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## Behavioral Economics and the Conduct of Benefit-Cost Analysis: Towards Principles and Standards

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# Behavioral Economics and the Conduct of Benefit-Cost Analysis: Towards Principles and Standards

Lisa A. Robinson and James K. Hammitt

## Abstract

As traditionally conducted, benefit-cost analysis is rooted in neoclassical welfare economics, which, in its most simplified form, assumes that individuals act rationally and are primarily motivated by self-interest, making decisions that maximize their welfare. Its conduct is evolving to reflect recent work in behavioral economics, which explores the psychological aspects of decisionmaking. We consider several implications for analyses of social programs, focusing largely on economic valuation. First, benefit-cost analysis often involves valuing nonmarket outcomes such as reductions in health and environmental risks. Behavioral research emphasizes the need to recognize that these values are affected by psychological as well as physical attributes. Second, benefit-cost analysis traditionally uses exponential discounting to reflect time preferences, while behavioral research suggests that individuals' discounting may be hyperbolic. While the appropriate rates and functional form are uncertain, market rates best represent the opportunity costs associated with diverting funds to support a particular social policy or program. Such rates reflect the intersection between technological progress and individual preferences, regardless of whether these preferences fit the standard economic model or a behavioral alternative. Third, behavioral research emphasizes the need to consider the influence of other-regarding preferences on valuation. In addition to acting altruistically, individuals may act reciprocally to reward or punish others, or use the status of others as the baseline against which to assess their own well-being. Fourth, behavioral economics identifies factors that can help researchers develop valuation studies that provide well-informed, thoughtful preferences. Finally, while behavioral research has led some to argue for a more paternalistic approach to policy analysis, an alternative is to continue to focus on describing the preferences of those affected by the policy options while working to ensure that these preferences are based on knowledge and careful reflection. Benefit-cost analysis can be best viewed as a pragmatic framework for collecting, organizing, and evaluating relevant information.

**KEYWORDS:** behavioral economics, benefit-cost analysis, nonmarket valuation, discounting, social preferences

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## **1. INTRODUCTION**

Policymakers face difficult choices in determining how to best allocate scarce resources across social programs and other desirable goods and services. Benefit-cost analysis provides useful information for these decisions, by indicating the extent to which the values that individuals place on program outcomes are likely to exceed program costs. Determining these values has always been challenging, however. Most social programs lead at least in part to outcomes for which no market value exists, such as improved health and longevity or environmental quality. Instead, these values must be estimated from market behavior for related goods or by asking individuals about their willingness to pay. Recent research in behavioral economics adds to the complexity of this task, documenting ways in which individuals at times appear to act irrationally or contrary to their own interests.<sup>1</sup>

This article supports the development of principles and standards for conducting benefit-cost analyses of social programs, focusing on the implications of behavioral economics for how outcomes are valued in monetary terms. We review traditional practices, discuss findings from behavioral research, and recommend ways in which these findings might be integrated into benefit-cost analyses. We take the perspective of an analyst who has been asked to evaluate a given set of policy options and is curious about how behavioral economics might influence the assessment. We concentrate largely on empirical research results and their practical application, while recognizing that theory provides a useful, albeit simplified, model of reality that can help promote rigorous thinking about these issues.

Behavioral economics is a large and rapidly growing field, and has not yet evolved into a unified theory that provides a cohesive alternative or supplement to the standard economic model. Its status has several implications for our discussion. First, the dividing line between behavioral economics and conventional neoclassical economics is often murky. Both address behavior, and many findings identified as behavioral economics can be accommodated within the standard model. Second, while researchers have found an increasing number of behavioral deviations from neoclassical economic assumptions, it is not yet clear how significant many of these deviations are in terms of magnitude or pervasiveness. Much of the research involves small-scale laboratory experiments and needs to be supplemented by additional fieldwork to explore the real-world importance of the findings. Third, these deviations are often dependent on the context, and more work is needed to determine whether the deviations found in

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<sup>1</sup> Examples of seminal work and comprehensive reviews include Thaler (1992), Rabin (1998), Kahneman and Tversky (2000), Camerer, Loewenstein, and Rabin (2004), Fudenberg (2006), and DellaVigna (2009).

the contexts frequently studied (e.g., financial decisions) are equally important in the context of the policy decisions we consider. Finally, the rapid growth in related research means that it is not possible to be comprehensive. We select key topics for detailed consideration rather than attempting to review the entire literature. Because we are drafting this article as behavioral economics evolves in significant ways, we often raise questions or pose alternatives without attempting to resolve the underlying issues, describing concerns that researchers and analysts may wish to consider.

Below, we briefly summarize the distinction between behavioral and neoclassical economics, then introduce the features of the benefit-cost analysis framework that are the focus of this article. The remaining sections then discuss each topic in turn.

### **1.1 Behavioral vs. Neoclassical Economics**

“Behavioral” economics is somewhat of a misnomer, because all economics is concerned with how people behave in economic contexts. Behavioral economists often distinguish their work by noting that, in its simplest form, the standard economic model assumes that people behave self-interestedly and rationally (as “econs” or “homo economicus”), while they consider how human behavior may deviate from this model. However, this framing oversimplifies the neoclassical model and ignores other distinguishing features.

Behavioral economics has grown largely from the increased integration of psychological research into the models used to explain or predict economic behavior. In this respect, the distinction between neoclassical and behavioral economics may be largely a matter of emphasis. In addition, as discussed below, neoclassical economics often relies on expected utility theory as initially formulated by von Neumann and Morgenstern in the mid-1940s, while behavioral economics reflects challenges to that model, beginning most notably with work by Kahneman and Tversky and by Thaler in the late 1970s and early 1980s.

Thaler and Mullainathan (2008) provide an example of how behavioral economists distinguish their work. They argue that the standard economic model assumes three unrealistic traits: unbounded rationality, unbounded willpower, and unbounded selfishness. Bounded rationality recognizes that humans have limited capacity to process information, so often do not solve problems optimally. Instead, we may come to conclusions based on heuristics or simple decision rules. Bounded willpower reflects humans’ incomplete self-control. We may engage in unhealthy behavior (such as eating or drinking too much, saving too little, or smoking) while at the same time recognizing that such behavior is damaging. Bounded selfishness refers to the fact that we may act selflessly. The neoclassical model is more complex than recognized in this description and can accommodate

many behavioral findings, as discussed in more detail below. For example, other-regarding preferences (such as altruism and existence values) have long been recognized within the standard model.

An important element of behavioral economics is the rejection of expected utility theory as a model of decision making under uncertainty. Expected utility theory assumes individuals assign utilities to consequences and prefer the choice that maximizes the expected value of this utility. In contrast, Prospect Theory (Kahneman and Tversky, 1979) and related models suggest that preferences depend on the reference point from which they are measured (with losses valued more than gains and diminishing sensitivity with increasing distance from the reference point) and that probabilities are evaluated nonlinearly (with changes in probabilities near zero and one more important than changes in intermediate probabilities). While some characterize the assumptions of expected utility theory as “rational” and alternatives to that theory as “irrational,” both models are simplifications. For the purpose of benefit-cost analysis, our goal is to understand individual preferences over the outcomes of concern. If these preferences are reasonably well-informed and stable, then they are useful for understanding the relative merits of different policies regardless of whether they are consistent with standard theory or an alternative model.

In this article, we are primarily concerned with the use of behavioral data to determine preferences for, or the value of, the outcomes of social programs. Bernheim and Rangel (2007) note that “[p]ublic economics has positive and normative objectives; it aims both to describe the effects of public policies and to evaluate them. This agenda requires us to formulate models of human decision-making with two components – one describing choices, and the other describing well-being. Using the first component, we can forecast the effects of policy reforms on individuals’ actions, as well as on prices and allocations. Using the second component, we can determine whether these changes benefit consumers or harm them” (p. 7). This distinction between behavior and welfare is not necessary under the traditional economic model. That model assumes that individuals choose what they want; i.e., that their preferences are revealed through their behavior.

While there is no consensus on how to evaluate welfare given this distinction, Bernheim and Rangel (2007) describe two options.<sup>2</sup> One is to continue to rely on revealed preferences, expanding how we think about preferences to include deviations from the standard model. The second is to modify or reject revealed preferences, using preferences to measure welfare only in those cases where they appear consistent with the individual’s self-interest. While proposed to protect against decisionmaking errors, this more paternalistic

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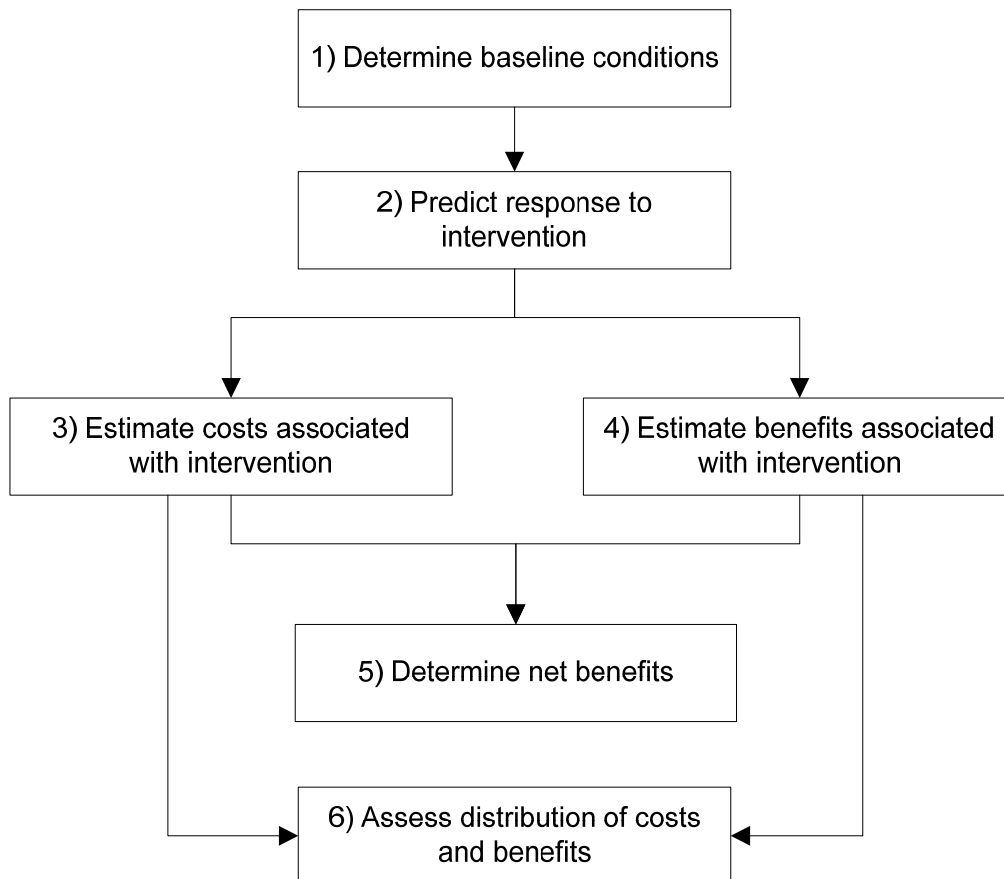
<sup>2</sup> Other examples of alternative framing include: Sugden (2004, 2005a, 2009), Bernheim and Rangel (2009), Green and Hojman (2009), and Smith and Moore (2010).

approach may be abused if individual preferences can be overridden without adequate, evidence-based justification. This tension between unquestioning acceptance of individual choices and acceptance of only those that are judged to be rational and welfare-enhancing is at the heart of many of the implications of behavioral economics for how we conduct benefit-cost analysis.

