Preferences, Knowledge, and Citizen Probability Assessments of the Terrorism Risk of Nuclear Power

Quan Li
Texas A&M University
quanli@tamu.edu

Matthew Fuhrmann
Texas A&M University
mfuhrmann@tamu.edu

Bryan R. Early
SUNY at Albany
b.early1@gmail.com

Arnold Vedlitz
Texas A&M University
avedlitz@bushschool.tamu.edu

Acknowledgement: An earlier version of this paper was presented at the Third Annual Conference on Terrorism and Policy, University of Texas at Dallas, May 20-21, 2010. We thank Todd Sandler, Claude Berrebi, David Darmofal, Walt Enders, other conference participants, Charles Lindsey, Cale Horne, Liu Shi, Nell Lindquist, Christopher Gore, and two anonymous referees for helpful comments and suggestions. This material is based upon work supported by the U.S. Department of Homeland Security under Grant Award Number 2008-DN-077-ARI018-03. The views and conclusions in the paper are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Department of Homeland Security.

Preferences, Knowledge, and Citizen Probability Assessments of the Terrorism Risk of Nuclear Power

Abstract

How does the American public assess risk when it comes to national security issues? This paper addresses this question by analyzing variation in citizen probability assessments of the terrorism risk of nuclear power plants. Drawing on the literature on how motivated reasoning, selective information processing, and domain specific knowledge influence public opinion, we argue that heterogeneous issue preferences and knowledge of nuclear energy and homeland security have important explanatory power. Using original data from a unique 2009 national survey in the United States, we show that Americans are divided in their probability assessments of the terrorism risk of nuclear power plants. Consistent with our theoretical expectations, individuals who support using nuclear power to meet rising energy demands, who are generally less concerned with terrorism, or who are more knowledgeable about terrorism and nuclear security tend to provide lower assessments of the likelihood that nuclear power plants increase terrorist attacks, and vice versa. The findings have implications for the literature on public opinion, risk assessment, energy policy and planning, and homeland security.

.

Keywords: homeland security, nuclear energy, terrorism, risk assessment, public opinion

Preferences, Knowledge, and Citizen Probability Assessments of the Terrorism Risk of Nuclear Power

I. Introduction

Policymakers and academics alike largely agree that nuclear and radiological (NR) terrorism now represents a significant threat to U.S. national security. In April 2010, President Barack Obama said that "the single biggest threat to U.S. security – both short-term, medium-term and long-term – would be the possibility of a terrorist organization obtaining a nuclear weapon" (Reuters, 2010). This view was shared by his predecessor, George W. Bush, who frequently referred to the dangers at the intersection of radicalism and technology. Meanwhile, dozens of countries, including the United States, are considering pursuing nuclear energy more aggressively as part of a movement that some have called the "nuclear energy renaissance" (e.g., Fuhrmann, 2009, 2012a; Miller & Sagan, 2009). Nuclear power is growing in popularity, in part, because it has the potential to reduce greenhouse gas emissions and help meet growing energy demands. Unfortunately, there may be a relationship, either real or perceived, between the diffusion of civilian nuclear programs and NR terrorism. Indeed, some have argued that nuclear reactors could be a source of nuclear materials for "dirty bombs" or improvised nuclear devices. Nuclear power plants could also turn into targets of opportunity for terrorists. For example, al Qaeda reportedly planned to strike American nuclear facilities with airplanes as part of the 9/11 attacks (Holt & Andrews, 2010).

Yet we know quite little about how the American people assess the likelihood of terrorist attacks related to nuclear power plants. Answering this question has important implications for energy and homeland security policies. To the extent that politicians respond to the preferences of the electorate, the public's probability assessment of the terrorism risk of nuclear power plants could influence the direction of nuclear energy policy in the United States and other democracies (see, e.g., Kitschelt, 1986). Understanding this issue is also important for garnering public support for future homeland security policy and expenditures. If citizens perceive a high risk for terrorism involving nuclear energy, policymakers may have to raise security standards for protecting nuclear power plants and allocate even more resources towards that end. Our understanding of counter-terrorism policies can also be enhanced by examining the factors that make citizens feel more or less vulnerable to this threat. Finally, this research also helps us better understand the formation of public opinion in an important issue area and contributes to the discussion of risk assessment of new technologies (e.g., Druckman & Bolsen, 2011; Gardner, 2008; Legge & Durant, 2010).

To explain variations in citizen probability assessments of the terrorism risk associated with nuclear power plants, we draw on the literature on how motivated reasoning, selective information processing, and issue knowledge influence public opinion. We argue that pre-existing attitudes toward, and knowledge of, nuclear energy and homeland security have important explanatory power. Citizens who support nuclear power because of future energy needs may assign a lower probability that nuclear power plants could contribute to terrorism. Individuals who worry more about terrorism may be more likely to offer a higher probability estimate. Those who have little specific knowledge about terrorism and nuclear security may be more likely to assess a higher probability for the terrorism risk of nuclear power plants, especially within the context of heightened anxiety since 9/11. Using original data from a unique national survey of a random digit sample of all telephone households in the United States conducted in 2009, we show that the American public is divided in its probability assessments of the terrorism risk of nuclear power plants. Further statistical analysis produces supporting evidence for our theoretical expectations.

The rest of the paper proceeds as follows. In Section II, we present the new survey evidence on the link between nuclear energy and terrorism. In the next section we offer some theoretical explanations for the divided probability assessments. In Sections IV-VI, we discuss our research design, present our findings, and carry out additional robustness checks. We conclude the paper by summarizing the findings, discussing their implications for theory and policy, and identifying various limitations and possible future research efforts.

II. Citizen Probability Assessments of the Terrorism Risk of Nuclear Energy

How do the American people assess the terrorism risk in the use of nuclear energy? In a national telephone survey developed by researchers at the Institute for Science, Technology and Public Policy (ISTPP) at Texas A&M University, funded by the U.S. Department of Homeland Security (DHS) and conducted by the Public Policy Research Institute (a Computer Assisted Telephone Interviewing unit at Texas A&M University) in August 2009, a total of 924 individuals from a random national sample of adults 18 years and older completed interviews. The survey employed a random digit sample of all telephone households in the United States.[1]

---

[1] The survey was supported by the U.S. Department of Homeland Security under Grant Award Number 2008-DN-077-ARI018-03. The dates of the survey were August 6, 2009 – September 21, 2009. Following the American Association for Public Opinion Research (AAPOR) conventions and algorithms, the survey's computed completion rate was 78.4%, the cooperation rate was 16.8%, and the response rate was 5.4%. We do not believe the absence of cell telephone numbers in the sample has negatively affected the representativeness of the overall sample, even for younger respondents who tend to be more personally cell phone exclusive than older adults. In their recent comprehensive study comparing 81 national surveys with response rates varying from 5% to 54%, Holbrook,

Each interview session was conducted in English and averaged 35 minutes in duration. Each respondent was asked whether he or she strongly agrees, agrees, disagrees, or strongly disagrees that "using nuclear power plants increases the possibility of a terrorist attack involving nuclear weapons or nuclear materials."

Risk as a measurable concept in many disciplines (psychology, statistical decision theory, business, public health and safety, etc.) is often defined as the product between the probability of an adverse event and the severity of injury or quantified loss from the event (see, e.g., Fischhoff, Lichtenstein, Slovic, Derby, & Keeney, 1984; Hubbard, 2009). Since the severity of injury or quantified loss from a terrorist attack is often more likely to be subjective and inflated (see, e.g., Gardner, 2008), we choose to analyze the relatively objective probability component of the terrorism risk of nuclear power plants.

