

**Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.**

**Implications of Behavioral Research for the Use and Regulation of
Consumer Credit Products**

Gregory Elliehausen

2010-25

NOTE: Staff working papers in the Finance and Economics Discussion Series (FEDS) are preliminary materials circulated to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the authors and do not indicate concurrence by other members of the research staff or the Board of Governors. References in publications to the Finance and Economics Discussion Series (other than acknowledgement) should be cleared with the author(s) to protect the tentative character of these papers.

Implications of Behavioral Research for the Use and Regulation of Consumer Credit Products

Gregory Elliehausen

Federal Reserve Board and
George Washington University

March 31, 2010

Implications of Behavioral Research for the Use and Regulation of Consumer Credit Products

Abstract

This paper reviews the behavioral literature on inter-temporal choice and decision making under uncertainty and assesses the evidence on behavioral influences affecting consumers' credit decisions. The evidence reviewed suggests that consumers often do not consider all information available in the market nor deliberately evaluate each alternative. Consumers simplify, take shortcuts, and use heuristics, which may not always be optimal but nevertheless may be an economical means for achieving desired goals. While most economists and psychologists agree that cognitive errors and time inconsistent behavior occur, the extent to which these phenomena impair actual decisions in markets is not at all clear. At this time, neither existing behavioral evidence nor conventional economic evidence supports a general conclusion that consumers' credit decisions are not rational or that markets do not work reasonably well. Empirical evidence suggests that behavioral research can help improve required information disclosures and contribute to more effective regulation, which enhances the performance of markets and improves individual outcomes.

Implications of Behavioral Research for the Use and Regulation of Consumer Credit Products

Behavioral research sometimes seems to suggest that cognitive errors and behavioral biases cause consumers to behave irrationally in making economic decisions. Experimental studies of choice under risk and uncertainty have found that in statistical or logical problems individuals are prone to make choices that violate normative rules for rational behavior (see Tversky and Kahneman 1974 and 1981). Other, mostly experimental studies have found that individuals discount proximate prospects more than more distant prospects, which can cause choices to be inconsistent over time again violating normative rules for rational behavior (see Frederick, Loewenstein, and O'Donoghue 2002). Such evidence has raised questions about the applicability of economic models of credit use and inter-temporal choice and stimulated development of models with various psychological assumptions about consumer behavior. Behavioral models have been proposed to explain, for example, the observation that consumers fail to reallocate income or wealth to smooth monthly consumption (Thaler 1985), US workers' low levels of saving for retirement (Thaler and Benartzi 2004), and Ausubel's (1991) conjecture that consumers systematically underestimate their future credit card borrowing (Prelec and Loewenstein 1998). Cognitive errors and behavioral biases have been alleged to cause market failure (Ausubel 1991, Gabaix and Laibson 2006, for example) and are cited as possible justification for regulatory intervention (Lynch and Zauberman 2006; Barr, Mullainathan, and Shafir 2009).

This paper reviews the behavioral literature on inter-temporal choice and decision making under uncertainty and assesses the evidence on behavioral influences affecting consumers' credit decisions. The evidence reviewed in this paper suggests that consumers often do not consider all information available in the market nor deliberately evaluate each alternative. Consumers simplify, take shortcuts, and use heuristics, which may not always be optimal but nevertheless may be an economical means for achieving desired goals. While most economists and psychologists agree that cognitive errors and time inconsistent behavior occur, the extent to which these phenomena impair actual decisions in markets is not at all clear. At this time, neither existing behavioral evidence nor conventional economic evidence supports a general conclusion that consumers' credit decisions are not rational or that markets do not work reasonably well.

Psychology and the Economics of Credit Use

Psychology has long influenced economists' thinking about inter-temporal choice. John Rae (1834), seeking to explain why wealth differed among nations, proposed that "the effective desire of accumulation" determined a nation's investment and hence its wealth. Rae identified several factors that either promoted or discouraged the desire for accumulation. Promoting accumulation were bequest motives or altruistic feelings and the propensity to exercise self-restraint. Discouraging the desire for accumulation were the uncertainty of human life and the excitement from the prospect of immediate consumption (or the pain from delaying consumption). Böhm-Bawerk (1890) added a new factor influencing inter-temporal choice—an inability to foresee future desires accurately, particularly ones that are remotely distant—and proposed modelling inter-temporal choice as allocating scarce resources across time, just as income is allocated across goods. Fisher (1930) formalized Böhm-Bawerk's model, developing the familiar consumption/investment model, which Seligman (1927) and later Juster and Shay (1964) adapted to analyse consumer credit decisions. Fisher also extensively discussed personal psychological characteristics that contribute to (lessen) impatience. These

characteristics include short-sightedness (foresight), weak will (self-control), habit of spending freely (thrift), emphasis on shortness and uncertainty of life (expectation of a long life, selfishness (concern for welfare of family after death), and slavish following of whims of fashion (independence to maintain a balance between income and expenditures).¹

Soon after Seligman's adaption of the consumption/investment model, N. R. Danielian (1929) disputed the model's applicability to consumer credit decisions.² Danielian acknowledged that Seligman's model might apply to the decisions of some consumers and that consumer credit might benefit consumers under ideal conditions. He argued, however, that circumstances surrounding consumer credit transactions invalidate models of rational choice and limit the benefits derived from credit use. The psychological circumstances included a pressing need for credit, due to most consumers' lack of available cash, and an asymmetry in consumers' valuation of future utilities and disutilities.

Danielian focused particularly on an asymmetry in consumers' valuations of future utilities and disutilities that causes consumers to overestimate the desirability of purchasing a durable good in a credit transaction. Underlying his analysis was a belief that consumers tend to discount future disutilities more relative to present satisfactions. He contended that in a cash transaction, this tendency is not present: the consumer compares the present value of utility from durable goods to the present sacrifice of other goods that must be given up to make the purchase. Both the benefits and costs are immediately perceived and consistently valued.

In contrast, Danielian argued, the asymmetry in valuation can lead consumers to overestimate benefits and underestimate costs in a credit transaction. As in a cash transaction, the future utilities from the durable good are reflected in present value of current satisfactions from increased total consumption and its new time path. Payment in a credit transaction is largely deferred, however, leading to relatively little current sacrifice in alternative consumption to satisfy any down payment requirement. The sacrifices in future consumption to satisfy future monthly payments may be only vaguely foreseen at the time of the transaction. Thus, in this view, consumers are apt to discount future disutilities from sacrifices in future consumption more than future utilities from the durable good. This tendency causes consumers to overestimate the net present value of durable purchases when credit is involved. As a result, consumers can overinvest in consumer durables, resulting in suboptimal allocation of consumption over time. Danielian's analysis is notable because it presages behavioral models of mental accounting developed a half century later.

The role of psychology in economic models of inter-temporal choice diminished after publication of Samuelson's "A Note on Measurement of Utility" in 1937.³ In this paper, Samuelson developed a

¹ See Becker and Mulligan (1997) or Frederick, Loewenstein, and O'Donoghue (2002) for brief discussions of economists' views on time preference in the eighteenth and early twentieth centuries.