## 1.2 Behavior and Benefit-Cost Analysis

Implementing benefit-cost analysis involves several iterative and intertwined steps to characterize the affected universe with and without the policy intervention and assess the incremental social costs and benefits. We provide a simplified overview of this process in Figure 1.<sup>3</sup>

**Figure 1. Simplified Overview of Benefit-Cost Analysis**



<sup>3</sup> See Robinson (2004) and Robinson (2008a) for more information on current practices for regulatory analysis; practices will vary in other policy contexts.

There is no principled distinction between costs and benefits: costs can be defined as negative benefits and vice-versa. Typically, however, costs are defined as the opportunity costs of the real resources expended to develop, implement, and operate a program or to comply with government or other requirements, including any market impacts. Benefits typically include the monetary value of the outcomes that are the goal of the policy: improved education, increased safety, greater employment, enhanced housing, and so forth. Ideally, any significant side effects (cost-savings or ancillary benefits) are included, and the implications of nonquantified effects and uncertainty are carefully assessed. While these analyses provide important and useful information, policy decisions are rarely, if ever, based solely on their results. Decisionmakers often seek additional information that cannot be easily captured in economic analysis.

Behavior, and the implications of behavioral economics research, permeate each step of a benefit-cost analysis. They also influence how policy decisions are made and how the public perceives the impacts. Some analytic steps involve predicting future behavior, while others use behavior more indirectly to value nonmarket outcomes. We focus largely on the latter issues, because they raise more difficult issues for the analyst.

We do not discuss the implications of behavioral economics in two areas that are also important in this context. First, we do not consider its implications for predicting how individuals or organizations will behave; neither for determining current and potential future baseline conditions in the absence of intervention, nor for estimating responses to different policies. For example, behavioral economics is helpful in forecasting how individuals are likely to respond to information provision (e.g., on the caloric content of food or on the energy efficiency of appliances or cars), including information on the trade-off between short-term costs and longer-term savings.<sup>4</sup> A well-conducted analysis attempts to be as realistic as possible; it seems self-evident that analysts should use whatever information appears likely to improve their predictions, regardless of whether the behavior appears rational or welfare-enhancing. The implications of behavioral economics for these types of predictions are diverse, vary significantly across different contexts, and are addressed in a large and rapidly growing literature.<sup>5</sup>

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<sup>4</sup> In its simplest form, neoclassical theory assumes perfect information. However, an entire field has developed within the standard model around the economics of information, including topics such as decisionmaking under uncertainty, insurance, the optimal acquisition of costly information, and the effects of information asymmetries (e.g., adverse selection and moral hazard).

<sup>5</sup> See, for example, Diamond and Vartiainen (2007), Thaler and Sunstein (2008), and Congdon, Kling, and Mullainathan (2011).

Second, we do not discuss the role of behavioral economics in estimating social costs. The focus on real resource expenditures means that market data are often used to estimate monetary values, and such data already reflect behavioral influences. In the case of a small program (such as a local addiction treatment center), the analyst is likely to be concerned primarily with direct expenditures on wages and benefits, space rental, equipment, supplies, and so forth, which can be directly estimated from market prices. Implementation of the program is not likely to significantly change these prices.

When a program is large enough to noticeably affect market conditions, price changes are more likely. In these cases, analysts again may be able to rely on market data that already reflect any associated behavioral anomalies (e.g., observed supply or demand elasticities). In other cases, analysts may need to predict impacts outside the range of the available data. In this case, consideration of behavioral factors becomes more important because resource costs may differ from those that would be estimated if the markets functioned in accordance with the standard model. As an example, if consumers undervalue future cost-savings from adopting compact fluorescent light bulbs or more fuel-efficient motor vehicles (because of hyperbolic discounting, as discussed in Section 3), the demand for these products will be lower than might be otherwise predicted. As a result, market prices and the estimated costs of requiring these more efficient products will be higher than if consumers evaluated future cost savings using exponential discounting.<sup>6</sup>

These considerations are closely linked. Predicting baseline and post-intervention conditions is intertwined with understanding how individuals and organizations react to costs and prices. For example, individual decisions (and any associated behavioral anomalies) may determine program size (e.g., the number of addicts served by a new center and the efficacy of the treatment), in turn affecting those costs that vary with participation rates.<sup>7</sup>

Once we begin to consider the monetary valuation of nonmarket outcomes, the potential distinction between choices and welfare increases in importance for two reasons. First, the value of these outcomes must be inferred; we generally cannot predict it directly from market prices. Second, if individuals' behavior suggests preferences that appear irrational, unstable, or contrary to their self-interest, choosing a policy to satisfy those preferences may not improve social well being. In this case, we face difficult decisions. We could use the resulting values (or a range of values) in our analysis, we could explore the effects

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<sup>6</sup> See, for example, Allcott and Mullainathan (2010) for discussion of the implications of behavioral research for energy policy.

<sup>7</sup> See, for example, Bernheim and Rangel (2007) for discussion of the implications of behavioral research for addiction programs.

of providing more education or experience, or we could substitute expert judgment. Each of these options raises thorny practical and philosophical issues.

In this article, we take the perspective that benefit-cost analysis should attempt to describe, rather than prescribe, individual preferences. In other words, analysts should avoid making judgments about whether values are “rational” or “irrational,” but instead attempt to ensure that studies are designed to elicit well-informed, thoughtful preferences. “Mistakes” or “errors” may occur when choices diverge from how an individual would define his or her own preferences given adequate reflection and self-control, absent the biases that may result from cognitive or emotional challenges. While perfection in decisionmaking may be impossible, our hope is to at least attempt to avoid paternalistic views of what individuals “should” prefer, deferring to the preferences that individuals express when provided opportunities for contemplation and learning. In other words, we maintain the traditional reliance on individuals’ own definition of their welfare, while recognizing that education and experience may be needed to aid them in developing a reliable understanding of how particular choices might support their well-being.<sup>8</sup>

Data limitations play an important role in benefit-cost analyses, particularly in valuing nonmarket effects. The research base rarely includes studies that address an outcome that is identical in all respects to the outcome of a particular social policy. Time and resource constraints mean that analysts are generally unable to conduct new primary valuation research. Instead, they follow the benefit-transfer framework, which involves taking values developed in one context (a primary research study or group of studies) and applying them in a somewhat dissimilar context (the policy analysis) based on careful review of the literature. While values may be adjusted to reflect differences in the characteristics of the outcomes or the affected population, the available research is often insufficient to support quantitative adjustment. These differences are frequently addressed in more qualitative terms. Analysts can explore the resulting uncertainty using sensitivity or probabilistic analysis, or by examining breakeven values; i.e., the values at which the benefits of a policy no longer exceed its costs, or at which the ranking of the policy options changes. Because using multiple values and/or discussing these issues qualitatively can complicate presentation of the results, analysts need to carefully summarize the implications for busy decisionmakers.

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<sup>8</sup> Manski (2009) goes further and proposes that economists should evaluate behavior in the context of the actual choice situation without imposing conditions about consistency with choices in other contexts. He notes that an individual “only wants to make a reasonable choice from the choice set that he actually faces. Hence, I reason that prescriptions for decision making should *respect actuality*. That is, they should promote welfare maximization in the choice problem the agent actually faces.” (p. 1).

In the sections that follow, we begin by discussing several issues related to the implications of behavioral research for defining what it is that we are trying to measure, regardless of whether we are conducting primary research or reviewing studies for benefit transfer. In Section 2, we focus specifically on benefits, considering how behavioral research might affect the attributes included in nonmarket valuation studies. In Section 3, we turn to the discounting of costs and benefits to reflect their timing. Section 4 discusses the distinction between private and social preferences. In Section 5, we turn to issues related to the quality of valuation studies, considering how behavioral research might affect their design and implementation.

Section 6 concludes by looking at the more general implications of behavioral economics. Although the goal of benefit-cost analysis is normative; i.e., to identify the preferred policy from the perspective of economic efficiency, practitioners often advocate it because of its positive, descriptive components: it investigates what individuals would prefer (given the current distribution of income and other baseline conditions) and summarizes the results, rather than relying solely on the (perhaps unarticulated) preferences of decisionmakers.<sup>9</sup> Substituting expert judgment for observed choices is a slippery slope: there is often no clear dividing line between irrational and rational decisions or stable and unstable preferences. Behavior that appears irrational or unstable on the surface may in fact reflect an underlying rationality; the problem may be that the investigator simply has not discovered or does not understand the rationale.<sup>10</sup> As Smith (2007) notes, experts make mistakes too, and there is no consensus on whose expert judgment should prevail. Thus, as discussed in Section 6, we advocate a pragmatic view of these analyses as attempting to reflect the thoughtful, well-informed preferences of those affected to the greatest extent possible.

## 2. VALUING PSYCHOLOGICAL ATTRIBUTES

The value of the benefits of social programs – such as those targeted on reducing crime, increasing education, improving housing, or decreasing environmental, health, or safety risks – frequently cannot be fully captured by directly referencing market behavior. Instead, these values are estimated through revealed- and stated-preference research. Revealed-preference studies use data from market

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<sup>9</sup> For more discussion of benefit-cost analysis as a normative or positive exercise, see, for example: Adler and Posner (2006), Just et al. (2004), and Hammitt (2009).

<sup>10</sup> Smith and Moore (2010) note that: “[d]ecisions that appear incoherent or contradictory may simply reflect the analysts’ failure to fully specify the constraints to choice.” (p. 226) These constraints include factors such cognitive capacity, the energy available for decisionmaking, and physical dexterity, as well as budget constraints.

transactions or observed behavior to estimate the value of related nonmarket goods, while stated-preference studies involve asking respondents how they would behave in a hypothetical market. Regardless of whether they are conducting new primary research or transferring values from existing studies, analysts need to start with a clear definition of the key attributes of the outcome of interest. In this section, we discuss how behavioral research might affect the attributes that analysts consider important.

As noted earlier, behavioral economics highlights ways in which psychological responses may lead to values that appear irrational or inconsistent with the standard economic model. For example, Prospect Theory (Kahneman and Tversky, 1979) suggests that preferences vary depending on the reference point from which they are measured and whether the change is a loss or a gain.

The importance of psychological concerns has been long recognized in traditional research. For example, numerous studies have explored how risk perception affects the valuation of mortality risks, leading individuals to value risks of the same outcome and magnitude differently depending on their cause. Much of this work builds on research summarized in Slovic (1987), which suggests that individuals are more likely to want to see a risk reduced if it is more dreaded (i.e., perceived as more uncontrollable, catastrophic, likely to be fatal, inequitable, risky to future generations, difficult to reduce, risk increasing (rather than decreasing), and/or involuntary). Individuals also have a greater desire for addressing risks that are unknown or unfamiliar (i.e., that are unobservable, unknown to those exposed, new, unknown to science, or have delayed effects).

