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Asian Disease Problem Applied to Climate Change: A Study of the Impact of Framing Risk Preferences Driven by Socio-Economic Indicators for Climate-Change-Related Risks

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Abstract: The Asian disease problem has long been studied since first introduced by Tversky and Kahneman in 1981. This study explores the mechanics of the Asian disease problem to a scenario reflecting deaths attributed to climate change. The study examines the gain/loss frame setup of the Asian disease problem. To research the Asian disease problem, in partnership with a Qualtrics panel, we surveyed 1209 customers of Utah utilities. Through statistical tests on the survey data, we confirmed the existence of the gain/loss framing effect. Moreover, the framing effect held when separating and examining responses based on unique socio-economic characteristics (i.e., age, gender, race, marital status, income, educational attainment, political preference, living status, household size, years at current residence, and energy-saving preference). In short, like the original Asian disease problem, the framing impact varied regardless of the characteristic studied. Based on these findings, we recommend implementing the framing effects of the Asian disease problem to an expanded realm for energy- and climate-related programs, initiatives, and academic research. We believe that this framing could spur action to mitigate climate change. Moreover, we recommend an expanded empirical study of the Asian disease problem to novel and understudied realms beyond our focus area.

Keywords: socio-economic factors and risk tolerance; prospect theory; prospect theory and climate change; Asian disease problem; risk tolerance; energy economics; framing impacts; climate change mitigation; Utah energy study; climate change; energy policy

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1. Introduction

The United Nations reports that "climate change is the defining issue of our time and we are at a defining moment" [1]. The consumption and generation of energy are of paramount concern to the public, policymakers, scientists, and private business interests. Energy is a sizeable share of the United States economy, estimated at 5.8 percent of gross domestic product [2]. Climate change's impact stems as a pervasive but seemingly invisible threat, whereby in contemporary life, it may not be currently perceived. Still, as climate change is of paramount concern, understanding the role of decisions in conjunction with decision theory can ameliorate its impacts.

Von Neumann and Morgenstern's [3] Expected Utility Theory explains how rational agents make choices. In economic terms, Expected Utility Theory remains the gold standard for how decisions should be made in the face of risk. Expected Utility Theory presents how to rationally choose when unsure which outcome will result from one's actions. The overall goal aims to choose the action with the highest expected utility with an emphasis on risk aversion for decision-making. In the economic context, homo economicus, or "rational person", weighs each option and makes a value-maximizing decision. The tenets

of expected theory have been applied to multiple fields, such as international relations in assessing state behavior [4] or in finance with the Efficient Market Hypothesis [5]. The Expected Utility Theory could even be applied to energy when buying an energy-efficient appliance that involves risks of a fixed upfront cost with the promise of energy savings in return. However, those savings amounts are unknown [6].

In contrast to the Expected Utility Theory, Kahneman and Tversky [7] present an alternative theory to address empirical violations found with rational decision making. Prospect Theory posits that welfare change from gains and losses is evaluated concerning a reference point, usually the status quo. This theory stems from experiments conducted in the 1970s revealing that people fail to make decisions based on expected-utility theories of economics. Moreover, "people normally perceive outcomes as gains and losses, rather than as final states of wealth or welfare" ([7], p. 28).

Prospect Theory suggests consumers are risk averse with respect to gains and risk seeking with regard to losses, resulting in a welfare change that is much greater from a loss than from an expected gain of comparable magnitude. In this regard, decisionmakers are risk averse when they are content or satisfied with their situation and risk seeking when they are dissatisfied with their situation [8]. This situation can lead to loss aversion, anchoring, status quo bias, and other anomalous behavior [9]. Prospect Theory is foundational to behavioral economics and establishes a critical experimental methodology within economics. It has also been widely studied, such as in international relations describing foreign policy decisions (i.e., [10]).

In the context of climate change, Kunreuther et al. [11] argue that loss aversion should motivate more action than would be undertaken using a rational choice model. Still, in the realm of energy-efficiency investments, scholars argue that a gap exists between the observable and some notion of optimized energy consumption. Behavioral biases in individual decision making may contribute to this gap [12]. Furthermore, while energy-efficient investments "seem to present clear economic and environmental advantages, the level of investment in them does not reach the levels which would correspond to such benefits" [13], suggesting that risk assessment on the part of decision makers may have undue influence on the collective investment.

Perhaps a little too close to home, given the 2020 widespread devastation of the COVID-19 crisis in the United States and around the world, Tversky and Kahneman's [14] widely cited Asian disease survey provides an empirical example of the influence of framing in a respondent's decision. Therein, respondents are asked to choose a policy alternative that combats the outbreak of a dangerous new illness that infected 600 people. To study this survey, Tversky and Kahneman divide the respondents into two response groups, whereby participants make a binary choice between one alternative with a risky outcome with the frame manipulated by the reference point. The outcomes are framed in two distinct ways: gains (promoting risk-averse behavior) or losses (facilitating risk seeking behavior). The scenario from Tversky and Kahneman's research follows:

Scenario: Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

If Program A is adopted, 200 people will be saved.

If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved. Which of the two Programs would you favor?

In the second group of respondents, instead of Programs A and B, two alternative Programs were given with the scenario being the same.

If Program C is adopted, 400 people will die.

If Program D is adopted, there is 1/3 probability that nobody will die, and 2/3 probability that 600 people will die.

