1/10

Respondents who did not increase risk estimates from before the Columbia accident to after it, as best they could remember, show hindsight bias. Overall, 6 percent of the sample believed that the risk would be lower after the Columbia space shuttle accident than before, even assuming no new precautions. A substantial 55 percent of the sample believed that the risks would be the same both before and after the accidents, and 39 percent believed that the risk would be higher after the accident. Given the significant uncertainties about the safety of space flights, most experts agree, the Columbia accident should have substantially increased perceived risk. In our regressions, the space shuttle hindsight bias variable takes a value of 1 if respondents believe that the risk was either the same or lower after the Columbia accident than it was before, assuming no new precautions. To the extent that the influence of hindsight bias reflects a general approach to risk information, it may predict decisions on terror policies, though one would expect the space shuttle hindsight variable to have a less strong effect on attitudes toward terrorism risk prevention than did the events of 9/11.

The extent to which the space shuttle hindsight bias predicts hindsight bias with respect to terrorism risks will depend to what extent hindsight bias is context specific as opposed to a fixed effect that varies across individuals. For these survey responses, those exhibiting WTC hindsight bias were somewhat more likely to exhibit hindsight bias on space shuttle risk. Overall, 65 percent of those exhibiting WTC hindsight bias also exhibited space shuttle hindsight bias, as compared to 57 percent of those who did not exhibit WTC hindsight bias.

Even if there is not perfect correlation of the two measures, the space shuttle hindsight variable serves an additional role as well. If hindsight bias varies across individuals and is not strictly context-specific, then the space shuttle variable serves as an alternative indicator of hindsight bias. Suppose that some respondents misinterpreted the WTC hindsight bias question as perhaps inquiring whether the actual risks had decreased since before 9/11 rather than their own beliefs decreasing since before 9/11. Then the space shuttle hindsight bias variable will provide corroboration of whether people who exhibit hindsight bias have a different attitude toward antiterrorism policies.

### B. Determinants of Terrorism Risk Assessments

The respondents also considered a series of questions asking them to assess the likelihoods of various death tolls from terrorism attacks. Their answers were taken to be a measure of individuals' probabilistic risk beliefs. Below, we analyze how hindsight bias regarding the World Trade Center attack influences risk beliefs, and whether both hindsight bias and risk beliefs affect attitudes toward protective measures against terrorism. The questions on risk beliefs are:

Based on some estimates, the September 11, 2001 disaster led to 266 deaths in the planes and 2,717 deaths at the World Trade Center. The total number of deaths was about 3,000. Below is a series of questions about the number of deaths on the ground and to passengers in the U.S. in the next 12 months because of attacks by foreign terrorists on airplanes.

- a. Think of the best outcome in which the number of terrorism deaths could be low. Suppose there is only one chance in 20 that the number of terrorism deaths could be at this low level or below. What is your estimate of this low-end death toll in the U.S.?  
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- b. Now think of the worst outcome. Suppose there is only one chance in 20 that the number of terrorism deaths could be this

high. What is your estimate of this high-end death toll in the U.S.?

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c. Your best estimate of the actual death toll will be somewhere between your estimate of the low-end death toll and your estimate of the worst death toll. What is your best estimate of the expected number of terrorism deaths over the next 12 months in the U.S.?

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d. If we were to average the best estimate of your classmates of the terrorism death toll in the U.S., i.e., their answers to part c, what number do you think we will get?

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e. If a plane with 300 passengers were shot down by terrorists at the London Heathrow Airport, what would your best estimate be of the number of deaths on the ground and to passengers in the U.S. in the following 12 months because of attacks by non-U.S. citizens on airplanes? Do not count any passengers killed in this attack.