² Among the institutional conditions he noted were consumers' difficulties in determining the interest rate and the lack of a competitive market structure for consumer credit. Both of these conditions were consequences of state interest rate ceilings for consumer credit. See Durkin, Elliehausen, Staten, and Zywicki (2010).

³ Fisher (1930), for example, extensively discussed personal characteristics that contribute to (lessen) impatience. These characteristics include short-sightedness (foresight), weak will (self-control), habit of spending freely (thrift), emphasis on shortness and uncertainty of life (expectation of a long life), selfishness (concern for welfare of family after death), and slavish following of whims of fashion (independence to maintain a balance between income and expenditures). See Frederick, Loewenstein, and O'Donoghue (2002) for a brief discussion of economists' views on inter-temporal choice before development of the discounted utility model.

discounted utility model as a generalization of Fisher's consumption/investment model. Economists adopted the discounted utility model, largely ignoring questions about the descriptive validity of the model's underlying assumptions. These questions will be addressed in a later section of this paper.

Removal of wartime credit controls stimulated interest in consumer credit in the 1950s, particularly on macroeconomic effect of consumer credit use. Behavioral studies contributed to the research program. The research was survey-based and focused on the role of credit in consumers' spending and saving decisions. In the late 1960s, attention shifted to the functioning of credit markets. Survey-based studies conducted by National Commission on Consumer Finance and the Federal Reserve Board investigated the effects of Truth in Lending, rate ceilings, and competition on consumers and consumer credit markets. Finally, experimental work by Tversky and Kahneman on decision making under risk and uncertainty, which they summarized in influential articles in *Science* (1974 and 1981), stimulated economists' renewed interest in psychological influences on economic choices. The next sections review and assess these studies.

The Role of Credit in Consumers Spending and Saving Decisions

During the 1950s and 1960s, much of the early empirical analysis of the effects of psychology on consumers' economic behavior was produced by George Katona and his colleagues at the University of Michigan's Survey Research Center. Katona and his colleagues studied extensively the process of consumer spending, especially spending on consumer durable goods. They included consideration of the role of credit in household investment and the influence on consumer behavior of expectations about both personal finances and macroeconomic conditions. Katona (1975) summarized much of a quarter century of survey research on consumers' financial behavior at the Survey Research Center in his classic *Psychological Economics*.

The survey research on the process of spending supports the theoretical analyses that treat consumer credit as a part of consumers' investment-consumption decisions. The surveys found that consumers generate relatively little new consumer credit for current consumption or for dealing with the financial consequences of hardship or distress, such as medical expenses, paying recurring bills, or the burden of already existing debts. Indeed, this research found that concern over personal financial situation or future macroeconomic conditions is associated with less, not more, use of credit by consumers.⁴ Consistent with the theories of the economists, surveys find that credit use is greatest in early family life-cycle stages, particularly in families with young children, and the bulk of consumer credit arises in the process of purchasing household durable goods and services. Such families typically start with relatively low stocks of durables and can obtain high rates of return on additional household investments.

A major focus of the survey research was to investigate the extent to which consumers' durable goods purchasing and financing decisions were rational. The research indicated that few purchases include all of the elements of rational decision-making, namely planning for purchases, extensive search for information, formulation of evaluation criteria, and careful consideration of alternatives before making decisions.⁵ Consumers often simplify, take shortcuts, or use heuristics. Consumers may focus on one or

⁴ See, for example, Maki (2002) and comments on his paper by Richard T. Curtin, director of the Surveys of Consumers program at the Survey Research Center.

⁵ Katona and Mueller (1954) provide an especially comprehensive analysis of deliberation in consumers' durable goods purchase decisions.

a few product characteristics or rely on the experience of friends, for example. Nevertheless, most consumers use one or more elements of deliberative behavior in decisions about consumer durables and credit. The behavioral concept of rationality is broader than that of economic theorists. Economic theory is concerned with specific goals like utility maximization, evaluation of all available alternatives, choice of the alternative that best achieves the goal, and consistency in choice. In contrast, behavioral economists expand this concept of rationality. Behavioral researchers view rational behavior as purposive and deliberative but not necessarily strictly optimal.

The research identified several circumstances that lead to more or less deliberation in durable goods purchases. Situations in which consumers tend to follow more closely the economists' model of rational decision making include the purchase of an item that is considered expensive or particularly important, purchase of a new or unfamiliar product, dissatisfaction with a previous purchase, and a strong new stimulus that causes uncertainty about previous attitudes or experience. In these situations, consumers are more likely to gather additional information, formulate or revise evaluative criteria, and deliberate more on alternatives, although they may still take shortcuts, simplify, or use heuristics. Few consumers collect all available information or carefully consider all possible choices. But even in context of the optimizing models of traditional economics, consumers may not want to collect all available information. The decision process is costly. Learning about product characteristics, identifying sellers, collecting information about prices and characteristics of specific product choices, and evaluating alternatives is time consuming and may include explicit expenses. Consumers will collect additional information only as long as the cost of search is less than its benefits (see Stigler 1961 and Durkin and Elliehausen 2010, Chapters 2 and 6).

In contrast, consumers tend to limit deliberative behavior in situations where they perceive a special opportunity that would not be available in the future, have an urgent need, or are satisfied with a previous purchase of the item. Such decisions still may include important elements of rational decision making. For example, consumers gathering information about products and sellers may perceive a special opportunity and decide without much further information gathering or careful evaluation of alternatives. Or consumers who are satisfied with a recent previous purchase may feel they have sufficient information to make a decision, without much search or consideration of alternatives. Even consumers who perceive an urgent need, such as a need to replace an automobile or important household durable, may recognize the problem in advance and take steps to prepare for the eventual purchase.

Another area of survey research examined the extent of consumers' knowledge of the cost of credit. Surveys indicated that most consumers were not fully aware of the cost of installment credit in the period before Truth in Lending. When asked what the interest rate on a two-year automobile loan would be (a much more common product at that time than today), many consumers said that they did not know, and a substantial proportion reported rates that were unreasonably low. At that time, between 20 to 30 percent of consumers reported interest rates that could be considered accurate. Katona (1975) argued that the reason few consumers were aware was that the interest rate had little effect on their credit decisions. Most consumers, he explained, were concerned with the size of monthly payments, because the amount that they have to pay each month affected their decision to buy or not, an explanation reminiscent of the once popular monthly payments model. As discussed in the previous chapter, Katona's explanation is not inconsistent with informed behavior. Juster and Shay's

theoretical analysis provided an explanation for the role of monthly payments in some consumers' decisions and they provided empirical evidence supporting their theoretical explanation.