In Tversky and Kahneman's study, which stands as an empirical basis for Prospect Theory, the absolute effect of each program scenario remains constant throughout the

experiment—200 individuals were saved while 400 died. Additionally, the expected utility of the second group was also consistent—200 individuals are saved, while 400 died. Nonetheless, in the second group, an element of risk is introduced.

Despite the equivalency of the options presented in Tversky and Kahneman's study [14], 72% of respondents who received choice set 1 selected Program A (safe option) when the problem was framed as gains, while 78% of individuals in the second group who were given set 2 chose Program D (risky option) when the program was framed as a loss. In this regard, when the choices were framed in terms of saving individuals (choice set 1), subjects were risk averse and settled for saving 200 people rather than accepting a 33% chance of saving all 600 with Program B. In contrast, as options were framed in terms of people dying as was the case in choice set 2, respondents were more willing to choose the riskier Policy B, which again, had a 33% chance of saving all 600, but a 67% chance of losing all 600, as opposed to the certain loss of 400 individuals that came with Policy A.

While the Asian disease problem shows the merits of framing, Expected Utility Theory's invariance assumption argues that varying choice presentation should yield the same preference order regardless of its framing [15]. In this regard, framing does not impact choices, preferences, or individual decisions. Theoretically, the decision is independent of the frames; how the question or the situation is framed does not affect behavior, decision, or preferences.

Notably, this Tversky and Kahneman's framing observation held constant even among university professors and physicians, despite expectations that these groups may be less susceptible to the effects of framing [16]. This result represents a general tendency for people to be risk averse when exposed to gains (survival) and risk seeking when exposed to losses (mortality) format. Li and Xie [17] note that the Asian disease study has triggered multiple studies, including those in applied realms. For example, this framing effect has been tested in various realms such as cancer treatment, jobs, taxes, military decisionmakers [18], health behaviors during pandemics [19], product desirability [20] and financial planning [21]. Framing choices have been available for both real and hypothetical decisions [22]. Still, not every scholar who looks for framing effects finds them (i.e., [23]).

Heutel [6] writes about Prospect Theory and energy efficiency. Heutel ([6], p. 236) notes that the "choice over energy efficient investments, like buying an energy-efficient car or appliance, involves risk". As with nearly any household purchase, the act of acquiring these energy-efficient appliances and household improvement purchases involves a fixed upfront cost along with some future promise of energy savings, while the amount of those savings is unknown. Greene [24] offers an explanation that the concept of loss aversion can elucidate the "energy efficiency gap", where individuals appear to neglect ostensibly cost-effective efficiency investments [25]. Through the incorporation of the dimension of risk weighting into the gain/loss framing, Tversky and Kahneman introduced Cumulative Prospect Theory [26]. Moreover, Heutel [6], p. 239) contends that at the time of his paper, "little is known about whether consumers' choices over energy efficiency are explained by Prospect Theory, nor about how policy can be designed if this is the case," suggesting a further opportunity to explore this relationship.

Prospect Theory founder Kahneman [27] concedes that Prospect Theory faces weaknesses in describing behavior. Prospect Theory fails to consider disappointment and regret. Nonetheless, Kahneman [27] remarks that model predictions of disappointment and regret are no better than Prospect Theory. Rossiter [28] explores weaknesses of Prospect Theory, contending that Prospect Theory depends entirely on the concept of loss aversion.

Moreover, the idea that decisionmakers weigh losses more heavily than equivalent gains stands as an illustration of loss aversion but, in the same manner, consists of the two main Prospect Theory principles. For instance, the "certainty effect for gains" can be expressed in the popular proverb "a bird in the hand is worth two in the bush". Furthermore, the "probabilistic effect for losses" can be seen as following from loss aversion in that decisionmakers are averse to subjecting themselves to a seemingly certain loss and will proverbially "grasp at straws" or take any chance in the hope of avoiding such a loss

(Rossiter, [28], p. 400). In this regard, the concept of loss aversion to skeptics is neither new or novel, but rather just a different nomenclature or term that has long since been known and described in literature as "negativity bias" [29]. Moreover, Rossiter [28] argues that Prospect Theory fails to adequately apply to complex real-world decisions.

Prospect Theory's narrow focus on framing raises several ethical concerns. Positive framing could be unethical in high-involvement consumer marketing. In a similar vein, negative framing could be unethical in social marketing. McDermott [30], p. 304) notes that rational choice theorists and others criticize Prospect Theory on the grounds of lacking a theory of framing effects. While this criticism may be legitimate, McDermott ([30], p. 304) contends that this limitation is still similar to the lack of a theory regarding the origins of preferences in a rational choice model.

2. Research Question

This paper will contribute to the existing body of literature by applying the Asian disease example to energy choices in the realm of climate change. Through this inquiry, the paper seeks to gain insights on the impacts of framing in decision theory on a topic with far reaching impacts that may be perceived as in the distant future. Thus, it is conceivable that with the appropriate framing on climate change, it may motivate greater action on the part of private and public enterprises. The application of Prospect Theory to climate change and energy policy seems to be limited [31]. In this scenario, the paper modifies the original Asian disease scenario with binary choices and consistent mathematical applications from Tverksy and Kahheman. The study explores gains and losses as lives saved/lost as a result of climate change related impacts.

