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Nativity and Environmental Risk Perception: An Empirical Study of Native-Born and Foreign-Born Residents of the USA

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Abstract

This study examines the major differences between native-born and foreign-born residents of the United States on measures of environmental risk perception and risk attitudes. Hypotheses derived from the cultural theory of risk were tested. Discriminant analysis of the General Social Survey (GSS) and International Social Survey Program (ISSP) data was conducted using environmental and technological risk perception and attitudes modules. The results indicate that foreign-born respondents are more risk averse and skeptical about sources of information about environmental risks than their native-born counterparts. While there are some points of agreement, these groups exhibit dissimilar environmental risk perception on several measures. Native-born respondents scored significantly lower on risk perception and attitudes toward technological and environmental risks relative to their foreign-born counterparts. Methodological and theoretical implications of these findings are discussed.

Keywords: *environmental risks, risk perception, general social survey (GSS), discriminant analysis, risk society, environmental inequity, cultural theory, trust, environmental justice, and psychometric paradigm*

Introduction

Risk perception, defined as people's judgments and assessment of hazards or danger that might pose immediate or long-term threats to their health and well-being has gained currency among sociological research since the 1980s (Slovic et al. 1979; Short 1984; Slovic 1987; Tierney 1999; Rohrmann and Renn 2000; Strydom 2002; Lupton 1999). Social scientists have focused considerable attention on the relationship between risk perceptions and socio-demographic characteristics such as race, class, and gender in recent years (see Bord and O'Connor 1997; Flynn et al. 1994; Finucane et al. 2000; Vaughan and Nordenstam 1991; Kalof et al. 2002; Palmer 2003; Adeola 2004a,b; Hakes and Viscusi 2004). Despite the proliferation of studies on socio-demographic predictors of attitudes concerning environmental and technological risks, public health concerns, and risk perceptions, very little is known about attitudes towards risk and risk perception among foreign-born residents of the United States. Cross-cultural studies of risk perception have produced inconsistent results to date in terms of socio-cultural conception of risk, prominence and salience of what is risky and public understanding or knowledge concerning different types of hazards (see Boholm 1998; Brenot et al. 1998; Sjoberg 1998; Rohrmann and Renn 2000). Risk aversion among immigrants in the U.S. has not been systematically addressed to any significant extent in the current literature.

Hunter (2000) was the first to notice the omission of immigrants in environmental opinion/attitude studies. She assessed environmental concerns and pro-environmental orientation and behavior among this group relative to non-immigrant populations and found that shorter-term immigrants (those who lived in their country of origin at age 16) exhibited more environmental concern and pro-environmental behavior than their native-born counterparts. They expressed greater concern for environmental risks posed by pesticides, pollution, and greenhouse effect. Pfeffer and Stycos (2002) assessed environmental behaviors among native-born and foreign-born New Yorkers and found that while the latter group exhibited lower level of environmentally oriented political behavior (i.e., signing petitions and writing letters to political representatives on environmental matters), they displayed remarkably higher pro-environmental consumption behaviors. Others specifically focusing on risk perception, risk assessment, and risk communication have ignored or overlooked foreign-born segments of the U.S. population. Hence, the pertinent research question yet to be addressed centers on whether foreign-born residents are more risk averse than native-born residents of the United States.

Among the compelling reasons for including foreign-born residents in the study of environmental and technological risk perception is the fact that immigrants represent the fastest growing segment of the U.S. population in recent years (Larsen 2004; Martin and Midgley 1999; U.S. Census Bureau 2003). Official statistics reveal that immigration has accounted for more than one-third of the U.S. population growth in the past three decades. According to the U.S. Census Bureau (2000a, 2003), the foreign-born population in the U.S. increased from 19.8 million to 33.5 million between 1990 and 2003, and this trend is projected into the future (Larsen 2004). Presently, foreign-born residents represent 11.7% of the U.S. population.[3] Unlike in the past, recent immigration into the U.S. is largely composed of newcomers from developing nations of Asia and Latin America with diverse cultural backgrounds (U.S. Census Bureau 2000b, 2003; Larsen 2004). Furthermore, it is also important to note that foreign-born U.S. residents tend to be more vulnerable to poverty, occupational hazards, environmental injustice, and other risks mostly associated with central city communities where the majority of recent immigrants are concentrated (U.S. Census Bureau 2000; Larsen 2004; Martin and Midgley 1999; Bullard 2000; Snyder 2004).[4] Therefore, their perceptions of environmental and technological risks and level of trust in established authorities to safeguard these risks may be different from native-born groups. Including foreign-born U.S. residents in the study of attitudes and perception of ecological risks offers an opportunity to test the cultural theory of risk and to expand our knowledge concerning appropriate risk communication strategies for this group relative to native-born population.

Several scholars including Szasz (1994), Hunter (2000), Novotny (2000), Mohai (1990, 2003), and Satterfield et al. (2004) have suggested that concern about environmental risks has spread throughout the fabric of the society. This is supported by studies that show that minority groups of different cultural backgrounds exhibit pro-environmental behavior and significant risk aversion (also see Morrison 1986; Vaughan and Nodenstam 1991; Parker and McDonough 1999; Bullard 2005). While environmental risks and their adverse effects on humans, the physical environment, and other species have entered the consciousness of average American residents over the past 25 years, risk perceptions are not uniform across various sub-groups within the population. As pointed out by Douglas and Wildavsky (1982, 1), disagreement over the problem of risks is deep and widespread in the Western World. As people have become more sensitized and concerned about environmental hazards, others, perhaps due to their location within the social structure and perceived sense of control, have downplayed ecological risks at the local and national levels (see Adeola 1998, 2000, 2002; Krause 1993; Kempton et al. 1995).

