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Heuristics, biases, and the regulation of risk

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Abstract. Research by cognitive psychologists has led to the identification of systematic deviations from rationality – termed heuristics and biases – in people’s judgment and decision making. These heuristics and biases form the core of behavioral decision theory, a descriptively accurate model of human judgment and choice. This article describes key heuristics and biases and discusses their effects on policy outcomes in the area of risk regulation. Heuristics and biases can affect both the demand for risk regulation by the public, and also the manner in which political actors and institutions choose to manage risk. Analyzing regulatory policy through the interpretive framework of heuristics and biases can help to explain regulatory outcomes considered by rational choice analyses of the public policy process as paradoxes and anomalies. The utility of this interpretive framework is explored through an examination of the origin, persistence, and repeal of the Delaney Clause – a key paradox in the context of risk regulation in the United States.

1. Introduction

In recent years, the regulation of health, safety, and environmental risks in the United States has been the target of substantial criticism. Risk regulation is alleged to be inefficient and counterproductive, because it is driven more by irrational public demands and less by scientific and economic considerations. For example, Stephen Breyer, Associate Justice of the Supreme Court, suggests that a ‘vicious circle’ of counterproductive regulation is set into motion by political responses to public demands (Breyer, 1993). Similarly, Zeckhauser and Viscusi (1996: p. 144) emphasize the need for risk regulatory reform which will enable governments ‘to avoid institutionalizing common irrational responses to risk.’

A prominent example that Breyer uses is the Superfund requirement that hazardous waste site cleanup be 100 percent complete. Diminishing returns typically make the last increments of cleanup substantially costlier than earlier increments. These resources could instead be spent on other risk-reduction projects, since a lower cleanup standard would arguably pose minimal health risks. Therefore, Breyer argues that the regulatory standard of complete cleanup results in a misallocation of resources and thereby leads to a lower level of risk reduction in society. Zeckhauser and Viscusi’s ire is drawn by the same concern for efficiency. They claim that relatively more resources are allocated to highly visible risks such as airline safety and hurricane damage compensation, whereas these resources could have saved more lives if allocated to less visible risks such as highway accidents.

Noll (1996: p. 166) summarizes these critiques of risk regulation by stating that they point to ‘the policy problem [as one of] incoherency and unpredictability in deciding when to regulate a given risk (the prioritization problem) and how rigorous each regulation should be (the consistency problem).’ In these terms, Zeckhauser and Viscusi’s (1996) attack is about prioritization and Breyer’s (1993) is about consistency. According to these authors, the key forces behind these policy problems are the public and its demands for risk regulation and political actors and their supply of risk regulation, which these authors characterize as irrational.

The notion that various political actors – the public and policymakers – are irrational poses an interesting challenge to a variety of analytic models of politics and the policy process which are built on a foundation of rational individual behavior.¹ The authors quoted above all analyze politics and policy from the perspective of rational choice, an approach derived from economics. This approach fundamentally regards people as rational, in the sense that they behave according to the tenets of expected utility theory. Rational choice scholars regard expected utility theory as both normatively appropriate because it leads individuals to maximize their utility, and more importantly, descriptively accurate, because people do behave in this manner. For some reason, in the context of risk regulation it appears that various political actors are behaving irrationally, violating the standards of expected utility theory, and causing suboptimal outcomes to occur.

We argue that a more comprehensive understanding of the paradoxes of risk regulation can be obtained by building on an alternative interpretation of the public’s behavior provided by experimental research in cognitive psychology. This body of research suggest that individuals deviate from the expected utility or rational choice standard of rationality in ways that are ‘persistent and large’ and ‘systematic rather than random’ (Knetsch, 1995: p. 75). This research has led to the development of a more descriptively accurate model of human behavior, broadly labelled behavioral decision theory, which tries to capture the complexity of human judgments and choices. Behavioral decision theory’s findings show that people: (i) use shortcuts when processing information; and (ii) rely on inherent preferences that are significantly different from that assumed in expected utility or rational choice.

The use of shortcuts, or heuristics, is sometimes efficient in that they facilitate judgments without tremendous information-processing costs. However, some judgmental heuristics can lead to inefficient or suboptimal outcomes that people would reject if confronted with a detailed analysis utilizing statistical arguments. When judgmental heuristics lead to suboptimal outcomes, they are termed biases (Camerer, 1995).

However, in the realm of choice, where people have to make decisions rather than arrive at judgments about probabilities, their preferences are significantly different from those considered rational by expected utility theory. This is made clear in prospect theory, a descriptive theory of choice advanced by Kahneman and Tversky (1979) (and a key component of behavioral decision theory). For

example, in striking contrast to expected utility theory which predicts invariance, prospect theory shows that people have different preferences for the same outcomes framed as losses and gains.

In this article we construct an interpretive analysis of risk regulation utilizing the insights of behavioral decision theory. We hope to demonstrate that building from the fundamental premise that people behave as described by behavioral decision theory will enable us to explain the origin and persistence of the inefficiencies and paradoxes that are alleged to be pervasive in the area of risk regulation. Our approach should provide a more realistic understanding of risk regulation and, by extension, the policy process, than is achievable through the rational choice approach.