The effects of psychological responses on valuation, and the types of nonmarket outcomes associated with social programs, are too diverse for comprehensive review here.<sup>11</sup> Instead, we begin by addressing the distinction between willingness to pay (WTP) and willingness to accept (WTA) compensation. This distinction is fundamental to valuation in almost every context and has been identified by several scholars as an area where behavioral economics has significant implications. We then consider the valuation of mortality risk reductions in light of behavioral findings related to psychological attributes and the interpretation of probabilities. We use mortality risk reductions as an example both because they are an important outcome of many social programs and because their value has been relatively well-studied.

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<sup>11</sup> We do not discuss research on happiness (or life satisfaction) in detail. Several scholars have suggested that these approaches should replace the use of WTP or WTA measures in benefit-cost analysis (see, for example, Kahneman and Sugden, 2005 and Layard, 2010 as well as the August 2008 special issue of the *Journal of Public Economics*). However, more work is needed to improve related research methods, collect empirical data, and assess the implications for policy analysis. For a thoughtful critique of related issues, see Smith (2008).

## 2.1 Willingness to Pay vs. Willingness to Accept Compensation

WTP and WTA can be used to value beneficial or harmful changes. For a beneficial outcome, WTP represents the maximum amount of money an individual would be willing to give up in exchange for the amenity, while WTA represents the minimum amount he would need to be paid to forego the amenity. For a harmful outcome, WTP is the maximum an individual would pay to avoid the harm and WTA is the minimum he would require to accept the harm. Under conventional assumptions, Willig (1976) demonstrates that these values should be similar as long as income effects are negligible; i.e., if purchases of the good represent a small proportion of income and if changes in income do not lead to large changes in demand. Willig's analysis pertains to private goods, where the individual chooses the quantity to purchase. For public goods, where the individual cannot choose the quantity, Hanemann (1991) finds that WTP and WTA may diverge significantly when there are no private goods that are good substitutes for the public good.

A number of empirical studies have found substantial differences between WTP and WTA (see, for example, Horowitz and McConnell, 2002).<sup>12</sup> Behavioral economists argue that these differences cannot be fully explained by income and substitution effects. Kahneman, Knetsch, and Thaler (1991) and several subsequent studies highlight the implications of Prospect Theory for this divergence, identifying it as a major concern for benefit-cost analysis.

In particular, Knetsch (2005, 2010) notes that behavioral studies indicate that WTP and WTA differ due to the combined effects of two factors. First, values depend on whether individuals view the reference state as their present status or as their status after the change. Second, individuals value the change more highly if it is viewed as a loss from this reference state rather than as a gain. This implies that WTP for a gain will be smaller than WTA compensation to forgo the gain if the respondent takes his present status as the reference state for the WTP question and the status after the change as the reference state for the WTA question.

This divergence raises the question of which measure is most appropriate for policy analysis. Freeman (2003) argues that the choice should be based on

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<sup>12</sup> This issue arises primarily in stated-preference studies. As discussed in Smith and Moore (2010), hedonic models (such as those examining wage-risk trade-offs to estimate the value of mortality risks) result in point estimates of marginal WTP based on equilibrium conditions. Information on discrete changes is needed to detect disparities between WTP and WTA.

property rights.<sup>13</sup> If the property right is associated with the status quo, then WTP to obtain an improvement is the correct measure. If the property right is instead associated with the change, then WTA to forgo the improvement is the correct measure. However, particularly for nonmarket goods, these property rights are often not well-defined. In addition, the legal definitions of rights may not correspond with how individuals identify the starting point when assessing changes in their own welfare. In particular, they may view the status quo as the more intuitive basis for valuing the changes associated with implementation of new social programs.

Once a reference state is established, differing values could be applied depending on whether a policy results in a gain or a loss from that state. However, as discussed in Guria et al. (2005) and elsewhere, this approach could lead to recommendations that vary depending on the perspective: an *ex ante* evaluation of a proposed program could support a differing conclusion than an *ex post* evaluation of an existing program; a proposal to introduce a program could be evaluated differently than a proposal to abolish that program.<sup>14</sup> When the individuals who benefit from a policy change are the ones to bear the costs, it seems illogical for the evaluation of the policy to depend on the reference point. In addition, if a program involves both losses and gains, the use of different values could lead to counterintuitive results. The extent to which these sorts of problems arise will depend on the extent to which the values vary when viewed from these differing perspectives; for many outcomes these differences have not yet been well-studied.

Much of the work identifying the behavioral anomalies that may underlie the divergence between WTP and WTA measures has been conducted in a laboratory setting with students as subjects, so often lacks the types of feedback mechanisms associated with real world exchanges. In addition, laboratory experiments usually involve exchanges of relatively simple goods (money, coffee mugs) that lack the multiple attributes associated with the outcomes of social programs. For more complex (and less familiar) nonmarket goods, differences between WTP and WTA measures may be driven at least in part by attributes of the outcomes themselves for which sufficient controls are not included in the data

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<sup>13</sup> More precisely, these measures are based on the concepts of compensating and equivalent variation (or compensating and equivalent surplus for public goods). The two measures differ in their starting points: for a beneficial outcome, compensating variation references the level of utility without the improvement, while equivalent variation references the level with the improvement.

<sup>14</sup> Even under conventional welfare economics, intransitivities can arise (e.g., the Scitovsky reversal paradox) and the valuation of an intervention can depend on how its benefits and costs are distributed. For example, policies that prevent the same number of expected fatalities can be valued differently depending on how the risk reductions are concentrated or diffused in the population (Pratt and Zeckhauser, 1996, Hammitt and Treich, 2007).

analysis and by challenges related to how the values are elicited or measured, as well as by loss aversion and other behavioral anomalies. Thus more study is needed (building on the work of Horowitz and McConnell, 2002), to better understand why WTP and WTA estimates diverge for particular types of outcomes and to estimate the size of the difference.

Policy analysts often focus on WTP estimates for more practical reasons, including skepticism about WTA estimates that appear implausibly large.<sup>15</sup> The extent to which these differences stem from problems with the data and methods used for nonmarket valuation, rather than from the sorts of concerns noted above, remains unclear. One particular methodological challenge arises from the relationship of these measures to income or wealth. Because WTP cannot exceed an individual's ability to pay, stated-preference researchers can remind respondents to consider their budget constraints and can identify values that appear unrealistic given reported income levels. In contrast, WTA amounts are unconstrained, and may lead respondents to overstate what they would in fact accept when hypothetical surveys are used to elicit values. Large values also may be reported as protest bids when respondents do not accept the scenario presented by the researchers. Estimates of WTA that are consistent with an underlying utility function can be obtained instead using a preference-calibration approach using theoretically valid structural models and multiple data sources (Smith et al., 2006).

Thus more research is needed to examine the extent to which WTP and WTA estimates are likely to diverge for the particular outcomes of concern in benefit-cost analyses of social programs. In the interim, analysts can test the sensitivity of their findings to variation in these values. For example, if the benefits analysis relies on WTP estimates but consideration of the reference state and loss aversion suggests that WTA may be more appropriate, then the analyst may wish to test the impact of larger values on the results.

## **2.2 Psychological Responses to Risk**

Behavioral research has other potentially significant implications for the attributes considered in nonmarket valuation, including how risks are perceived and valued. Some of these issues relate to the cognitive processing of risk information, including the misinterpretation of probabilities and the tendency to rely on simple heuristics or decision rules. In this section, we focus more directly on underlying preferences, while recognizing that it can be very difficult to distinguish "real" from "mistaken" choices or values. We illustrate these issues using research on the value of small mortality risk reductions.

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<sup>15</sup> This preference for WTP estimates due to perceived WTA measurement problems is reflected in current guidelines, such as OMB (2003).

Typically, the value of mortality risks is expressed as the value per statistical life (VSL). VSL represents the value of small risk changes (e.g., of 1 in 10,000) in a defined time period, expressed as a “statistical” life for convenience – it is not the value of saving an individual’s life with certainty.<sup>16</sup> The VSL has been estimated in over 60 revealed-preference studies (Viscusi and Aldy, 2003) and over 70 stated-preference studies (Lindhjem et al., 2010); the implications of these studies have been assessed in numerous literature reviews and meta-analyses as well as in guidance for regulatory analyses.<sup>17</sup>

This research suggests that both personal characteristics and risk characteristics affect VSL; its variation is not limited to possible differences between WTP and WTA. The influence of income, age, and other personal characteristics can be described at least in part by standard economic theory. For example, the lifecycle consumption model takes into account the relationship between the probability of survival and the utility associated with consumption in each time period (see, for example, Shepard and Zeckhauser, 1984, Rosen, 1988, Hammitt, 2007, Hammitt and Robinson, 2011). This model suggests that expected lifetime utility is equal to the sum of the utility gained from the consumption associated with living in each future year, multiplied by the probability of surviving through that year.

Risk characteristics include both physical attributes (such as whether the risk is latent or involves significant morbidity prior to death) and psychological attributes (such as whether the risk is perceived as voluntarily incurred or under an individual’s control). Research on the effects of these perceptions suggests that individuals may value risks of the same expected magnitude (e.g., 1 in 10,000) and same outcome (e.g., immediate death) differently if they stem from causes that are viewed differently. More work is needed to better understand how these perceptions affect valuation; however, the available empirical evidence suggests that risks viewed as less controllable, voluntary, or familiar, or as more feared or ambiguous, may be valued up to twice as much as other risks (Robinson et al., 2010).

Under the standard economic model, changes in attributes are expected to lead to changes in value. However, some stated-preference research findings illustrate the influence of the types of anomalies emphasized by behavioral economists. First, when faced with uncertain risk information, individuals tend to respond differently than when faced with a point estimate equivalent to the

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<sup>16</sup> In other words, VSL is equal to individual WTP for a small risk change in a defined time period, divided by the risk change; it is the local slope of an indifference curve between risk and wealth (see Hammitt 2000).

<sup>17</sup> See, for example, the meta-analyses in Viscusi and Aldy (2003) and Lindhjem et al. (2010), the reviews in Robinson (2008b), Robinson and Hammitt (2009), and EPA (2010a), and the guidance in OMB (2003) and EPA (2010b).

expected value of the range, reflecting ambiguity aversion.<sup>18</sup> For example, work by Viscusi et al. (1991), Shogren (2005), and Riddel and Shaw (2006) indicates that WTP for fatal or nonfatal risk reductions increases as risk ambiguity increases. Second, some research shows that individuals tend to overweight small risks (particularly when they are viewed as fearsome), consistent with Prospect Theory (see, for example, the review in Johannsson-Stenman 2008). Third, individuals are often insensitive to small changes in risks, reporting the same or similar values for risk changes that differ in magnitude (Hammitt and Graham, 1999, Corso et al., 2001).

Some of these anomalies do not necessarily create problems for the analyst. Ideally, the values used in benefit-cost analysis would reflect all of the attributes of the risk, including the ambiguity and fear associated specifically with that risk (see, for example, Robinson et al., 2010). However, this may mean that the analyst needs to test a wide range of values either because of deficiencies in the research base or because of uncertainty regarding the applicability of the results.