While previous studies on the Asian disease problem assess respondents on the same characteristics, our study seeks to further refine the effects on framing in certain socio-economic factors. We investigate this research question in light of the applied Asian disease scenario through a state-wide survey of 1209 respondents who were assessed based on age, gender, household income, etc. Through our work, we hypothesize that positive (vs. negative) framing decreases respondents' likelihood to consider risk-seeking (vs. risk-averse) decisions, regardless of climate change's impact type (real vs. hypothetical).

3. Materials and Methods

Data collection for this study was contracted through a commercial survey sampling and administration company, Qualtrics. Qualtrics uses its panel aggregator to recruit online panel participants for internet-based surveys. This aggregator provides clients access to members of various market research panels and through digital fingerprinting technology and IP address checks, ensures that participants' data are as valid and reliable as possible. For this reason, Qualtrics is commonly used for academic research in broad academic explorations such as an analysis of firearm owners [32], a study of people of color experiencing psychedelic experiences [33], and sexual harassment at work since the #MeToo movement [34].

This research received Institutional Review Board approval at the University of Utah. A grant from the University of Utah Sustainable Campus Initiative Fund supported the funding for this research. This survey conducted 1209 responses from adult utility customers currently residing in Utah. Utah was selected due to its unique diversity with significant opportunities for a well-rounded test market, its high growth rate relative to the rest of the United States, its relative conservative slant compared to the rest of the United States, and to present results more salient and applicable to this survey sponsor, the University of Utah Sustainable Campus Initiative Fund. While, for some, our sample selection may lack external generalizability, our survey responses are derived from appropriate grant funding; nonetheless, with the quotas and insights established to mirror the state of Utah, we believe that our insights reflect closer to the general United States than otherwise may be considered on the surface. Moreover, our results offer valuable insights that can be applied to further contribute to the literature and discussion on the tenants

Prospect Theory as explored through the experiment of the Asian disease problem applied to climate change.

Once the survey parameters were put into place, Qualtrics recruited panel participants via email. These individuals were invited to participate in the study by clicking on a link to screening questions that assess eligibility. These participants were targeted by certain profiling attributes; for this study, respondent data were based on resident location (Utah), age (at least 18 years or older), utility customer, and a commitment to provide the highest quality responses requirements.

At the beginning of the survey, respondents were asked three filtering questions to ensure the highest quality responses based on the targeted group of interest. First, the respondent was asked if they lived in the state of Utah or not. Second, if the respondent was in charge of the electric or natural gas utility bill. Third, if they were over the age of 18. Fourth, if they were committed to providing the highest quality responses. Respondents who failed to agree to meet any of the above screening questions were excluded from the study and omitted from the analysis.

Qualtrics initially gathered 1209 responses. Through Qualtrics' scrubbing based on filtering criteria and our own scrubbing procedures that included identifying and removing incomplete responses/outliers, a total of 1021 respondents were presented as the final group for analysis. The survey embodied a cross-sectional survey. The responses for the survey were collected between 11 July and 4 September 2022.

To further analyze the Asian disease problem, framing effects were analyzed on the entire sample group of respondents and according to demographic. Demographics used in this study include age, electric and gas utility, gender, marital status, race/ethnicity, annual household income, living status, number of years at current residence, number of people living in respondent's home, political preference, and energy efficiency preferences.

4. Methods

Druckman [35] explains two approaches to evaluating the Asian disease problem. The first, described as the unidirectional approach, examines the comparison between participants in the risk-averse/risk-seeking alternative in the positively framed/survival format to those in the risk-averse/risk-seeking alternative in the negatively framed/mortality format [35].

The second approach, or the bidirectional approach, investigates if (1) risk-averse choices predominant for the gains format and (2) risk-seeking choices are predominant for the losses format [36]. This necessitates for more than a risk neutral of 50% opting for a risk-averse alternative and fewer than 50% opting for risk aversity in the loss format.

Conversely, more recent approaches for conducting analysis included a chi-square test and the statistical difference of two proportions test (i.e., [18]). These tests examine the null hypothesis of independence between two variables and compare it with a 95% confidence level. If by using both tests, the results are proven statistically dependent, we will reject the null hypothesis that framing effect is independent of respondent's risk seeking and risk averse choices.

The chi-square test is a statistical hypothesis test that compares observed frequencies with expected frequencies. Considering the inclusion of two or more variables, the chi-square test of independence was used to analyze both survival versus mortality choices in positive and negative frames. In calculating a chi-square test, a test statistic and subsequent p value are generated based off of the difference between expected and observed frequencies. When this difference results in a test statistic higher than the critical value of 1.96 for a 95% confidence interval, we reject the null hypothesis and state that survival versus mortality frames are dependent on positively versus negatively framed questions.

The difference of proportions test is analogous to a difference-of-means test except that it applies to the case of two proportions from two samples or conditions (Blalock, [37], pp. 232–233). The difference of proportions test indicates that the difference between the two formats is highly significant ($z = 5.54$, $p < 0.05$). Moreover, both the survival format

and the mortality format results significantly differ from 50% in the expected directions ($\lambda 21 = 9.06$, $p < 0.05$; $\lambda 21 = 23.41$, $p < 0.05$, respectively). In this analysis, a chi-square critical value of 1.96 and a corresponding p value of 0.05 will be used to assess statistical independence for each variable under examination in this study.