2. Heuristics, biases, and individual behavior

Political economy scholars have long recognized that people utilize shortcuts when faced with decision-making tasks that require significant processing of information. Indeed, the concept of the Downsian voter (Downs, 1957), who minimizes information costs and uses heuristics such as party identification in the process of voting, is well accepted in even rational choice analysis. Similarly, Simon's (1955) observation that people act in a boundedly rational manner, and satisfice rather than maximize, is well recognized in political scholarship. Both of these perspectives are considered to be within the domain of rational behavior, because people are maximizing their return while minimizing their information search and processing costs.

But utilizing such shortcuts is not necessarily rational if it leads to suboptimal results and lowers a decision maker's utility. This is precisely the finding that emerges from experimental research in cognitive psychology, brought together under the rubric of behavioral decision theory. Behavioral decision theory goes beyond the work of Downs or Simon by demonstrating and delineating the nature of the heuristics which characterize behavior. We consider some of the principal findings of behavioral decision theory and their potential relevance to the policy process below.

Heuristics and biases in judgment

Cognitive psychology has shown that people utilize heuristics both in judgment and choice, and both under conditions of certainty as well as conditions involving uncertainty. Here we highlight only a few of the most prominent heuristics which are the most applicable to the study of political judgment. For each heuristic or bias discussed, we provide a brief definition, an example, and a description of the impact of these decisional shortcuts on people's political judgments.²

The availability heuristic

The availability heuristic states that people ‘assess the frequency of a class or the probability of an event by the ease with which instances or occurrences can be brought to mind’ (Tversky and Kahneman, 1997: p. 1127). In other words, if people can readily think of examples of events, they will inflate their probability estimates of the likelihood of their occurrence.

Example: The availability heuristic affects how people assess the risks associated with different causes of death. People typically rate accidents as causing as many deaths as diseases, even though diseases kill more than ten times as many people. People appear to base their judgments on media coverage, which typically devotes substantially more coverage to accidents than to diseases (Slovic, Fischhoff and Lichtenstein, 1979).

Implications: Availability can lead to erroneous estimates with important public health consequences if people adopt only accident-avoidance measures and pay less attention to disease-prevention measures. In the risk-regulatory context, the availability heuristic can lead people to demand the allocation of more regulatory resources toward the prevention of vivid and available risks, such as airline crashes, rather than toward highway safety, even though the latter costs substantially more lives (Zeckhauser and Viscusi, 1996).

The representativeness heuristic

The representativeness heuristic states that people judge probability or likelihood ‘by the degree to which A is representative of B, that is, by the degree to which A resembles B’ (Tversky and Kahneman, 1974: p. 1124). For example, people ascribe characteristics to groups or subgroups based on their experiences with or perceptions of members of a group (Tversky and Kahneman, 1982). When an individual’s experiences with members of a population are not representative of that population, the individual might incorrectly ascribe the characteristic to the entire population. Another instance of the use of the representativeness heuristic arises when people believe that some sequence of events is more likely because it seems more believable than another sequence of events. The representativeness heuristic leads people to ignore base-rates, regression toward the mean, and conjunction probabilities.

Example: Tversky and Kahneman (1983) conducted an experiment where subjects rated the probability of ‘a massive flood somewhere in North America in 1989, in which 1,000 people drown’ as being lower than the probability of ‘an earthquake in California sometime in 1989, causing a flood in which more than 1,000 people drown.’ The introduction of the California earthquake possibility made the latter sequence of events more believable, and seemingly more representative of potential real world events. However, since the latter sequence of events is a subset of the former, the subjects’ judgments violate the logic of conjunction probabilities, and demonstrate the workings of the representativeness heuristic.

Implications: Working in tandem with the availability heuristic, the use of the representativeness heuristic suggests that people can be readily persuaded

that a few examples of unfortunate results are an adequate representation of a policy's overall performance. Presenting a sequence of inferences which seem believable may persuade people towards such conclusions. This could lead to support for an unwarranted overhaul of the policy. The representativeness heuristic could also affect people's willingness to support risk management policies, e.g., flood risk-reduction measures, if the adduced sequence of future events leading to such disasters does not seem believable.

Hindsight bias

The hindsight bias states that people retrospectively change their estimates of the likelihood of events and outcomes after they are known (Fischhoff, 1975; 1982). *Post-hoc* assessments of foresight are exaggerated, and people behave as if an outcome was never in doubt when there was, in reality, a great deal of uncertainty before the fact. The hindsight bias arises because it is difficult for people to separate what they presently know from their previous knowledge. As a result, people tend to overestimate what was knowable before the fact.

Example: Child protection agencies return children to parents after an assessment of the likelihood that the child will be safe in their hands. However, some parents may subsequently harm, sexually molest, or murder the child. When such a tragic outcome occurs, there is widespread public and media condemnation of the child protection agency. In hindsight, critics argue that the harm to the child was inevitable and should have been foreseen by the agency. The only way to prevent such tragedies from occurring would be for the agency to have perfect judgment or to adopt a policy of never returning the children to the parents.