Survey work in this area also provided evidence of an additional role for monthly payments: budgeting. This role, called "pre-commitment" in some studies (Strotz 1956, for example) and, more recently, "mental accounting" in others (Thaler 1985, for example), involves use of installment credit contracts by consumers to force themselves to set aside money for specific purposes. The survey efforts found that a considerable percentage of consumers used installment credit to purchase durable goods despite having sufficient liquid assets to pay cash. Many of these consumers apparently doubted their ability to save, believing that they did not have the discipline to replenish the liquid assets if they depleted them. Installment credit contracts force consumers to budget their money, saving via the debt repayment rather than frittering away future income on the numerous goods and services that are available in the marketplace. This practice is costly, but evidence suggests that many consumers are willing to pay to protect themselves against their own bad habits. While, strictly speaking, such behavior does not represent definitional economic rationality, it does not either imply irrationality if that term means uncontrolled credit use outside the general boundaries posed by the economic theory devised by Fisher, Seligman, and Juster and Shay. Rather, it implies a high perceived return on held liquid assets, as discussed earlier.⁶

Information and Search in the Decision Process

The passage of the Truth in Lending Act in 1968 stimulated further research on the role of credit in consumers' decision process. Much of the motivation was an interest in evaluating the effects of Truth in Lending disclosures on consumers' use of credit. The decision to use credit is often itself part of a series of interrelated decisions involving choices for the type of product, the amount to spend, the time and effort to gather information, and sources for the product and credit. To evaluate the effects of the new law, researchers drew on contemporary advances in modeling consumers' purchase decisions that produced a comprehensive theory of the purchase decision, which has come to be known as the "buyer behavior model" (Nicosia 1966; Engel, Kollat, and Blackwell 1968; and Howard and Sheth 1969).

The buyer behavior model formally links psychological and social influences into the stages of a rational decision process. The details of buyer behavior models differ, but the basic outline is similar across models. The decision process consists of several stages: 1) identification of a problem; 2) acquisition of pertinent information; 3) development of possible solutions; 4) evaluation of alternatives using relevant decision criteria; 5) choice of an alternative; and 6) assessment of the decision. Each stage of the decision process is affected by many individual, psychological, and social influences that cause the length and intensity of the decision process to vary from consumer to consumer and from decision to decision. Individual or psychological influences include consumer resources, motivation and involvement, knowledge, attitudes, personality, values, and lifestyle. Social influences include culture, social class, personal influences, family, and the situation.⁷

⁶ Consumers have also used other types of contractual arrangements, or pre-commitments, to force themselves to budget money. Whole life insurance, lay-away plans, and "Christmas Club" or "Holiday Club" accounts are other examples of pre-commitments. See Strotz (1956) for theoretical analysis of pre-commitment.

⁷ For further discussion, see Blackwell, Miniard, and Engel 2006. Studies using this model as a framework for examining aspects of consumers' credit decision include Day and Brandt (1973), Deutscher (1973), Durkin and Elliehausen (1978), Shay and Brandt (1979), Lawrence and Elliehausen (2008), and Elliehausen (2005, 2006, and 2009). Durkin and Elliehausen (2010) review studies of consumer credit in the buyer behavior framework at some length in their Chapter 6.

Day and Brandt's (1973) study of durable goods and credit purchase decisions undertaken for the National Commission on Consumer Finance is perhaps the most comprehensive of the consumer credit studies based on the buyer behavior model, and their findings suggest that most consumers were purposive and deliberate in their purchase decisions.⁸ By far most consumers planned for major purchases for several weeks or more. The lengthy planning periods after a need is recognized suggest that few purchases were truly urgent, a condition that Katona and others had found to limit deliberative behavior. Day and Brandt noted that planning periods for purchases of replacements for items that were no longer usable tended to be longer than those for other purchases. Apparently, many consumers in this situation recognized the condition of the present item and took steps to prepare for the eventual breakdown. Well over half shopped for a period of at least a few days, during which they obtained information about the item and sometimes also credit before making a decision. Nearly three-fourths of consumers considered more than one brand or store. Most did not shop extensively, but many consumers' knowledge from previous experience may have limited shopping, since well over half of the items purchased were additions or replacements of items already owned. As mentioned, satisfaction with previous purchases was another condition that Katona and others had found to be associated with limited search. Day and Brandt also considered the effect of previous product and store experience on search behavior. Previous experience was associated with significantly less search in some of their regressions predicting the number of brands considered, stores visited, and information sources consulted.

Day and Brandt found that consumers were less deliberative in their credit decisions than in their product decisions. A little more than a quarter of consumers using credit searched for information about credit sources, and only one in five considered alternative types of creditors. Many consumers apparently simplified the decision process and relied on the retailer for credit, either by using a retail credit plan or allowing the retailer to arrange a loan at a financial institution. Today, this approach has been replaced in many non automotive purchases by use of an existing bank type credit card account (Discover, MasterCard, and Visa).

Credit availability did not appear to have much effect on shopping or choice of retailer. Credit purchasers' product and credit shopping behavior was similar regardless whether or not they could have paid in cash had they wanted to do so. While almost half admitted that they gave some consideration to credit availability in their selection of a retailer, only a little more than one in ten credit purchasers said that they would have purchased elsewhere if credit had not been available. A likely explanation for the lack of effect is that credit availability was not a critical issue for most consumers. When questioned about it, relatively few survey respondents believed that credit was extremely or very difficult for them to obtain from any source.

The survey evidence provided by Day and Brandt suggests that consumers often chose to simplify the decision process by limiting credit shopping and allocating time and effort to the product decision. When asked about the difficulty of different choices in the decision process, most consumers mentioned as most difficult the choices on amount to spend or product characteristics. Credit choices were rarely considered among the most difficult choices and often considered among the least difficult choices to be made when purchasing durables. That the cost of credit is usually only a small part of the total purchase

⁸ For their empirical work, Day and Brandt surveyed a representative sample of 650 California households and a separate sample of 150 black families. The oversample of black families was obtained to allow separate analysis of any particular credit problems of minorities at that time.

outlay makes credit a likely area for simplification. Consumers also relied on past experience. Many consumers purchased from retailers from whom they had previously made purchases, often using credit. Consumers were much more likely to have relied on past experience for purchases of household durable goods than for cars. The greater reliance on past experience for household durable goods than cars may be explained by the smaller outlay required for most durables.

A major motivation for the Day and Brandt's study was an interest in assessing early effects of the Truth in Lending Act. Awareness of credit costs was one criterion for evaluating the act. While awareness does not imply that cost information was used in making credit decisions, a lack of awareness suggests that the information probably was not used.

Day and Brandt observed an increase in the level of awareness in annual percentage rates over pre-law levels, but still fewer than half of credit purchasers at the time of their survey reported reasonably accurate annual percentage rates fifteen months after Truth in Lending. Awareness of annual percentage rates was positively related to income, education, and previous experience. Most consumers were generally aware of interest rate differences among different types of creditors at that time, however, a distinction sometimes called institutional knowledge. Large percentages of consumers said that finance company loans, retail credit, and bank card credit were more expensive than bank installment loans and that credit union loans were less expensive than bank installment loans. By far most consumers reported believing that differences in credit costs across lenders justified shopping around, but, as mentioned, only a small percentage of them actually shopped for credit.