The demographic correlates of environmental concern and risk perception have been studied extensively by social scientists producing conflicting results, especially on the relative contributions of race, gender, class, and age (e.g., see Samdahl and Robertson 1989; Baldassare and Katz 1992; Krause 1993; Braud 1997; Blocker and Eckberg 1997; Brenot et al. 1998; Klineberg et al. 1998; Finucane et al. 2000; Flynn et al. 1994; Johnson 2002; Palmer 2003). However, there are some unresolved questions including: (1) whether every subgroup in the U.S. (especially by nativity) exhibits similar attitudes toward environmental risks; (2) whether there are significant sub-group differences in environmental risk perception; and, (3) to what extent sub-cultural factors explain variation in risk perception among foreign-born groups relative to native residents.

The purpose of this article is to address the risk perception gap between foreign-born and native-born U.S. residents. The worldviews and environment of orientation of the former may be different from those of the latter. Core American values such as faith in science and technology, individualism, liberty and free enterprise, and shared values, norms, and attitudes concerning environmental protection and risk management may set native-born groups apart from their foreign-born counterparts (Kempton et al. 1995). Specifically, this article explores the extent to which foreign-born and native-born respondents are similar or dissimilar on environmental risk perceptions and trust in institutions, authorities, and social organizations providing public information about risks. This endeavor builds upon some recent empirical studies (e.g., see Adeola 2004b, 1998; Hunter 2000; Finucane et al. 2000; Kalof et al. 2002; Sjoberg 2000; and Satterfield et al. 2004). The structure of similarities or dissimilarities will be assessed using multivariate discriminant analysis (MDA). A test of the corollary hypothesis that there is no significant difference in environmental risk perception and concerns about such risks between the two groups was conducted using a nationally representative General Social Survey (GSS) data-set. Although previous studies have used similar data to analyze racial, gender, and class differences in environmental behavior, attitudes, and levels of concern, none has examined the structure of group similarities and dissimilarities in risk perception among foreign-born and native-born respondents. This article is organized into six major sections. Following the introduction, background literature and theoretical issues are presented. Subsequently, data and method, empirical analysis, results, discussion, and conclusions are offered.

Background

Since the 1960s, especially following the publication of *Silent Spring* by Rachel Carson in 1962, risk has entered the forefront of expert, social-scientific, and public discourses concerning the hazards of modern technology and the environment (see Strydom 2002; Adeola 2004a). The study of risk perception was influenced by the work of Slovic et al. (1979) and associates and Short's (1984) presidential address to the American Sociological Association. Short (1984) encouraged sociologists to be engaged in the study of risks for both basic research and applied policy purposes. A significant number of sociologists have been attracted to the study of risks, technological and natural disasters since the 1980s. However, major contributions to the body of knowledge on risk perception have come from multiple disciplines including anthropology, economics, geography, sociology, political science, and psychology (see Boholm 1998; Tierney 1999). Social science research in this area has evolved into two basic orientations. First is the psychometric approach which was used by Slovic and various collegues (Fischhoff et al. 1978; Slovic et al. 1979; Slovic 1987) to examine variation in expert judgment and lay-people's perceptions of risks. The second orientation is the "cultural approach," which contends that "risk" is a socially constructed concept with different meanings depending upon the socio-cultural situation or context, and socially shared worldviews (Strydom 2002; Lupton 1999; Douglas and Wildavsky 1982). A brief sketch of these approaches is in order.

The Psychometric Approach

The psychometric paradigm was launched in the late 1970s by Fischoff et al. (1978) as a theoretical and methodological framework for classifying hazards and understanding and predicting people's perception of different types of risk. This approach operates under the assumption that risk is subjectively defined by individuals who are typically influenced by a host of social, cultural, institutional and psychological factors. This model assumes that public risk perceptions can be quantified and predicted by focusing on cognitive factors influencing individuals' perception of risk. Multi-dimensional scaling procedures and factor analysis were used to determine the structure of people's beliefs, knowledge, values, and judgment regarding specific risks (Slovic et al. 1978; Fischoff et al. 1978; Slovic 1987). Using the psychometric method, Slovic et al. (1978) and Slovic (1987) asserted that lay people think of hazards according to the attributes of the hazards instead of their expected fatalities while the experts mostly emphasized the fatalities.

The attributes of a hazard that result in the lay public perceiving them as very risky are: (1) unknown risks, characterized by such properties as being insidious, unobservable, unfamiliar, delayed or chronic impacts both on the present and future generations; (2) dread risks are defined as those hazards that cannot be controlled, are involuntary, catastrophic, unjustly and inequitably distributed, with fatal consequences. Recent empirical studies based on public perception of Chernobyl-type accidents have added two additional dimensions including exposed and unnatural/immoral risk (see Sjoberg 2000). The experts tend to rely on probability or statistical theory of probability while lay people consider experiential accounts to be more important when it comes to environmental and technological risks.