Implications: The hindsight bias could play an important role in policy evaluation. When faced with negative outcomes, the hindsight bias may lead people to criticize the decisions leading to failure as if the negative outcome should have been foreseen as inevitable rather than merely probable. Closely related to the hindsight bias, the outcome bias leads people to judge the goodness of risk-related decisions on the basis of their outcomes. Decisions that produce good outcomes are, by definition, deemed to be good, and vice versa (Baron and Hershey, 1988). The hindsight and outcome biases could generate charges of incompetence or corruption to explain the failures of policies which may have failed by chance.

Heuristics and biases in choice

Based on the above discussion, it is clear that people rely on several important and systematic shortcuts when they make judgments about the probabilities of events. While such errors in judgment could be theoretically ameliorated through education, deviations from rationality in the realm of choice are caused by factors other than 'rational laziness.' Interestingly, people tend to stand by 'inferior' or 'irrational' choices even after they are made aware of their mistakes.

This is because when individuals make choices, their heuristics are derived more from intuition than from cognition, i.e., they represent true preferences. While errors in judgment result from correctable mistakes in the thought process, errors in choice stem from fundamental violations of the assumptions of expected utility theory (Tversky and Kahneman, 1986). This finding has led scholars to search for dimensions of choice which are not traditionally included in rational models of decision making. Deviations in choice, like deviations in judgment, arise under conditions of certainty and uncertainty. We discuss these findings below.

Framing

Framing effects mean that people's response to information is influenced by how that information is presented to them. People's preferences can be reversed by an appropriate framing of information.

Example: Framing effects can be understood through an experiment conducted by Kahneman and Tversky (1984: p. 343). subjects were given the following choices:

- 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 estimates of the consequences of the program are as follows:
 - If Program A is adopted, 200 people will be saved (chosen by 72 percent).
 - If Program B is adopted, there is only one-third probability that 600 people will be saved, and a two-thirds probability that no people will be saved (chosen by 28 percent).
- Another set of subjects were given the same problem but with a different set of outcomes.
 - If Program A is adopted, 400 people will die (chosen by 22 percent).
 - If Program B is adopted, there is a one-third probability that nobody will die and a two-thirds probability that 600 people will die (chosen by 78 percent).

Thus 'by restating the consequences of the alternative programs in terms of potential losses ("will die") rather than the potential gains ("will be saved"), the structure of preferences was reversed even though the choices were identical' (Kahneman and Tversky, 1984).

Implications: The idea that public reactions to policy choices can be drastically affected by and even reversed by framing effects is a powerful and sobering insight. It raises fundamental questions for democratic theory, because it suggests a potential irrationality in people's opinions and preferences. It also suggests that framing effects can be utilized to manipulate people's preferences and support for policies.

Indeed, framing effects may be a more general feature than political scientists recognized early on. For example, while Riker (1986) argued that politicians who possessed the ability to create alternative frames would be able to obtain positive political outcomes, he believed framing required the introduction of another dimension of the choice problem which would then lead to intransitive outcomes. However, because every choice involves winning and losing, prospect theory's insights about framing could be important to every political choice. Any choice can be framed either as a gain or a loss with consequent impacts on people's choices.

More recently, Iyengar (1991) discusses how framing of questionnaire items affects how people respond to questions in opinion polls. He points out that framing effects have been found in a variety of laboratory and field studies and that they affect both the informed and the ignorant. Rochefort and Cobb (1994) and Jones (1994) provide a discussion of the critical role of framing in affecting policy choices. In the context of risk regulation, the acceptability of a particular risk-reduction program may well depend significantly on the manner in which it is framed, as illustrated in the preceding example.

Reference point effects

People evaluate identical facts differently depending on whether they are presented as negative or positive in terms of a reference point. This feature is central to prospect theory because this implies that 'values are attached to changes rather than final states' (Kahneman and Tversky, 1979: p. 277).

Example: Policy debates fundamentally arise because people evaluate policies with respect to different reference points. To take a non-risk example, consider the case of disputes over affirmative action policies. For those whose reference point is a situation where minorities are underrepresented in a variety of settings due to historic racial discrimination, affirmative action programs are regarded as necessary and even insufficient measures to redress injustice. For those whose reference point is a level playing field in a race-blind society, affirmative action measures are seen as racial preferences which lead to reverse discrimination.

Implications: The prospects for the success or failure of regulatory reform would hinge on which of the competing combatants succeeds in winning the battle over the appropriate reference point. This may be significantly affected by the point in time during which the debate is conducted. Historic developments may make it easier for one reference point to prevail over another in the court of public opinion; for example, in the affirmative action context, the non-availability of instances of overt racial discrimination at the current time may make it easier for the level playing field reference point to dominate people's understanding of the issue.