Of the more than half of credit shoppers who noticed Truth in Lending information on credit costs, fewer than one in ten said that the information caused them to compare rates or would cause them to compare rates or postpone purchases in the future. Awareness of annual percentage rates was positively related to credit shopping, but only a little more than a quarter of credit purchasers actually shopped for credit.⁹ Awareness of annual percentage rates was not significantly related to the decision to use cash or credit, probably because the greater percentage of these consumers did not have sufficient savings to purchase the item without credit. Thus, Truth in Lending appears to have had only a small effect on consumers' behavior at that time.

Later surveys show large increases in awareness of annual percentage rates since Day and Brandt's study. Durkin and Elliehausen (1978) found that more than half of borrowers using closed-end credit reported reasonably accurate annual percentage rates in 1977, which was about a two-fold increase in the level of awareness since 1970. Durkin (2000) reported that nearly all holders of bank credit cards in 2000 provided reasonably accurate annual percentage rates for bank cards, compared to a little more than six in ten bank credit card holders in 1970. Changes in behavior are much smaller than changes in awareness, however. The proportion of borrowers using closed-end credit who shopped for credit terms increased from a little more than a quarter in 1970 to a third in 1997 (Durkin and Elliehausen 2010, Chapter 6). That credit shopping has not changed much despite large increases in awareness suggests consumers today continue to simplify and focus on the product decision. Indeed the widespread availability of prearranged credit through bank cards may make the credit decision a less important part of many consumers overall decision process than it was in the 1970s.

⁹ The survey responses did not indicate whether shopping caused awareness or awareness caused shopping.

New Behavioral Models: Heuristics, Loss Aversion, and Inter-Temporal Choice

Work by Tversky and Kahneman on decision making under risk and uncertainty, which they summarized in influential articles in *Science* (1974 and 1981), stimulated economists' renewed interest in psychological influences on economic choices. Kahneman and Tversky described various logical errors (cognitive biases) that result from use of heuristics. They also described a tendency to prefer avoiding losses much more strongly than to acquiring gains, which produces inconsistent choices depending on whether a prospect is defined as a loss or gain (framing). Based on these considerations, Kahneman and Tversky (1981) proposed a model of choice under risk called prospect theory. Prospect theory, they argued, provides more realistic behavioral assumptions and predicts individual choices better than traditional economic models.¹⁰ These theories challenged assumptions about rationality in economic decision making, including decisions about consumer credit use.

Heuristics and Cognitive Biases

Heuristics are decision rules that reduce complex tasks of assessing values to simpler judgmental operations. They allow individuals to make decisions quickly using limited information. Heuristics may be specific to certain tasks or be more general. Heuristics are not optimizing techniques. They are methods that take account of computational limitations to achieve satisfactory outcomes with moderate amount of computations (Simon 1990). The term "satisficing" has been coined to designate such behavior. Common heuristics include availability (predicting the frequency of an event based on how easily an example can be brought to mind), representativeness (judging the frequency of a hypothesis by considering how much the hypothesis resembles available data), and recognition (inferring that a recognized object has the higher value with respect to some criterion than an object that is not recognized). A heuristic for credit decisions is choosing the lowest monthly payment from among consumer credit contracts with the longest available term (see Juster and Shay 1964).

Heuristics work well under many circumstances. Limited theoretical analysis suggests that a satisficing heuristic (choose an action again if it previously satisfied aspirations; search otherwise) produces optimal long-run outcomes in some circumstances and improved though not optimal outcomes in others (Bendor, Kumar, and Siegel 2009).¹¹ Several empirical studies have found that that simple heuristics often perform as well as models based on extensive information and weighing of alternatives.¹² For consumer credit decisions, Juster and Shay (1964) demonstrated that the lowest monthly payment heuristic is equivalent to optimizing behavior for credit constrained borrowers.

¹⁰ The economic model is one that defines the expected utility of a risky prospect U as the sum of each possible outcome x_i multiplied by the probability of the outcome p_i . That is, $U = p_1 u(x_1) + \dots + p_n u(x_n)$. For further discussion, see Schoemaker 1982.

¹¹ Satisficing does not work well in circumstances in which all alternatives sometimes fail. Because the heuristic is failure driven (search if the outcome does not satisfy aspirations), it sometimes causes individuals to switch from a better to a worse alternative. Satisficing also has problems when environments change and what works today does not work tomorrow. However, even under circumstances where satisficing is ill suited to inducing optimal long-run behavior, it may lead to improved outcomes (Bendor, Kumar, and Siegel 2009, pp. 24-5).

¹² For example, Borges, Goldstein, Ortmann, and Gigerenzer (1999) found that stock portfolios chosen on the basis of firm name recognition (availability heuristic) performed better than portfolios run by fund managers (and random portfolios). Also see Oaksford and Chater (1996), Gigerenzer and Goldstein (1999), Griffiths and Tenenbaum (2006) for analyses and evidence suggesting that heuristics provide accurate predictions in many other areas. See Gigerenzer and Brighton (2009) for a review and assessment of the evidence on the use of heuristics in decision making.

Individuals make by far most decisions quickly using heuristics rather than extended decision processes. When heuristics are used, certain cognitive processes or biases can produce outcomes that violate principles of rational choice. For example, considerations that influence one's ability to imagine an event (such as a recent coverage of an airline accident) or misperceptions about statistical influences (such as ignoring the effect of a small sample size when assessing observed sequences or frequencies) may bias estimates produced by availability or representativeness heuristics. Numerous cognitive biases have been identified and investigated, but the nature of the problem and the research issues are similar in each case. The following pages discuss some of the observed biases, psychological hypotheses, and the evidence associated with them.

Tversky and Kahneman's (1983) "Linda Problem" is one of the best known experimental tests of a cognitive bias attributed to use of a heuristic. For the test, participants were presented with the following problem:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti nuclear demonstrations.

Which is more probable?

(1) Linda is a bank teller, or

(2) Linda is a bank teller and is active in the feminist movement.

The correct answer to this statistical problem is (1). The probability of any one of two events is always equal to or greater than the probability of the two events occurring together. That is, the probability that Linda is a bank teller has to be at least as great as the probability that she is a bank teller *and* a feminist.

Kahneman and Tversky presented this problem to three groups of students, whose experience with statistics ranged from casual to advanced. Eighty-nine percent of participants with no formal statistics training said that the correct answer was (2), that Linda was a bank teller and active in the feminist movement was more probable than that Linda was a bank teller. Surprisingly, about the same percentages of participants with introductory and advanced statistics coursework (90 and 85 percent, respectively) also said that the correct answer was (2). Apparently, the representativeness heuristic caused study participants to view Linda as more typical of someone who is active in the feminist movement rather than someone who is a bank teller. This view led participants to provide an incorrect response to the statistical problem, even when they should have known better.

Framing, Loss Aversion, and Mental Accounts

Kahneman and Tversky proposed other cognitive biases that they attributed to framing and loss aversion. Framing is the manner in which an option is presented. Loss aversion is a tendency to prefer avoiding losses much more strongly than acquiring gains, which leads to risk aversion when individuals evaluate a possible gain, since they prefer avoiding losses to making gains. In other circumstances when

individuals are facing a loss, loss aversion may cause them to prefer a riskier prospect if the riskier prospect provides the possibility of mitigating a loss.¹³

Tversky and Kahneman (1981) presented experimental evidence that individuals' risky choices depend on whether an option is framed as a loss or a gain. In the experiment, participants were asked to choose from among hypothetical public health programs to prevent the death of 600 persons from a disease. One problem was presented in terms of saving lives or gains, the other in terms of deaths or losses (see box).