According to Slovic (1987, 236), psychometric methods appear suitable for identifying similarities and dissimilarities among groups on measures of risk perceptions and attitudes concerning risks. A number of cross-national comparative studies of risk perception have been conducted with inconsistent results (see Boholm 1998; Rohrmann and Renn 2000). As noted by Boholm (1998, 145), among the lessons from cross-national studies is the fact that the perception of risks across nations or cultures is both uniform and variable. Across the globe, humans share similar concerns about certain risks while they diverge on some others. Examples of risks where there is consensus include natural disasters, cataclysmic technological disasters, and those risks over which people have control. Examples of risks where people diverge are genetically modified foods, global warming, and other risks with delayed manifestation of impacts (also see Satterfield et al. 2004, 121). As noted by Boholm (2003, 162), cross-national or cross-cultural differences can be explained by the presence or absence of actual risks due to the prevailing conditions of existence in different societies (see Adeola 1998). The psychometric paradigm has been criticized for neglecting social and cultural influences on risk perception (Rippl 2002). It cannot account for variation in levels of risk perception among different social and ethnic groups (Vaughan and Nordenstam 1991; Flynn et al. 1994; Rohnrmann and Renn 2000). In addition to low percentage of risk perception variance explained by the psychometric model, Sjoberg (2000, 5) notes that its empirical analyses can be less robust than they appear because researchers use average values which are less sensitive to errors instead of raw data which are more subject to error. Empirical tests of the psychometric paradigm are beyond the scope of the present study.

Risk Society, Cultural Variation, and Risk Perception

Increased media exposure of a series of catastrophic environmental disasters in the past three decades (e.g., the 2005 Katrina flood in New Orleans, the 1989 Exxon Valdez oil spill, the Love Canal toxic contamination in New York, the 1986 Chernobyl nuclear meltdown in the Soviet Union/Russia [now Ukraine], the 1984 catastrophic Union Carbide chemical (methyl isocyanate) releases in Bhopal, India, the 1979 Three Mile Island nuclear reactor accidents near Middletown, Pennsylvania, and numerous other cases of toxic calamities widely covered by the mass media), has sensitized people of different nationalities and cultural backgrounds to environmental risks and technological hazards of contemporary risk societies. Ontological security has been challenged by these events and people's trust both in expert judgments and authorities has been called into question.

As noted by Strydom (2002, 25), the Chernobyl disaster marked the turning point in public risk discourse. The taken-for-granted assumptions about nature, social institutions, science and technology, and expertise and progress were challenged in a period characterized by conflicts, anxiety, acute and chronic impacts, and uncertainty. Risk awareness, concerns, and anxiety have spread across different groups, nationalities, and sub-nationalities reflecting the characteristics of a global risk society (see Beck 1992). That different people perceive different hazards differently was made clear by Beck (1999, 56-57), who states that:

> *In the chain of publicly revealed catastrophes, near-catastrophes, whitewashed security faults and scandals, the technically centered claim to the control of governmental and industrial authority shatters quite independently of the established measure of hazards: the number of deaths, the danger of contamination, etc. ... Precisely because of their explosiveness in social-political space, hazards remain distorted objects, ambiguous, interpretable, resembling modern mythological creatures, which now appear to be an earthworm, now again a dragon, depending on perspective and the state of interests.*

Thus, risks are contentious as they are often socially constructed and amplified. According to Douglas and Wildavsky (1982, 1-3), different groups in society tend to give exposure to toxic hazards different significance. Even political parties, interest groups, and government officials do not attach the same meanings and interpretations to different risks; for example, it has been noted that those who are most concerned about terrorist attacks from abroad tend to be less concerned about environmental and technological risks at home. The Federal government's lethargic response to the Hurricane Katrina disaster in New Orleans and the entire Gulf Coast seems to support this assertion (see *The Great Deluge* by Douglas Brinkley [2006]).

Risks are not evenly distributed in society; some groups such as immigrants and people of color are more vulnerable to the proliferation of risks and more susceptible to exposure to environmental hazards than others (Adeola 2004b; Bullard 2000; Satterfield et al. 2004; Fitzpatrick and LaGory 2000; Pinderhughes 1996). Foreign-born residents are relatively powerless and as such, their communities represent the paths of least or no resistance to hazardous facilities in the U.S. Furthermore, they are disproportionately represented in occupations with higher risks of exposure to toxic materials (Snyder 2004; Martinez-Alier 2002). As noted by Beck (1995), social risk positions tend to develop in conjunction with inequalities of place, race/ethnicity, and social class. Newly arrived foreign-born residents are more vulnerable to hazards associated with occupational and residential inequalities, which are the main focus of the environmental justice movement. The fundamental objective of this movement is to ensure fair and equal protection under the existing environmental laws and equal access of all people to environmental resources remains elusive to thousands of minorities across America (see Bullard 2000; Novotny 2000; Allen 2003; Satterfield et al. 2004; Lerner 2005).

Similar to environmentalism, demographic differences in risk perception have been emphasized in the literature (Kalof et al. 2002; Finucane et al. 2000). There is ample evidence of significant differences across race/ethnicity, gender, and social class in judgment and perception of many environmental and technological risks (cf. Vaughan and Nordenstam 1991, 30). Douglas and Wildavsky (1982) suggest that individuals from diverse cultural backgrounds may differ in their tendency to emphasize certain types of risks while downplaying others. On the other hand, cultural assimilation, involving a gradual acceptance of the host society's cultural elements by immigrants may bring about similarities in values, attitudes, and perceptions over time. Furthermore, globalization has led to the spread of cultural elements across the globe. Through voluntary acculturation, foreign-born residents may adopt new cultural elements as their native-born counterparts. Therefore, it is plausible that foreign-born residents may exhibit similar risk perception as the native-born population due to acculturation and assimilation processes.[5] On the other hand, due to their prior socialization and exposure to environmental hazards, risk perceptions among foreign-born groups may be higher than those of their native-born counterparts.