To test the Asian disease problem as it relates to climate change, questions were designed to mirror the Asian disease problem but were reworded and refocused on the consequence of death as a result of climate change. This adjustment requires the respondent to process potential impacts of climate change and decisions that can alter the outcomes. This test was conducted using randomization whereby some survey respondents received positively framed question set 1 while the remaining survey respondents received negatively framed question set 2. To examine Prospect Theory, this survey was designed using A/B testing, with each question set as a gain or loss, presented to the respondent as shown below.

Please consider the following scenario and identify your selection.

Imagine that the U.S. is preparing to mitigate climate change. The long-term effects of climate change are expected to kill 9,000,000 people. Two alternative programs to combat climate change have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows (without the "Certain Option" and "Risky Option" labels):

Gain Frame:

If Program A is adopted, 3,000,000 people will be saved. (Certain Option).

If Program B is adopted, there is 1/3 probability that 9,000,000 people will be saved, and 2/3 probability that no people will be saved. (Risky Option).

Please choose an option (Certain Option or Risky Option), and in a few sentences, explain your choice.

Loss Frame:

If Program A is adopted 6,000,000 people will die. (Certain Option).

If Program B is adopted there is 1/3 probability that nobody will die, and 2/3 probability that 9,000,000 people will die. (Risky Option).

Please choose an option (Certain Option or Risky Option) and in a few sentences, explain your choice.

Mathematically, the equivalency in the altered questions is the same as the Asian disease problem but adjusted in millions to more accurately reflect a perceived impact based on those throughout the United States. With this survey specifically, we take a deep dive on this phenomenon in relation to demographic and psychographic groups from survey population, including age, gender, marital status, income stratification, educational obtainment, political orientation, ethnicity/race, etc.

5. Results

In order to examine Asian disease problem and framing effects, the data were processed by totaling the number of respondents in each of the four option categories: those who chose certain versus risky options in the gain frame and those who chose certain versus risky options in the loss frame. This was first performed for the collective group as a whole and then according to the demographic attributes under study.

5.1. Collective Sample

As a collective sample, the number of respondents who elected for risk aversion in the positive frame versus risk seeking in the negative frame were 444 and 345, respectively (see Figure 1). When conducting the chi-square test, one would expect the values to be 305 and 206 in order to prove independence. However, the differences were so large that it resulted in a test statistic of 17.41, much higher than our critical value of 1.96.

Question Set	Format		Total
	Survival	Mortality	
Positive frame	444	74	518
Negative frame	158	345	503
Total	602	419	1021

Figure 1. Collective sample results.

According to the conducted difference of two proportions test, the same results were discovered with a p value of 0. We conclude that at a 95% level of confidence, both tests demonstrate a relationship between respondent's choices in a survival versus negative format when framed positively versus negatively.

5.2. Age

We next observed the impact of age on the mortality versus survival format. Upon completion of our study, the survey sample encompassed respondents whose ages range from 18 to 83 years of age. To perform our analysis, we stratified respondents into four distinct quartiles of less than 30 years of age, 30 to 38, 39 to 52, and 53 and above (see Figure 2).

Question Set	Interval	Format		Total
		Survival	Mortality	
Positive frame	18–30	122	17	139
	31–39	93	13	106
	40–53	113	26	139
	54+	116	18	134
Negative frame	18–30	34	104	138
	31–39	44	87	131
	40–53	39	75	114
	54+	41	79	120
Total		602	419	1021

Figure 2. Respondent totals by age.

In our difference of two proportions, we observed a p value of 0 for every quartile. In our chi-square test, we observed test statistics of 10.89 for the first quartile, 8.32 for the second, 7.47 for the third, and 8.35 for the fourth. While each quartile is statistically significant in framing effects, the younger (18 to 30 years) quartile has the largest proportional difference. Based on our results, both tests indicate that there is a statistically significant relationship between those choosing a mortality versus survival response when positively or negatively framed.

5.3. Gender

In addition to age, we wanted to observe the effects of gender on respondent's choices. For this variable, respondents within each question set were segregated based off of the two binary genders of male and female. A total of 408 males and 613 females participated in the study. Figure 3 illustrates the results for each question set, format, and gender.

When assessing gender effects, both males and females were assessed separately under the chi-square and difference of two proportions tests. This resulted in a p value of 0 for both genders and a chi-square test statistic of 10.7 for males and 13.7 for females. Under both analytical tests, we can see that there is statistically significant relationship between mortality versus survival choices when positively and negatively framed, regardless of one's gender.

Question Set	Gender	Format		Total
		Survival	Mortality	
Positive frame	Male	177	33	210
	Female	267	41	308
Negative frame	Male	62	136	198
	Female	96	209	305
Total		602	419	1021

Figure 3. Respondent totals by gender.

5.4. Race

Another analysis of respondent decision-making behavior was performed to determine the effect of race. For purposes of this study, respondents were given the following racial category options; White/Caucasian, Asian, Black or African American, Hispanic, and Other. Respondents included in the Other category identified themselves as belonging to two or more racial categories or did not constitute a large enough sample to test, (such as Native Hawaiian or American Indian). Results for this variable can be found in Figure 4.