The survey NR question intends to capture two types of terrorist attacks associated with nuclear power plants. In the first type, nuclear power plants become a source of nuclear materials that terrorists could acquire to produce crude nuclear weapons or dirty bombs to attack any target (which may or may not include nuclear power plants). In the second type, nuclear power plants are targets of terrorist attacks, causing radioactive fallout, radiation exposure, and other radiological, environmental, and health consequences. Our survey question does not distinguish between the two types of attacks, but this is not problematic for the purposes of our analysis. This is because we are interested in citizens' highest perceived risk among the different threats, and respondents are likely to report their answers based on the risks which they believe are most

---

Krosnick and Pfent (2007) found that RDD telephone surveys with low response rates "do not notably reduce the quality of survey demographic estimates" (p. 527). See also Lavrakas, Shuttles, Steeh, and Fienberg (2007) for significant problems and difficulties in cell phone interviewing.

probable. Moreover, both types of threats are associated with the broad notion of nuclear and radiological terrorism.[2] Many nuclear security experts take both types of threats seriously (e.g., Allison, 2004; Bunn & Braun, 2003; Ferguson & Potter, 2004; Hirsch, 2002). Real world events also suggest that nuclear power plants could be exposed to these terrorism risks.[3] Terrorist attacks involving nuclear power plants or materials obtained from them have also received attention from the media and in a number of pop culture depictions (e.g., the 2010 film, *Edge of Darkness;* the 2005 film, *Last Best Chance,* and the television series, *24*). Hence, we believe broad public awareness exists concerning both types of threats. The question allows us to examine how citizens in the United States gauge the likelihood of nuclear power plants leading to these terrorist attacks involving nuclear weapons or materials.

Figure 1 presents the distribution of responses to the survey NR question, based on whether the respondents agree, strongly agree, disagree, or strongly disagree. Overall, among the 861 respondents who replied to the question (the other 63 respondents did not answer this question), about 43% agree or strongly agree that using nuclear power plants increases the possibility of terrorist attacks involving nuclear weapons or materials, whereas about 57% disagree or strongly disagree. The pattern of responses in Figure 1 indicates that the American people are divided in their probability assessments of terrorism risk associated with nuclear

[2] As a caveat, we do not distinguish nuclear and radiological terrorism in this analysis because separating the two requires technical knowledge many respondents simply do not possess.

[3] See Ferguson and Potter (2004) for a discussion of the relevant historical cases.

energy. This finding does not differ dramatically from the results of other similar survey questions, and indicates a lack of consensus on the question and the perceived risk.[4]

[Insert Figure 1 here]

III. Explaining Divided Probability Assessments of the Terrorism Risk of Nuclear Energy

Why do the American people have different probability assessments over the terrorism risk of nuclear energy? We argue that the answer lies in people's heterogeneous preferences and knowledge levels regarding nuclear energy and nuclear security.

Effects of Issue Preference Heterogeneity

Individuals have different prior dispositions, beliefs, and preferences regarding nuclear energy and terrorism (e.g., Kuklinski, Metlay, & Kay, 1982). Assuming the same level of issue-specific knowledge, when individuals are compelled to identify the link between these two phenomena, their prior beliefs and preferences often influence how they process information and draw inferences. As the risks of nuclear and radiological terrorism tend to be nuanced and complex (e.g., Allison, 2004; Bunn & Braun, 2003; Bunn & Wier, 2006), "hard" domain-specific information is likely scarce and costly for citizens to acquire (Alvarez & Brehm, 2002, p. 40). Thus citizens' predispositions on the two issues should affect their motivation to acquire specific information and how they incorporate it within the context of their established beliefs. This suggests that those who favor nuclear energy are more likely to downplay the risk of nuclear power plants, whereas those who oppose nuclear energy are more likely to emphasize the risk.

---

[4] For example, Harris Interactive conducted a survey in 2007 that included the question: "How would you rate the likelihood of each of the following happening as a terrorist attack in the United States? An attack on a nuclear power station." 62% of respondents said such an attack was likely, while only 32% said it was not likely.

At the same time, those who are relatively more concerned about personal security from terrorism will be more sensitive to the terrorism risk of nuclear power plants, whereas those who are relatively less concerned about terrorism will be less sensitive to any risks.

This explanation draws on the large body of literature on how motivated reasoning and selective information processing influence the formation of public opinion. In that literature, an important premise is that all reasoning is motivated (Druckman and Bolsen, 2011; Kunda, 1990; Taber & Lodge, 2006) and, consequently, people aim for preferred outcomes, irrespective of whether or not they are correct (Lebo & Cassino, 2007).[5] Arguably, "tension between drives for accuracy and belief perseverance underlies all human reasoning" (Taber & Lodge, 2006, p. 756; see also Jacobson, 2010). This notion underscores the role selective information processing plays in the formation of individual attitudes and risk assessments.

Along this line of reasoning, several psychological mechanisms can come into play in the formation of individual attitudes on a topic. First, individuals often seek out information that supports their existing beliefs (Lodge, Taber & Galonsky, 1999; Schultz-Hardt, Frey, Luthgens & Moscovici, 2000), a characteristic labeled as the "confirmation bias" (Gardner, 2009). For example, Sweeney and Gruber (1984) find that in elections, people look for negative information about candidates that are from a political party different from their own. Second, individuals might convince themselves that information contradicting their existing beliefs is actually supportive (Bartels, 2000), or they often discount dissonant information from less trusted sources (Festinger, 1957; Petty & Wegener, 1998). Third, people often have selective memory

---

[5]In accepting this premise, we depart from traditional Bayesian explanations of opinion formation, which suggest that individuals rationally evaluate information and update their beliefs on the basis of new information (Gerber & Green, 1999).

(Jacobson, 2010). That is, individuals often remember information that reinforces their existing beliefs but tend to forget events that contradict them. Fourth, some scholars argue that motivated skepticism or selective judgment explains why biases influence public opinion. When faced with information that contradicts their beliefs, individuals work hard to develop counterarguments or discredit the source (Lodge & Taber, 2000; Rucker & Petty, 2004). On the other hand, citizens often accept information that supports their predispositions without reservation. For example, during the Monica Lewinsky scandal Republicans were more likely to accept negative reports about President Clinton at face value (Fischle, 2000). None of these mechanisms and arguments implies that citizens intentionally deceive themselves. Individuals often believe that they are approaching a given question objectively, but they are unaware that their preconceived notions and preferences make it difficult for them to be fair-minded (Lodge & Taber, 2005, 2006).

The theory of motivated political reasoning informs us about how citizens will assess the risks of nuclear energy, including terrorism. Both the Three Mile Island (TMI) and Chernobyl accidents illustrate that motivated reasoning played a role in how nuclear accidents affect public perceptions of nuclear safety. The partial nuclear reactor meltdown that took place in 1979 at the TMI nuclear plant near Harrisburg, Pennsylvania had a dramatic effect on public attitudes towards the safety of nuclear energy. In evaluating the American public's comparative perceptions of the risks in various activities and technologies, Slovic (1987) found that nuclear power topped the list of the public's fears. Yet, the public's incident-induced fears stood in stark contrast to the views held within the scientific community regarding the safety of nuclear energy (Lichter & Rothman, 1983; Rothman & Lichter, 1987; Slovic, 1987; Slovic, Fischhoff, & Lichtenstein, 1980). Research conducted on American opinions of the effects of the disastrous accident at the Soviet nuclear facility at Chernobyl in 1986 revealed that, while the incident had a severe negative effect on public opinion for citizens who had indifferent beliefs about nuclear power prior to the accident, it had less of an impact for people who supported nuclear energy prior to the incident (Renn, 1990). This suggests that, compared to citizens who oppose nuclear power or do not have strong prior beliefs one way or the other, individuals who support the use of nuclear energy are likely to be more dismissive of its problems, exhibiting motivated skepticism (e.g., Taber & Lodge, 2006).

As another example, the World Nuclear Association, which supports the global nuclear industry, formed a rival interpretation of the TMI and Chernobyl accidents rather than changing its prior beliefs. The Association suggested that the relative rarity of disasters over a period of several decades actually was indicative of nuclear power's safety, especially when compared to other technologies (World Nuclear Association, 2010).

Comparable dynamics are likely to be present when it comes to assessing the terrorism risk of nuclear power plants. We expect that people's pre-existing preferences about nuclear energy will influence their assessments of the connection between nuclear power and terrorism. Individuals who have favorable priors regarding nuclear energy will tend to see less of its dangers of terrorism. Moreover, they are less likely to scrutinize statements by politicians and alarmists that emphasize the risks of nuclear terrorism. In contrast, those who oppose nuclear power are more likely to emphasize the terrorism risk of nuclear energy. These individuals are more likely to seek out and remember information indicating that such a possibility exists.