Insensitivity to risk changes is troubling, however. Economic theory suggests that WTP should increase almost proportionately to the size of the risk change, as long as the change is small, which means that VSL would be nearly constant. Most studies find that WTP varies much less than proportionately to the risk change. For example, a recent review (EPA, 2010a) found that when the sensitivity of WTP to the magnitude of the risk change could be tested, about 85 percent of studies found that the change was much smaller than proportional. While it is possible that individuals are indifferent between risk changes of these magnitudes, this explanation is contradicted by some studies. As discussed in Corso et al. (2001), individuals may be misinterpreting the probabilities; this misunderstanding can be reduced by using visual aids that more effectively communicate the size of the change. While many studies that use these aids find increased sensitivity to risk magnitude, some continue to find a degree of insensitivity (e.g., Alberini et al., 2004). Other work (e.g., Morris and Hammitt, 2001, Desaigues et al., 2007) suggests that expressing risk reductions as changes in life expectancy may lead to better comprehension of the effects of the small probabilities involved, although careful presentation is needed to ensure that the change in life expectancy is not misinterpreted as adding longevity only “at the end of one’s life span.”

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<sup>18</sup> The distinction between uncertain and ambiguous risks is not always clear. In principle, an uncertain probability may have a (subjective) expected value but an ambiguous one cannot. In his seminal work on this topic, Ellsberg (1961) notes that ambiguity depends on the amount, type, reliability, and unanimity of information on probabilities and the resulting degree of confidence one has in the data.

It may be preferable to use the sensitivity of WTP to risk change as a criterion for evaluating the quality of the studies for benefit-transfer, rather than assuming that it reflects indifference between risk changes of these magnitudes. More generally, differences between the risks studied and the risks associated with various social policies will lead to uncertainty in the estimates, the implications of which will need to be addressed in the analysis.

Our focus on mortality risks skirts some difficult questions, which we believe cannot be answered definitively. For example, there is substantial evidence that individuals' evaluations differ before, during, and after an experience (e.g., Kahneman, 2000a, 2000b). This means that, for example, the values for reducing the risk of a particular injury or illness may depend on whether the individual has experienced that health effect. One could argue it is the prospective, *ex ante* perspective of the inexperienced, healthy individual that matters in policy analysis, assuming that the goal of the policy is to help the currently healthy person avoid transitioning into the less healthy state.<sup>19</sup> Alternatively, one could argue that the experienced, ill individual is better informed and hence his or her values should be used. A third choice could involve somehow integrating values across inexperienced and experienced health states over time. These sorts of debates again argue for using a range of values in benefit-cost analysis, to determine how the differences affect the results.

### **2.3 Conclusions and Implications**

The first step in valuing any outcome involves defining it, including both its physical and psychological characteristics. Behavioral economics suggests a number of attributes that may be worth investigating when valuing the nonmarket benefits of social programs. Assuming that our goal is to provide information on the amount of money that affected individuals would be willing to trade for the outcome of concern, it seems appropriate to examine the effects of these attributes regardless of whether the results appear consistent with the standard economic model; the findings may provide important insights. While inconsistencies in policy recommendations could potentially arise when such context-dependent

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<sup>19</sup> When assessing the cost-effectiveness of health policies and medical interventions, recommendations for best practices suggest that, while descriptions of health states should be based on information from patients or others familiar with the condition, preferences for different health states should be based on the community or societal perspective. One way of describing the desirability of this perspective "is to imagine that we are looking at the world before we are born, or at least before we encounter any serious health problems, and to ask what kind of world we would like it to be. In that "ex ante" position we would not yet know what health problems we were destined to develop – only that there was some chance that we might develop any of them" (Gold et al., 1996, p. 7). Similar recommendations have been developed for cost-effectiveness analysis of environmental, health, and safety regulations (Institute of Medicine, 2006).

values are used in benefit-cost analysis, it is difficult to determine the importance of these inconsistencies without more information on the extent to which values might vary. In addition, the effects of such uncertainties are useful information for decisionmaking; distinguishing cases where the evidence clearly supports a particular choice from those where the evidence is less clear is an important function of policy analysis.

As we discuss in more detail later, addressing these issues requires ensuring that valuation studies are well-designed, to help separate values that reflect misinformation or misunderstanding from values that reflect more stable and carefully-considered preferences. However, we also need more research that tests the effects of these attributes on valuation, so that we are better able to sort out what is and is not important in different contexts, as well as to determine the extent to which they are outweighed or counterbalanced by other considerations. For example, it is unclear whether differences between WTP and WTA are more or less important than whether a mortality risk is particularly feared or ambiguous. Regardless of whether we view these issues from a traditional or behavioral perspective, our understanding of how nonmarket values vary in different contexts is incomplete.

Two types of research would be helpful. First, because the effects of different attributes may be interrelated, studies are needed that consider them jointly – holistically assessing the specific outcome of concern. Second, studies that consider the effects of varying attributes one-by-one are also useful, because they provide insights that can be used to make adjustments (or to calibrate results) when benefit transfers are conducted. These studies should investigate the extent of heterogeneity in the population as well, to determine whether changes in attributes are perceived and valued similarly by different individuals.

Such studies can take years to complete, and funding for nonmarket valuation work is very limited. In the absence of reasonably consistent or conclusive research evidence, analysts will need to carefully describe the potential implications of differences between the study and policy outcome when interpreting benefit-cost analysis results, including both factors that are, and are not, consistent with the standard economic model. We expect that analysts will continue to use the benefit-transfer framework to explore the effects of context differences both quantitatively and qualitatively; using sensitivity, breakeven, or probabilistic analysis where appropriate to test the implications of related uncertainties.

In conclusion, we recommend that analysts avoid making *a priori* judgments about whether values appear “rational” or “stable,” and instead consider the following:

- 1) Studies should be designed to test the effects of the psychologically-salient attributes found in behavioral research on benefit values, as well as the effects of other physical and psychological attributes.
- 2) Such studies should consider both the holistic effect of the full range of attributes relevant to a particular context and the effects of varying the attributes one-by-one to develop adjustments for transferring values to other contexts.
- 3) Values should be not be rejected unless the study does not meet basic criteria for quality or adhere to generally-accepted principles for best practices. Rejected values, and the basis for rejecting them, should be clearly documented.
- 4) When values are uncertain, sensitivity, probabilistic, or breakeven analysis should be used to test the effects of this uncertainty on the results.
- 5) Where quantitative estimates are not available, the potential effects of both psychologically-salient and physical attributes should be discussed qualitatively.

### **3. ESTIMATING TIME PREFERENCES**

Evaluating the benefits and costs of social programs often involves comparing impacts that occur at different dates, using discounting to reflect time preferences. Two questions arise in this context: (1) what is the appropriate form of the discounting function; i.e., should it be exponential or hyperbolic? (2) what is the appropriate basis for the discount rate; i.e., should it be based on individual or market rates?

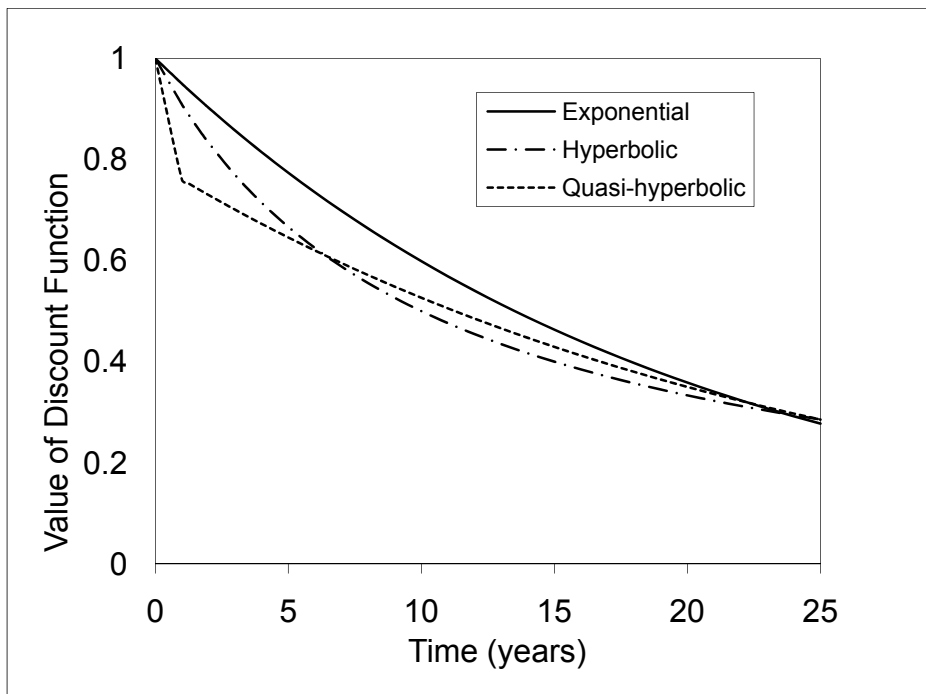
Traditionally, exponential discounting is used in benefit-cost analysis, while behavioral research suggests that hyperbolic functions may be appropriate. This distinction reflects simplifying assumptions more than theoretical differences. Exponential discounting can be traced to Samuelson's (1937) work on discounted utility, which was intended to highlight certain theoretical relationships. Samuelson himself recognized that his assumptions were a simplification, neither necessarily predictive of actual behavior nor associated with a normative view of welfare. More recent work (Weitzman, 2001) suggests that hyperbolic discounting is appropriate under the standard economic model when the discount rate is uncertain.<sup>20</sup> Gollier and Zeckhauser (2005) also discuss theoretical reasons why aggregating individual discount rates will lead to a rate that decreases over time. Thus the distinction that we explore in this section

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<sup>20</sup> This results because the discount factor  $[1/(1+r)^t]$  is a nonlinear function of the discount rate  $r$  over time  $t$ , so the expected value of the discount factor corresponds to smaller values of  $r$  as  $t$  increases.

relates more to practical application than to theory. Figure 2 provides an example of exponential, hyperbolic, and quasi-hyperbolic functions.

**Figure 2. Exponential, Hyperbolic, and Quasi-Hyperbolic Discounting Functions (based on Berns et al., 2007, Figure 1.)**



To answer the questions about both functional form and the appropriate discount rate requires clearly defining what it is that we are trying to measure. In benefit-cost analysis, we are interested in estimating opportunity costs; i.e., the value of the best alternative use of the resources to be devoted to the policy or program. In this case, discounting is intended to reflect real resource expenditures, and relying on market rates seems appropriate. Market rates result from the intersection of supply and demand conditions and reflect technological progress as well as individual tastes and preferences. Behavioral economics provides insight into how discounting affects individual choices, which in turn affect market rates.

One problem that arises in this context is the difficulty of disentangling the effect of timing from the effects of other characteristics of an outcome. Frederick et al. (2002) note that, for a given time delay, the empirical evidence suggests that rates vary depending on the context: “(1) gains are discounted more than losses; (2) small amounts are discounted more than large amounts; (3) greater

discounting is shown to avoid delay of a good than to expedite its receipt; (4) in choices over sequences of outcomes, improving sequences are often preferred to declining sequences though positive time preference dictates the opposite; and (5) in choices over sequences, violations of independence are pervasive, and people seem to prefer spreading consumption over time in a way that diminishing marginal utility alone cannot explain” (p. 362). As they note, these problems relate more to how the utility function is specified than to the discount rate. To avoid redundancy, below we focus on the effects of timing alone, while recognizing that the dividing line between pure time preferences and other types of preferences is somewhat murky.