Risk seeking in domain of losses

Rational choice scholars have long accepted that people are risk-averse. While this description is true, it is only half so. Prospect theory also holds that when people are faced with a choice and their reference point puts them in the

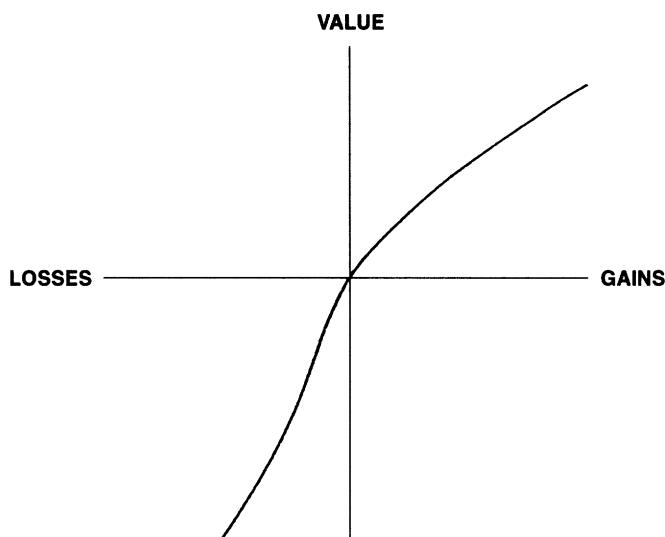


Fig. 1. A typical value function (Tversky and Kahneman, 1990).

domain of gains, people tend to be risk averse, just as the rational choice model suggests. However, when people are in negative or loss situations, they are much more likely to choose risky options (Kahneman and Tversky, 1979; Quattrone and Tversky, 1988). Prospect theory's description of behavior under risk can be captured by a 'value function' where values are calculated with regard to a reference point.³

Example: Quattrone and Tversky (1988) showed that people who view themselves to be in the domain of losses – due to deteriorating economic conditions – are more likely to support the riskier (less well-known) challenger in a hypothetical election. When in the domain of gains, people were more risk averse, preferring the better-known, hence safer, incumbent candidate.

Implications: Reform initiatives which generally pursue uncertain and unproven governmental reforms are more likely to succeed when people are significantly dissatisfied with the status quo. This implies that people are otherwise much less willing to try alternatives to the status quo, even if the changes might bring better results.

Loss aversion, the status quo bias, and the endowment effect

There is an asymmetry in people's value function under prospect theory. Losses 'loom larger' than gains. Thus a loss would be felt more strongly than a gain of an equivalent amount (Kahneman and Tversky, 1979). This is in contrast with expected utility theory which only takes net wealth into consideration in calculating a utility function, and which regards losses and gains of equal amounts as eliciting identical responses. As a result of loss aversion, people place a higher value on the status quo (Samuelson and Zeckhauser, 1988). Another related

result is the endowment effect, where people ascribe a higher value to items in their possession than they would ascribe to the same items if they were not in their possession (Kahneman, Knetsch, and Thaler, 1990).

Example: A farmer forced to give up land due to regulatory takings is likely to feel cheated even if he is compensated for it at the fair market value. However, the same farmer may have been unwilling to purchase the same land at the going market price if he were buying it from someone else (Sunstein, 1993).⁴

Implications: These findings suggest an inherent inertia with respect to policy change, which works in the opposite direction of a number of the heuristics and biases described above, especially risk-seeking behavior in the domain of losses. Perhaps a threshold of losses needs to be crossed before the inertia induced by loss aversion, the status quo bias, and the endowment effect yields to risk-seeking behavior.

Certainty effect and zero risk bias

People prefer small benefits which are certain to larger benefits that are uncertain (see Baron, 1994: pp. 358–361 for a discussion; Plous, 1993). For example, people tend to place a higher value on reducing the probability of a negative outcome from five percent to zero percent than reducing the probability of another, perhaps more serious, danger from 30 percent to 20 percent.

Example: The Superfund hazardous waste cleanup legislation instructed the EPA to clean up hazardous waste site completely. The drive for certainty led lawmakers to establish the standard of ‘zero risk’ instead of ‘reasonable risk’ for the EPA’s cleanup efforts. Instead of (efficiently) reducing the risk of hazardous waste sites to a reasonable level, this legislation has resulted in efforts to clean up a handful of sites completely, while many others have not been cleaned up at all (Baron, Gowda and Kunreuther, 1993; Breyer, 1993).

Implications: Of all the heuristics and biases cognitive psychologists have identified, politicians seem to understand the certainty effect better than any other. Politicians have an extraordinary propensity for playing off of people’s desire for certainty, offering ‘certain’ solutions such as eliminating all carcinogenic food additives, allowing zero tolerance for drug trafficking, or simple reforms that ‘fix’ complex problems such as term limits, and three-strikes-and-you’re-out laws. Voters, meanwhile, seem to expect clear and certain solutions, and politicians propagate the myth that they exist by continuing to promise them. While incorporating certainty in a goal may be a worthy aspiration, e.g., a zero sexual harassment goal in the military, certainty as enforceable standard may be inappropriate and inefficient from an economic perspective, e.g., the Superfund complete cleanup clause.

3. Biases or preferences?

Based on this more complex view of human preferences and actions, we can now address the central questions of whether risk regulation is inefficient and

whether people and policymakers are irrational. Inefficiency and irrationality by definition arise from deviations from normative standards. We consider risk regulation from two normative standards: that of science, and that of utility maximization.