Public Health Programs

Problem 1

Program A: 200 lives will be saved.

Program B: 1/3 probability of saving 600 lives, and 2/3 probability of saving no lives.

Problem 2:

Program C: 400 people will die.

Program D: 1/3 probability that no one will die; 2/3 probability that 600 people will die.

Otherwise, the problems are identical. Participants who were presented problem 1 were more likely to choose program A than program B: certain saving of 200 lives over 1/3 chance that no one will die. In contrast, participants who were presented problem 2 were more likely to choose program D than program C: a 1/3 chance that no one would die over a certain loss of 400. In problem 1, where outcomes were framed in terms of gains, participants' choices were risk averse, but in problem 2, where outcomes were framed in terms of losses, participants' choices were risk seeking.

Kahneman and Tversky also pointed to inconsistencies in preferences for options due to framing and loss aversion when contingencies are involved, such as a two-stage process where an uncertain outcome in the first stage determines whether proceeds to an uncertain second stage. In one experiment, a group of participants was presented a choice between (1) a certain win of \$30 or (2) an 80 percent chance to win \$45 contingent on being selected with a probability of 25 percent in a first stage. Participants in this experiment were asked to state their preferred option before the beginning of the first stage. Their choices were similar to choices of a second group that was presented with options (1)

¹³ Loss aversion may also influence choices in situations that do not involve risk. Loss aversion may induce individuals to consider sunk costs in decisions involving future actions. Sunk costs are costs that cannot be recovered once they have been incurred. Managers considering future funding of an unprofitable project, in the hope of avoiding a certain loss, might be tempted to continue funding the project.¹³ Loss aversion may also explain some individuals' willingness to reject a credit card surcharge (a loss) but not an equivalent cash discount (a gain).

and (2) without any first stage contingency. Seventy-four and 78 percent of the two groups chose option (1), respectively.¹⁴

A third group was offered a choice with the same expected values as the choice offered the first group, (3) a 25 percent chance to win \$30 and (4) a 20 percent chance to win \$45; but in this case no contingency was involved. Forty-two percent of this group chose option (3), which was equivalent to option (1) for the first group. Kahneman and Tversky concluded from the responses of these three groups that participants tended to overlook the 25 percent chance of moving to the second stage, focusing only on the outcomes of the second stage in making their choice. For participants in the first group, option (1) appeared more attractive because it had the appearance of being certain. Thus, whether or not prospects are framed as contingencies may affect individuals' choices.

Kahneman and Tversky developed prospect theory to address such deviations from expected utility theory. One psychological assumption of prospect theory is that individuals perceive outcomes relative to a reference point rather than as an absolute value.¹⁵ That is, outcomes are perceived as gains or losses. Outcomes are first edited and then evaluated. Editing organizes and reformulates options to simplify subsequent evaluation and choice. This feature of prospect theory is consistent with earlier behavioral research indicating that individuals tend to simplify decisions. Kahneman and Tversky identified several possibilities for simplification:

- Prospects can sometimes be simplified by combining probabilities of identical outcomes. For example, two \$200 outcomes having probabilities of 0.25 and 0.33 can be combined into a single outcome having a probability of 0.58.
- Sometimes prospects can be segregated into risky and riskless prospects. A prospect paying \$100 with probability of 0.67 and \$300 with probability 0.33 could be segregated into certain receipt of \$100 and a risky prospect paying \$200 with probability of 0.67.
- In two prospects having a common component, the common component could be discarded. For example, in the two-stage process described above in which participants were presented a choice in the second stage between (1) a certain win of \$35 or (2) an 80 percent chance to win \$45, the first stage might be ignored because it was common to both choices.¹⁶
- Prospects can also be simplified by rounding outcomes or probabilities (\$101 to \$100 or 0.49 to 0.50) and discarding extremely unlikely outcomes. In addition clearly inferior prospects can be rejected without further consideration.

Kahneman and Tversky suggested that many anomalies and inconsistencies in preferences result from the editing phase. The experiment involving the contingent two-stage prospect is an example in which

¹⁴ Expected values are for the first group (1) $\$7.50=0.25 \times 1.00 \times \30 and (2) $\$9.00=0.25 \times 0.80 \times \45 and for the second group (1) $\$30=1.00 \times \30 and (2) $\$36=0.80 \times \45 .

¹⁵ In the cash discount/credit card surcharge example, for instance, the outcome is the deviation from the posted price, not the final price that matters. The posted price would be the higher credit card price (lower cash price) when the seller offers a cash discount (credit card surcharge). Consequently, the outcome is framed as either a gain or loss, which may influence whether or not an individual pays with a credit card.

¹⁶ The prospects (3) \$200 with probability 0.20, \$100 with probability 0.50, and -\$50 with probability 0.30 or (4) \$200 with probability 0.20, \$150 with probability 0.50, and -\$100 with probability 0.30 provide another example of a possibility for discarding a common component. Eliminating the common component \$200 with probability 0.20 reduces the prospects (3) and (4) to a choice between (3a) \$100 with probability 0.50 and -\$50 with probability 0.30 and (4a) \$150 with probability 0.50 and -\$100 with probability 0.30.

ignoring information in editing (the 25 percent probability of being eligible for the second-stage lottery) may have changed preferences.

Edited prospects are then evaluated, and the highest valued prospect is chosen. The value of a prospect is a weighted sum of the utility of outcomes associated with the prospect. The utility of each outcome is an individual's evaluation of a monetary value of an edited gain or loss (value function). The weight for each outcome (decision weight) reflects the likelihood of the outcome but is not a probability.¹⁷ Kahneman and Tversky argued that individuals overweight very small probabilities. Hence, individuals are willing to buy insurance [incur a certain small loss (insurance premium) in order to avoid a smaller expected loss (a very small probability of incurring a large loss)] and to purchase a lottery tickets for a higher price than the expected payout (a large payout received with a very small probability).¹⁸ Over the entire range of probabilities, Kahneman and Tversky argued, individuals are not especially sensitive to variations in probabilities, and decision weights need not and typically do not sum to unity.

Thaler (1980, 1985) adapted elements of prospect theory to develop the concept of mental accounting, a set of cognitive operations to organize, evaluate, and manage budgets. Thaler focused his attention on the value function $v(x_i)$. He maintained the assumptions that individuals define utility derived from outcomes in terms of gains or losses relative to a reference point. Considering Kahneman and Tversky's evidence on loss aversion, he proposed additional rules for editing prospects:

- Evaluate gains separately (because utility increases less than proportionately with the amount of gain);
- Combine losses (because utility decreases less than proportionately with the amount of loss);
- Integrate smaller losses with larger gains (to offset disutility arising from loss aversion); and
- Segregate small gains from larger losses (because the utility of a small gain may be greater than the utility from a small reduction in the amount of a loss).