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A second version of the survey, given to different respondents, was identical except that instead of the risks arising solely because of attacks by non-U.S. citizens on airplanes, it also included “violent terrorist attacks by non-U.S. citizens more generally, e.g., crashed airplanes, bombs, and bullets.” The purpose of this expanded set of outcomes was to test for possible embedding effects. Embedding occurs when two or more risks are combined in a class, and the total estimated risk for the class falls far below the sum of the individual risks.<sup>12</sup>

Table 3 reports the responses to these questions for respondents considering airplane risks alone or multiple risks from terrorism.<sup>13</sup> The responses in panel A and panel B for airplane risks and multiple risks are very similar, though the median upper bound estimate, best estimate, and others’ estimate are higher for the multiple risk case, as the subsequent regression results will indicate. Overall, however, there is no significant difference that would indicate that people

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<sup>12</sup> As long as the risks are small, the possibility that two or more may occur in the same period does not reduce the total probability much. Kahneman and Knetsch (1992) discuss the embedding phenomenon.

regard the hazards of multiple risks as being noticeably greater than the risks posed by airplane risks alone. This failure to distinguish between one risk and a class of risks in which it is included is a classic embedding effect. Given its appearance here, we pool groups A and B, and consider the pooled estimates in panel C.

The first set of results pertains to the lower-bound estimate, or what the respondents believe is the 5<sup>th</sup> percentile of the terrorism fatality risk distribution. The mean of this value is 56. The second row of values pertains to the 95<sup>th</sup> percentile of that distribution, which is the high end of the risk estimate.<sup>14</sup> For this sample, this mean value is 41,183.

The third estimate presented is the respondent's best estimate of the risk. While the survey did not indicate whether the "best estimate" should be the mean value or the median, the previous survey questions were in terms of percentiles of the distribution, which would be consistent with the median. The fact that the best estimate responses were much closer to the low end rather than some average of high and low estimates, also suggests respondents were thinking more in terms of the median,<sup>15</sup> which we will assume to be the case for the following discussion. The mean of these median terrorism death tolls was 312. Even on a logarithmic basis, this value is closer to the lower-bound estimate than to the upper-bound worst case. Individuals' loss estimate distributions appear to have a long right tail. Respondents' best estimate of their classmates' estimates of terrorism risk are higher than their own estimates of the risk; respondents believe others will assess the risk as being greater than they do.

Finally, the survey included questions about how respondents' best estimate of the risk would change were an airplane to be shot down by terrorists, killing 300. The scenario reported

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<sup>13</sup> Similar results for 2002 for several of these variables appear in Viscusi and Zeckhauser (2003).

<sup>14</sup> The potential for alarmist responses to such a risk information situation, which is one of substantial risk ambiguity, is discussed in Viscusi (1997, 1998).

on in panel A was a terrorist attack at London Heathrow Airport, and the scenario in panel B an attack on Los Angeles Airport. Our hypothesis was that an attack in the U.S would have greater impact; however, the risk estimates after attacks at the two airports are quite similar. More surprising, the numbers hardly rise above the individuals' previous best estimates of terrorism risk. This hypothetical attack barely budes risk estimates. Such inertia could reflect resistant learning, or perhaps people do not change risk perceptions much in response to hypothetical events.

To analyze the determinants of best estimates of terrorism risks, we prepared Tobit estimates regressing those estimates on other aspects of risk beliefs, as shown in Table 4. These Tobit estimates jointly estimate the influence of whether the respondent assesses a nonzero level of terrorism deaths coupled with an estimate of the scale of these deaths. The first set of results is based on the 2003 survey; the second set uses pooled 2002 and 2003 samples. For each set we estimate both a linear equation where the dependent variable within the Tobit framework is the subject's best estimate of the terrorism risk, and an equation where the dependent variable is the log of the subject's best estimate.

The lower- and upper-bound estimates of the terrorism risk comprise the first pair of explanatory variables. The lower-bound variable is always a significant predictor of the best estimate of the terrorism death toll. The upper-bound estimate is only significant after taking the log transformation of it and the terrorism death toll, thus muting the influence of the high-end outliers. These results are consistent with the sample statistics in Table 3 indicating a much closer relationship of the best estimate with the lower-bound estimate than to the upper-bound estimate.

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<sup>15</sup> Indeed, since the "upper-bound" estimate is only the 95<sup>th</sup> percentile, and the estimates were substantially skewed to the right, the mean estimate should be well above the average of the 5<sup>th</sup> and 95<sup>th</sup> percentiles.