In this discussion, we address discounting of the monetary value of costs and benefits, not the underlying physical impacts. To the extent that timing affects the value of these physical outcomes, its impact is best represented by using their time-specific monetary value rather than by adjusting the discount rate. For example, if latent health effects are valued differently than effects experienced immediately, this difference should be reflected in the unit values applied to the health effects at the time they manifest, which then can be discounted at the same rate as other monetary amounts included in the analysis.

The time period over which an analysis is conducted has important implications for discounting. We concentrate here on discounting annual quantities over an intra-generational time period, consistent with the likely time frame of interest for analyses of social programs. We do not discuss the additional complications that arise when assessing programs (such as climate change or nuclear-waste storage) where inter-generational impacts are of major importance. Below, we first briefly review the traditional exponential approach, then discuss the evidence from behavioral economics and describe the implications.

### **3.1 Exponential Discounting**

Time can influence the value of costs and benefits in a variety of different ways. Outcomes further in the future may be more uncertain or risky; new opportunities, information, or technologies may arise while current options may disappear; and an individual’s preferences may change as he or she ages. In theory, discounting as traditionally implemented should not reflect any of these factors (which may be addressed separately elsewhere in the analysis); it should simply reflect the “pure” effect of timing.

Typically, benefit-cost analysis is conducted with constant discount rates (using the same rate for both costs and benefits), although rates that change over

time have been used in some cases for longer-term impacts.<sup>21</sup> Exponential (i.e., constant-rate) discounting assumes that time preferences are constant over different periods.<sup>22</sup>

For government analyses of social programs, rates are established by OMB in Circular A-94 (1992) and Circular A-4 (2003); the former focuses more on government programs while the latter focuses on economically-significant regulations.<sup>23</sup> Both suggest the use of exponential discounting, using a 7 percent real annual rate to approximate the average marginal pretax rate of return on private investments.<sup>24</sup> Circular A-4 requires that analysts also report the results using a 3 percent rate to reflect consumption time preferences (or the “social rate of time preference”).<sup>25</sup> OMB derives the 3 percent rate from the pretax rate of return on long-term government debt to approximate the interest paid on savings, assuming that the savings rate represents the average by which consumers discount future consumption.

The use of two alternative rates reflects uncertainty about whether these programs primarily affect the allocation of capital or private consumption. In theory, the rates would not diverge in perfectly competitive markets, but in actuality economic distortions such as taxes lead to differences. Given this and other sources of uncertainty, OMB also requires that agencies provide a schedule that shows how the undiscounted costs and benefits are likely to be distributed over time and discusses the use of alternative rates in sensitivity analysis. Thus the traditional approach for intra-generational discounting relies on a number of simplifying assumptions, and includes recommendations for testing these assumptions by considering the impact of alternative discount rates.

### 3.2 Hyperbolic Discounting

Time preferences have been one of the most active and well-developed components of behavioral economics research. As summarized in Chabris et al.

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<sup>21</sup> For example, the United Kingdom’s guidance for evaluation of public programs (HM Treasury, 2003) suggests that declining discount rates be used for analyses that cover periods greater than 30 years. Wietzman (2001) also suggests declining rates for assessing climate change policies.

<sup>22</sup> This means that the present value (PV) of a benefit or cost (S) at time (t) using a discount rate (r) is calculated as  $PV = S_t / (1+r)^t$ .

<sup>23</sup> Both Circulars note that the shadow price approach would be preferable but is not recommended due to difficulties in its implementation. In addition to discussing social programs, Circular A-94 also discusses rates to be used in analyses that reflect trade-offs within the Federal budget, which are based on Treasury borrowing rates and updated annually.

<sup>24</sup> All discount rates are reported as real rates, net of inflation.

<sup>25</sup> Three percent is also recommended as the base rate for cost-effectiveness analysis of health and medical interventions, with an alternative of 5 percent (for comparability with older studies) and a range from zero to 7 percent in sensitivity analysis (Gold et al., 1996).

(2008), numerous studies conducted over many years have found higher discount rates in the near-term than over the longer term. As a result, behavioral economists have explored hyperbolic functions with discounted values that drop steeply in the immediate future and more gently over the longer run.<sup>26</sup> These functions are often described as “present-biased.”

The exponential function is often described as the only discounting approach that yields dynamically consistent decisions.<sup>27</sup> Under hyperbolic and other functions, the preferred choice between policies having only future consequences can change solely because time passes. In other words, a project that appears desirable (e.g., the present value of its net benefits is positive) in time period 1 may appear undesirable (e.g., may have a negative net present value) in time period 2. As noted by Laibson (1997) “from today’s perspective, the discount rate between two far-off periods,  $t$  and  $t + 1$ , is the long-term low discount rate. However, from the time  $t$  perspective, the discount rate between  $t$  and  $t + 1$  is the short-term high discount rate” (p. 445-446). This inconsistency is often referred to as a “preference reversal,” although it can perhaps be better characterized as a sort of tug-of-war between these two perspectives or “as a game between a sequence of short-run impulsive selves and a long-run patient self” (Fudenberg and Levine, 2006, p. 1449).

Many of the studies that find declining rates were conducted in laboratory settings. In these experiments, a small number of subjects (often students) are offered choices between receiving differing amounts of money (or another reward, often small) sooner or later. Declining rates have also been found in some field studies that address real-world behavior. Frederick et al. (2002) list 42 studies conducted between 1978 and 2002, including 34 laboratory experiments and eight field studies. The number of studies is increasing rapidly. Laibson (2010) lists almost 20 additional studies completed since 2002, including several conducted under field rather than laboratory conditions.

The results are diverse. The studies reviewed by Frederick et al. imply annual discount rates ranging from zero to thousands of percent, based on data collected for timeframes as short as one day to as long as 25 years. Frederick et al. note that this lack of agreement reflects at least in part the difficulties inherent in isolating pure time preferences from other (theoretically distinct) considerations.

While many studies demonstrate hyperbolic discounting, this pattern appears to apply primarily to relatively short near-term time periods. Frederick et al. report that if they exclude studies with time horizons less than one year,

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<sup>26</sup> Alternatives to the hyperbolic discounting model have been proposed by some to explain these research results, including subadditive discounting (Read, 2001) and similarity relations (Rubinstein, 2003).

<sup>27</sup> If preferences are characterized by date rather than distance from the present, hyperbolic discounting can be dynamically consistent (Harvey, 1994).

discount rates no longer decline over time, clustering around an average annual discount factor of 0.8. This factor implies an annual discount rate of 25 percent, however, well above market rates. Frederick et al. note that the high rates may be due to the effects of several confounding factors that tend to bias the results of these studies upwards.

Laibson et al. (2007) explore time preferences over the life-cycle more systematically, using a structural model with data on age-specific income, credit-card borrowing, marginal propensity to consume, retirement-wealth accumulations, household characteristics, mortality rates, and other factors. If they restrict their model to a single (exponential) function, they find an annual discount rate of about 16.7 percent. However, their analysis rejects this single rate hypothesis. Allowing a quasi-hyperbolic function, they find a short-term annualized discount rate of 39.5 percent and a long-term annualized rate of 4.3 percent.

Behavioral economists have explored a number of motivations behind these patterns. The high near-term rates are often described as resulting from imperfect self-control, which leads individuals to seek immediate gratification even if it diverges from their own longer-term preferences.<sup>28</sup> Examples of this behavior, such as eating dessert despite wanting to lose weight, are abundant. Individuals vary in the extent to which they correctly predict these types of problems. Behavioral researchers identify “sophisticated” consumers as those who are more fully aware of the potential for future self-control issues, while “naive” consumers are more likely to incorrectly predict their future behavior. Sophisticated consumers may implement self-control measures or use commitment devices (such as avoiding temptation or establishing penalties) to reinforce their self control.

### 3.3 Conclusions and Implications

Although most economists agree that discounting is needed, there is some disagreement on the appropriate rate for social programs even within the traditional approach to benefit-cost analysis. Conceptually, under this framework, the rate should reflect the opportunity cost of investing in the intervention of concern; i.e., the best alternative use of the resources. However, it is often unclear what types of investment or consumption are affected when particular social programs are implemented, leading to the widespread use of generic defaults for discount rates, usually accompanied by sensitivity analysis.

Traditionally, benefit-cost analysis involves discounting the monetary values of future impacts at a constant exponential rate, based on market data, with

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<sup>28</sup> As discussed in Berns et al. (2007) and Chabris et al. (2008), behavioral economists are also exploring the potential neurological basis of the tendency to discount hyperbolically.

real rates often in the range of 3 percent to 7 percent annually. Behavioral economics suggests that individuals instead discount in a hyperbolic pattern, with varying rates.

In the context of social programs, rates reflecting a longer-term view appear more appropriate than the steep near-term rates found in behavioral research (regardless of whether they are exponential or hyperbolic) for two reasons. First, these programs are generally intended to operate over a several year period, which means that the planning horizon is consistent with longer-term rates. Second, these programs are focused on providing lasting (rather than temporary) improvements in welfare. To the extent that short-term rates reflect impulsive behavior and self-control problems (rather than more patient and thoughtful consideration), they are inconsistent with this goal. To reflect true improvements in social welfare, it appears desirable to focus on the time preferences that result from more careful assessment of long-range well-being.

In addition, in benefit-cost analysis we are interested in market rates, which reflect both technological progress and individual preferences (including any behavioral anomalies), while most behavioral research focuses solely on individual decisions. Market rates indicate real resource costs; i.e., the opportunity costs of investing in social policies or programs.

Behavioral research may be very useful, however, in predicting individual decisions; e.g., to participate in an addiction treatment or smoking cessation program, or to purchase an energy efficient car. While the reviews cited earlier compile the results of numerous studies, they do not evaluate these studies against criteria for quality or for applicability to social programs. Systematic review is needed both to determine the extent to which individual discount rates might decrease over time (and whether they may be close-to-constant over the long run as suggested by Frederick et al.) and the extent to which they might differ from the 3 percent to 7 percent range now often used to represent market rates.

Given these considerations, we advise our prototypical policy analyst as follows.

- 1) Discounting in benefit-cost analysis should reflect market rates; i.e., the investment or consumption foregone when resources are diverted to social programs or policies. The appropriate functional form and discount rate are uncertain, however.
- 2) Analysts should provide a schedule of undiscounted costs, benefits, and net benefits, in the form of bar charts (or other graphics) or a table, so that the decisionmaker can inspect this pattern. Simply summarizing costs and benefits as a net present value does not provide adequate information.
- 3) In choosing a discount rate or set of rates, as well as a functional form (exponential or hyperbolic) analysts must be clear about what,

conceptually, they intend to represent for review by decisionmakers. The quality of the underlying data and related assumptions should also be described.

- 4) Analysts should consider the impact of alternative rates on their results, emphasizing the discount rates at which benefits do, and do not, exceed costs, and/or at which the relative ranking of different policy options change.<sup>29</sup> Comparing these switch points to rates reported in the empirical literature will provide insights into the implications of related uncertainties for decisionmaking.