Similarly, preferences about homeland security should also affect citizens' probability assessments of the terrorism risk of nuclear power. We expect that the extent to which people worry about terrorism influences their evaluations. Scholars have found that fear and anxiety shape how individuals form opinions (e.g., Gardner, 2009; Marcus, 1988). As Lebo and Cassino

(2007) note, “anxiety leads individuals to pay more attention to the political landscape and to contemporary political information” (p.726). Thus people who worry about issues such as terrorism and nuclear security may be more aware of relevant expert opinions and public statements by policymakers. As noted above, the media often point to the terrorism potential associated with nuclear facilities and materials and, in a general sense, the post 9/11 trend is to be "terrified of terrorism" (Gardner, 2009). Thus citizens who are already concerned about terrorism are likely to listen more closely and are more likely to believe that using nuclear power increases the possibility of terrorist attacks. On the other hand, those who are less concerned about terrorism will tend to pay less attention to related statements in the media by policymakers and scholars. Even when they do listen, they may be more dismissive of information suggesting that a terrorist attack of any kind is likely, given that their existing beliefs suggest otherwise. This discussion leads to two testable hypotheses on citizens’ perceptions of the terrorism risks stemming from nuclear power:

Hypothesis 1: Individuals who support the use of nuclear power are less likely to agree that using nuclear power increases the probability of nuclear and radiological terrorism, and vice versa.

Hypothesis 2: Individuals who are more concerned about homeland security and terrorism are more likely to agree that using nuclear power increases the probability of nuclear and radiological terrorism, and vice versa.

Effect of Issue Knowledge

The likelihood that terrorists could acquire materials from nuclear power plants to construct crude nuclear weapons or dirty bombs for attacks is low (Bunn & Wier, 2006; Ferguson & Potter, 2004), but terrorists contemplating nuclear attacks may believe otherwise. In addition, a terrorist attack severe enough to lead to the release of nuclear materials from a nuclear power plant (e.g., a breach of a spent nuclear fuel pool) is also a low probability event, but the consequences are potentially severe (Hirsch, 2002).[6]

One obstacle for extremist groups interested in nuclear and radiological terrorism is obtaining access to weapons grade highly enriched uranium (HEU) or plutonium (Allison, 2004; Bunn, 2007; Cirincione, 2007; Holgate, 2005). Civilian nuclear programs could raise the risk of nuclear terrorism if they increase the availability of these fissile materials for terrorists (see Early, Fuhrmann, and Li, 2011). However, it is worth noting that most modern nuclear power reactors do not rely on HEU for fuel, instead using low enriched uranium (LEU) that might be used to produce dirty bombs but could not be used directly to build nuclear weapons.[7] Civilian power plants produce plutonium when fuel rods are burned in a reactor, but it would be difficult for terrorists to obtain and extract this material. Meanwhile, since 9/11, nuclear power plants have received increased protection, making them much more difficult for terrorists to attack.

The complex nature of nuclear technology implies that accurate assessments of its risks depend on the extent of citizens' domain-specific information regarding nuclear technology and

---

[6] The March 2011 accident at Japan's Fukushima Daiichi nuclear power plant illustrates this point. An earthquake and tsunami caused nuclear fuel rods at the facility to meltdown, leading to the release of radioactive materials, widespread environmental contamination, and panic among the local population.

[7] LEU could only be used to build nuclear weapons through a complicated process known as enrichment, which increases the percentage of U-235. Uranium generally needs to include 90% U-235 in order to be useful for nuclear weapons. Uranium fuel rods used in power plants typically include less than 5% U-235.

homeland security. For a number of reasons we expect that many individuals do not possess the requisite knowledge to assess those risks accurately, leading them to assign high probabilities to the terrorism risks posed by nuclear power plants. As noted, this is particularly likely given the salience of the terrorism issue since 9/11 (e.g., Gardner, 2008).

First, relevant information on the nuanced nature of the threat posed by nuclear and radiological terrorism is complex, scarce, and costly for citizens to acquire (e.g., Allison, 2004; Bunn & Braun, 2003; Bunn & Wier, 2006). As Alvarez and Brehm (2002) point out regarding public opinion and public policy in general, “hard information about policy issues is likely to be less widely held by the public, since it is the sort of information that would be known by only those who are well informed about politics in general or who are knowledgeable about the policy in question” (p. 40). The highly technical nature of nuclear technology, in general, makes hard information on the specific security policies required to protect against NR terrorism threats especially difficult to acquire for the general public.

Second, a number of past studies have questioned the American public’s ability to accurately assess the safety risks posed by nuclear energy (e.g., Darmofal, 2005; Inglehart, 1984; Rothman & Lichter, 1987; Slovic et al., 1980), the logic of which also applies to the terrorism risk of nuclear power plants. As noted earlier, past findings regarding nuclear safety revealed a significant divergence between public attitudes and the views held by the scientific community. A survey of American elites (i.e., scientists, lawyers, bureaucrats, media pundits, etc.) conducted by Rothman and Lichter (1987) showed that 76% of the energy experts and almost 99% of the nuclear energy experts from the scientific community sampled agreed that nuclear energy was safe (p. 386). Despite this fairly broad consensus of the scientific community on the issue, the American public continued to view the risks of nuclear energy “as far more dangerous than any realistic assessment would indicate" (Rothman & Lichter, 1987, p. 387). Many scholars have also argued that the general public's perceptions of the safety risks in nuclear energy are irrational and uninformed (e.g., Cohen, 1983). Inglehart (1984) found that roughly six out of seven Americans thought that it is possible for nuclear power plants to produce atomic bomb-style explosions—a physical impossibility. If individuals often fundamentally misunderstand the nuclear-energy technologies in a way that overinflates the threat they pose, they also are likely to assign a higher probability to the terrorism risk of nuclear power plants.

The degree of a high probability risk assessment, however, varies among individuals depending on their issue-specific knowledge. Kuklinski et al. (1982) found that more knowledgeable individuals tended to make better calculated choices in weighing the costs and benefits of nuclear energy in determining their level of support for it (p. 621-622).

The logic articulated above suggests that the lack of accurate information regarding nuclear technology and terrorism leads some individuals to conclude greater terrorism risks than their more informed fellow citizens. It would not be surprising, then, to find that variations in individuals' levels of hard knowledge regarding nuclear and terrorism issues helps to explain divergent probability assessments of the terrorism risk posed by nuclear power plants. Citizens who lack the domain-specific knowledge necessary to understand the complex and low-probability nature of the event are more likely to rely on cues from pop culture and the media, which tend to overinflate the risk (e.g., Gardner, 2008).[8] A third hypothesis relating to the importance of knowledge in evaluating risk emerges from this discussion:

---

[8] The effect of the March 2011 nuclear disaster in Japan has yet to be determined and may affect this calculation in the future. This study was conducted before that tragic event.

Hypothesis 3: Relative to those with more issue-specific knowledge, individuals with less knowledge about nuclear and homeland security are likely to assign a higher probability to the terrorism risk of nuclear power plants.

IV. Research Design

To test these expectations, we estimate the following model using our 2009 national survey data:

> *Pr(Terrorism Risk of Nuclear Energy)* = β_0 +β_1 *Support Nuclear Energy* + β_2 *Terrorism Concern* + β_3*Terrorism/Nuclear Knowledge* + β_4*Education* + β_5*Plant Proximity* + β_6*Evangelical* + β_7*Independent* + β_8*Democrat* + β_9*Ideology* + β_{10}*Age* + β_{11}*Male* + β_{12}*Income* + ε, where ε is the error term.

As shown in Figure 1, the variable we are interested in explaining has four categories. Since our primary interest is to analyze the public divide in their assessments of the terrorism risk of nuclear power plants, we dichotomize the variable into two categories to sharpen our analysis.[9] Hence, the dependent variable, *Terrorism Risk of Nuclear Energy*, is coded 1 if a respondent agrees or strongly agrees that operating nuclear power plants increases the risk of terrorist attacks involving nuclear weapons or materials and 0 if a respondent disagrees or strongly disagrees.