From the perspective of scientific knowledge, risk is a particularly intractable concept, and scientific uncertainties are endemic to risk regulation. The preliminary processes of risk assessment which serve as the scientific foundation for 'objective' risk regulation are still nascent disciplines grappling with somewhat limited models of risks and their impacts (Pollak, 1996). This accentuates the difficulties of providing countervailing evidence to improve risk management policies because the scientific findings needed for such purposes will typically not be available for many years (Renn, 1992). Further, in some instances any exposure to toxic substances results in significant damage to health (there is no threshold below which exposure is harmless). Here a 'zero risk' standard would be potentially justifiable even on the criterion of economic efficiency, rather than as a political response to public demands. Thus, scientifically, it is far from clear that a normative standard exists for judging efficiency in risk regulation.

In terms of utility maximization, a normative standard would be whether regulation maximizes risk reduction in society for a given set of resources, taking public values into account in the prioritization process. In this context, heuristics used by the public in the area of probability judgements represent biases which are correctable. For example, people may overestimate the importance of accidents over diseases as causes of death due to the effects of availability and representativeness, and demand resource allocation accordingly. Such biased demands could be ameliorated through risk communication efforts aimed at providing people with accurate statistical information, which should result in the revision of their probability estimates, and thus maximizing their utility in the arena of risk reduction.

In practice, the situation is more complex. The key challenge is to separate substantive rationality, or people's true preferences over multiple dimensions, from irrationality, or cognitive errors or mistakes in estimation of risks. Under such a classification, demands for relatively greater resource allocation or airline rather than highway safety would be appropriate if they represent people's preference to avoid catastrophic accidents, i.e., when people do not regard the resulting deaths to be comparable. However, such resource allocation would be inefficient if it is driven by erroneous assessments of probability or death rates, perhaps as a result of media coverage. Similarly physically impossible and economically wasteful goals, such as complete cleanup of Superfund sites or zero-risk standards, can be regarded as mistakes, unless they represent an aspiration rather than a requirement.

Scholars working on risk perception argue that the public, far from being ignorant and irrational, seeks to improve risk regulation (Hadden, 1991; Slovic, 1987; 1992). Slovic (1987: p. 285) lucidly captures the essence of this argument: 'Lay people sometimes lack certain information about hazards. However, their

basic conceptualization of risk is much richer than that of the experts and reflects legitimate concerns that are typically omitted from expert risk assessments.' The concerns affecting the public include qualitative factors such as voluntariness, catastrophic potential, and impact on future generations, which experts typically ignored by restricting their focus to only quantitative factors such as expected mortality and morbidity (Slovic, 1992). As Leiss (1992) points out, the public's perceptions of risk have also been affected by its awareness of the historical record of risks being underestimated by governments and industries.

In terms of policy-oriented learning (Jenkins-Smith and Sabatier, 1993), the more complex view of people's preferences has prevailed in risk regulation. This view accords public input respect on its own merits, rather than regarding it as pathological on the basis of economic-technical criteria (Bradbury, 1989). For example, a recent Clinton Executive Order mandates that public input explicitly be taken into account in policy making (Pildes and Sunstein, 1995). We can therefore infer that policymakers regard the criticisms of risk regulation articulated by economists such as Zeckhauser and Viscusi (1996) merely as expressions of a culture or belief system which advocates efficiency (Wildavsky and Dake, 1990; Dake, 1991) rather than as a normative standard for regulation. In the longer run, however, economics and science arguably matter as much as people's preferences. If policy makers are unable to separate the influence of misguided probability judgments and heuristics from true preferences, and are unable to assuage impractical preferences such as that for certainty, the effect will be to make risk regulation inefficient and irrational.

In a more global sense, however, the very notion that optimal risk regulation can be achieved may be overly optimistic. At most, what may be achievable is a local optimum in terms of efficient allocation of resources to manage a particular type of risk. This is so because of the existence of 'health-health' tradeoffs, where a by-product of risk management in one arena is that risks increase in another arena (Sunstein, 1998; see generally Graham and Wiener, 1995). For example, taxing people to raise the resources for reducing some risks leaves them poorer and thus more vulnerable to other sorts of risks, such as those from a less healthy diet (Keeney, 1990). Further, in terms of institutional efforts to manage risks, given the absence of inter-agency coordination and the fragmentation of risk management efforts, it is particularly difficult to organize a coordinated efforts at efficient allocation of risk management resources across the entire range of risks (Sunstein, 1998).

4. Heuristics, biases, and the policy process: The case of the Delaney Clause

Why are certain public policies hard to amend or replace even when they are regarded as inefficient and counterproductive by significant policy actors? Public choice scholars offer alternative explanations: One explanation is that such 'policy inertia' arises when various interest groups develop a stake in a particular legislative or regulatory arrangement and work to prevent change. Another

explanation is that the phenomenon of ‘structure-induced equilibrium’ works to prevent change; i.e., stalemate occurs because of members’ preferences with respect to the status quo policy (Shepsle and Weingast, 1981). In addition to these explanations, we offer a behavioral decision theoretic interpretation that suggests that policies will be difficult to amend if they already cater to people’s heuristics and biases. We demonstrate the logic underlying such an interpretation by considering the repeal of a celebrated paradox in risk regulation – the Delaney Clause.