The third variable in the equation addressed the potential embeddedness effect. It is a dummy variable for the version of the survey in which respondents were asked to assess the terrorism risk deaths from multiple sources of risk, not just risks to passengers on airplanes. The multiple risk coefficients fail the usual tests of statistical significance in every instance. Quite simply, respondents do not take into account the additional risk when multiple risks are considered rather than a single source of risk. This result reinforces traditional findings about embeddedness.

The WTC hindsight variable takes the value 1 when the ex ante risk estimate at least equals the ex post estimate. This variable is never statistically significant. Respondents who indicate that they believe the risk is lower or the same as they thought it was before the 9/11 attack do not have lower values for their best estimate of the terrorism risk.<sup>16</sup> This is strong evidence against the resistant learner hypothesis—that these people have simply failed to raise their risk estimates. Rather, they have the same risk beliefs as those who raised their estimates but claim that they knew the level of these risks before the World Trade Center attack. The respondents' claim that the risks have not risen coupled with no significant discrepancy between their risk beliefs and those of the rest of the population implies that these individuals are not resistant learners (they would not place the risk at a in Figure 1). Rather they have risk beliefs that give expected terrorism losses of  $d$ , which is where respondents not exhibiting hindsight bias place the risk as well.

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<sup>16</sup> This result also suggests that these people exhibiting WTC hindsight did not misinterpret the question of whether they thought the actual risks were the same or lower rather than their perceived risks before 9/11. If that had been the case, one would have expected this group to have lower values of the best estimate of the risk.

The final variable included in Table 4 is a dummy variable for the survey conducted in 2003. There is no significant change from spring 2002 to fall 2003.<sup>17</sup>

#### **4. Support for Anti-Terrorism Risk Policies**

##### A. Use of Profiling for Passenger Screening

The principal anti-terrorism policy that we analyze is the profiling of airline passengers based on demographic characteristics to identify potential terrorist threats on airplanes. In particular, we explore the extent to which people are willing to trade off additional time waiting in line for the infringement on civil liberties that such profiling might represent. The basic survey question mentioned three different periods of waiting time -- 10 minutes, 30 minutes, and 60 minutes. In each instance, the respondent could avoid this additional wait in line if a policy were adopted to screen passengers based on demographic profiling.

In one version of the survey the respondent is told: “*You would not* be singled out for such a search based on terrorist risk profiling.” In the second version of the survey, the respondent is told: “*You would be* singled out for such searches based on terrorist risk profiling.” The exact wording of the full question for the version in which the subject would not be singled out for searches is the following:

One way of reducing terrorism risks to plane flights is better screening of passengers. The FBI has developed a profile of the chances that a passenger is a terrorist, taking into account the person’s age, race, gender, national origin, appearance, and baggage. Airlines either could screen all passengers, leading to additional delays in line, or they could screen passengers based on the terrorist risk profiling. Targeted screening would reduce the terrorist risk by as much as random searches, but would involve time delays for passengers. People who are singled out based on the terrorist risk profiles will have to undergo an extra 10 minutes of searches. *You would not* be singled out for such racial profiling.

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<sup>17</sup> Since there were no terrorist attacks in the U.S. between the survey dates—a pleasant surprise—we might have expected a decrease in risk. The change was in the right direction, but far from significant.

- a. Would you favor terrorist risk profiling if the alternative was for you to wait in line an extra 10 minutes so that all passengers could be screened randomly?

Yes \_\_\_ No \_\_\_

- b. Would you favor terrorist risk profiling if the alternative was for you to wait in line an extra 30 minutes so that all passengers could be screened randomly?

Yes \_\_\_ No \_\_\_

- c. Would you favor terrorist risk profiling if the alternative was for you to wait in line an extra 60 minutes so that all passengers could be screened randomly?

Yes \_\_\_ No \_\_\_

Note that respondents are being asked to trade off time waiting in line versus profiling, not safety versus profiling. If freedom from profiling is regarded as a civil liberty, and if civil liberties are regarded as a fundamental value, not to be compromised unless some equivalently fundamental value is at stake, individuals should prefer even the 60-minute wait to airport profiling.<sup>18</sup> The profiling here reduces inconvenience and does not increase safety itself, as the alternative is to screen everyone. However, the fact that the profiling takes place in a safety-controlled context may have made it more acceptable. It is noteworthy that even though the context of the tradeoff involved safety, what subjects were trading off was time against civil liberties rather than safety against civil liberties. We might have expected people to be more reluctant to trade off a savings in their time against a loss in civil liberties than they would be if they were trading off a reduction of risk against civil liberties. However, the fact that the profiling

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<sup>18</sup> A more extreme version of this example would highlight the drawbacks to strict lexicographic preferences. We expect that even staunch civil libertarians might accept profiling rather than a 20-hour wait in line that yielded equivalent safety.

took place in a safety context, though the tradeoff itself didn't make people safer, made it more acceptable.