#### **4. SEPARATING PRIVATE FROM SOCIAL PREFERENCES**

While the outcomes of social programs vary in the extent to which they meet the economic definition of a public good (i.e., are non-rival and non-excludable), these programs differ from markets for private goods and services along several dimensions, that interact with individuals' preferences regarding program effects on others. In its simplest form, the standard economic model assumes that individuals are primarily self-interested, yet other-regarding preferences have been long-recognized within the traditional framework. As examples, we briefly discuss the treatment of altruistic motives and note issues related to valuing a social program rather than a private good and to assessing equity along with economic efficiency.

Behavioral studies reinforce the importance of these types of considerations, suggesting that individuals often act selflessly. They also identify other types of interpersonal considerations that may affect preferences, including vengeful as well as welfare-enhancing motives. Behavioral research on these issues is less well-developed than research in the areas discussed previously, but provides potentially useful insights.

##### **4.1 Social Preferences within the Traditional Framework**

While self-interested preferences are a standard assumption of the most simplified version of the traditional economic model, scholars have long recognized that individuals also care about others' welfare. For example, existence values for natural environments (Krutilla, 1967) are well-recognized within the standard model. Incorporating other-regarding preferences into benefit-cost analysis can be difficult due to data limitations as well as conceptual challenges, however related issues have been explored extensively within the traditional framework.

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<sup>29</sup> In some cases, there may be more than one switch point (i.e., internal rate of return), depending on the distribution of costs and benefits over time.

In particular, the appropriate treatment of altruism has received substantial attention. Economic theory distinguishes between two forms. Pure, or non-paternalistic, altruism means that I respect the preferences of others: I weight the benefits they receive and the costs they incur exactly the same as they do. In contrast, paternalistic altruism involves ignoring other's preferences to some extent. If those affected by the costs and benefits of a policy are pure altruists, counting both their altruistic and private values in benefit-cost analysis simply scales the costs and benefits upwards without affecting the overall analytic conclusions, so that ignoring or including altruistic values leads to identical results (Jones-Lee, 1991, Bergstrom, 2006). If their altruism instead varies depending on the outcome (e.g., is greater for health than for other aspects of well-being) or depending on the individuals affected (e.g., is greater for poor individuals than for the wealthy), then it can affect the sign of net benefits.<sup>30</sup> In particular, there is some evidence that health and longevity are viewed more paternalistically than most other goods (e.g., Jacobsson et al., 2007).

Paternalistic motives also appear more plausible when inequalities exist: I may wish to help those in impaired health by funding a program that exceeds their willingness to pay for it (and decreasing my own consumption).<sup>31,32</sup> Alternatively, selective paternalistic altruism could involve caring about the costs incurred by others rather than the risks they incur. For example, I may be willing to pay \$75 for my own risk reductions plus \$50 to offset the costs to poorer individuals, allowing them to use their funds for other purposes. In this case, the subsidy is a means to re-distribute the costs of the program without changing its total costs nor the value of the benefits that accrue. With such a subsidy, the value may not be truly altruistic (i.e., reflect how I value these particular costs or benefits for others); it may instead reflect how I value the distribution of impacts. This means that analysts will need to carefully distinguish general preferences for redistribution from preferences related to the outcome of concern.

In more complex, real-world situations, determining whether and how the values of various outcomes are differentially affected by paternalistic altruism is a difficult task. For example, Viscusi, Magat, and Forrest (1988) demonstrate that individuals are willing to pay additional amounts to reduce the risks of insecticide poisoning to others. However, they note that extrapolating their results to other

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<sup>30</sup> We follow the usual assumption that the values to be counted in the benefit-cost analyses are those held by the individuals who bear its costs and/or receive its benefits. Decisionmakers may, of course, have altruistic motives or other interests that differ from those of the affected individuals.

<sup>31</sup> We default to the usual convention of referring to WTP rather than both WTP and WTA for ease of presentation. See Section 2 for discussion of these measures.

<sup>32</sup> It is worth considering, in this case, whether those receiving the excess health benefits (e.g., poorer members of the population) would benefit more if the altruists were willing to provide an additional \$50 in cash rather than spending it on risk reduction.

contexts is not appropriate because the analysis was exploratory, the contributions were hypothetical, and the values are likely to vary across contexts. Due to these sorts of challenges, altruistic values are typically not quantified when valuing nonmarket goods.<sup>33</sup>

Another issue that is receiving increased attention is the difference between individual WTP for a “unit” of a particular good or service for private use versus WTP for a program that benefits the entire community of which the individual is a part. With purely self-regarding preferences, these values would be equal, if the outcomes are otherwise identical. However, while several stated-preference studies consider public programs rather than, or in addition to, private goods, they have not yet been reviewed systematically to provide insights into the extent to which the values vary. Because it is difficult to design a believable scenario that is identical in all respects other than whether the good is provided privately or to a community, determining the extent to which such values diverge is challenging. For example, to be otherwise comparable, a risk-reducing program would need to deliver the same expected risk reduction as the private option, and to be described in a way that avoids strategic bias (e.g., free-riding).<sup>34</sup>

Finally, as traditionally practiced, benefit-cost analysis focuses on economic efficiency, supplemented at times by separate assessment of distributional equity. Advocates of this separation between equity and efficiency suggest that programs designed primarily to achieve outcomes other than income redistribution should focus on maximizing net social welfare; taxes and similar strategies can be used to more effectively achieve distributional goals.<sup>35</sup> However, if WTP for a particular outcome in part reflects altruistic motives (intentionally or inadvertently) that result from concerns about disparities, and this WTP is used in the analysis of efficiency, the results of the benefit-cost analysis will, at least in part, also reflect equity concerns.

Social programs can exacerbate or ameliorate current inequalities both directly (depending on who receives the benefits and who bears the costs) and indirectly (e.g., because improved health can lead to greater productivity and income). Proposals to weight costs and benefits to reflect equity concerns have generally not been accepted in the U.S. due to the lack of agreement on the

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<sup>33</sup> One area where paternalistic values have been increasingly recognized is in valuing health risks to children; see, for example, Dockins et al. (2002).

<sup>34</sup> A related issue is whether adult WTP reflects only personal values or also incorporates values associated with the well-being of other household members regardless of their age. See Munro (2009) for discussion of related issues in the context of stated-preference studies. Similar issues may arise in revealed-preference studies. For example, researchers generally assume that VSL estimates from wage-risk studies represent individual values, but decisions to trade income for risk changes may represent a household decision and include consideration of other’s well-being.

<sup>35</sup> In reality, such redistribution may be difficult to achieve due to administrative costs, political constraints, and other factors.

appropriate weights as well as concerns about transparency.<sup>36</sup> However, several scholars have proposed approaches for more rigorously assessing equity (e.g., Sunstein, 2007, Adler, 2008, Graham, 2008, Farrow, 2009, Loomis, 2009, Zerbe, 2009, Johansson-Stenman and Konow, 2010). The feasibility and usefulness of these approaches have not yet been carefully tested. However, they suggest that equity effects could be addressed in more detail within the traditional framework, in part by taking advantage of the existing research on social welfare functions, optimal taxation, the marginal utility of income, and related topics.

#### **4.2 Behavioral Research on Social Preferences**

The strong interest in altruism, in valuing public programs as distinct from private goods, and in developing proposals to better incorporate equity into benefit-cost analysis, are consistent to a large extent with the emerging behavioral research on social preferences. Both laboratory and field studies suggest that individuals frequently consider others' welfare in decisionmaking. While this behavior is often altruistic, it may also involve acting reciprocally to reward or punish others.<sup>37</sup> In addition, individuals may use others' status as the baseline against which to assess their own well-being.

Charness and Rabin (2002) discuss three types of models that could explain behaviors found in laboratory settings: “ ‘[d]ifference aversion models’ assume that players are motivated to reduce differences between theirs and others’ payoffs; ‘social-welfare models’ assume that people like to increase social surplus, caring especially about helping those (themselves or others) with low payoffs; reciprocity models assume that the desire to raise or lower others’ payoffs depends on how fairly those others are behaving” (p. 817-818). They conclude that their experimental results are consistent with the social welfare and reciprocity models, but suggest that difference aversion is less important, and indicate the need for further research.

The evidence from experimental research may be limited, however, in the extent to which it predicts behavior in more complex situations. As summarized in DellaVigna (2009), the role of social preferences has been studied in some field settings, particularly charitable giving and employer-employee relationships. The results suggest varied motives and do not necessarily match the experimental findings. DellaVigna notes that it can be difficult to separate social preferences

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<sup>36</sup> Other countries appear more willing to use distributional weights; for example, the United Kingdom suggests weighting to reflect the marginal utility of income in policy analyses (HM Treasury, 2003).

<sup>37</sup> For example, Fehr and Schmidt (1999) explore inequity aversion, and find that the interaction between self-interested and inequity-averse individuals will affect each others' willingness to contribute to public goods.

from strategic decisions such as responses to social pressures, or from the “warm glow” associated with giving rather than with a particular outcome (see, for example, Kahneman and Knetsch, 1992, Andreoni et al., 2008). Thus while behavioral research provides support for the presence of altruistic (as well as malevolent) preferences, it does not provide values that can be directly used in benefit-cost analysis.

Finally, research also suggests that preferences are formed in part by interpersonal comparisons, indicating that private WTP will depend not only on one’s current endowment of income, health, and so forth, but also on how this endowment compares to that of others (see, for example, Luttmer, 2005, Frank, 2005, and Solnick and Hemenway, 2005).<sup>38</sup> This research suggests that positional concerns are stronger in some areas and can lead to a sort of “arms race” involving cyclical increases as each individual responds to positional changes made by others, ultimately leading to an oversupply of positional goods relative to other goods.

Substantially more research is needed to determine how these positional concerns affect the valuation of outcomes from social programs. The results of the few studies to date are inconsistent. For example, Frank and Sunstein (2001) argue that ignoring the effects of relative income leads to benefit measures that are far too low, and suggest that the VSL estimates used in regulatory analysis may be significantly understated. However, Kneisner and Viscusi’s (2005) analysis of wage-risk trade-offs suggests that the opposite is true: relative position appears to have little effect on compensating wage differentials for mortality risks and may decrease VSL. In addition, much of the behavioral research focuses on private goods; the effects of social preferences may have significantly different consequences in the case of public goods.

### 4.3 Conclusions and Implications

As indicated by the above discussion, practitioners have long struggled with how to represent social preferences (such as paternalistic altruism) in benefit-cost analysis, due to both research challenges and theoretical considerations. Behavioral research suggests additional ways in which concerns for others might affect valuation, such as reciprocating “good” and “bad” behavior or improving one’s relative position.

The research on social preferences reinforces the discussion in Section 2 on the potential importance of psychological attributes in valuation. For example, reciprocity may affect how individuals value mortality risks from crime (or from dangerous working conditions or polluting industries) in comparison to risks

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<sup>38</sup> Solnick and Hemenway (2005) trace this concern with relative position to work by Thorstein Veblen in 1899 and cite several theoretical treatments published since that time.

viewed as more accidental or naturally occurring; concerns about relative position may affect programs providing income transfers differently than programs promoting improved health. This research also foreshadows some of the issues in study design discussed in Section 5, emphasizing the need to be clear about whether values reflect only an individual's private consumption or also reflect benefits to the household or community. To the extent that studies (intentionally or inadvertently) include other-regarding preferences related to disparities, the values used in the analysis of efficiency may incorporate some equity concerns, potentially blurring the distinction between the two types of analysis.