Question Set	Race	Format		Total
		Survival	Mortality	
Positive frame	White/Caucasion	343	58	401
	Asian	20	2	22
	Black or African American	16	3	19
	Hispanic	47	5	52
	Other	18	6	24
Negative frame	White/Caucasion	127	259	386
	Asian	8	10	18
	Black or African American	2	14	16
	Hispanic	12	37	49
	Other	9	25	34
TOTALS		602	419	1021

Figure 4. Respondent totals by race.

Although the predominate racial category in our analysis was White/Caucasian at 77%, each of the racial categories satisfied the assumptions necessary to perform a chi-square test, (having expected values greater than five, etc.). Similar to our analysis on gender, each of the racial categories were analyzed independently in both tests. In all racial categories, a p value of 0 resulted under the chi-square test. For the difference of two proportions test, z-scores of 14.7 for White, 2.93 for Asian, 4.69 for Black, 6.98 for Hispanic, and 3.64 for Other were observed. Therefore, under both tests, we can conclude that there is statistical significance between the mortality versus survival format when framed positively and negatively irrespective of one's racial category.

5.5. Marital Status

The next characteristic analyzed was marital status. Respondents were asked to identify as either single, partnered, married, divorced, or widowed. The largest differences between survival versus mortality formats occurred when the question was positively framed, with much closer variation present when expressed in a negative frame, see Figure 5.

Question Set	Status	Format		Total
		Survival	Mortality	
Positive frame	Divorced	62	6	68
	Married	232	40	272
	Partnered	32	6	38
	Single	99	20	119
	Widowed	19	2	21
Negative frame	Divorced	20	47	67
	Married	87	169	256
	Partnered	17	32	49
	Single	30	80	110
	Widowed	4	17	21
Total		602	419	1021

Figure 5. Respondent totals by marital status.

When analyzed independently, each marital status category resulted in a p value of 0 under the chi-square test. Under the difference of two proportions test, z-scores of 8.52 for single, 4.58 for partnered, 11.79 for married, 7.31 for divorced, and 5.12 for widowed were observed. In all cases, the statistical significance of framing effect stands regardless of one's marital status.

5.6. Income Stratification

When analyzing framing effect, it is possible that one's income level can have an effect on risk-seeking behavior. To analyze this possibility, respondents were asked to state their approximate annual household income. These incomes were then stratified into four equal quartiles of less than USD 30,000, 31,000–49,000, 50,000–80,000, and 81,000 and above, (see Figure 6). Unlike the other variable tests, this analysis removed 13 income-specific respondent outliers, dropping the sample size from 1021 to 1007.

Question Set	Interval ($k)	Format		Total
		Survival	Mortality	
Positive frame	>30	115	23	138
	31–49	108	21	129
	50–80	119	14	133
	81+	98	12	110
Negative frame	>30	30	86	116
	31–49	39	87	126
	50–80	45	93	138
	81+	43	74	117
Total		597	410	1007

Figure 6. Respondent total by income.

Under the chi-square test, each income level independently returned a p value of 0. In the difference of two proportions tests, z-scores of 9.23, 8.43, 9.45, and 7.89 were observed for quartiles 1, 2, 3, and 4, respectively. This further confirms our previous results of statistical significance in the framing effect but illustrate that one's specific income level does not impact decision-making behavior in this case.

5.7. Educational Obtainment

Another reasonable assumption on decision-making behavior would be the impact of one's educational attainment. To test this assumption, respondents were asked to identify the extent of their academic career, including those with less than high school experience, a high school diploma, some college, an associate's degree, a bachelor's degree, and/or a graduate/doctorate degree, (see Figure 7). Survey respondents were also given an "Other"

category with a prompt to explain their answer, wherein many of them stated trade school or other specialized training unrelated to formal degree attainment.

Question Set	Degree Type	Format		Total
		Survival	Mortality	
Positive frame	Less than high school	11	2	13
	High School	89	18	107
	Some college	119	22	141
	Associate	62	4	66
	Bachelor	119	15	134
	Graduate/Doctorate	37	12	49
	Other	7	1	8
Negative frame	Less than high school	6	9	15
	High School	28	87	115
	Some college	46	92	138
	Associate	17	33	50
	Bachelor	48	86	134
	Graduate/Doctorate	12	36	48
	Other	1	2	3
Total		602	419	1021

Figure 7. Respondent totals by education level.

Under this analysis, all levels produced a chi-square p value of 0 except for those who did not complete high school (0.02) and those in the Other category. Due to the limited sample size of those falling within the Other category (11 respondents) a chi-square test or difference of two proportions test could not be conducted on that rage. The z-scores in the difference of two proportions test include 2.37 for less than high school, 8.9 for those with a high school diploma, 8.53 for those with some college experience, 6.52 for those with an associate's degree, 8.69 for those with a bachelor's degree, and 4.97 for those with a graduate/doctorate degree. Those falling in the graduate/doctorate degree category express the lowest difference between respondents choosing survival versus mortality in both formats, (of those in a positive frame, 75.51% chose survival and 24.49% chose loss; in a negative frame, 25% chose gain and 75% chose loss). Based on our aforementioned critical values, we can conclude that there is statistical significance of framing effect on decision-making behavior without variation among those with differing levels of educational obtainment.

5.8. Political Orientation

Another variable worth consideration is political orientation. Despite Utah being a predominately conservative state, our survey quotas sought to include a diversity of respondents ranging from very conservative to very liberal. Upon survey completion and proper data scrubbing, we were left with a majority of respondents (44%) belonging to the moderate category, (see Figure 8).