Table 5 summarizes the willingness of respondents to support terrorist screening policies based on the length of time waiting in line and on whether the respondent would be affected by this screening policy. In every instance in this table, the support for targeting increases as the time waiting in line rises. In the pooled survey results, for example, if the incremental cost of avoiding targeting was a ten minute wait, 38 percent of the passengers would support targeting if the screening only affected others, while 45 percent would support screening if it affected the respondents themselves. Somewhat surprisingly, respondents are not generally more willing to support screening that targets other people rather than themselves. Their concern for civil liberties is broader than mere self-interest. Indeed, some respondents may feel more comfortable with profiling—which brings efficiency advantages—if they would be a target, since that defuses the unjust imposition issue.

Once the additional time in line to avoid the targeting policy rises to 30 minutes, roughly three-fifths of the respondents would favor such targeting. By the time the additional wait in line reaches an hour, about three-fourths of all respondents support screening. Indeed, nearly two-fifths of the respondents change from opposing to favoring profiling as the wait increases. The civil liberties issue proves important, but is not a trumping consideration.<sup>19</sup>

The sample used for this survey is not a random sample of the U.S population. If anything, given their fields of study our respondents are likely to be less supportive of the practice of profiling than the general population. Law School students and Kennedy School students, whose fields are government and public policy, are likely to be particularly sensitive to

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<sup>19</sup> The authors recognize that by giving respondents three different times, they were to some extent framing a situation where different answers were reasonable; neither civil liberties nor safety would be trumping concerns.

civil liberties issues and the importance of preserving civil liberties from unnecessary infringement.

Table 6 presents the probit estimates of the probability that the respondent favored targeting passengers for screening based on profiling. The first set of estimates in Table 6 pools the various waiting time observations and includes a variable for the length of waiting time. The length of the wait is statistically significant; the coefficient implies that for every additional ten minutes of waiting in line a respondent is 7 percent more likely to favor the profiling of passengers for screening purposes.

Our main variable of interest is whether the respondent exhibited hindsight bias. Respondents who exhibit World Trade Center hindsight bias are 11 percent less likely to favor targeting of passengers in the pooled estimates. That is, individuals who do not recognize an increase in terrorist risk since 9/11 are less likely to favor profiling. This is precisely the pattern predicted by hindsight-choice bias.

Interestingly, the best risk estimate for the respondent never has a statistically significant effect on support for passenger screening. It is not the level of risk estimates that drives support for anti-terrorism policies but rather the perception that since 9/11 we are on a steeper portion of the risk-civil liberties tradeoff frontier. Once again this result is consistent with the hindsight-choice bias framework, as outlined in Section 2. People who do not believe that there has been an upward shift in the risk level are less supportive of passenger screening regardless of the value of their best risk estimate.

In the pooled and sixty-minute regressions female respondents are less supportive of passenger screening to about the same extent as are people who exhibited World Trade Center

hindsight bias. Similarly, non-whites and U.S citizens are less supportive of profiling in the pooled estimates.

The variables that are never statistically significant are the year 2003 dummy variable as well as the variable indicating whether the respondent will or will not be targeted for screening. As in Table 5, there is no evidence that self-interest influences individuals' tradeoff between civil liberties and time-in-line.

Table 7 repeats each of these regressions except that the space shuttle hindsight bias variable replaces the World Trade Center hindsight bias variable. As before, the best estimate of the risk is not statistically significant, and the other variables perform in much the same manner as in Table 6, so are not reported. Respondents who exhibit hindsight bias with respect to the space shuttle, like their WTC-hindsight-biased peers, are less supportive of passenger targeting. There is a significant negative effect of space shuttle hindsight bias in both the pooled estimate and the ten-minute scenario. The coefficients are negative but not statistically significant at the usual levels for the space shuttle hindsight bias variable in the 30-minute and 60-minute regressions.