In recent empirical studies, white males have been reported to have lower perceptions and attitudes toward risks relative to other groups in the U.S. (Satterfield et al. 2004; Finucane et al. 2000). Minority groups such as African Americans are said to exhibit higher perceptions, concerns, and anxiety about environmental risks (see Flynn et al. 1994). According to Finucane et al. (2000, 161), white males score lower on risk perception relative to others because they are most likely to be actively involved in creating, managing, controlling and benefiting from technologies producing most of the risks. Minorities, including foreign-born residents, Blacks, Hispanics, and other people of color, perceive greater risks because they are more vulnerable, alienated, fatalistic, and have less power or control over environmental risks (see Flynn et al. 1994; Adeola 2000, 1994; Bullard 2005).

Finucane et al. (2000) suggest that white males in particular have distinct worldviews about risks not applicable to any other groups. For instance, they tend to display authoritarian, hierarchical, and individualistic views more than the fatalistic and egalitarian views common among minorities including immigrants. It has also been suggested that native-born White Americans may display low risk perception because they are the ones generating most of the hazards and reaping the benefits from these hazards, and they tend to display individualist and hierarchical (or authoritarian) attitudes. Non-whites on the other hand, who typically have egalitarian and communal attitudes, may feel disconnected and perhaps victimized by the sources of these hazards. Perceived vulnerability to the consequences of undue exposure to environmental and technological hazards tend to shape minority risk perceptions (Adeola 2000; Allen 2003; Lerner 2005).

Recently, Palmer (2003) has questioned the validity of the white male effect on all types of risk. While she found both white males and Taiwanese-American males to score relatively lower on health and technology risks, there was no group difference on financial risks. Nevertheless, given the cultural differences between Americans and immigrants, it is reasonable to hypothesize that native-born residents are most likely to downplay the dangers associated with technological risks because they have more trust in authorities and social organizations concerned with the tasks of risk management. Therefore, it can be hypothesized that on the aggregate, there is a major difference in risk perception among native-born and foreign-born segments of the U.S. population. More specifically, the first hypothesis (H_1) from the cultural theory states that:

> *H_1: Significant differences exist between foreign-born and native-born residents in technological and environmental risk perceptions and attitudes toward such risks with the latter exhibiting lower scores on attitudes concerning environmental and technological risks relative to the former.*

Public Trust and Risk Perception

Another aspect of cultural theory of risk perception focuses on the levels of public trust in experts and authorities charged with risk management. Studies have shown that social trust significantly affects risk perception of a specific technology (Kowalewski and Porter 1993; Bord and O'Connor 1997). For instance, studies of nuclear or hazardous waste disposal sites and chemical plants have demonstrated that social trust has a significant effect on public perception of risks associated with the technology (see Bord and O'Connor 1997; Flynn et al. 1992; Siegrist et al. 2005; Spies et al. 1998). In their analysis of the Canadian National Health Risk Perception Survey, Lee et al. (2005) found that respondents with high trust in government regulation, high perceived benefits of technology, low worry, and low personal control displayed low risk perception (also see Spies et al. 1998 for similar results in a study conducted in the United States). As noted by Siegrist et al. (2005, 146), people who have high trust in authorities and the management in charge of technology or industrial plant perceived less risks than people with lower level of trust in such systems.

Due to their disadvantaged position and historical experience in the U.S., minority groups in general have lower levels of trust in the government and other entities charged with the tasks of risk management. Therefore, it is expected that foreign-born groups would exhibit lower social trust and high risk perception relative to their native-born counterparts. While there is no generally agreed upon method of conceptualizing trust, previous studies have asked respondents about their level of trust in various institutions and this is the approach used in the present endeavor. The second hypothesis (H_2) states that:

> *H_2: Foreign-born residents are most likely to exhibit less trust in institutions and social organizations providing information about environmental and technological risks relative to native-born residents.*

Data and Method

Data Sources

The data used in this study came primarily from the cumulative 1972-2002 General Social Surveys (GSS), administered by the National Opinion Research Center (NORC), archived and distributed since 1972 by the Inter-university Consortium for Political and Social Research (ICPSR). Additional data on foreign-born residents, their origins, and social characteristics were obtained from the U.S. Bureau of the Census. The GSS is a random sample of the non-institutionalized adult population (18 years old and above) of the United States (see Davis and Smith 1996, 1998; Davis et al. 2003). Surveys have been conducted between February and April of all but six years (1979, 1981, 1992, 1995, 1997 and 1999) since 1972. The 1993, 1994, and 2000 GSS/International Social Survey Program (ISSP) data sets each contain an environmental module which provides a more comprehensive array of questions on environmental attitudes, pro-environmental behavior, and perceptions of environmental risks among different groups in the U.S.[6] These environmental modules of the GSS/ISSP data sets pooled for all the years available were used for the purpose of this study.

Variable Measures

Consistent with the primary objective of this study, the GSS/ISSP questionnaire items tapping respondents' risk perceptions and attitudes about environmental risks and trust are used to determine group differences or similarities by nativity. That is, native-born vs. foreign-born status of respondents constitutes the categorical grouping (indicator/dependent) variable and the GSS items on attitudes toward environmental risks and risk perception are the predictor (or discriminating) variables. From the GSS/ISSP environmental module, items reflecting the themes of environmental risk perception are the predictors or discriminant variables in the statistical models estimated.