To test Hypothesis 1, we construct a key independent variable, *Support Nuclear Energy*, to capture an individual's preference for using nuclear energy to meet rising energy demands. The variable is dichotomous, coded 1 if a respondent agrees or strongly agrees that "the U.S. should construct new nuclear power plants to meet its future energy needs," and 0 otherwise. If

[9] For robustness check, we also estimate the primary model using the four-category dependent variable and ordered probit. The results for the key variables remain significant and in the expected directions.

our expectation is correct, β_1 should be negative, indicating that those who prefer using nuclear energy to satisfy the energy needs are more likely to assign a lower probability to the terrorism risk of nuclear power plants.

We employ an ordinal variable from the survey to capture a respondent's preference for personal security from terrorism to test Hypothesis 2. *Terrorism Concern* is a respondent's rating of how worried or concerned he or she is about terrorism and homeland security. It ranges from 0 to 10, with higher values indicating greater concerns. We expect β_2 to be positive. That is, the stronger one's concern over terrorism and nuclear materials, the more likely a respondent is to think that nuclear power plants increase the risk of terrorism.

To test Hypothesis 3, we code *Terrorism/Nuclear (T/N) Knowledge* as a "hard information" measure of a respondent's knowledge about terrorism and nuclear security. It ranges from 0 to 5, with higher values indicating more knowledge regarding terrorism and nuclear security. The variable is based on five true-false questions regarding (1) the first atomic bombs used, (2) which country has the most nuclear weapons, (3) whether terrorists have ever stolen a nuclear weapon, (4) whether air cargo shipped on U.S. passenger aircrafts are inspected prior to its loading, and (5) whether the ban of liquids over 3.4 ounces on passenger airplanes is based on scientific studies.[10] Individuals with more substantive knowledge should be more capable of relatively accurately assessing the risk of terrorism and may be more informed about the risks identified by the nuclear security community. As a caveat, the variable is a proxy for knowledge of terrorism and nuclear security rather than a perfect measure. To the extent that the measure is valid and Hypothesis 3 is correct, β_4 should be negative. That is, individuals with less

[10] The distribution of the number of the correct answers among the survey respondents is as follows: 0 (19), 1 (86), 2 (245), 3 (376), 4 (170), and 5 (28).

knowledge are likely to report a greater likelihood for terrorism attacks involving nuclear power plants.

In addition to heterogeneous preferences and knowledge about nuclear energy and terrorism, individuals may also vary in terms of income, age, gender, religious belief, educational background, ideology, partisanship, and residential location. To ensure that our empirical tests of the three hypotheses are not confounded by these other factors, we control for them in our model. The variable *Education*, which is on a 6-point scale measuring a respondent's educational level (lowest level=1; highest level=6), also helps capture the respondent's ability to assess the terrorism risk of nuclear energy accurately. The variable *Plant Proximity* is a dummy variable, coded 1 for those who reported that they live within 50 miles of a nuclear power plant, and 0 otherwise. This variable allows us to assess whether living near a nuclear power plant affects individuals' views concerning the terrorism risks of the plant.

Evangelical is a dummy variable indicating whether a respondent is an Evangelical Christian or not, which helps to control for the impact of religion. Self-identification as an Evangelical Christian is becoming an important organizer of individual political attitudes, behavior and policy choices in the U.S. Recent research has identified Evangelical status as being strongly related to attitudes and policy choices about family decline issues (Brooks, 2002), abortion (Bolzendahl & Brooks, 2005), divorce (Stokes & Ellison, 2010), same-sex marriage (Campbell & Monson, 2008; Sherkat, Powell-Williams, Maddox, & de Vries, 2011) and evolution (Berkman & Plutzer, 2009; Freeman & Houston, 2009). In addition to these social issues, Evangelical identifications have been shown to be strongly related to national security issues like support for a hawkish policy in the Middle East and the Iraq War (Baumgartner, Francia, & Morris, 2008; Froese & Mencken, 2009). As another national security issue, it is possible that Evangelical status may be conditioning nuclear terror orientations and we, therefore, include it in the present analysis.

Independent and *Democrat* are two dummy variables for partisanship, indicating whether a respondent is an Independent or a Democrat, with the base category indicating Republican. Given the past affiliation of the anti-nuclear movement with the Democratic Party, Democrats may be more motivated to seek out negative information on the security risks of nuclear energy than Republicans (Joppke, 1993, p. 138-140). *Ideology* is a variable on a 7-point scale measuring a respondent's ideological orientation, with higher values indicating more conservativeness. *Income* is a measure of wealth based on an 11-point scale, with levels ranging from less than $10,000 to more than $100,000. *Age* and *Male* indicate the respondent's age and gender, respectively.

In survey research, framing often plays an important role in biasing the responses. This is particularly important for the validity of our analysis since a respondent, if asked first about the terrorism risk of nuclear power plants, may then answer the other questions about their preferences over nuclear energy and nuclear security based on their responses to the first question. To minimize the possibility of such an endogeneity bias, the survey asks the respondent to answer first the questions regarding their preferences over nuclear energy and homeland security and then the question regarding the terrorism risk of nuclear power plants.

Since the dependent variable is dichotomous, we use the probit estimator, with robust standard errors to deal with possible heteroskedastic error variance. Summary statistics are reported in Table 1. The correlation matrix of all the variables is presented in Appendix 1.

[Insert Table 1 here]

V. Findings

Table 2 reports the results from six statistical models. Column 1 is the baseline model upon which we focus our discussion, which includes all variables except for income. We exclude this variable in the baseline test because a large number of respondents are not willing to report information pertaining to their income. Column 2 includes the income variable. Columns 3-6 report the results from a series of robustness tests, which we discuss in the next section.

[Insert Table 2 here]

We start with the findings displayed in columns 1 and 2 of Table 2. *Support Nuclear Energy* has a statistically significant negative effect in columns 1 and 2. Individuals who prefer the development of new nuclear power plants for the sake of meeting rising energy demands tend to report that nuclear power plants do not increase the risk of terrorist attacks. When the dummy variable goes from zero to one, the predicted probability that an individual reports that nuclear power plants increase the likelihood of terrorist attacks drops by about 0.26 in the baseline model. To gauge whether these effects are large in size or not, we compare them to the sample average of the dependent variable, which is about 0.42. Substantively, respondents who support the use of nuclear power to meet rising energy needs are 62% less likely to agree that nuclear power plants increase the possibility of terrorist attacks involving nuclear weapons or nuclear materials. Hence, an individual's preference for nuclear energy is a powerful predictor of his or her assessment of the effect of nuclear power plants on the terrorism risk. Hypothesis 1 is confirmed.

Terrorism Concern has a statistically significant positive effect in columns 1 and 2, as predicted. Individuals who are more concerned about personal security from terrorism are more likely to see nuclear power plants as increasing the probability of terrorist attacks. Since the terrorism concern variable ranges from 0 to 10, we compute its substantive effect on the predicted probability of the dependent variable when it increases by one unit, by one standard deviation (from 0.5 standard deviation below the mean to 0.5 standard deviation above), and by ten units (from minimum to maximum) using the baseline model. The predicted probability that an individual reports that nuclear power plants increase the likelihood of terrorist attacks rises by about 0.02, 0.06, and 0.22, respectively, amounting to about 5%, 14%, and 52% increases over the sample average (0.42) of the dependent variable. The larger the gap between two individuals in their concerns over homeland security, the more likely their views are to diverge on whether nuclear power plants increase terrorist risks involving the use of nuclear weapons and nuclear materials. Hypothesis 2 is confirmed.

Lastly, *T/N Knowledge* demonstrates the statistically significant negative effect that we expected in columns 1 and 2. Individuals with less hard information about homeland security and nuclear security are more likely to assess nuclear power plants as increasing the probability of terrorist attacks. This result is consistent with our theoretical expectation and other findings in the literature regarding the effect of knowledge on individual assessments of nuclear safety. When *T/N Knowledge* rises from its minimum (0) to maximum (5) values, the predicted probability that an individual reports that nuclear power plants increase the likelihood of terrorist attacks declines by 0.21. Put differently, all else being equal, a respondent who answered all of our test questions correctly was 50% less likely to view nuclear power plants as increasing terrorist risks than a respondent who answered none of the questions correctly. Domain-specific knowledge thus has a salient impact upon how individuals perceive the terrorism risks associated with nuclear power. Hypothesis 3 is confirmed.