He cited evidence from a small experiment in which most participants judged events consistent with these rules more favorably than events not edited according to these rules.¹⁹

Individuals then evaluate edited prospects. Thaler posited that individuals consider two types of utility in evaluating prospects: (1) acquisition utility, which depends on the value of the prospect relative to the outlay required to obtain the prospect; and (2) transaction utility, which reflects the outlay relative to a reference price. The reference price Thaler defined as a "fair" price. This evaluation process, he suggested, might explain why an individual would pay a higher price for an item in one context but not in another. For example, an individual might be willing to pay a considerably higher price for a bottle of water at an expensive hotel than a supermarket. Because the hotel price would be considered unreasonably expensive at a supermarket, an individual might refuse to pay the hotel price at the supermarket.

Thaler proposed that individuals group prospects in categories of expenditure. The purchase decision takes place within the context of a category and subject to a local temporal budget constraint. The

¹⁷ The value of a prospect is $V(x,p)=\sum\pi(p_i)v(x_i)$, where x_i is the monetary value of the outcome i , $v(x_i)$ is the utility of x_i , p_i is the probability of outcome i , and $\pi(p_i)$ is weight associated with p_i . The value of a two outcome prospect of \$600 with probability of 0.33 and \$200 with probability of 0.67, for example, would be $V(x,p)=\pi(0.33)v(\$600)+\pi(0.67)v(\$200)$. This valuation differs from standard economic theory (expected utility theory), where the $v(x_i)$ are weighted by probabilities p_i , not the $\pi(p_i)$.

¹⁸ Overweighting is not the same as overestimating the probability of an event.

¹⁹ In a later experimental study, Thaler and Johnson (1990) found support for three of these four rules. Most study participants not prefer to combine losses.

budget constraint is more likely to be based on current income flows (perhaps augmented by access to credit that the income can service) than the more general concept of present value of lifetime wealth, which is commonly assumed in neoclassical economic models. Thus, the mental accounting system consists of a set of expenditure categories or mental accounts with a portion of monthly income allocated to each category. The individual would normally restrict monthly expenditures in each category to the income allocated to the category. This simple heuristic likely works well in most circumstances but can be non-optimal. It prevents an individual from shifting income from one category to another to equalize marginal consumption across categories.

Mental accounting is a heuristic that simplifies decision-making and may facilitate self-control. Mental accounting may help explain the often cited observations that many consumers focus on monthly payments in making credit decisions (which simplifies decision making) and that many consumers simultaneously have substantial liquid assets and owe credit card debt (which prevents depletion of funds saved for emergencies). Researchers have also suggested that mental accounting may help explain consumers' unwillingness to use credit to smooth income over time, as opposed to smoothing expenditures on durable goods. This explanation is developed more fully in a mental accounting model proposed by Prelec and Loewenstein (1998).

Prelec and Loewenstein (1998) argued that when individuals make purchases the pain of paying undermines the pleasure derived from consumption. To evaluate the interactions between the pleasure of consumption and the pain of paying they proposed a "double-entry" mental accounting model in which an individual evaluates both the utility from consumption after subtracting the imputed cost (net utility of consumption) and the disutility of payments after subtracting the imputed benefit associated with payments (net disutility of payment). When benefits or costs occur over time, they are discounted, not necessarily at a constant rate. Prelec and Loewenstein's net utility/disutility are analogous to Thaler's (1980, 1985) acquisition and transaction utilities.

Three additional assumptions underlie their mental accounting model. First, they assumed that past events are largely written off (prospective accounting). This assumption implies, for example, that when a vacation is paid in advance, the cost is essentially zero, and the vacation feels as if it were free. In contrast, much of the utility of a vacation financed by credit would be forgotten, and the pain of future debt repayments would be paramount in the mind.²⁰ The second assumption is that individuals allocate future payments to consumption or allocate consumption over future payments (prorating over multiple events). In other words, individuals try to match consumption to payments. The third assumption is that individuals do not always fully link payments and consumption (decoupling). The extent to which payments and income are coupled, they suggested, varies according to the situation, payment method, and individual.

Prelec and Loewenstein hypothesized that prepayment enhances consumption. The prospect of future consumption diminishes the pain of prepayment, while the prospective accounting assumption implies that past payments are largely written off at the point of consumption. In contrast, debt financing tends to diminish the utility of consumption. Future payments are discounted for current consumption, but past consumption is written off when future payments are made. Thus, consumers would tend to have an aversion to debt. These considerations do not imply that prepayment would always be preferred and credit purchases avoided. An individual may well prefer prepaying a vacation because the payments

²⁰ In the former case, net utility of consumption would be about equal to total utility of consumption because the imputed cost is essentially zero. In the latter case, the net cost would be about equal to the total cost because the imputed benefit is nearly zero.

would be a memory when consuming the vacation (and no thought of future debt payments diminish the pleasure). However, an instalment purchase of a durable may be attractive if the durable provides a series of surpluses of consumption over the periodic payment or the durable provides services after the loan is paid in full. This is often the case for instalment purchases of durables. Consumers consume the items as payments are made.

Prelec and Loewenstein suggested that debt aversion resulting from mental accounting may help explain why individuals with temporarily low incomes fail to borrow sufficiently against future income to maintain a constant consumption profile over their lifetime. They also suggested that mental accounting might prevent consumers from paying off credit card debts. The pain of repaying a credit card debt immediately would be relatively large and possibly greater than the discounted disutility of making relatively small minimum payments to repay of the debt. And if expenditures financed by credit cards provide little or no stream of future consumption, any benefits experienced in the past would tend not to be recalled and therefore be available to offset the pain of repayment. Prelec and Loewenstein speculated further that credit cards may actually enhance consumption paid by credit card if payment is associated with the monthly credit card payment rather than signing the credit card slip. This possibility arises because mental accounting enables the consumer to decouple the consumption from thoughts about paying.

Prelec and Loewenstein's provided evidence from several small-scale experiments involving hypothetical choices to support the theoretical predictions of their mental accounting model. Experiments included rankings of schedules for taking vacation and payment, preferences for fixed or variable fees for different services, pleasure associated with a windfall used to pay various types of bills or purchases, and preferences for saving or borrowing to pay for a party or miscellaneous expenses.¹ Other researchers have considered Prelec and Loewenstein's double entry mental accounting model to investigate in experimental settings how differences in the timing or form of payment affect choices (Gourville and Soman 1998, Soman 2001, Soman 2003, for example). Experimental results in these studies appear to be consistent with predictions of the mental accounting model, but it is difficult to assure in such studies that participant responses are affected by the treatment and not transaction cost, incentives, or some other environmental factor.

Robustness of Experimental Evidence of Cognitive Biases

Replications of results of experimental studies strongly support the existence of certain cognitive biases. The significance of observed biases is uncertain, however. The experimental tests are sensitive to the format of the problem and experimental procedures. Changing the format of the question or implementing different procedures can make cognitive biases disappear. There is no generally accepted theory explaining why cognitive biases occur or what causes them to disappear, although some hypotheses have been suggested. The extent to which cognitive biases affect actual behavior, including purchasing behavior, remains unresolved.