Indicator Variable

In the GSS questionnaire, respondents were asked to indicate whether they are native-born (coded as 1) or foreign-born (coded as 2).[7] The relative percentage of foreign-born and native-born in the sample is much less than their national composition according to the U.S. Census Bureau (2000). Consequently, data limitation does not permit decomposition of this variable into different nationalities or geographical regions of origin of the foreign-born sample in the present analysis. Nevertheless, consistent with the U.S. Census Bureau's data, initial analysis of GSS data shows that the majority of foreign-born respondents are non-white.

Discriminant/Predictor Variables

Predictor variables tapping attitudes and judgments concerning environmental and technological risks are used. Also included are items on respondents' trust on specific sources of information on environmental risks. The measurement of these items is explained in the following sections.

Measures of Environmental and Technological Risk Perception, Opinions, and Attitudes

On the theme of environmental and technological risks, 13 items on respondents' opinions, attitudes, and perceptions about specific types of risk were used. These items were measured on the scale of extremely dangerous (1), very dangerous (2), somewhat dangerous (3), not very dangerous (4), not dangerous at all (5) to the environment and can't choose (8) in the GSS/ISSP. This scale was re-coded so that positive scores would imply higher concern about risks (i.e., 1 = not dangerous at all, 2 = not very dangerous, 3 = can't choose, 4 = somewhat dangerous, 5 = very dangerous, and 6 = extremely dangerous. Items ranked with this scale include:

> *Car pollution danger to environment; car pollution danger to my family; nuke power plants danger to environment; nuke danger to my family; industrial air pollution danger to environment; industrial air pollution danger to my family; pesticides danger to environment; pesticides danger to my family; water pollution danger to environment; water pollution danger to my family; greenhouse effect danger to environment; greenhouse effect danger to my family; and increase in car pollution-induced ill-health in America's cities.*

One item: increase in car pollution-induced ill-health in America's cities was measured on a scale raging from 1 = certain to happen to 5 = not at all likely to happen which was also reverse-coded.

Measures of Trust in Sources of Information on Environmental and Technological Risks

On the theme of trust, six GSS/ISSP items are used. Respondents were presented with six different sources of information on environmental and technological risks (including business, environmental groups, government, newspapers, radio/TV, and universities) and asked: How much trust do you have in each of these to give you correct information on the causes of pollution risks, a great deal (coded as 1), quite a lot (coded as 2), some trust (coded as 3), not much trust (coded as 4), or hardly any trust (coded as 5)?

Empirical Analyses

In the discriminant analysis used, mean differences and discriminant scores for native-born and foreign-born respondents were calculated for the two themes explored, i.e., environmental and technological risk perception and trust in sources of information concerning these. For mean differences, positive values indicate higher means for the native-born group, and negative values indicate higher scores for the foreign-born group (see the first column of Tables 1 and 3). Next, a multivariate discriminant analysis (MDA) was conducted both for description and prediction (hypothesis testing) purposes. MDA is quite useful for evaluating differences among two or more groups in terms of specific attributes (see Klecka 1980; Norusis 1990; Huberty 1994; McClachlan 1992; Tabachnick and Fidell 2001). In MDA, Fishers' linear discriminant functions of multivariate attributes (measures at interval-ratio level) in relation to a categorical dependent variable are computed in conjunction with related statistics that help to determine specific discriminating variables.[8]

Huberty (1994) and Tabachnick and Fidell (2001) suggested that MDA and related statistics are appropriate for describing group differences or predicting group membership on the basis of an independent variable while controlling for all other factors (also see Klecka 1980; McClachlan 1992). A discriminant function score for a case is predicted from the sum of the series of predictors, each weighted by a coefficient (see Tabachnick and Fidell 2001, 466).[9] In the present study with two groups, only one discriminant function is possible.[10] Standardized discriminant function coefficients (SDFCs), Fisher's coefficients, Wilks' lambda, F-ratios, canonical correlations and group centroids are calculated. Wilks' lambda could be considered a test of equality of group means; for instance, a lambda of 1.00 occurs when all observed group means are equal (see Norusis 1990). Therefore, values approaching 1.00 imply little or no difference in group means. According to Klecka (1980, 34), all of the lambdas will be positive or zero, and the larger the value of lambda, the more the groups will be separated on that function. The key findings of the analysis are presented in the following section.

Findings

The results of the analysis are summarized in Tables 1 to 4. Out of the 13 items in Table 1 (first column), foreign-born respondents registered higher means for six and native-born respondents have higher means for only four and there is no significant group difference for three items. More specifically, the foreign-born group scored higher means for the following items: car pollution induced illnesses will increase in the next 10 years, nuke power danger to the environment, nuke power danger to my family, industrial air pollution danger to my family, pesticides danger to my family, and greenhouse effect danger to my family.