Two important points regarding the three key independent variables are worth noting. First, the effects of individual issue preferences and knowledge are statistically and substantively significant when they are included simultaneously in the same model. These results demonstrate that when individuals assess the probability component of the terrorism risk of nuclear power plants, both issue preferences and knowledge levels exert significant, independent influences.[11] As discussed later in the conclusion section, the finding contributes to the literature on how individuals assess the risks associated with new technologies. Second, the effects of individual issue preferences and knowledge are both statistically and substantively important even when we control for individual differences in other personal attributes.

In terms of the control variables, as shown in column 2, people with higher incomes are less likely to assess nuclear power plants as raising the likelihood of terrorist attacks. Respondents with higher educational levels are less likely to see the construction of nuclear power plants as increasing the risk of terrorist attacks, although the statistically significant effect in column 1 turns insignificant in column 2 when we account for the confounding effect of income.[12]

Relative to the Republicans, the Democrat respondents tend to assign a higher terrorism risk to nuclear power plants. This statistically significant difference in column 1 washes out, though, when income is included in column 2. In contrast, an Independent respondent is statistically indistinguishable from a Republican respondent in both columns 1 and 2.

---

[11] When the three variables enter the models sequentially, they remain statistically significant in the expected directions in the respective models. These results are not reported for the sake of space.

[12] This is not surprising given the strong correlation between income and education, which is 0.39—the third highest correlation as shown in Appendix 1.

Finally, as shown in columns 1 and 2, respondents do not exhibit statistically significant gender, age, religious faith, or ideological differences over their assessments of the terrorism risk of nuclear power plants. Interestingly, people who report living close to nuclear power plants do not report higher nuclear and radiological terrorism risks, compared to those who do not live near such a facility. This finding could emerge because of a possible selection effect (see, e.g., Tiebout, 1956).[13]

VI. Robustness Tests

We conducted three important robustness checks of our initial findings reported in columns 1 and 2 of Table 2. First, one may be concerned that, contrary to our expectation, one's probability assessment of the terrorism risk of nuclear power causes his or her preferences for nuclear energy. This possibility renders the *Support Nuclear Energy* variable endogenous to the dependent variable. The best econometric strategy to address this possibility is to find a valid instrument that is theoretically related to *Support Nuclear Energy* but unrelated to *Terrorism Risk of Nuclear Energy*.

We use an individual's reported attention to the environment issue in the news as a direct instrument for the variable *Support Nuclear Energy* for the following reasons. Given the public's past opposition to nuclear energy on the basis of the environmental hazards of nuclear accidents

[13] The 2008 MIT Energy Survey revealed that 76.5% of Americans would oppose the siting of new nuclear power plant within 25 miles of their homes—with 55.3% of them strongly opposing it (Ansolabehere & Konisky, 2009, p. 570). People who perceive nuclear power plants as dangerous are unlikely to choose to live near them. On the other hand, individuals with low incomes may not have a choice regarding where they live. These citizens might be forced to live in close proximity to a nuclear power plant even if they believe that it is dangerous from the perspective of safety or security. This could explain why the net effect of plant proximity is statistically insignificant.

and nuclear waste, we would expect a negative relationship between the salience of individual attention to environmental issues and support for nuclear energy. Though scientific elites have increasingly embraced nuclear energy as a potential solution to environmental problems, such as global warming (e.g., Pralle and Boscarino, 2011), general public attitudes have tended to diverge from the vanguard scientific opinion on nuclear energy issues since the 1980s (e.g., Rothman & Lichter, 1987). At the same time, we have no theoretical reason to expect that an individual's attention to environmental issues should be related to his/her perception of terrorism risk. This makes attention to the environment a theoretically valid instrument; it is negatively correlated with an individual's support for nuclear energy but not closely related to the terrorism risk of nuclear energy. Hence, when we enter the instrumental variable in the model instead, we expect that it should positively affect *Terrorism Risk of Nuclear Energy*—given that it is negatively correlated with *Support Nuclear Energy*.

The results for this test are reported in columns 3 and 4 of Table 2. As shown, the instrumental variable does exercise the statistically significant positive effect on the terrorism risk of nuclear energy that we expected. Hence, the results on *Support Nuclear Energy* in columns 1 and 2 are not an artifact of the possible endogeneity bias.

The second robustness test examines whether the non-random missing values for the income variable bias our results. In the survey, the income variable produced the largest number of missing values, with 171 respondents refusing to report income and 57 respondents saying they do not know—a total of 228 respondents. Analysis suggests that these missing values are not random, with older people, women, and less educated respondents more likely to provide no information on income.

To examine whether the results in columns 1 and 2 of Table 2 are sensitive to the non-random missing pattern in the income variable, we estimate a Heckman-like selection model (Heckman, 1979) to control for the non-random selection by individuals providing information on income. The main identification variables for the selection equation include a constructed continuous measure of how many questions an individual chooses to answer in the whole survey, capturing the general willingness of an individual to provide information, as well as age, gender, and education. Interestingly, the hypothesis that the cross-equation correlation (ρ) equals zero fails to be rejected as shown in columns 5 and 6; hence, the selection effect does not affect the estimates of those variables in columns 1and 2. Still, as reported in columns 5 and 6 of Table 2, the effects of the three key independent variables of interest remain statistically significant and in the expected directions.

Finally, in a third robustness test not reported here due to space constraint, we estimated column 1 in Table 2 for three separate groups: Democrat, Republican and Independent. This allows us to assess the possibility that an individual may adopt his/her party's view such that he/she ignores his/her own issue-specific knowledge. It turns out that the knowledge variable remains statistically significant for Independents, but loses its significance in both the Democrat and Republican samples.[14] So the effect of issue knowledge appears to be moderated by an individual's partisanship, but does not influence Independents.

VII. Conclusion

[14] We also explored running a weighted survey analysis using a weight variable that adjusts for income, education level, race, and age based on U.S. census data. While the results from this analysis largely support our findings from above, the weights used are not completely accurate for our sample and hence, the results are not presented here.

In this article, we examine variations in citizen probability assessments of the terrorism risk of nuclear energy. Our analysis makes several important findings. First, using original survey data from a national random sample, we demonstrate that Americans are divided over their probability assessments of the terrorism risk of nuclear power plants. While 43% of the respondents believe that nuclear power plants increase the possibility of a terrorist attack involving nuclear weapons or nuclear materials, 57% of the respondents do not. Second, we offer and test several theoretical explanations for the variations in respondents' probability assessments of the terrorism risk posed by nuclear power plants. We demonstrate that heterogeneous public preferences and knowledge levels regarding nuclear energy and homeland security matter the most. Individuals who support using nuclear power to meet rising energy demands, who are generally less concerned with terrorism, or who are more knowledgeable about terrorism and nuclear security tend to provide lower assessments of the likelihood that nuclear power plants increase terrorist attacks. In contrast, those who are opposed to using nuclear power, are more concerned with homeland security, or are less knowledgeable about terrorism and nuclear security often provide higher assessments of the likelihood of terrorist attacks due to nuclear power plants.

Our research has several important implications. First, contrary to the views of many pundits and experts, the American people appear split in their probability assessments of the terrorism risk of nuclear energy. When they design and seek support for their security policies, U.S. officials should be aware that more than half of the citizens polled in our survey disagree that nuclear power plants make terrorist attacks more likely. After the accidents at the Three Mile Island and Chernobyl nuclear facilities, fear-invoked public opposition to nuclear power in the United States led to greater regulation of the nuclear energy industry, dramatically increased the costs of constructing and operating nuclear power plants, and led a number of state governments to pass full moratoriums on their construction (Fuhrmann, 2012b). The March 2011 nuclear meltdown that occurred at the Fukushima Daiichi nuclear facility in Japan appears to have generated similar responses. In comparing these safety concerns to citizens' security concerns regarding nuclear power's usage, we find that respondents' probability assessments of the terrorism risk it poses do not suggest a wide demand for extensive, expensive security measures to protect nuclear power plants. This appears consistent with the controversial observation and criticism that the Nuclear Regulatory Commission has a record of imposing rather lax security standards for U.S. nuclear power plants (see Hirsch, 2002).