In the chi-square test, each political preference category independently returned a p value of 0. The corresponding z-scores from the difference of two proportions test were 4.51 for very conservative, 8.24 for conservative, 11.18 for moderate, 9.27 for liberal, and 3.92 for very liberal. Each category proved statistical significance of framing effects on one's decision-making behavior when positively and negatively framed.

Question Set	Preference	Format		Total
		Survival	Mortality	
Positive frame	Very Conservative	42	10	52
	Conservative	115	26	141
	Moderate	188	28	216
	Liberal	81	6	87
	Very Liberal	18	4	22
Negative frame	Very Conservative	11	24	35
	Conservative	36	83	119
	Moderate	80	153	233
	Liberal	24	65	89
	Very Liberal	7	20	27
Total		602	419	1021

Figure 8. Respondent total by political preference.

5.9. Living Status

Occasionally, individuals may choose to rent rather than own their own property due to liability concerns or income limitations. To account for this possibility, respondents were asked to specify whether they own, rent, or have some other arrangement at their current place of residence. In our survey, 54% of respondents own their own home, 43% rent, and 3% have some other arrangement, (see Figure 9).

Question Set	Arrangement	Format		Total
		Survival	Mortality	
Positive frame	Own	246	42	288
	Rent	184	28	212
	Other	14	4	18
Negative frame	Own	80	184	264
	Rent	67	155	222
	Other	11	6	17
Total		602	419	1021

Figure 9. Respondent totals by living status.

Due to limited sample sizes of those belonging to the "Other" category, neither of the two statistic tests in this analysis could be completed. However, both the "Rent" and "Own" categories (own or rent) returned a p value of 0 and z-scores of 13.00 and 11.9, respectively. Under both the chi-square and difference of two proportions tests, both categories prove statistical significance on framing effects when posed in positive versus negative frames. Therefore, one's current living arrangement does not have an effect on expected decision-making behavior.

5.10. Household Size

Another variable worth considering is a respondent's household size. Whether this be from a large family size or extended family cohabitation, assessing this factor allows us to analyze whether it has any impact on decision-making behavior. To do this, respondents were asked, "Including yourself, how many people live at your home?" These results were then stratified across four quartiles of two or less, three, four, and five or more people. Upon survey completion, 44% of respondents fell within the two or less people category, followed up by those with five or more members at 21%, (see Figure 10).

Similar to the previously assessed variables, each quartile category resulted in p values of 0 under the chi-square test. Under the difference of two proportions test, z-scores for each quartile were 10.78 for two or less people, 7.99 for three, 7.39 for four, and 8.51 for five or more people. As a result, both tests prove there is statistical significance of the framing

effect when presented in a positive versus negative frame, but one's household size has no effect on an individual respondent's decision.

Question Set	Size	Format		Total
		Survival	Mortality	
Positive frame	<2	200	32	232
	2–3'	69	16	85
	3–4'	80	13	93
	5+	95	13	108
Negative frame	<2	79	143	222
	2–3'	17	65	82
	3–4'	28	61	89
	5+	34	76	110
Total		602	419	1021

Figure 10. Respondent total by household size.

5.11. Years at Current Residence

Another attribute considered in our study were the number of years a respondent has spent in their current home. Since our respondents encompassed those from 18 to 83 years of age, our survey sample consisted of respondents in varying life stages and living statuses. Upon survey completion, respondent choices were stratified into four quartiles of two or less years, three to four years, five to nine years, and ten plus years, (see Figure 11). In total, 37% of respondents fall in the first quartile of two or less years, followed closely by the fourth quartile of ten or more years at 25%.

Question Set	Years	Format		Total
		Survival	Mortality	
Positive frame	<2	153	27	180
	3–4'	88	9	97
	5–9'	87	14	101
	10+	116	24	140
Negative frame	<2	56	145	201
	3–4'	29	54	83
	5–9'	30	74	104
	10+	43	72	115
Total		602	419	1021

Figure 11. Respondent total by years in home.

Under the chi-square analysis test, all quartiles independently produced a p-value of 0. Under the difference of two proportions test, accompanying z-scores of 11.25, 7.51, 8.29, and 7.26 were observed in quartiles one through four, respectively. As a result, we can again conclude that there is statistical significance in framing effects, with years spent at one's current residence not deviating from expected decision making behaviors.

5.12. Energy Saving Practices

Our final analysis on framing effects in this survey was based on respondent's energy-saving practices. With some respondents being more energy conscious than others, we wanted to determine whether these preferences influence respondent decisions in a climate change setting. To do this, each respondent was asked, "In the past year, have you taken any actions or changed anything in your household to save energy?" Of the 1021 respondents, 54% said yes, (see Figure 12).

Question Set	Preference	Format		Total
		Survival	Mortality	
Positive frame	Yes	236	46	282
	No	208	28	236
Negative frame	Yes	79	190	269
	No	79	155	234
Total		602	419	1021

Figure 12. Respondent totals by preference.

Upon completion of both the chi-square test and the difference of two proportions test, we were again able to satisfy the statistical significance of framing effects. All respondents regardless of energy saving preferences were susceptible to the framing effect, with neither being more risk adverse than the other. According to the chi-square test, p values of 0 for both responses were calculated along with z-scores of 12.8 for those who said yes and 11.83 for those who said no.