Table 2 shows the results of MDA conducted. Consistent with the findings reported in Table 1, Table 2 displays significant differences between native-born and foreign-born respondents in at least 10 out of the 13 items. The standardized discriminant function coefficients (SDFCs) reveal the items with the most significant discriminating power between the two groups as: nuke power danger to the environment (SDFC = .466 and within group correlation = .744, $p < .01$), greenhouse effect danger to the environment (SDFC = -.471 and within group correlation = -.412, $p < .05$), and pesticides danger to my family (SDFC = .205 and within group correlation

Table 1. Means, Mean Difference and Standard Deviations of Environmental Attitudes of Native-Born and Foreign-Born Respondents

Discriminant Variables	Native-Born Means (Std. Dev.)	Foreign-Born Means (Std. Dev.)	Mean Difference
Car pollution danger to environment [CARSGEN]	2.88 (1.34)	2.78 (1.33)	.10
Car pollution danger to my family [CARSFAM]	3.23 (1.34)	2.98 (1.33)	.25**
Car pollution induced illnesses will increase in the next 10 years [CARSTEN]	3.34 (1.00)	3.58 (.96)	-.24***
Nuke power danger to the environment [NUKEGEN	3.43 (1.04)	3.86 (1.01)	-.43***
Nuke power danger to my family [NUKEFAM]	3.28 (1.10)	3.71 (1.09)	-.43***
Industrial air pollution danger to the environment [INDUSGEN]	2.58 (1.32)	2.32 (1.25)	.26**
Industrial air pollution danger to my family [INDUSFAM]	3.63 (.93)	3.87 (.86)	-.24***
Pesticides danger to my family [CHEMFAM]	3.33 (.91)	3.60 (.95)	-.27***
Pesticides danger to environment [CHEMGEN]	3.24 (1.32)	2.87 (1.41)	.37**
Water pollution danger to the environment [WATERGEN]	2.33 (1.33)	2.36 (1.37)	-.03
Water pollution danger to my family [WATERFAM]	3.69 (.95)	3.75 (1.05)	-.06
Greenhouse effect danger to environment [TEMPGEN]	3.18 (1.45)	2.86 (1.45)	.32**
Greenhouse effect danger to my family [TEMPFAM]	3.30 (1.03)	3.50 (1.04)	-.20**
N (2,233 total)	2,084	149	

Note: ***$p < .01$; **$p < .05$ significance.

Table 2. Discriminant Analysis of Risk Perception among Native-Born and Foreign-Born Respondents

Discriminant Variables	SDFC (Within Group Corr.)	Fisher's Coefficients. G1	G2	Wilks' Lambda	F-Ratio	Sig.
Car pollution danger to environment [CARSGEN]	.316 (- .148)	-1.488	-1.362	1.000	.862	.353
Car pollution danger to my family [CARSFAM]	-.184 (- .348)	7.611	7.538	.998	4.778	.029**
Car pollution induced illness will increase in next 10 years [CARSTEN]	.214 (.449)	5.801	5.915	.996	7.968	.005***
Nuke power danger to environment [NUKEGEN]	.466 (.744)	8.058	8.297	.989	23.736	.000***
Nuke power danger to my family [NUKEFAM]	.172 (.744)	-6.406	-6.322	.990	21.824	.000***
Industrial air pollution danger to environment [INDUSGEN]	.058 (-.377)	6.800	6.824	.997	5.608	.018**
Industrial air pollution danger to my family [INDUSFAM]	.206 (.504)	10.955	11.074	.996	10.019	.002***
Pesticides danger to environment [CHEMGEN]	-.227 (-.536)	10.707	10.616	.995	11.325	.001***
Pesticides danger to my family [CHEMFAM]	.205 (.561)	14.140	14.260	.994	12.440	.000***
Water pollution danger to environment [WATERGEN]	.377 (.033)	3.355	3.506	1.000	.042	.837
Water pollution danger to my family [WATERFAM]	-.285 (.114)	7.382	7.224	1.000	.513	.474
Greenhouse effect danger to environment [TEMPGEN]	-.471 (-.412)	10.560	10.388	.997	6.691	.010**
Greenhouse effect danger to my family [TEMPFAM]	-.260 (.368)	13.770	13.636	.998	5.337	.021**
Fisher's Constant	-149.833	-153.592				

Group Centroids:		
G1 (Native-Born)	-.003	
G2 (Foreign-Born)	.497	
Canonical Correlation (CCr)	.132	
CCr^2	.017	
Eigenvalue	.018	
Wilks' Lambda	.983	
Chi Square (df = 13)	39.012***	
N (2,233 total)	2,084	149

Note: ***p < .01; **p < .05; *p < .10 significance. N =2233; Mean Diff. = mean difference; SDFC = Standardized Discriminant Function Coefficients. 93.3% of original grouped cases are correctly classified.

= .561, p < .01). Fishers' coefficients indicating the strength of each item in predicting group membership are also displayed in the table. The results clearly support the first hypothesis (H_1) as the foreign-born group exhibited higher risk perception than their native-born counterparts. The values of Wilks' lambda of 1.00 for three items indicates there is no statistically significant difference between the two groups on these items.

In Table 3, the means and standard deviations of respondents' scores on measures of trust in major sources of information about environmental risks are presented. In all the items, foreign-born respondents are generally more skeptical about sources of information concerning environmental risks. The results of MDA in Table 4 further show the trust items with significant discriminating power between the two groups as: trust in government for pollution information [INFOGOVT], trust in mass media (i.e., newspapers, radios, and television) and trust in universities for pollution information [INFOCOL]. Foreign-born respondents appear to be more trusting of information from universities relative to any other social institutions. They are less trusting of the government, environmental groups, and newspapers when it comes to information on environmental risks. The group centroids, canonical correlation, eigenvalue, model's Wilks' lamda and chi-square are also shown in the table, suggesting significant disparity between the two groups in the model.