Second, the finding that individuals with less domain-specific knowledge are more likely to have higher probability assessments of the terrorism risk of nuclear energy is consistent with the view that many Americans do not understand the intricacies of the threats posed by nuclear and radiological terrorism. It is not uncommon for citizens to conflate nuclear weapons with dirty bombs in the same way that many think that nuclear power plants can yield nuclear explosions. When citizens possess a greater scientific and technical understanding of nuclear technologies and homeland security policies, we expect that their assessments of the probable risk of nuclear power facilities contributing to terrorism would be more likely to reflect the true risk posed. To encourage the adoption of sound nuclear security policies, then, educating the public about nuclear energy and terrorism deserve an important place on the public policy agenda—especially following the tenth anniversary of 9/11. This is a difficult task, however, because of the technical complexity of nuclear technology and the difficulty of translating technical knowledge into accessible language for laypersons, but one nonetheless worthy of pursuit. It may also pay positive dividends in helping the public respond appropriately to nuclear accidents, disasters, or terrorist attacks if they occur.

Third, as we have shown, individual predispositions towards nuclear energy and homeland security significantly affect assessments of the likelihood of terrorist attacks associated with nuclear power plants. The strong substantive effects of individual predispositions suggest that citizens are more drawn to information that supports their existing views. The finding also shows that the reason why it may be difficult to obtain consensus agreements regarding the security risks of nuclear plants is due in large part to citizens' heterogeneous preferences over substantive and competing issues (e.g., preference for low cost energy). Hence, identifying individual issue preferences is important in order to understand the formation of public opinion in general.

Finally, our research contributes to the discussion of risk assessment of new technologies and related public policies, such as genetically modified foods and stem cell research (see, e.g., Critchley & Turney, 2004; Druckman & Bolsen 2011; Kearns, Grove-White, Macnaghten, Wilsdon, & Wynne, 2006; Legge and Durant, 2010; Nisbet, 2005). The issue is whether risk assessment for new technologies and their regulation should be driven primarily by scientific knowledge and related cost-benefit analysis alone; or should it also consider other sociocultural, political, ideological, and demographic factors, as well as the relevance of involuntariness and high uncertainty of risk? Recent studies (e.g., Legge & Durant, 2010; Nisbet, 2005) tend to find that information and knowledge matter, but so do many other forces, including individual issue preferences, religious and ideological value predispositions, and trust in experts and government regulators. By focusing on the probability aspect of risk assessment, our research speaks directly to this literature. As probability assessment often relies more on scientific knowledge and methods, we should expect individual issue preferences and tradeoffs to play a smaller role. Our findings, however, indicate that even for probability assessment, individual issue preferences have a much larger impact than issue knowledge. Hence, risk assessment is rarely a neutral and objective exercise.

Our research has its own limitations and thus, future research may expand it in several directions. First, to sharpen our analysis, we focus on the probability assessment of the terrorism risk of nuclear power plants. Future research may explore how citizens assess the size of actual costs and losses in the terrorism risk of nuclear energy, addressing the other component of the risk concept. Second, many studies of individual attitudes toward technologies study the relationship between expert or scientific knowledge and layperson judgments (see, e.g., Critchley & Turney, 2004; Kearns et al., 2006; Legge & Durant, 2010; Rothman & Lichter, 1987; Slovic, 1987; Slovic, et al., 1980); while we only focus on the effect of hard knowledge, future research may explicitly distinguish and study the tension between expert knowledge and layperson judgments over nuclear energy. Third, many studies of individual attitudes toward new technologies have shown the conditional or unconditional effects of social trust (e.g., Critchley & Turney, 2004; Legge & Durant, 2010; Segrist, 2000). While we have not considered the issue of trust in this paper, it is certainly useful to study the role of social trust for the risk of nuclear technology. This is particularly relevant today, considering that the Fukushima Daiichi nuclear disaster exposed the systemic failure of Japanese corporations and governmental regulators to responsibly mange safety risks in the country's nuclear power industry. Finally, surveys conducted following the Fukushima nuclear disaster survey may be useful in helping to ascertain the impact of that event on the public's perception nuclear power's safety risks and, potentially, security risks. The new evidence will bring us closer to a better understanding of energy policy planning and homeland security.

References

Allison, G. 2004. *Nuclear terrorism: The ultimate preventable catastrophe.* New York: Times Books/Henry Holt.

Alvarez, R. M., & Brehm, J. (2002). *Hard choices, easy answers: Values, information, and American public opinion*. Princeton, NJ: Princeton University Press.

Ansolabehere, S., & Kinisky, D. (2009). Public attitudes toward construction of new power plants. *Public Opinion Quarterly, 73*(3), 566–577.

Bartels, L. (2000). Beyond the running tally: Partisan bias in political perceptions. *Political Behavior*, *24*(2), 117-150.

Baumgartner, J. C., Francia, P. L., & Morris, J. S. (2008). A clash of civilizations? The influence of religion on public opinion of U.S. foreign policy in the Middle East. *Political Research Quarterly, 61*(2), 171-179.

Berkman, M. B. & Plutzer, E. (2009). Scientific expertise and the culture war: Public opinion and the teaching of evolution in the American states. *Perspectives on Politics, 7*(3), 485-499.

Bolsen, T. & Cook, F. (2008). The polls-trends: Public opinion on energy policy: 1974-2006. *Public Opinion Quarterly*, *72*(2), 364-388.

Bolzendahl, C., & Brooks, C. (2005). Polarization, secularization, or differences as usual? The denominational cleavage in U.S. social attitudes since the 1970's. *Sociological Quarterly, 46*(1), 47-78.

Brooks, C. (2002). Religious influence and the politics of family decline concern: Trends, sources, and U.S. political behavior. *American Sociological Review, 67*(2), 191-211.

Bunn, G., & Braun, C. (2003). Terrorism potential for research reactors compared with power reactors. *American Behavioral Scientist*, *46*(6), 714-726.

Bunn, M., & Weir, A. (2006). Terrorist nuclear weapon construction: How difficult? *Annals of the Academy of Political and Social Science, 607,* 133-148.

Bunn, M. (2007). *Securing the bomb.* Cambridge: Project on Managing the Atom, Harvard University.

Campbell, D. E., & Monson, J. Q. (2008). The religion card: Gay marriage and the 2004 presidential election. *Public Opinion Quarterly, 72*(3), 399-419.

Cirincione, J. (2007). *Bomb scare: The history and future of nuclear weapons*. New York: Columbia University Press.

Cohen, B. L. (1983). *Before it's too late: A scientist's case for nuclear energy*. New York: Plenum Press.

Critchley, C., & Turney, L. (2004). Understanding Australians' perceptions of controversial scientific research. *Australian Journal of Emerging Technologies and Society, 2*(2), 82-107

Darmofal, D. (2005). Elite cues and citizen disagreement with expert opinion. *Political Research Quarterly, 58*(3), 381-395.

Deutch, J., & Moniz, E. (Eds). (2003). *The future of nuclear power: An iInterdisciplinary MIT study.* Cambridge, MA: MIT.

Druckman, J., & Bolsen, T. (2011). Framing, motivated reasoning, and opinions about emerging technologies. *Journal of Communication, 61*, 659-688.

Early, B., Fuhrmann, M., and Li, Q. (2011). Why are countries targeted with nuclear and radiological terrorism? Evidence from non-catastrophic events. Unpublished manuscript.

Ferguson, C., & Potter, W. (2004).*The four faces of nuclear terrorism.* Monterey, CA: Monterey Institute for International Studies.

Festinger, L. (1957). *A theory of cognitive dissonance.* Stanford: Stanford University Press.

Fischhoff, B., Lichtenstein, S., Slovic, P., Derby, S. L., & Keeney, R. L. (1984). *Acceptable risk*. New York: Cambridge University Press.