The broad hypothesis that emerges from these results is that an individual displaying hindsight bias after a catastrophic event is less likely to favor an expensive policy shift that makes a future catastrophe less likely. This result holds true whether the hindsight bias is determined using space shuttle disasters or terrorist risks.

## B. Attitudes Toward Surveillance Measures

Although the main focus of the survey was on targeting of passengers for airplane screening, the survey also asked about the respondents' support for various kinds of surveillance

measures. In particular, each respondent in both the 2002 and 2003 surveys considered the following question:

Would you support policies that made it easier for legal authorities to read mail, e-mail, or tap phones without a person's knowledge so long as it was intended to prevent terrorism?

Yes \_\_\_\_\_ No \_\_\_\_\_

Table 8 reports the responses to these questions for the 2002 survey, the 2003 survey, and the pooled results. For every way in which the sample was analyzed, there is a somewhat greater support for these forms of surveillance in 2002 than in 2003.<sup>20</sup> As the 9/11 attack receded into memory, and given that there were no new attacks in the United States, support for anti-terrorism surveillance diminished.<sup>21</sup>

The pooled results from both surveys for the full sample indicate that just under one-third of all respondents support surveillance of mail, e-mail, and telephones. Of those who supported passenger profiling to avoid a 60-minute wait, 37% support surveillance, while among respondents who opposed such profiling, only 13 percent support surveillance measures. As expected, the concern with respect to preserving civil liberties is reflected across both surveillance and profiling.

The hindsight bias of the respondent comes into play as well.<sup>22</sup> For each of the surveys, respondents who did not exhibit WTC-hindsight bias have a 10% greater likelihood of favoring surveillance compared to those who did exhibit bias. These results are consistent with our findings pertaining to passenger profiling. Those who exhibit hindsight bias have a consistent

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<sup>20</sup> Conceivably this difference could arise because of a difference in attitudes between Law and KSG students, since the latter were only included in 2003. In fact, a KSG dummy variable proved insignificant.

<sup>21</sup> Views may have also changed about government policies, such as the Patriot Act, which came into being in the interim.

pattern of attitudes toward anti-terrorism efforts, be they passenger profiling or other forms of intervention that many perceive as infringements on civil liberties.

While there is a positive correlation between support for surveillance policies and passenger profiling, respondents were more reluctant to support surveillance efforts than profiling. Of the sample, 28 percent support both surveillance and passenger screening (based on the 60-minute wait scenario), and 21 percent of the sample oppose both. However, for those respondents whose attitudes differ for the two forms of civil liberties infringement, the much greater support is for passenger profiling. A substantial 47 percent of respondents favor profiling and oppose surveillance, while only 3 percent support surveillance but oppose profiling.

## **5. Conclusion**

The 9/11 attack dramatically transformed the scale of terrorism risks facing U.S. citizens. As a result, the policy frontier with respect to terrorism risk and civil liberties moved substantially. Assuming preferences between safety and civil liberties of the usual shape, and that the productivity of anti-terror measures increases with the level of risk, optimal anti-terrorism measures post-9/11 will be more strict than those before. Hence, civil liberties will be reduced, but terror risks are likely to be higher as well.

Among people with common preferences, assuming rational choice, levels of support for anti-terrorism efforts should be positively related to perceived risks. However, our results indicate that the perceived risk level is not a predominant factor affecting support. Indeed, it is never significant in our empirical analyses.

Quite remarkably given the magnitude and surprise of the WTC attack, 70 percent of respondents exhibited traditional hindsight bias: they stated that the risks were no greater post-

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<sup>22</sup> While these differences are substantial, they fall short of being statistically significant based on a t-test at the 5 percent level, two-tailed test.

than pre-attack. The risk estimates of those exhibiting hindsight bias were no lower than the estimates of those who did not exhibit such bias; the bias was not due to a failure to perceive the risks after 9/11 as others do. Rather, it was a failure to recognize that they had updated their risk beliefs just as had other people.