Behavioral research on social preferences is not as well developed as the research discussed in the prior sections, in part because of the complex interactions between social preferences and social pressures as well as the difficulty of extrapolating from experimental results to more complex real-world behaviors. Thus it is hard to offer much concrete advice to policy analysts that can be implemented immediately. However, this research suggests that these issues should be considered both when valuing particular nonmarket outcomes and when considering the distributional and other consequences of social programs.

This discussion leads to two recommendations for our prototypical policy analyst.

- 1) In addition to other psychological attributes, studies should be designed to test the effects of social preferences on benefit values, focusing on outcomes associated with social programs rather than private goods or services.
- 2) When reviewing studies for benefit transfer, analysts should consider whether the results are likely to reflect other-regarding as well as private preferences and discuss the implications for both the analysis of economic efficiency and its relationship to equity concerns.

## **5. IMPROVING VALUATION STUDIES**

Thoughtful and well-informed preferences are desirable when valuing outcomes in policy analysis for several reasons. First, decisions to divert limited resources to achieving particular social goals warrant careful consideration. Given that there is no market to test the match between choices, preferences, and values for many of the outcomes associated with social programs, it seems that decisions to expend resources on these types of public goods should be justified with particular care. Interactions in real markets can provide various types of feedback and learning that may be lacking in nonmarket valuation studies, hence the studies may not capture market dynamics that could lead to more well-informed choices. However, in real markets firms face incentives to cater to consumer biases. They

may also conceal information or provide misleading information to protect their market share or increase profits. Thus analysts need to recognize that review of market decisions could also lead to erroneous understanding of underlying consumer preferences.

Second, these programs and policies are generally focused on achieving long-term improvements in welfare, suggesting that we want to value the outcomes based on individuals' thoughtful assessment of how they might benefit over the long-run. Third, and perhaps most relevant for the purposes of this article, behavioral research suggests that individuals may at times make "mistakes" or "errors" in expressing preferences or values, following simple decision rules or making choices that do not fully coincide with their assessment of their own welfare (see DellaVigna, 2009 for a recent review). However, evidence that suggests that values are stable or robust across studies and across contexts provides useful information for policy decisions, regardless of whether these preferences are consistent with the standard model.<sup>39</sup> While researchers have developed a number of strategies to address these issues, studies must be carefully designed so that the results do not ultimately reflect the values held by the researcher rather than the individuals studied.

## 5.1 Stated-Preference Research

Stated-preference researchers have a long tradition of considering psychological factors in designing their studies and behavioral concerns are well-integrated into related guidance. Early work by Mitchell and Carson (1989) on best practices discusses approaches for encouraging honest and meaningful responses and controlling biases that may result from strategic behavior. In 1993, a National Oceanic and Atmospheric Administration (NOAA) expert panel (chaired by Kenneth Arrow and Robert Solow) issued guidelines for these studies in the context of natural resource damage assessment cases, particularly to assess nonuse (or existence) values. They discuss several behavioral considerations, such as pretesting surveys to ensure that the responses are not biased by the desire to please an interviewer and using a referendum format (rather than an open-ended valuation question or payment card) to alleviate problems related to framing. Since that time, substantial additional research has been conducted that provides insights into how to best conduct these studies.

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<sup>39</sup> One underlying issue in this research is the effect of "constructed" preferences. Particularly when faced with unfamiliar goods, individuals are not likely to have pre-existing preferences. Rather, their preferences will be formed when related decisions are required. This raises the question of whether these preferences will then be stable over time and across different contexts, and of how education and experience relate to creating this stability.

For example, in 2005 and again in 2010, the journal *Environmental and Resource Economics* published special issues that address these concerns. The 2005 issue includes seven articles on anomalies and stated-preference research (Braga and Starmer, 2005, Guria et al., 2005, Hanley and Shogren, 2005, Kahneman and Sugden, 2005, Knetsch, 2005, List, 2005, Sugden, 2005a, and Sugden, 2005b). For example, List finds that experienced market participants behave in ways that appear consistent with the traditional economic model, while those with less experience exhibit some of the anomalies found in laboratory studies. Hanley and Shogren describe many options for improving stated-preference research, such as using workshops to better inform respondents, allowing “maybe” responses to recognize that individuals may only know their preferences over a limited range, and including “cheap talk” that discourages free-riding. Researchers are increasingly using choice experiments that ask respondents to value varying combinations of attributes rather than a single outcome, to mimic market choices and avoid overly narrow framing of decisions.

The 2010 issue deals specifically with behavioral economics, and includes several articles that provide insights for stated-preference research (particularly Carlsson, 2010, Hepburn et al., 2010, Johansson-Stenman and Konow, 2010, Knetsch, 2010, Smith and Moore, 2010, and Shogren et al., 2010). For instance, Carlsson notes that while stated-preference researchers have much to learn from behavioral economics, behavioral economists can also learn from stated-preference research. He discusses four topics: revealed versus normative preferences (see Section 5.2), learning and constructed preferences, context dependence, and hypothetical bias. He indicates, for example, the importance of providing opportunities for learning, including practice and repetition. He also notes that while comparing results from studies with real and hypothetical payouts can be useful, there are several reasons for exercising caution in these comparisons.

The proliferation of these types of articles suggests that the intersection between behavioral research and the conduct of stated preference studies is fertile ground, with abundant lessons for researchers. However, it also means that there is a need to integrate the results of the numerous new studies to provide updated guidelines for best practices, including guidance on how to best tailor stated-preference studies to different contexts and outcomes.

## **5.2 Revealed-Preference Research**

The issues raised by behavioral research also affect revealed-preference studies. In particular, Beshears et al. (2008) distinguish between revealed (or positive) preferences (the choices people actually make) and normative preferences (the choices people think they should make). They note that actual choices result from

combining normative preferences with the sorts of decisionmaking biases and anomalies found in behavioral research.

While Beshears et al. focus largely on how revealed and normative preferences diverge in savings and investment decisions, their findings have implications for many other contexts. They identify five factors that increase the likelihood of a disparity: (1) passive choice (acceptance of defaults); (2) complexity (delayed choice, avoidance of complicated options, or misunderstanding of options due to cognitive difficulties); (3) limited personal experience (lack of learning through feedback); (4) third-party marketing (manipulating preferences); and (5) intertemporal choice (inconsistent time preferences, discussed in Section 3).

Beshears et al. then describe six approaches that can, in combination, help identify normative preferences:

...“*Structural estimation* specifies a positive model with a precise set of economic and psychological motives (perhaps including non-Bayesian thinking and other decision-making errors). This model is then estimated using data, and the resulting positive preferences are mapped into normative preferences using normative axioms.

*Active decisions* eliminate some biases generated by default regimes. Under an active decision regime, individuals are required to *explicitly state their preference* without being influenced by (or being able to rely on) a default option. In some circumstances, this preference elicitation will be more reliable and more socially efficient than allowing consumers to express their preferences by opting into or out of a pre-chosen default.

In most stationary economic environments, initial choices are likely to be further from normative optimality than choices made after many periods of experience. One should therefore give more weight to *asymptotic choices* when attempting to infer normative preferences.

When homogeneous individuals make noisy, error-prone decisions, their individual decisions do not reflect normative preferences, but their aggregate behavior can. Hence, normative preferences can sometimes be inferred from the central tendencies of *aggregated preferences*.

*Self-reported preferences* reveal something about an agent's goals and values. Normative economics should allow self-reports to have some standing. This is particularly true when self-reports can be used to distinguish confident consumer decisions from decisions that were made in a state of confusion.

Informed opinions come in two forms. External observers may offer expert advice, and decision-makers may themselves gain more

expertise when they receive training or education. When trained/educated decision-makers make a choice, we call this an *informed preference*. Economists measuring normative preferences should give disproportionate weight to the actors who are most likely to know what they are doing.” (Beshears et al., 2008, p. 1793).

When revealed-preference studies are used to value nonmarket outcomes, researchers first identify a market good that includes the nonmarket outcome as one of its attributes. They then apply statistical methods to distinguish the value of the nonmarket outcome from the value of other attributes. For example, they may look at the trade-off between wages and job-related risks to value mortality risk reductions, or at residential decisions, recreational choices, or purchases of consumer goods to value various nonmarket attributes (see Freeman 2003 for more detailed examples). It seems sensible to consider whether both the market outcome and preferences toward the nonmarket attribute of concern may be significantly affected by the factors identified by Beshears et al.

Although the data and methods used in revealed-preference studies of nonmarket outcomes have been scrutinized (see, for example, Dockins et al., 2004), to the best of our knowledge these reviews have not systematically addressed the full range of behavioral issues listed above. More work is needed to determine the extent to which revealed-preference studies reflect normative preferences, rather than decisionmaking biases, when used to value the diverse outcomes associated with social programs. Thus while there is substantial synergy between the findings of behavioral economics and the evolving conduct of stated-preference research, more consideration of the implications of behavioral anomalies for revealed-preference research may also be desirable.

### **5.3 Conclusions and Implications**

Under the standard economic model, the goal of nonmarket valuation is to mimic a market: to estimate the amount of money that individuals would be willing to exchange for these outcomes if they could be directly bought and sold. Under standard assumptions, these choices would be consistent with individual welfare. However, implementing this approach presents challenges given the findings of behavioral research. If individuals make mistakes, and their choices do not correspond with their welfare (as self-defined), relying on choices for valuation may not lead to the identification of the policy option that best enhances social welfare. Improving related studies so that they result in well-informed, thoughtful preferences is thus an important goal for researchers and policy analysts.

These issues have received substantial attention over the years in stated preference research, although the proliferation of new studies suggests that more

review and integration is now needed. They have received relatively little attention when revealed preference methods are used, although similar issues may arise in market contexts.

This discussion has implications for both researchers and policy analysts:

- 1) Researchers should continue to incorporate the results of behavioral research into the design of valuation studies where useful and relevant, with the goal of identifying well-informed, thoughtful preferences, regardless of whether stated- or revealed-preference methods are used.
- 2) When evaluating study quality for benefit transfer, analysts should consider possible decisionmaking bias along with other uncertainties, including any evidence that the study population did not fully understand the context or made other cognitive errors.

## **6. DETERMINING THE ROLE OF BENEFIT-COST ANALYSIS**

Many reviews of the implications of behavioral economics compare and contrast a simplified version of the standard economic model with the findings of behavioral research. However, the standard model incorporates more complex considerations than suggested by these reviews. Some of these complexities reflect elaboration of the model; e.g., to incorporate lifecycle consumption, household production, or social-welfare functions. Others integrate behavioral findings, such as the effects of psychological factors on the valuation of nonmarket outcomes. Overall, the conduct of benefit-cost analysis reflects a number of pragmatic concerns, using economic theory as a starting point, incorporating behavioral considerations, and focusing on information that is useful for decisionmaking. In practice, the gap between the traditional and behavioral models is narrower than it might appear, and there is substantial synergy between nonmarket valuation and behavioral research.

The discussion in the prior sections of this article suggests additional avenues to explore. Below, we first summarize the recommendations from the previous sections. We then discuss the more general implications for the conduct and interpretation of benefit-cost analysis, focusing on its practical implementation.