Fischle, M. (2000). Mass response to the Lewinsky scandal: Motivated reasoning or Bayesian updating? *Political Psychology, 21*(1), 5-15.

Freeman, P.K., & Houston, D. J. (2009). The biology battle: Public opinion and the origins of life. *Politics and Religion, 2*(1), 54-75.

Froese, P., & Mencken, F. C. (2009). A U.S. holy war? The effects of religion on Iraq war policy attitudes. *Social Science Quarterly, 90*(1), 103-116.

Fuhrmann, M. (2009). Spreading temptation: Proliferation and peaceful nuclear cooperation agreements. *International Security, 34*(1), 7-41.

Fuhrmann, M. (2012a). *Atomic assistance: How atoms for peace become atoms for war.* Ithaca, NY: Cornell University Press.

Fuhrmann, M. (2012b). Splitting atoms: Why do countries build nuclear power plants? *International Interactions*, forthcoming.

Gardner, D. (2008). *Risk: The science and politics of fear*. Toronto: McClelland & Stewart.

Gardner, D. (2009). *The science of fear: How the culture of fear manipulates your brain*. New York, N.Y: Plume.

Gerber, A., & Green, D. (1998). Rational learning and partisan attitudes. *American Journal of Political Science, 42*, 794-818.

Harris Interactive. (2007). *The war on terror: What is it? Who are our enemies and how likely are different types of terrorist attacks in the U.S.?* Retrieved from: http://www.harrisinteractive.com/vault/Harris-Interactive-Poll-Research-War-On-Terror-06-21-07.pdf.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica,* 47(1), 153–162.

Hirsch, D. (2002). The NRC: What me worry? *Bulletin of the Atomic Scientists, 58*(1), 38–44.

Holbrook, A., Krosnick, J., & Pfent, A. (2007). The causes and consequences of response rates in surveys by the news media and government contractor survey research firms. In J. M. Lepkowski et al. (Eds.), *Advances in telephone survey methodology* (pp. 499-528). New York: Wiley.

Holt, M., & Andrews, A. (2010). *nuclear power plant security and vulnerabilities.* Washington, D.C.: Congressional Research Service.

Hubbard, D. (2009). *The failure of risk management: Why it's broken and how to fix it*. Hoboken, N.J: John Wiley & Sons.

Inglehart, R. (1984). The fear of living dangerously: Public attitudes toward nuclear power. *Public Opinion, 6*, 41-44.

Jacobson, G. (2010). Perception, memory, and partisan polarization on the Iraq war. *Political Science Quarterly, 125*(1), 31-56.

Joppke, C. (1993). *Mobilizing against nuclear energy: A comparison of Germany and the United States.* Berkley: University of California Press.

Kearns, M., Grove-White, R., Macnaghten, P., Wilsdon, J., & Wynne, B. (2006). From bio to nano: Learning lessons from the UK agricultural biotechnology controversy. *Science as Culture*. *15*(4), 291-307.

Kitschelt, H. (1986). Political opportunity structures and political protest: Anti-nuclear movements in four democracies. *British Journal of Political Science, 16*(1), 57-85.

Kuklinski, J., Metlay, D., & Kay, W. D. (1982). Citizen knowledge and choices on the complex issue of nuclear energy. *American Journal of Political Science, 26*(4), 615-642.

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*(3), 480-498.

Lavrakas, P. J., Shuttles, C. D., Steeh, C., & Fienberg, H. (2007). The state of surveying cell phone numbers in the United States: 2007 and beyond. *Public Opinion Quarterly, 71*(5), 840-854.

Lebo, M., & Cassino, D. (2007). The aggregated consequences of motivated reasoning and the dynamics of partisan presidential approval. *Political Psychology*, *28*(2), 719-746.

Legge, J., & Durant, R. (2010). Public opinion, risk assessment, and biotechnology: Lessons from attitudes toward genetically modified foods in the European Union. *Review of Policy Research*, *27*(1), 59-76.

Levi, M. (2007). *On nuclear terrorism.* Cambridge, MA: Harvard University Press.

Lichter, S. R., & Rothman, S. (1983). Scientists' attitudes towards nuclear energy. *Nature*, *305*(8), 91-94.

Lodge, M., & Taber, C. (2000). Three steps toward a theory of motivated political reasoning. In A. Lupia, M. McCubbins, & S. Popkin (Eds.), *Elements of reason: Understanding and expanding the limits of political rationality* (pp.183-213). Cambridge: Cambridge University Press.

Lodge, M., & Taber, C. (2005). Automaticity of affect for political candidates, parties, and issues: An experimental test of the hot cognition hypothesis. *Political Psychology, 26*(3), 455-482.

Lodge, M., Taber, C., & Galonsky, A. C. (1999). *The political consequences of motivated reasoning: Partisan bias in information processing*. Paper presented at the annual meeting of the American Political Science Association, Atlanta, GA.

Marcus, G. (1988). The structure of emotional response: 1984 presidential candidates. *American Political Science Review, 82*, 737-761.

Miller, S., & Sagan, S. (2009). Nuclear power without nuclear proliferation? *Daedalus*, *138*(4), 7-18.

Mueller, J. (2009). *Atomic obsession: Nuclear alarmism from Hiroshima to Al-Qaeda.* Oxford: Oxford University Press.

Nisbet, M. C. (2005). The competition for worldviews: Values, information, and public support for stem cell research. *International Journal of Public Opinion Research, 17*(1), 90-112.

Petty, R. E., & Wegener, D. T. (1998). Attitude change: Multiple roles for persuasion variables. In D. Gilbert, S. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed.) (pp. 323-390). New York: McGraw-Hill.

Pralle, S., & Boscarino, J. (2011). Framing trade-offs: The politics of nuclear power and wind energy in the age of global climate change. *Review of Policy Research*, *28*(4), 323-346.

Renn, O. (1990). Public responses to the Chernobyl accident. *Journal of Environmental Psychology, 10*(2), 151-167.

Reuters. (2010, April 12). Obama highlights threat of nuclear terrorism.

Rosa, E., & Dunlap, R. (1994). Poll trends: Nuclear power: Three decades of public opinion. *Public Opinion Quarterly, 58*(2), 295-324.

Rothman, S., & Lichter, S. R. (1987). Elite ideology and risk perception in nuclear energy policy. *American Political Science Review, 81*(2), 383-404.

Rucker, D., & Petty, R. (2004). When resistance is futile: Consequences of failed counter-arguing for attitude certainty. *Journal of Personality and Social Psychology, 6*(2), 219-235.

Schulz-Hardt, S., Frey, D., Luthgens, C., & Moscovici, S. (2000). Biased information search in group decision making. *Journal of Personality and Social Psychology, 78*, 655-669.

Sherkat, D.E., Powell-Williams, M., Maddox, G., & de Vries, K. M. (2011). Religion, politics, and support for same-sex marriage in the United States, 1988-2008. *Social Science Research, 40*(1), 167-180.

Siegrist, M. (2000). The influence of trust and perceptions of risks and benefits on the acceptance of gene technology. *Risk Analysis, 20*(2), 195-203.

Slovic, P. (1987). Perception of risk. *Science, 236*(4799), 280-285.

Slovic, P., Fischhoff, B. & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risk. In R. Schwing and W. A. Albers, Jr. (Eds.), *Societal risk assessment: How safe is safe enough?* (pp. 181-214). New York: Plenum Press.

Stokes, D. E., & Ellison, C. G. (2010). Religion and attitudes toward divorce laws among U.S. adults. *Journal of Family Issues, 31*(10), 1279-1304.

Sweeney, P. D., & Gruber, K. L. (1984). Selective exposure: Voter information preferences and the Watergate affair. *Journal of Personality and Social Psychology, 46*(6), 1208-1221.

Taber, C., & Lodge, M. (2006). Motivated skepticism in the evaluation of political beliefs. *American Journal of Political Science, 50*(3), 755-769.

Tiebout, C. M. (1956). A pure theory of local expenditures. *Journal of Political Economy*, *64*(5), 416-424.

World Nuclear Association. (2010). *Safety of nuclear power reactors*. Retrieved from: http://www.world-nuclear.org/info/inf06.html.