A striking consequence of this severe hindsight bias is that many respondents exhibit what we call hindsight-choice bias. That is, they do not change the nature of their optimal policy regarding safety-civil liberties tradeoffs. We posit that these individuals were internal to or invested in past choices; they approved of the civil liberties level relative to terrorism in effect pre-9/11. Given that they do not perceive risk levels to have changed, there is no need to increase the vigilance of our anti-terrorist efforts. Such respondents were less supportive than their peers of both targeting of passengers based on profiling to save waiting time and of surveillance measures to reduce risk. Thus, we find that hindsight bias contaminates individuals' backward estimates of how they estimated risk, but also affects recommended future actions after an unlikely event takes place. Those who assumed that risk levels have not changed, assuming they believed old policies to have been appropriate, have no reason to favor a change, and show themselves less likely to curtail civil liberties to promote safety.

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Figure 1

Terror Risk Versus Civil Liberties

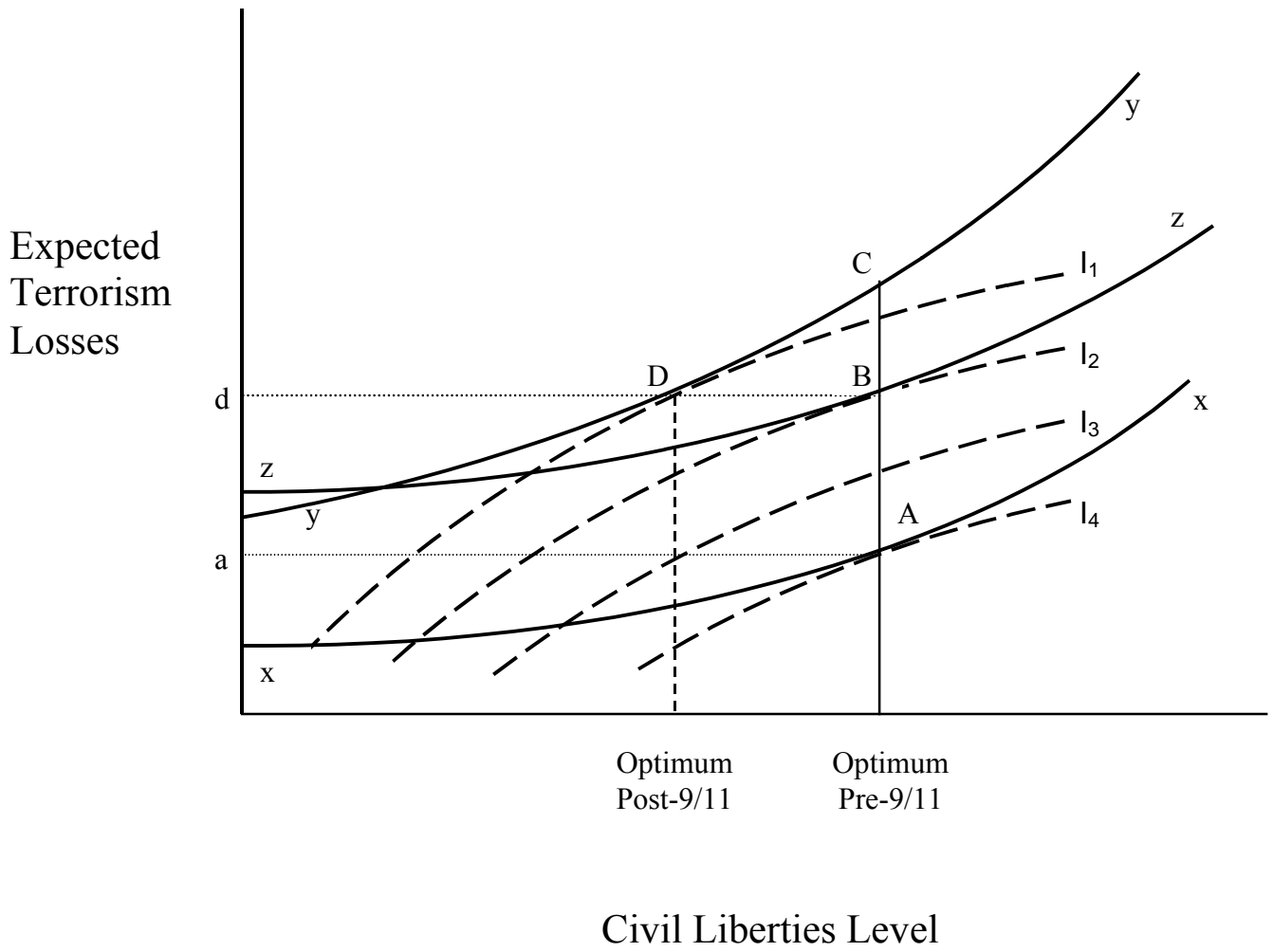


Table 1

Risk Perceptions and Policy Views After Unlikely Adverse Outcomes  
For Individuals Whose Terrorism Risk Estimates Did Not Rise After 9/11

<b>Phenomenon</b>	<b>Risk Beliefs Relative to Population</b>	<b>Judgment of Past Policy Choice</b>	<b>Proposed Future Policy Choice</b>
Resistant Learners	Significantly lower	Appropriate	Same as past
Hindsight Bias, External to Policies	Same as population	Too lax	Safer than past
Hindsight-Choice Bias, Internal to (Invested in) Policies	Same as population	Appropriate	Same as past

Table 2

Change in Terrorist Risk Estimates

	<b>2002 Sample</b>	<b>2003 Sample</b>	<b>Pooled Sample</b>
Higher, Post 9/11	43%	54%	49%