Researchers in the field of evolutionary psychology have proposed hypotheses to explain why cognitive biases are observed in some situations and not in others. Evolutionary psychologists approach the problem on the basis of a theory that humans have many specialized cognitive processes that underlie their reasoning and that these responses are adaptations to the humans' natural environment.²¹ They

²¹ For a brief description of the theory, see Samuels, Stich, and Falcher (2004).

argue that human cognition of statistical processes occurs naturally through observation of a series of events. Thus, human cognitive processes have adapted to process frequency information rather than probabilities. Experimental studies that frame problems in terms of probabilities therefore may not adequately replicate the situations in which individuals make decisions under uncertainty.

Based on their theory, researchers in evolutionary psychology have hypothesized that presenting statistical problems in terms of frequencies would produce fewer errors than problems presented in terms of probabilities. In one study, Fiedler (1988) replicated Kahneman and Tversky's experiment using the original formulation of the Linda problem. He found that 91 percent of participants responded that the feminist bank teller option was more probable than the bank teller option. He conducted a second experiment in which he asked which option is more frequent rather than which is more probable.²² In this experiment, only 22 percent of participants responded that the feminist bank teller option was more probable than the bank teller option. Similarly, Hertwig and Gigerenzer (1993), reported in Gigerenzer (1994), found that 88 percent of participants made cognitive errors for the probability format, but only 20 percent made errors for the frequency format.

The frequency format reduced cognitive errors in other experimental problems as well. Gigerenzer and Hoffrage (1995) and Cosmides and Tooby (1996) conducted experiments comparing responses to probability and frequency formats in medical diagnosis problems. In both studies, participants were considerably more likely to provide correct responses to frequency formats than probability formats. Such results support the hypothesis that frequency formats facilitate statistical inference under some circumstances. They do not indicate that cognitive biases do not exist, but they do refute the notion that all statistical reasoning is biased.

The context of the problem may also influence how individuals respond. Hertwig and Gigerenzer (1999) investigated this possibility, again using Kahneman and Tversky's Linda problem. Recall that participants were asked whether it was more probable that (1) Linda is a bank teller or that (2) Linda is a bank teller and active in the feminist movement. Hertwig and Gigerenzer pointed out that the opening statements in the problem (that Linda is 31 years old, single, outspoken, and very bright; that she majored in philosophy; and that as a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations) are not needed to answer the statistical problem. They hypothesized that these statements can be interpreted as asking for a typicality judgement. In that case, a representativeness heuristic might well be an efficient process for producing an appropriate judgement. Hertwig and Gigerenzer's empirical analyses supported this hypothesis. In a small-scale experiment, they found that by far most participants chose (2) as the correct answer. When asked about their understanding of the word "probable," most provided responses suggesting a non-statistical understanding. In a second experiment, Hertwig and Gigerenzer presented the problem in the original format to half of the participants and a modified format asking for both typical and statistical judgments. Participants responding to the modified, two-part, format provided correct answers to the statistical problem much more frequently than participants responding to the original format.

Hertwig and Gigerenzer conducted a similar analysis of participants' understanding of the question in a frequency format. When participants were asked about their understanding of "frequently", only one of 55 responses were nonstatistical. Thus, it seems that findings of considerably lower cognitive error rates for the frequency format than the probability format are not surprising, regardless of the validity of evolutionary psychologists' theories about frequency data.

²² That is, he substituted a frequency format: "There are 100 people who fit the description above. How many of them are (1) ... bank tellers? (2) ... bank tellers and active in the feminist movement?"

Krynski and Tennenbaum (2003) proposed another potential source for observed cognitive errors in experimental studies. They argued that human reasoning under uncertainty naturally operates over causal mental models, rather than purely statistical representations. Typically, individuals make correct statistical inferences only when the data can be incorporated into a causal model consistent with individuals' theories of the environment. The problem focused on predicting the incidence of cancer given a false positive test result. The possible cognitive error for this problem arises from failure to consider the overall base rate of cancer in the population. They hypothesized that lacking an explanation for a false positive test result, individuals will tend to believe the test and focus only on the information from the test.

Krynski and Tennenbaum conducted two experiments. In the first experiment, they tested whether describing false positive test results as uncertain would lead participants to believe the false positive rate and incorporate that information in their estimates. In the second test, they compared responses to a statistical question with those to a question that attributed false positive results to benign cysts. In both experiments, they found that providing a way for participants to make sense of false positive results improved estimates. The number of participants who failed to consider the low base rate (high false positive rate) was lower, and the number of correct or near-correct estimates was higher for the causal format. They interpreted these findings as evidence that human probabilistic reasoning operates over causal mental models. These findings suggest that failing to consider or misunderstanding causal structure may be an important source of error in experimental studies of problem solving involving uncertainty. In order to construct such causal models, theories of cognitive processes for specific environments are needed.

Even without accepting the theories of evolutionary psychologists, the sensitivity of experimental results to the format, context, and content of the problem suggests that some scepticism about the extent and impact of cognitive biases is warranted. Economists have also questioned the significance of experimental evidence of cognitive biases. Plott and Zeiler (2005) investigated differences in preferences attributed to an endowment effect, which is hypothesized to cause individuals' willingness to pay for an item to differ from their willingness to accept payment to do without the item. The endowment effect is attributed to loss aversion. Individuals' value an item that they own much more than an identical item that they do not own. Hence, they demand much more to do without the item than they would pay to obtain it.

Plott and Zeiler examined in detail previous experimental studies of the endowment effect. They noted that the different studies employed various procedures to avoid participant misunderstanding of the nature of the problem. The procedures included ones that

- Explained the nature of the experiment and optimal response;
- Provided with an opportunity to practice and experience the consequences of their decisions;
- Offered incentives to provide true valuations rather than respond strategically;
- Elicited valuations in a market environment with incentives for optimal responses; and
- Measured differences based on actual trades rather than willingness to pay and willingness to accept responses.

Previous studies did not agree on the nature of misunderstanding, and no study included all of procedures identified to avoid participant misunderstandings. Participant misunderstanding may have influenced the results of any of these experiments. It is also notable that the evidence is not robust,

despite beliefs to the contrary (see Kahneman, Knetsch, and Thaler 1991, for example).²³ Twelve of 39 experiments examined by Plott and Zeiler reported no significant difference in willingness to pay and willingness to accept. Evidence of an endowment effect is not conclusive.

In the absence of a theory of how perceptions might influence experimental results, Plott and Zeiler developed an experimental design to avoid all possible sources of misunderstanding identified in previous studies. They initially choose the experimental design reported in Kahneman, Knetsch, and Thaler (1990) and replicated Kahneman, Knetsch, and Thaler's results, finding that median willingness to accept was significantly greater than willingness to pay. Plott and Zeiler then modified the survey procedures to avoid possible participant misunderstandings identified in the literature. To elicit valuations, they used a market mechanism that provides incentives for participants to provide "true" valuations. They explained to participants how providing true valuations maximizes earnings and provided practice rounds for both selling (willingness to accept) and buying (willingness to pay) valuations. Participants kept any earnings from the practice rounds. Participants were told that strategic behavior was not optimal, and practice rounds allowed participants to learn that such behavior reduced earnings. Plott and Zeiler also ensured that decisions and payments were anonymous so that participants would not be tempted to consider how others (experimenters or other participants) would view their valuations.