6. Conclusions/Recommendations

The rational model for decision making stands as an "ideal", but when one moves past normative behavior to actual behavior, one often sees that, in practice, the ideal rational model fails to materialize. Tverksy and Kahneman's Prospect Theory argues that rational choice inadequately explains how people make decisions, particularly under conditions of risk [38]. Perhaps even more boldly, in the political realm, scholars Green and Shapiro [39] go so far as to argue that rational choice theory fails to contribute anything to an understanding by not in the least advancing the empirical study.

In thinking about this effort, we explore how framing impact and loss aversion may impact attitudes on climate change and energy efficiency. A decisionmaker is considered "risk averse" if he prefers a safe over a risky prospect of equal or higher expected value and is considered as "risk seeking" if he prefers a risky over a safe prospect of equal or higher expected value [40]. Under the Asian disease problem, a majority of respondents under gains prefer program A, the safe option, and a majority of respondents under losses prefer program D, the risky option, despite these programs being equivalent in terms of their expected value (when presented in a positive frame, the proportion of sample respondents who selected the risk-adverse response was 86% as opposed to 69% electing for risk seeking when posed in a negative frame).

By conducting both a chi-square test and a difference of two proportions test, it could be determined at a 95% confidence level the validity of framing effects on climate change questions. Firstly, a collective analysis was performed on the survey sample. With a resulting p value of 0, signifying a relationship between how the question is framed and a respondent's preference for risk. For more granular results, individual respondent attributes such as age, gender, race, marital status, income, educational attainment, political preference, living status, household size, years at current residence, and energy saving preference variables were also examined.

Upon analysis, each of these aforementioned variables yielded similar results, proving a statistically significant relationship between risk preferences and a positive/negative frame at a 95% confidence level. In other words, when potential solutions to climate change are expressed in terms of saving people, individuals are more likely to be risk averse. When the same potential solution is presented but in a negative context, i.e., if adopted a certain number of people will die, individuals are more risk seeking. Considering that all attributes were statistically significant, one should not expect a respondent with any given age, gender, race, etc., to deviate from this expectation. While some variables expressed greater proportional differences in respondent choices as explained in the Results section, all variables proved statistically significant.

While this study utilizes "Program A" and "Program B" as generalizations of opportunities that could limit the impacts of climate change, the respondent is not faced with the specific responsibilities of carrying out each program. This study specifically focuses on risk perception on the overall effects of climate change and not on the responsibilities associated with implementing specific programs or the consequential deaths that may occur without them. Nevertheless, these results provide a useful framework for those presented with the responsibility of helping the public take initiative for climate-changing behaviors.

Ultimately, the practical implications of such findings can extend to climate change advocates and program administrators at the private, city, state, and national levels. The impact of framing as presented in the Asian disease program frame for a loss/gain can be implemented to render more significant outcomes. Through these findings, we recommend incorporating the framing effects of the Asian disease problem into an expanded realm for climate-related programs, initiatives, and academic research. Moreover, the authors recommend expanded empirical study of the Asian disease to new understudied realms.

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References

1. *Climate Change*; United Nations: New York, NY, USA, 2020.
2. Francis, M. Energy Expenditures per Dollar of GDP Are Highest in Energy-Producing States. Available online: https://www.eia.gov/todayinenergy/detail.php?id=40773 (accessed on 5 April 2022).
3. Von Neumann, J.; Morgenstern, O. *Theory of Games and Economic Behavior*, 2nd ed.; Princeton University Press: Princeton, NJ, USA, 1947.
4. Levy, J. Prospect Theory, Rational Choice, and International Relations. *Int. Stud. Q.* **1997**, *41*, 87–112. [CrossRef]
5. French, E.; Fama, K. Common risk factors in the returns on stocks and bonds. *J. Financ. Econ.* **1993**, *33*, 3–56.
6. Heutel, G. Prospect theory and energy efficiency. *J. Environ. Econ. Manag.* **2019**, *2019*, 236–254. [CrossRef]
7. Kahneman, D.; Tversky, A. Prospect Theory: An Analysis of Decision under Risk. *Econometrica* **1979**, *47*, 263–292. [CrossRef]
8. McDermott, R. *Risk Taking in International Politics: Prospect Theory in American Foreign Policy*; University of Michigan Press: Ann Arbor, MI, USA, 2001.
9. Shogren, J.; Taylor, L. On Behavioral-Environmental Economics. *Rev. Environ. Econ. Policy* **2008**, *2*, 26–44. [CrossRef]
10. Jervis, R. *Perception and Misperception in International Politics*; Princeton University Press: Princeton, NJ, USA, 1976.
11. Kunreuther, H.; Gupta, S.; Bosetti, V.; Cooke, R.; Dutt, V.; Ha-Duong, M.; Held, H.; Llanes-Regueiro, J.; Patt, A.; Shittu, E.; et al. *Integrated Risk and Uncertainty Assessment of Climate Change Response Policies*; Cambridge University Press: Cambridge, UK, 2014.
12. Hackel, B.; Pfosser, S.; Trankler, T. Explaining the Energy Efficiency Gap—Expected Utility Theory v. Cumulative Prospect Theory. *Energy Policy* **2017**, *111*, 414–426. [CrossRef]
13. Linares, P.; Labandeira, X. Energy efficiency Economics and policy. *J. Econ. Survey* **2010**, *1*, 573–592. [CrossRef]
14. Tversky, A.; Kahneman, D. The framing decisions and the psychology of choice. *Science* **1981**, *211*, 453–458. [CrossRef] [PubMed]
15. Arrow, K. Risk Perception In Psychology And Economics. *Econ. Inq.* **1982**, *20*, 1–9. [CrossRef]
16. McNeil, P.; Pauker, S.; Sox, H.; Tversky, A. On the elicitation of preferences for alternative therapies. *N. Engl. J. Med.* **1982**, *306*, 1259–1262. [CrossRef]