Same, Post 9/11	17%	24%	21%
Lower, Post 9/11	40%	22%	30%

Table 3

## Terrorism Risk Estimates of Fatalities in Next 12 Months

	<b>Median</b>	<b>Mean</b>	<b>Std Error of Mean</b>
<b><u>Panel A: Airplane Risk</u></b>			
Lower Bound (5 <sup>th</sup> %-ile)	0	76.15	36.54
Upper Bound <sup>a</sup> (95 <sup>th</sup> %-ile)	2000	23,291.79	17,540.01
Best Estimate (50 <sup>th</sup> %-ile)	50	307.02	102.98
Estimates of Classmates	100	658.67	175.36
Post London Attack Estimate	100	408.55	113.25
<b><u>Panel B: Multiple Risks</u></b>			
Lower Bound (5 <sup>th</sup> %-ile)	1	34.39	15.60
Upper Bound <sup>a</sup> (95 <sup>th</sup> %-ile)	4000	59,724.18	26,869.58
Best Estimates (50 <sup>th</sup> %-ile)	87.50	316.91	90.01
Estimates of Classmates	200	2,267.14	1,779.04
Post L.A Attack Estimate	100	297.23	80.33
<b><u>Panel C: Pooled Survey Estimate</u></b>			
Lower Bound (5 <sup>th</sup> %-ile)	0	55.99	20.35
Upper Bound <sup>a</sup> (95 <sup>th</sup> %-ile)	2500	41,182.70	15,951.79
Best Estimates (50 <sup>th</sup> %-ile)	50	311.75	68.55
Estimates of Classmates	150	1,428.54	855.63
Post Attack Estimate	100	354.81	70.14

<sup>a</sup> Four observations with estimates of over 1,000,000 were excluded from these statistics.

Table 4  
Tobit Estimates of Best Estimate of Terrorism Risk<sup>a</sup>

	<b>Coefficient (Standard Error)</b>			
	<u><b>2003 Survey</b></u>		<u><b>2002 &amp; 2003 Surveys Combined</b></u>	
	Linear Equation	Log Equation <sup>b</sup>	Linear Equation	Log Equation <sup>b</sup>
Lower Bound	1.7506** (0.3016)	0.5825** (0.0854)	1.9844** (0.3688)	0.5549** (0.0628)
Upper Bound	0.00007 (0.0004)	0.2952** (0.0798)	0.0003 (0.0005)	0.2928** (0.0559)
Multiple Risks	111.3364 (135.8932)	0.0484 (0.3428)	150.2777 (128.6513)	-0.0958 (0.2394)
WTC Hindsight Bias	-170.2149 (136.1201)	-0.4127 (0.3493)	-4.4311 (129.3733)	-0.1126 (0.2435)
Year 2003	-	-	-76.3855 (129.7398)	-0.2085 (0.2419)

<sup>a</sup> Each equation also contains a constant term.