The Delaney Clause was a key component of the Food and Drug Act of 1958. It imposed a total ban on synthetic carcinogenic food additives, and thereby enshrined the zero-risk bias in policy. It was finally amended in 1996. The amendment process illustrates that once a bias is concretized in policy the effects of heuristics and biases make it particularly hard to amend or repeal that policy. Such a bias, as we show in this case, need not arise from strategic intent or purposeful exploitation of people’s preferences. The mere presence of a bias imbues a policy with tremendous political resilience.

The Delaney Clause was introduced by Congressman James Delaney after a series of hearings about the potential for food additives to cause cancer. Following the hearings, Rep. Delaney proposed an amendment to the Food and Drug Act to ensure that carcinogenic substances were kept out of food, and this amendment was readily passed. A public-choice interpretation of the passage of the Delaney Clause would argue that it arose because food additive manufacturers urged its adoption by Congress to create a barrier to entry to competitors (Sunstein, 1990).

However, an examination of the legislative history suggests that this was not the case. The clause was added at the insistence of a single member of Congress, Rep. Delaney (Merrill, 1988). It appears that Rep. Delaney was motivated by concerns ensuing from the loss of a family member to cancer. More importantly, the clause reflected the prevalent understanding of cancer causation which was in evidence during the committee hearings. This was that a few industrial chemicals were the predominant source of cancer, that potentially even the slightest dose of these chemicals would eventually result in cancer, i.e., there was no threshold effect (Weisburger, 1996), and that identifying carcinogens would be scientifically straightforward (Rodricks and Taylor, 1983). Therefore, while the Delaney Clause mandated a zero-risk standard, this was hardly a biased response. It was the best available and scientifically justifiable risk management response to a policy concern about the carcinogenic risks of synthetic chemicals and food additives.

Over the years, however, it became clear that the Delaney Clause worked out to be ‘unreasonably and pointlessly strict’ (Breyer, 1993: p. 41). Its zero-risk standard, far from protecting health, worsened people’s exposure to health risks. Sunstein (1990) calls it paradoxical because it may increase certain health risks by continuing to expose people to older, and potentially more dangerous, food additives already on the market which were ‘grandfathered’ in. Furthermore, it creates an incentive for manufacturers to introduce ‘non-carcinogenic,

but sometimes more dangerous substances' (Sunstein, 1990: p. 419). Other inefficiencies associated with the clause are that it bans only artificial food additives, even though natural additives may be equally or more carcinogenic; and it prevents risk-risk tradeoffs, where, for example, a diabetic may opt for the small carcinogenic risk of saccharin instead of using sugar. And as scientific knowledge has evolved it has become clear that the Delaney Clause is based on mistaken scientific notions of how cancers occur and what causes them (Weisburger, 1996). The zero-risk standard introduced in 1958 thus ended up becoming a zero-risk bias that persisted till 1996.

In addition to the inefficiencies listed above, the Delaney Clause had become unworkable due to efforts by environmental and consumer protection groups to force governmental agencies such as the Environmental Protection Agency to implement the zero-risk mandate. Such demands on the part of environmental groups could represent strategic behavior in interest group competition, but arguably represented their need to guarantee certainty to their own members. The agency had tried to finesse such implementation in practice, partly because of scientists' increasing ability to detect ever smaller traces of substances in foods. However, courts interpreted the law as written, thus tying the agency's hands (Merrill, 1988), and failed to take this opportunity to debias the law in light of practical and scientific considerations. Given these developments, a coalition of food additive manufacturers attempted to convince the Congress to repeal the clause but met with little success.

Why then did an inefficient and scientifically flawed policy last for thirty-eight years after it was enacted into law? It is when we consider efforts to amend the Delaney Clause that the relevance of our behavioral decision theoretic explanation becomes particularly pertinent. We argue that the Delaney Clause's resilience arose from the fact that it catered to the zero-risk bias and the certainty effect, even if it did so inadvertently. The Delaney Clause unequivocally guaranteed people the 'certainty' that no new carcinogen will be allowed in their food. As our understanding of the Delaney Clause's effects has improved it is clear that this guarantee derived more from the certainty effect than from a scientific consideration of risk. This posed a dilemma to politicians who may have been interested in amending the law. Politicians typically have a strong intuitive understanding of voters' heuristics and biases. They know that by supporting a standard of certainty even where it cannot be met, they will probably be viewed more positively than if they explained the tradeoffs between policies aimed at achieving 'optimal' regulations and policies aimed at eliminating risks completely.

If the Delaney Clause were to be amended, members of Congress would consider the amendment from two perspectives: whether the law was so bad that a case could be made to overturn it, and whether such an action would have negative electoral consequences. If the law's inefficiencies are substantially recognized, then risk-seeking in the domain of losses would prompt policy-oriented members to propose a change. But the importance of the zero-risk bias from an electoral perspective ensures that this does not happen easily.