In keeping with previous findings in the literature, the present results show that significant cultural gaps exist in the perception of risks (see Boholm 1998; Vaughan and Nordenstam 1991). The results in Tables 1 to 4 show that foreign-born U.S. residents are more risk averse on most of these items than their native-born counterparts, thus supporting H_1.[11] These findings are consistent with previous studies (e.g., see Flynn et al. 1994; Finucane et al. 2000). The group centroid for each discriminant model in the tables suggests that significant disparity exists between the two groups along various dimensions of risk perceptions and attitudes toward ecological and technological risks. In addition to SDFCs, the Fishers' function coefficients, group centroids, canonical correlation, eigenvalue, model's Wilks' lambda (.968) and chi-

Table 3. Means, Mean Difference, and Standard Deviations of Respondents Scores on Trust in Major Sources of Information on Environmental Risks*

Discriminant Variables	Native-Born Means (Std. Dev.)	Foreign-Born Means (Std. Dev.)	Mean Difference
Trust business for pollution information [INFOBIZ]	2.40 (.911)	2.51 (.970)	-.11
Trust environmental groups for pollution information [INFOGRN]	3.36 (1.003)	3.68 (.896)	-.32
Trust government for pollution information [INFOGOVT]	2.77 (.893)	3.27 (.907)	-.50
Trust newspapers for pollution information [INFONEWS]	2.89 (.904)	3.26 (.960)	-.37
Trust radio or TV for pollution information [INFOTV]	2.92 (.889)	2.96 (.896)	-.04
Trust universities for pollution information [INFOCOL]	2.31 (.928)	2.02 (.878)	.29
N	982	97	

*In the GSS/ISSP data, respondents were asked: How much trust do you have in each of the following to give you correct causes of pollution, would you say a great deal (1), quite a lot (2), some trust (3), not much trust (4), or hardly any trust (5)

square (35.33, df = 13) all suggest significant difference between native-born and foreign-born respondents on measures of trust in sources of information on environmental hazards.

Discussion and Conclusion

The primary aim of this study was to assess the extent to which foreign-born and native-born segments of the U.S. population concord or diverge on various dimensions of environmental risk perceptions, attitudes toward ecological risks, and trust in sources of information about environmental risks. The two hypotheses tested with a nationally representative data-set employed in MDA, H_1: on differential risk perception between native-born and foreign-born residents and H_2: on group differences in trust both received significant empirical support.

While people of different cultural backgrounds may share similar views and behavioral orientations toward certain aspects of the environment, immigrants remain unique in terms of what they consider to be salient environmental risk issues. Their cognized environment is fundamentally different from that of native-born, predominately white respon-

Table 4. Discriminant Analysis of Native-Born and Foreign-Born Scores on Trust in Major Sources of Information on Environmental Risks

Discriminant Variables	SDFC (Within Group r)	Fisher's Coefficient G1	G2	Wilks'	F Ratio Sig.	Lamda
Trust business for pollution information [INFOBIZ]	-.117 (.183)	1.192	1.110	.999	1.204	.273
Trust environmental groups for pollution information [INFOGRN]	.098 (.510)	4.967	5.029	.991	9.377	.002***
Trust govt. for pollution information [INFOGOVT]	.704 (.867)	2.633	3.136	.975	27.059	.000***
Trust newspapers for pollution info. [INFONEWS]	-.068 (.629)	1.927	1.880	.987	14.267	.000***
Trust radio or TV for pollution info. [INFOTV]	.542 (.774)	2.480	2.870	.980	21.597	.000***
Trust universities for pollution info. [INFOCOL]	.033 (-.488)	8.232	8.254	.992	8.573	.003***
Fisher's Constant		-30.018	-32.686			
Group Centroids: G1 (Native-Born) -.005; G2 (Foreign-Born) .581						
Canonical Correlation (CCr) CCr2 .032; Eigenvalue .033; Wilks' Lambda .968; Chi Square (df = 13) 35.327***; N = 1,079						

*Note: ***p < .01; **p < .05

dents. Toxic waste and lead exposure issues, industrial air pollution effects on family members, nuclear wastes, pesticides' and carcinogens' threat to human health, and the perception of de facto discrimination accounting for disproportionate exposures of immigrants and other minorities to environmental hazards shape their risk perception and attitudes toward sources of information about ecological risks. The present findings, while consistent with those reported earlier in the literature especially by Vaughan and Nordestam (1991), Parker and McDonough (1999), Thiele (1999), Uyeki and Holland (2000), Finucane et al. (2000), and Adeola (2004b), extend these earlier works by opening new areas of inquiry concerning the degree of cultural variation in risk attitudes among different subgroups especially by nativity in the United States. Given the small percentage of variance explained (CCr^2) for all the MDAs performed in this analysis, however, there are numerous factors yet to be explored in order to fully account for group differences and orientation towards technological and ecological risks.

It is particularly interesting to note that both groups have a common ground when it comes to risk items such as: car pollution danger to the environment, water pollution danger to my family, and water pollution danger to the environment, with calculated Wilks' lambda of 1.00. This is understandable given the fact that risks are ubiquitous in today's society. Thus, the results in Tables 1 and 2 also suggest some degree of commonality in public opinions, perceptions and attitudes toward ecological and technological risks.