<sup>b</sup> Natural logarithm is taken of best estimate, lower bound, and upper bound, where all are plus 1.

(\*) Indicates coefficients that are statistically significant at the 5% (10%) level, two-tailed test.

Table 5  
Attitudes Toward Use of Terrorism Risk Profiles

Percentage Favoring Risk Profiling

Delay in Line Due to Screening Time	Screening only Affects Others	Screening Affects Respondents
<b><u>Panel A 2002 Survey</u></b>		
10 minutes	40.91	41.46
30 minutes	59.09	58.54
60 minutes	77.27	65.85
<b><u>Panel B 2003 Survey</u></b>		
10 minutes	35.19	48.89
30 minutes	59.26	68.89
60 minutes	75.93	80.00
<b><u>Panel C Pooled Results</u></b>		
10 minutes	37.76	45.35
30 minutes	59.18	63.95
60 minutes	76.53	73.26

Table 6  
 Probit Estimates of the Probability of Favoring  
 Targeting Passengers for Screening<sup>a</sup>

	Coefficient (Std. Error)			
	Pooled Estimates	Waiting Time		
		10 minutes	30 Minutes	60 Minutes
Waiting time	0.0073** (0.0011)	-	-	-
Respondents targeted for screening	0.0714 (0.0447)	0.1153 (0.0754)	0.0898 (0.0749)	0.0010 (0.0661)
WTC hindsight bias	-0.1074** (0.0455)	-0.0686 (0.0777)	-0.1132 (0.0762)	-0.1209* (0.0664)
Best Risk Estimate	0.00005 (0.00003)	0.00008 (0.00006)	0.00005 (0.00005)	0.00001 (0.00004)
Year 2003	0.0074 (0.0564)	-0.0398 (0.0957)	0.0531 (0.0953)	0.0030 (0.0828)
Female	-0.1227** (0.0475)	-0.1145 (0.0783)	-0.1078 (0.0799)	-0.1248* (0.0720)
Nonwhite	-0.1078 (0.0541)**	-0.0862 (0.0882)	-0.1242 (0.0913)	-0.0879 (0.0826)
U.S citizen	-0.1111* (0.0643)	-0.0996 (0.1162)	-0.1032 (0.1084)	-0.1120 (0.0853)

<sup>a</sup> All regressions also include a variable for whether the respondent is a Kennedy School student, which is not statistically significant, as well as a constant term. Coefficients are transformed to reflect marginal probabilities. N=542 for the pooled estimates.

\*\* (\*) Indicates coefficients that are statistically significant at the 5% (10%) level, two-tailed test.

Table 7  
Risk Coefficients of the Probability of Favoring  
Targeting Passengers for Screening<sup>a</sup>

	Waiting Time			
	Pooled Estimates	10 Minute	30 Minute	60 Minutes
Space Shuttle Hindsight Bias	-0.1559** (0.0626)	-0.1883* (0.1114)	-0.1716 (0.1039)	-0.0829 (0.0877)
Best Risk Estimate	0.00006 (0.00005)	0.00012 (0.00008)	0.00008 (0.00008)	-0.00002 (0.00007)

<sup>a</sup> Other variables in the equation are the same as in Table 6, except for the year 2003 indicator variable. N=297 for the pooled estimates.

\*\* (\*) Indicates coefficients that are statistically significant at the 5% (10%) level, two-tailed-test.

Table 8  
Attitude Toward Surveillance of Mail, E-mail and Phones

	Percentage of Respondents Supporting Policy		
	2002 Survey	2003 Survey	Pooled Results
Full Sample	35.7	27.6	31.3
Respondents Answering Yes to Profiling <sup>a</sup>	43.3	32.5	37.2
Respondents Answering No to Profiling <sup>a</sup>	16.7	9.5	13.3
WTC Hindsight Bias	31.3	21.3	26.3
No WTC Hindsight Bias	41.7	33.3	36.8

<sup>a</sup> Respondents who answered yes to profiling to avoid a 60-minute wait.