Figure 1 Nuclear Power Plants and Risk of Terrorist Attack

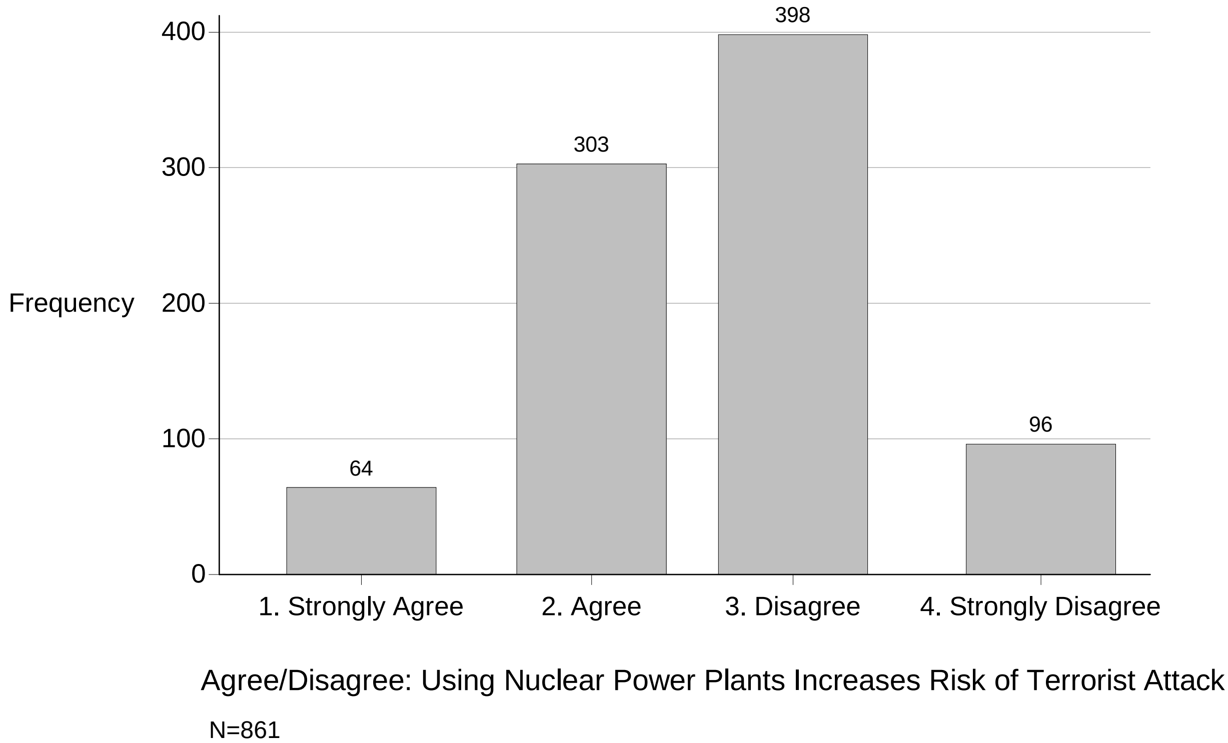

Table 1 Summary Statistics

Variables	N	mean	sd	min	max
Terrorism Risk of Nuclear Energy	861	0.4262	0.4948	0	1
Support Nuclear Energy	919	0.6866	0.4641	0	1
Support Nuclear Energy (instrument)	921	6.2215	2.6826	0	10
Terrorism Concern	920	7.0207	2.5769	0	10
T/N Knowledge	924	2.7316	1.0280	0	5
Education	918	4.2691	1.4374	1	6
Plant Proximity	923	0.2839	0.4511	0	1
Evangelical	892	0.1222	0.3277	0	1
Independent	872	0.4048	0.4911	0	1
Democrat	872	0.3039	0.4602	0	1
Ideology	880	4.5795	1.7554	1	7
Age	897	55.9175	15.3027	19	93
Male	924	0.4794	0.4998	0	1
Income	696	6.7356	3.3071	1	11

Table 2 Determinants of Individual Assessments of Terrorism Risk of Nuclear Energy

	(1)	(2)	(3)	(4)	(5)	(6)
Support Nuclear Energy	-0.652	-0.609			-0.617	-0.612
	(0.000)	(0.000)			(0.000)	(0.000)
Support Nuclear Energy (instrument)			0.063	0.057		
			(0.002)	(0.012)		
Terrorism Concern	0.059	0.060	0.036	0.042	0.065	0.059
	(0.003)	(0.007)	(0.066)	(0.055)	(0.004)	(0.009)
T/N Knowledge	-0.109	-0.097	-0.105	-0.088	-0.109	-0.101
	(0.027)	(0.079)	(0.031)	(0.108)	(0.049)	(0.069)
Education	-0.103	-0.005	-0.110	-0.014	-0.057	-0.013
	(0.003)	(0.899)	(0.002)	(0.747)	(0.193)	(0.784)
Plant Proximity	-0.017	0.013	-0.039	-0.011	0.021	0.011
	(0.875)	(0.910)	(0.712)	(0.928)	(0.860)	(0.925)
Evangelical	-0.065	0.094	-0.013	0.134	0.157	0.093
	(0.673)	(0.599)	(0.930)	(0.443)	(0.360)	(0.599)
Independent	0.155	0.100	0.120	0.089	0.124	0.103
	(0.203)	(0.467)	(0.325)	(0.514)	(0.364)	(0.453)
Democrat	0.295	0.251	0.267	0.227	0.298	0.252
	(0.047)	(0.133)	(0.068)	(0.167)	(0.072)	(0.131)
Ideology	-0.026	-0.056	-0.031	-0.067	-0.057	-0.056
	(0.454)	(0.161)	(0.379)	(0.097)	(0.152)	(0.159)
Age	0.002	0.002	0.000	-0.000	0.004	0.002
	(0.486)	(0.683)	(0.900)	(0.986)	(0.356)	(0.597)
Male	-0.033	0.001	-0.106	-0.084	-0.049	-0.010
	(0.737)	(0.993)	(0.266)	(0.440)	(0.668)	(0.933)
Income		-0.055		-0.055		-0.056
		(0.003)		(0.003)		(0.003)
Constant	0.461	0.463	-0.016	0.027	0.226	0.549
	(0.203)	(0.291)	(0.967)	(0.953)	(0.627)	(0.250)
Model Wald test (χ^2)	69.01	62.84	46.72	48.03	52.05	63.06
Prob> χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wald test of rho=0 (cross-equation)					0.01	0.18
Prob> χ^2					0.9049	0.6755
Observations	765	615	766	616	821	821

Robust p values in parentheses.

Results for the selection equation in the Heckman models of Columns (5) and (6) not reported.

Appendix 1 Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Terrorism Risk of Nuclear Energy	1.000													
2	Support Nuclear Energy	-0.250	1.000												
3	Terrorism Concern	0.054	0.159	1.000											
4	*T/N* Knowledge	-0.084	0.039	-0.032	1.000										
5	Education	-0.135	0.019	-0.140	0.165	1.000									
6	Plant Proximity	-0.017	0.051	-0.012	0.054	0.041	1.000								
7	Evangelical	-0.023	0.019	0.055	-0.011	0.023	0.008	1.000							
8	Independent	0.000	0.038	0.001	0.009	-0.069	0.046	-0.022	1.000						
9	Democrat	0.104	-0.202	-0.119	0.004	0.047	-0.027	-0.067	-0.545	1.000					
10	Ideology	-0.089	0.280	0.260	-0.027	-0.142	-0.005	0.183	0.040	-0.464	1.000				
11	Age	-0.003	0.067	0.144	-0.051	-0.092	-0.017	-0.128	-0.021	-0.002	0.117	1.000			
12	Male	-0.061	0.186	-0.105	0.141	0.058	0.080	0.028	0.134	-0.139	0.087	-0.120	1.000		
13	Income	-0.183	0.078	-0.098	0.133	0.390	0.059	-0.037	-0.009	-0.084	-0.012	-0.218	0.162	1.000	
14	Support Nuclear Energy (instrument)	0.154	-0.222	0.071	-0.041	0.014	0.032	-0.104	0.043	0.228	-0.378	0.039	-0.153	-0.090	1.000