Someone opposed to the Delaney Clause would have to argue – on the record – that small amounts of carcinogenic food additives are acceptable (for example, saccharin use by diabetics). While the benefits of a particular additive might outweigh its costs, this is not a popular argument to make, and runs the risk of being used in a negative advertisement or interest group attacks on the member in the next election. Members of Congress, constantly worried about giving ammunition to their political foes, are likely to be risk averse in the domain of gains (they are incumbents), and opt to leave the status quo intact.

However, events over the last few years so highlighted the inefficiencies of the Delaney Clause in public discourse that amending it became possible on both policy and electoral grounds. For example, Republicans advocating deregulation used the inefficiencies associated with the Delaney Clause as a case to prove their point. Along with the deregulatory agenda of the Republicans in 1994 came the influential bestseller, *The Death of Common Sense*, (Howard, 1994), which decried inefficiencies like the Delaney Clause. Thus the dominant interpretive frame for the Delaney Clause shifted from one of protecting health to one of being a poster-child for regulatory inefficiency. Environmental and consumer protection groups who previously defended the zero-risk standard were faced with a concerted attack on more important legislative fronts. Seeing that the Delaney Clause was substantially indefensible, these interest groups yielded in their opposition to its amendment.

Even then it was not easy to get rid of the Delaney Clause. Early efforts in 1994, which involved competing proposals from the Clinton White House and the Republican majority in Congress, were bogged down in acrimony. Influential senators such as Edward Kennedy defended the Delaney Clause as ensuring the protection of children's health – a powerful argument because children are among the significant consumers of food with artificial additives. Finally, in 1996 a broad consensus on amending the clause was established, which incorporated a significant margin of safety to take care of concerns over effects on children's health.

Interestingly, none of the debates on these amendments took place on the congressional floor; instead all discussion was limited to committee deliberations. Finally, when the amendments to the Delaney Clause were brought to the floor, they were approved *unanimously* by both chambers of Congress and signed into law by the President as the Food Quality Protection Act. The amended version of the Delaney Clause gave governmental agencies flexibility to implement the law at essentially the prevailing acceptable-risk standard for non-carcinogens, which the legislative language calls 'reasonable certainty of no harm.'

The 'stealth' manner and the unanimity which characterized the amendment process, and the language's continuing appeal to the certainty effect, suggest that members of Congress were arguably cognizant of the potential of a divisive legislative debate to make amending the Clause impossible. Unanimity and *sub rosa* passage of the amendment ensured that no member of Congress stood up to exploit the public's desire for certainty.⁵ This manner of passage therefore

ensured that future electoral opponents would not have much tangible ammunition to draw upon from a legislative debate. Further, the language of the amended Delaney Clause, ‘reasonable certainty of no harm,’ sounds synonymous enough with zero risk to potentially provide a justification for congressional action. Thus, the certainty effect can be seen to be a compelling explanation for the appeal and durability of laws such as the Delaney Clause.

5. Implications of behavioral decision theory for the policy process

Our exploration of the Delaney Clause’s amendment highlights the usefulness of a behavioral decision theoretic perspective on the policy process involved in risk regulation. Rational choice scholars regard the difficulties associated with weakening, and thus improving, a zero-risk standard as paradoxical and irrational. But from the perspective of behavioral decision theory, if voters exhibit a zero-risk bias, then policymakers’ behavior turns out to be a politically appropriate response. Behavioral decision theoretic analysis thus serve to improve on the rational choice framework by considering the implications of a more descriptively accurate model of people’s judgment and choice for the policy process.

Our conclusion contrasts with that of Noll and Krier (1990: p. 749), who argue that ‘although the cognitive theory is novel for its hypotheses about how people perceive risk and act in response to it, the hypotheses themselves have few novel implications for regulatory policy.’ We surmise that Noll and Krier conclude thus because they were expecting a totally different theory with radically different conclusions. For instance, they are surprised by ‘the large number of insights from the cognitive theory that are consistent with conventional [rational choice] analysis.’ Contrary to Noll and Krier, we suggest that if scholars want to consider the implications of behavioral decision theory for policy, they should focus not on its areas of overlap with expected utility theory (which are substantial, e.g., risk aversion in the domain of gains), but instead on those areas where it demonstrates that people behave in a manner different from that postulated by expected utility theory.

When we consider the central insights of behavioral decision theory – people’s use of judgmental heuristics like availability, representativeness, and the hindsight bias, and that people’s choices are affected by framing effects, reference point effects, and the certainty effect, and they demonstrate risk-seeking behavior in the domain of losses – we have the foundation for an important alteration in our understanding of political behavior. Expected utility theory can continue to remain a normative standard for rational behavior. However, behavioral decision theory should be a better tool of ‘positive’ analysis, because it is able to describe and predict people’s behavior more accurately.⁶

We suggest that there are many other major areas where further research may demonstrate the usefulness of the behavioral decision theoretic perspective. As examples, we offer two areas for further research: (i) policy change; and (ii)

‘institutional’ heuristics and biases. In terms of policy change, a number of scholars from different disciplines have pointed to a cyclicality evident in the nature of policies which have been adopted by the United States. For example, historian Arthur Schlesinger (1986), economist Albert Hirschman (1982), and sociologists Hilgartner and Bosk (1988) have all identified cycles of policy change where policies based on governmental solutions are replaced by those relying on the market mechanism and vice versa. Behavioral decision theory may offer an explanation, grounded in cognitive psychology, for the mechanism underlying such cyclical changes in policy frameworks because of its emphasis on the asymmetry in how people treat successes and failures. If people react differently to a policy framework’s successes and failures, this feature may give the policy process an inherent dynamism and a fundamental orientation toward change.