### **6.1 Summary of Conclusions and Recommendations**

In this article, we discuss the implications of behavioral economics for analyzing the benefits and costs of social policies and programs. While recognizing that behavioral research can aid in predicting program participation rates and effectiveness, as well as in predicting real resource costs conditional on these

responses, we focus on the valuation of program benefits and costs. We take the role of the analyst who is asked to assess an exogenously-determined program or policy and seeks advice on incorporating the results of behavioral research into the assessment given available data. We consider four areas: context-dependent valuation of nonmarket benefits (Section 2); present bias and exponential versus hyperbolic discounting (Section 3); social preferences such as altruism and equity (Section 4); and the conduct of nonmarket valuation studies (Section 5).

Because behavioral economics is a large and rapidly growing field, the significance or pervasiveness of many of its findings are not yet clear and these findings have not been combined into a widely-accepted model that supplements or supplants the standard economic framework. As a result, we often raise questions for further research or note options for the analyst rather than trying to resolve the underlying issues. Throughout, we attempt to maintain the traditional perspective of benefit-cost analysis as describing the preferences of affected individuals (contingent on baseline conditions, including the distribution of income and other resources). While we recognize that individual choices may include errors; i.e., diverge from what the individuals might choose given better information and more experience or reflection, we urge caution in substituting the judgment of the analyst for the information collected from representative members of the population.

In Table 1, we summarize our key recommendations.

**Table 1. Summary of Major Recommendations**

<b>VALUING PSYCHOLOGICAL ATTRIBUTES</b>
<ol style="list-style-type: none"> <li>1) Studies should be designed to test the effects of the psychologically-salient attributes found in behavioral research on benefit values, as well as the effects of other physical and psychological attributes.</li> <li>2) Such studies should consider both the holistic effect of the full range of attributes relevant to a particular context and the effects of varying the attributes one-by-one to develop adjustments for transferring values to other contexts.</li> <li>3) Values should not be rejected unless the study does not meet basic criteria for quality or adhere to generally-accepted principles for best practices. Rejected values, and the basis for rejecting them, should be clearly documented.</li> <li>4) When values are uncertain, sensitivity, probabilistic, or breakeven analysis should be used to test the effects of this uncertainty on the results.</li> <li>5) Where quantitative estimates are not available, the potential effects of both psychologically-salient and physical attributes should be discussed qualitatively.</li> </ol>
<b>ESTIMATING TIME PREFERENCES</b>
<ol style="list-style-type: none"> <li>1) Discounting in benefit-cost analysis should reflect market rates; i.e., the investment or consumption foregone when resources are diverted to social programs or policies. The appropriate functional form and discount rate are uncertain, however.</li> <li>2) Analysts should provide a schedule of undiscounted costs, benefits and net benefits, in the form of a bar chart (or other graphic) or a table, so that the decisionmaker can inspect this pattern. Simply summarizing costs and benefits as a net present value does not provide adequate information.</li> <li>3) In choosing a discount rate or set of rates, as well as a functional form (exponential or hyperbolic) analysts must be clear about what, conceptually, they intend to represent for review by decisionmakers. The quality of the underlying data and related assumptions should also be described.</li> <li>4) Analysts should consider the impact of alternative rates on their results, emphasizing the discount rates at which benefits do, and do not, exceed costs, and/or at which the relative ranking of different policy options change. Comparing these switch points to rates reported in the empirical literature will provide insights into the implications of related uncertainties for decisionmaking.</li> </ol>
<b>SEPARATING PRIVATE FROM SOCIAL PREFERENCES</b>
<ol style="list-style-type: none"> <li>1) In addition to other psychological attributes, studies should be designed to test the effects of social preferences on benefit values, focusing on outcomes associated with social programs rather than private goods or services.</li> <li>2) When reviewing studies for benefit transfer, analysts should consider whether the results are likely to reflect other-regarding as well as private preferences and discuss the implications for both the analysis of economic efficiency and its relationship to equity concerns.</li> </ol>
<b>IMPROVING VALUATION STUDIES</b>
<ol style="list-style-type: none"> <li>1) Researchers should continue to incorporate the results of behavioral research into the design of valuation studies where useful and relevant, with the goal of identifying well-informed, thoughtful preferences, regardless of whether stated- or revealed-preference methods are used.</li> <li>2) When evaluating study quality for benefit transfer, analysts should consider possible decisionmaking bias along with other uncertainties, including any evidence that the study population did not fully understand the context or made other cognitive errors.</li> </ol>

As the above summary indicates, behavioral research is not yet sufficient to support specific recommendations for adapting the practice of benefit-cost analysis in many areas. Our recommendations are thus similar to current best practice recommendations, which take into account uncertainty in the underlying data and analyses. In some cases (such as time preferences and the design of stated-preference studies), the behavioral research base is relatively large and additional criteria-driven review may be helpful. In other areas (such as social preferences), the behavioral research is limited and does not necessarily address outcomes relevant to the evaluation of social programs. In the near term, the implications of behavioral research can be explored by testing the sensitivity of the results to different values, using probabilistic or breakeven analysis, or discussing impacts qualitatively. In the longer term, more significant changes may be warranted as new research becomes available that provides more robust and stable estimates of the effects of these factors.

## **6.2 Benefit-Cost Analysis as Applied Pragmatism**

Conducting benefit-cost analysis is challenging, regardless of whether framed by the traditional or behavioral economic model. However, denoting values in monetary terms has the advantage of providing information on the intensity as well as the direction of preferences. It also mimics the effects of policy decisions, which often require trading money for the outcomes of concern.<sup>40</sup> Thus we believe that valuation research provides useful information, despite its limitations – as long as the analyst is clear about the implications of these limitations for the conclusions of the analysis.

Although benefit-cost analysis has normative goals, those conducting such analysis may be most comfortable describing it as a positive, descriptive exercise, that provides decisionmakers with factual information on the preferences of those potentially affected by the policy. Behavioral economics questions aspects of this model, suggesting that individuals do not always act rationally, are motivated in part by social preferences, and make choices that do not necessarily coincide with their own long-term welfare even as self-defined.

One possible response to these findings is to substitute a paternalistic approach for the positive or descriptive model, placing the analyst and/or policymaker in the position of deciding which preferences are rational and welfare-enhancing and which are not. This is a task worthy of Solomon, because the dividing line will often be vague and preferences that appear nonsensical on

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<sup>40</sup> In addition, given the Kaldor-Hicks potential compensation criteria, Hammitt (2009) notes, “[t]he justification for using a monetary metric is that money can be transferred among affected individuals at low or modest cost (e.g., through changes in the tax code and income-support programs), but other possible metrics are more difficult or costly to transfer” (p. 194).

the surface may become more sensible as one digs deeper. The alternative is to continue to work on developing information on the preferences that emerge when individuals are well-informed and have the opportunity for reflection. But this task may require the endurance of Hercules. While we can clearly improve our understanding of these preferences, the complex attributes of social programs as well as the complexities of human judgment mean that our understanding of these preferences will always be somewhat imperfect.

Fortunately, the approaches currently used in benefit-cost analysis provide several practical tools for dealing with these uncertainties. These tools include quantitative sensitivity, probabilistic, and breakeven analysis, qualitative discussion of the implications of concerns that cannot be easily quantified, and explicit recognition that benefit-cost analysis should be only one of several inputs into policy decisions.

These concerns suggest a more pragmatic role for benefit-cost analysis than indicated by either the simplified version of the standard economic model or by behavioral economics.<sup>41</sup> Imagine again our prototypical policy analyst, asked to provide information that supports a recommendation about whether or not to proceed with an exogenously-determined policy option. If well-conducted, following the benefit-cost analysis framework provides the analyst with several advantages. While some of these advantages are not exclusive to benefit-cost analysis, in combination they help develop useful information for decisions.

- 1) Benefit-cost analysis offers a well-established and tested approach for identifying and assessing the physical impacts of different policy options in addition to estimating their economic value, supported by substantial research and guidance documents that address best practices as well as by numerous examples of previously completed studies.
- 2) Benefit-cost analysis' focus on monetization provides information on the intensity of preferences as well as on individuals' willingness to make the types of trade-offs implicit in many social policy decisions (which often involve exchanging money for social outcomes rather than for other goods and services) while not precluding the consideration of nonquantifiable effects and uncertainty.

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<sup>41</sup> There is a large literature on the rationale for conducting benefit-cost analysis that is too extensive to summarize here, including more philosophical discussions (e.g., Adler and Posner, 2006) as well as more detailed practical recommendations (e.g., Harrington et al., 2000). In particular, Sunstein (2000) argues that benefit-cost analysis "is most plausibly justified on cognitive grounds – as a way of counteracting predictable problems in individual and social cognition" (p. 1059), describing how such analysis can be used to counterbalance related errors.

- 3) Benefit-cost analysis promotes a broad perspective, by incorporating the preferences of individuals affected by the costs and/or benefits of the policy options rather than being limited to the preferences of those most directly involved in the decision.
- 4) Benefit-cost analysis encompasses several tools for incorporating uncertain outcomes and values, including sensitivity, probabilistic, and breakeven analysis as well as qualitative discussion.
- 5) Benefit-cost analysis aids in focusing data collection and research and provides rough “stopping rules” for these efforts. These include the principle of proportionate analysis (matching the level of analytic effort to the stakes of the decision) and value of information considerations (focusing on research that is likely to affect the decision), essentially applying a benefit-cost test to the analysis itself.
- 6) Benefit-cost analysis provides a transparent record of the data, assumptions, and analyses considered in the decision, if well-documented.
- 7) Benefit-cost analysis helps decisionmakers and stakeholders to clarify areas of agreement and disagreement, separating data from assumptions and allowing those who disagree to test the effects of alternative analytic approaches.

Under this formulation, benefit-cost analysis becomes one of many sources of information for decisionmaking rather than providing “the” answer to a policy question. It is instead a method for collecting, organizing, and evaluating information relevant to the decision.

In summary, when taken to the extreme, traditional economic theory can be interpreted as suggesting that decisions are always rational and welfare-enhancing, while behavioral economics could be interpreted as suggesting that individual choices are so unstable or inconsistent with well-being as to render the results of benefit-cost analysis meaningless. Both extremes substantially overstate the implications of related research. Analysts recognize that benefit-cost analysis as traditionally conducted is one of many sources of information, and must be supplemented by consideration of other concerns including nonquantified effects and equity. Behavioral researchers acknowledge that behavioral anomalies may be limited in occurrence and/or in significance, and that these anomalies can be counterbalanced to varying degrees by education and experience.

The introduction to this article suggests that the core issue raised by behavioral economics is whether choices in fact reflect welfare-enhancing preferences. The answer to this question appears to be “it depends.” In some cases, behavioral research has identified attributes that individuals may truly value, that are not explicitly incorporated into the standard economic model. In other cases, decisions may reflect simplifying heuristics or emotional responses that drive a wedge between choices and underlying, normative preferences. We

are far from fully understanding these distinctions, but the questions raised by behavioral economics provide useful insights for how we might further explore these issues. While benefit-cost analysis is useful for many reasons, it will inevitably have limitations. Clear discussion of its implications and uncertainties will always be required.

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