17. Li, S.; Xie, X. A New Look At The Asian Disease Problem: A Choice Between The Best Possible Outcomes Or Between The Worst Possible Outcomes? *Think. Reason.* **2006**, *12*, 129–143. [CrossRef]
18. HAEREM, T.; Bård, K.; Bakken, B.; Karlsen, T. Do Military Decision Makers Behave asPredicted by Prospect Theory? *J. Behav. Decis. Mak.* **2011**, *24*, 482–497. [CrossRef]
19. Otterbring, T.; Festila, A.; Folwarcznyc, M. Replication and extension of framing effects to compliance with health behaviors during pandemics. *Saf. Sci.* **2021**, *134*, 105065. [CrossRef]
20. Wadhwa, M.; Kim, J.; Chattopadhyay, A.; Wang, W. Unexpected-Framing Effect: Impact of Framing a Product Benefit as Unexpected on Product Desire. *J. Consum. Res.* **2019**, *46*, 223–245. [CrossRef]
21. Levin, I.; Schneider, S.; Gaeth, G. All frames are not created equal: A typology and critical analysis of framing effects. *Organ. Behav. Hum. Decis. Mak. Process.* **1998**, *76*, 149–188. [CrossRef] [PubMed]
22. Kühberger, A.; Schulte-Mecklenbeck, M.; Perner, J. Framing decisions: Hypothetical and real. *Organ. Behav. Hum. Decis. Processes* **2002**, *89*, 1162–11175. [CrossRef]
23. Bohm, P.; Lind, H. A note on the robustness of a classical framing result. *J. Econ. Psychol.* **1992**, *13*, 355–361. [CrossRef]
24. Greene, D. Uncertainty, loss aversion, and markets for energy efficiency. *Energy Economics* **2011**, *33*, 608–616. [CrossRef]
25. Allcott, H.; Greenstone, M. Is There an Energy Efficiency Gap? *J. Econ. Perspect.* **2012**, *26*, 3–28. [CrossRef]
26. Tversky, A.; Kahneman, D. Advances in prospect theory: Cumulative representation of uncertainty. *J. Risk Uncertain.* **1992**, *5*, 297–323. [CrossRef]
27. Kahneman, D. *Thinking, Fast and Slow*; Farrar, Straus, and Giroux.: New York, NY, USA, 2011.
28. Rossiter, J. A critique of prospect theory and framing with particular reference to consumer decisions. *J. Consum. Behav.* **2019**, *18*, 399–405. [CrossRef]
29. March, D.; Gaernet, L.; Olson, M. In Harm's Way: On Preferential Response to Threatening Stimuli. *Personal. Soc. Psychol.* **2017**, *43*, 1519–1529. [CrossRef]
30. McDermott, R. Prospect Theory in Political Science: Gains and Losses from the First Decade. *Political Psychol.* **2004**, 289–312. [CrossRef]
31. Osberghaus, D. Prospect theory, mitigation and adaptation to climate change. *Econstor* **2013**, *20*, 909–930. [CrossRef]
32. Bryan, C.; Bryan, A.O.; Anestis, M. Associations among exaggerated threat perceptions, suicidal thoughts, and suicidal behaviors in U.S. firearm owners. *J. Psychiatr. Res.* **2020**, *131*, 94–101. [CrossRef] [PubMed]
33. Williams, M.; Davis, A.; Xin, Y.; Sepeda, N.; Grigas, P.; Sinnott, S.; Haeny, A. People of color in North America report improvements in racial trauma and mental health symptoms following psychedelic experiences. *Drugs Educ. Prev. Policy* **2021**, *28*, 215–226. [CrossRef] [PubMed]
34. Johnson, S.; Keplinger, K.; Kirk, J. *Has Sexual Harassment at Work Decreased Since #MeToo?* Harvard Business Review: Brighton, MA, USA, 2019.
35. Druckman, J. Evaluating Framing Effects. *J. Econ. Psychol.* **2001**, *22*, 91–101. [CrossRef]
36. Wang, X. Framing effects: Dynamics and task domains. *Organ. Behav. Hum. Decis. Processes* **1996**, *68*, 145–157. [CrossRef]
37. Blalock, H. *Social Statistics*; McGraw-Hill: New York, NY, USA, 1979.
38. Levy, J. Applications of Prospect Theory to Political Science. *Synthese* **2003**, 215–241. [CrossRef]
39. Green, D.; Shaprio, I. *Pathologies of rational choice theory: A critique of applications in political science.*; Yale University Press: New Haven, CT, USA, 1994.
40. Fox, C.R.; Poldrack, R.A. Prospect theory and the brain. In *Neuroeconomics: Decision Making and the Brain*; Glimcher, I.P.W., Fehr, E.C., Eds.; Academic Press: San Diego, CA, USA, 2009; pp. 145–173.