Behavioral decision theory may also enhance the analysis of institutional features which ameliorate the effects of heuristics and biases and those which promote or sustain biased policies. Extending a behavioral decision theoretic perspective to institutional analysis could be helpful in two ways. First, because political institutions are composed of individuals who are subject to heuristics and biases, institutions and their decision-making rules can either magnify or mitigate the impact of heuristics and biases. Identifying which procedures and processes have what effects on judgments and choices would dramatically extend our understanding of institutions and the importance of procedures within them. Second, an institution’s position in the policy process and its decision-making rules and procedures may themselves lead to the emergence and reinforcement of heuristics and biases.⁷

If this occurs, the processes established by institutions cannot be treated neutrally, simply as ‘the rules of the game.’ Institutional rules and procedures will affect the ability of actors to consider information completely, thereby institutionalizing certain heuristics and biases that will eventually affect outcomes. Extending behavioral decision theoretic insights to institutional behavior can thus enhance the arguments about the importance of policy venues to the acceptance of particular policy images and the consequent success of political agendas (Baumgartner and Jones, 1993). Such an extension may also lend insight to the logic of policy actors moving between different levels of action, including changing rules, advanced by the structural choice framework (Moe, 1990a; 1990b).

Overall, we conclude that while behavioral decision theory sheds new light on a range of political phenomena, the ultimate challenge before scholars working in this field is to not just show that political behavior is consistent with behavioral decision theoretic explanations, but that these explanations are superior to those advanced by rational choice interpretations based on expected utility theory (Levy, 1992). We hope that our illustrative examples – particularly the case of the Delaney Clause – have demonstrated how the heuristics and biases perspective significantly enhances our understanding of politics. We therefore suggest that public policy scholars could benefit significantly from an

integration of a behavioral decision theoretic perspective to improve the accuracy of their scholarly descriptions and explanations of policy processes.

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Notes

1. Leading theories of the policy process, notably Structural Choice (Moe, 1990a; Moe, 1990b) build their explanation on the fundamental foundation of human behavior based on utility maximization, i.e., expected utility theory. Other theories of the policy process build on a less stringent model of human behavior—termed bounded rationality—proposed by Herbert Simon (1955). For example, the Advocacy Coalition framework proposed by Sabatier and Jenkins-Smith (1993) conceives of people as procedurally rational, satisficing rather than maximizing their subjective utility.
2. For a more detailed, yet accessible introduction, see Frey and Eichenberger (1991), Levy (1992) and Kahneman, Slovic and Tversky (1982).
3. However, more recent work by Tversky and Kahneman (1992) demonstrates that behavior is more complex. They identify a ‘fourfold pattern of risk attitudes: risk aversion for gains and risk seeking for losses of high probability; risk seeking for gains and risk aversion for losses of low probability’ (Tversky and Kahneman, 1992: p. 297). We leave the consequent extension of our analysis to account for this feature to a future article.
4. The endowment effect typically pertains to situations where purchase is possible without accumulating debt. Thus, the possibility of income effects limit the usefulness of this example.
5. The fact that amendments to the Delaney Clause were formulated and agreed upon entirely out of the public eye suggests that legislators were arguably aware that increased transparency, and subsequent decreased potential for compromise, make it difficult to amend biased risk-regulatory provisions. As Cook (1989) points out, the advent of televised proceedings has led to an increase in media coverage of legislative activities with the following important consequences:
 Bargaining among members, once the hallmark of a legislative institution, becomes more difficult when reporters are watching – not so much because members act differently in public than in private but because reporters’ dislike for noncommittal stances tends to discourage the fluidity and maneuverability necessary to resolve differences on the fine points and to enact legislation (Cook, 1989: p. 170).
6. In his call for enhancing economic approaches with psychological findings, Ellickson (1989) argues that the enhancement of predictive power at the cost of the theoretical simplicity of rational choice is worthwhile even if it does not produce a paradigm shift. Ellickson uses the analogy of Kepler’s elliptical theory of planetary orbits. Kepler’s approach improved the

descriptive accuracy of the Copernican theory and thus laid the foundation for the practical achievements of modern astrophysics.

7. Our framework is analogous to that proposed by Page and Shapiro (1992) for understanding the role of various political actors and entities in affecting public opinion and, by extension, public policy. They argue that public opinion is affected by both misleading and manipulation. Misleading can result from the institutional workings of entities like the media in rational pursuit of their goals and does not necessarily involve strategic or intentional efforts to mislead the public. Manipulation, on the other hand, arises from strategic, self-interested behavior on the part of politicians and interest groups, and also includes efforts to capitalize on institutional features which can result in the public being misled.

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