As aforementioned, our ontological security and faith in science and technology have been brought to question by a number of recent catastrophic events widely publicized by the mass media. These common experiences notwithstanding, significant sub-cultural differences persist in attitudes and perception of risk items such as: car pollution induced illnesses will increase in the next 10 years [CARSTEN], nuke power danger to the environment [NUKEGEN], nuke danger to my family [NUKEFAM], industrial air pollution danger to my family [INDUSFAM], pesticides danger to the environment [CHEMGEN], pesticides danger to my family [CHEMFAM], greenhouse effect danger to the environment [TEMPGEN], and greenhouse effect danger to my family [TEMPFAM], which all support H_1. The corollary hypothesis suggesting that voluntary acculturation among immigrants may bring about attitudes and risk perception similarity to native-born population is not supported. The differences found in the present analysis seem consistent with Douglas and Wildavsky's (1982) cultural theory of risk. Immigrants and other minorities are particularly suspicious of the extent to which they are disproportionately exposed or burdened by these types of risks. Alienation, political distrust, and perceived objective and subjective victimization are among the factors associated with higher risk perception among minority groups in the U.S. (see Kowalewski and Porter 1993; Bullard 1990; 2000).

The present findings have important methodological, theoretical, and policy implications. This endeavor represents the first attempt to employ discriminant analysis to assessing native-born and foreign-born differentials and similarities on a wide array of measures of risk perception and attitudes about trust in sources of information on ecological risks in the United States. Also, the nationwide GSS/ISSP probability data with large sample size employed in this study make generalization of the results of the analyses quite possible. Thus, across the U.S., sensitivity to ecological and technological risks are found among various groups. However, due to differential cultural backgrounds and social experiences, a significant dissimilarity exists between native-born and foreign-born groups when it comes to risk perception and the issue of which institution or social organization to trust, as suggested by Vaughan and Nordenstam (1991), Flynn et al. (1994), Finucane et al. (2000). Limited sampling of foreign-born relative to native-born population restricts analysis of sub-cultural variation in risk perception and trust by immigrants' national origins. Although the U.S. Bureau of the Census provides official statistics on countries of origin of immigrants in the U.S., it remains a challenge for survey research to get adequate sampling of foreign-born residents of the U.S. by nativity and geographical regions.

It is especially crucial to understand the cognized environment and the structure of environmentalism of different social groups as conditioned by unique socio-cultural, historical, and contextual factors in society. By doing so, we can better understand the environmental concerns and risk perception among each group and respond to these with appropriate policies and programs. Understanding the structure of risk perception, attitudes toward risks, and trust in social institutions are particularly germane to risk communication among different groups in the country. Methodologically, this study suggests the need to incorporate multi-cultural factors in the conceptualization and measurement of risk perception and trust among diverse population. The socio-cultural and contextual factors associated with disproportionate exposure to environmental hazards and other types of risk are critical to our understanding of variation in risk perception.

Endnotes

1. An earlier version of this work was presented at the Annual Meeting of the Mid-South Sociological Association, Biloxi, Mississippi (October 20 - 23, 2004).
2. Author to whom correspondence should be directed:
   E-mail: fadeola@uno.edu
3. The U.S. Census Bureau Current Population Survey Reports (2003, 2004) based its estimates on responses from a sample of the popula-

tion. Data reported were tested and found statistically significant at the 90% confidence level. The Census Bureau defines foreign-born as those who were not U.S. citizens at birth. Native-born are those who were born in the United States or a U.S. Island Area such as Puerto Rico or born abroad of at least one parent who was a U.S. citizen.

4. In 2002, 16.6% of the foreign-born were living below the official poverty level relative to 11.5% of native-born (for foreign-born non-citizen, the poverty rate was 21.7%); unemployment rate among the foreign-born was 7.5 compared with 6.2 for the native-born; more than two-fifths (44.4%) of the foreign-born lived in a central city in a metropolitan area relative to slightly more than one quarter (26.9%) of the native-born population. In terms of occupation, foreign-born were more represented in low-skilled service occupations (23.3%) than their native-born counterparts (14.9%) (see Larsen 2004; U.S. Census Bureau 2003, 2004).
5. Acculturation refers to the modification of one's culture based on the acceptance of new cultural elements from a more advanced culture as a result of prolonged contact. Thus, acculturation represents a major catalyst for immigrants' assimilation.
6. For a complete explanation of sampling techniques, data processing and coding, see the GSS cumulative codebook by Davis and Smith (1996, 1998). Appendix A of the codebook provides detailed description of the sample design.
7. For a detailed explanation of "native-born and foreign-born," please refer to Davis and Smith (1996, 1998) and Davis et al. (2003). Respondents were basically asked to indicate whether they were born in the United States or in foreign country.
8. Fisher's coefficient is a linear combination of variables which maximizes group differences while minimizing variation within the groups.
9. The equation for computing standardized discriminant function is:

   $$Di = d_{i1z1} + d_{i2z2} + ... + d_{ikzk}$$

   Where:

   D_i is the standardized score on the *i*th discriminant function; z is the standardized score on each predictor; and d_i is the standardized discriminant function coefficient. The standardized coefficients are useful because they help us to determine which variables contribute most to determining scores on the function; the larger the magnitude, the greater the variable's contribution.
10. Canonical discriminant function is a linear combination of the discriminating variables which are formed by satisfying certain conditions. The mathematical equation for its derivation is:

    $$CDF_{km} = U_0 + U_1X_{1km} + U_2X_{2km} + ... + U_pX_{pkm}$$

    Where:

    CDF_{km} is the score on the canonical discriminant function for m in the group k; X_{ikm} is the value on discriminating variable X_i for case m in group k; and U_i represents the coefficients which produced the desired characteristics in the function (see Klecka 1982).
11. The only exception found in a separate analysis not reported here is among the native-born Blacks who exhibit similar risk perceptions and lack of trust in the system as foreign-born group.

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