Results of the modified experiment indicated that participants' willingness to accept was not significantly different from willingness to pay. Based on their findings, Plott and Zeiler concluded that the observed differences in willingness to accept and willingness to pay do not reflect a fundamental feature of preferences and do not support the endowment effect hypothesis:

The fact that the gap [between willingness to pay and willingness to accept] can be turned on and off demonstrates that interpreting gaps as support for endowment effect theory is problematic. The mere observation of the phenomenon does not support loss aversion—a very special form of preferences in which gains are valued less than losses. That the phenomenon can be turned on and off while holding the good constant supports a strong rejection of the claim that WTP-WTA [willingness to pay-willingness to accept] gaps support a particular theory of preferences posited by prospect theory (p. 542).

Plott and Zeiler did not advance a theory explaining participants' perceptions but did speculate about possible explanations for their findings. One explanation is that the valuations reflect motivations to announce a value other than the true value. Experimental procedures sought to eliminate motivations based on strategic considerations or concern about how others might judge their valuations, but other motivations might still exist. Explanations that the procedures removed any attitudes in which ownership plays a role or suggested that a value other than participants' valuations was desired are possible, but Plott and Zeiler's experimental data suggest that these explanations are unlikely. Other explanations included that participants perceived they were expected to remove any special value of ownership from their valuation and that the willingness to pay-willingness to accept gap reflects a learning process. Plott and Zeiler's experimental results provided no evidence regarding these latter explanations.²⁴

²³ "After more than a decade of research on this topic we have become convinced that the endowment effect, status quo bias, and the aversion to losses are both robust and important (Kahneman, Knetsch, and Thaler 1991, p. 205)."

²⁴ See Plott (1996) and Loomes, Starmer, and Sugden (2003) for further discussion and evidence of learning in repeated markets.

Heuristics and Market Performance

As mentioned earlier in this chapter, limited theoretical evidence indicates that a satisficing heuristic produces long-run optimal outcomes in some circumstances. Empirical evidence from experimental economics supports this theoretical conclusion.²⁵ The studies consistently indicate that individual decisions based on limited information in experimental markets produce prices and allocations that converge quickly to the neighborhood of optimal equilibrium values.²⁶ The results occur even though participants do not engage in extensive weighing of alternatives.²⁷ The behavior of participants using various heuristics with limited information produces efficient market outcomes. Experimental studies have also found that market environments reduce the incidence of preference reversals for risky prospects and losses from failure to recognize sunk costs and opportunity costs.²⁸ Smith (1991) argued that the findings of these studies suggest that markets reinforce or even induce individual rationality, although the manner in which markets promote rationality is not well understood (p. 881). In a later paper Smith (2005) speculated on how markets promote rationality. Market prices provide stimuli that cause individuals to take actions that better their situations. These actions move prices and allocations to competitive equilibrium. Focusing on whether or not individual decisions are optimal misses the point (p. 146).

Expected Utility and Time Preference

Samuelson's (1937) expected utility model posits an individual behaves so as to maximize the sum of all future utilities. Future utilities are reduced to comparable magnitudes by discounting. For simplicity, Samuelson assumed that individuals discount by a single constant discount rate, which is the same for all types of consumption and across all time periods. Assuming the same discount rate across all types of consumption precludes different discount rates for different items, such as gains being discounted more heavily than losses (that is, loss aversion discussed earlier in this chapter). Assuming the same rate across all time periods precludes discounting items closer in time more than more distant items. A declining rate of time preference is often termed "hyperbolic discounting" because a hyperbolic function provides a better fit to experimental data than a constant, exponential function. Samuelson did not claim that individuals actually discounted using a single constant rate. Instead he maintained that a single constant rate was a hypothesis, subject to refutation by the observable facts.

Many researchers have observed behavior consistent with hyperbolic or other non-constant rate of time discounting (see Frederick, Loewenstein, and O'Donoghue 2002 for a comprehensive list). Thaler (1981) is one such study. In Thaler's study, participants were asked to imagine that they had won a lottery.

²⁵ Experimental economics is a field of economics that applies experimental methods to study how markets and other exchange systems work.

²⁶ See Smith (1991) for references and a summary of the findings various studies.

²⁷ Smith proposed that markets and institutions serve as social tools that reinforce, or even induce individual rationality, although the manner in which they promote rationality is not well-understood (p. 881).

²⁸ Evidence from equity markets supports the findings studies in experimental economics. Reviewing studies of stock return anomalies attributed to behavioral biases, Malkiel (2003) noted that although statistically significant, the anomalies are generally quite small and that the anomalies sometimes persist for short periods but usually disappear quickly. Malkiel argued that while market participants clearly do make mistakes and the actions of some market participants are demonstrably less than rational, the preponderance of evidence suggests that the market is remarkably efficient. Whatever evidence of anomalies in pricing of equities have been found, he concluded, do not persist and provide few opportunities for investors to obtain extraordinary returns. For a similar assessment of the evidence on behavioral anomalies in stock market returns, see Fama (1998).

They could receive an amount of money immediately or a larger amount if they wait. Participants were asked how much money they would need to receive to wait different periods of time. For one set of options involving receipt of \$15, for example, the median amount participants required to wait three months was \$30, which implied a discount rate of 277 percent; a one-year wait required \$60 or 139 percent, and a three-year wait required \$100 or 63 percent. For another set of options also involving receipt of \$15, the median amount participants required to wait one month was \$20 or 345 percent per annum. The median amount for three months was \$30 or 277 percent, for one year \$50 or 120 percent, and for 10 years \$100 or 19 percent. Other researchers, also using experimental data, have found similar patterns. Such findings suggest that individuals are more impatient when delays are shorter than when they are longer.

Available evidence from many different studies suggests that discount rates decline sharply during the short run and then level off and become practically constant. Frederick, Loewenstein, and O'Donoghue (2002) examined the relationship between estimated discount rates and the time horizon from different studies. They found that the discount rate was inversely related to the length of the time horizon. The highest discount rates were for time horizons of one year or less. Discount rates decreased with the length of the time horizon. After a year, the discount rate was nearly constant, on average about 25 percent. This relationship is quite imprecise, however. Estimates from the individual studies varied quite substantially.

Constant, exponential discounting ensures that decisions are time consistent (Strotz 1956). Time consistency means that if receiving Y tomorrow is preferred to X today, then receiving Y in 101 days will be preferred to X in 100 days. With hyperbolic discounting, the discount rate for evaluating options received tomorrow is greater than the discount rate for evaluating options received between the 100th and 101st day. Consequently, an individual could well prefer receiving X today while preferring to receive Y in 101 days to X in 100 days. In words, the individual's preference over options X and Y reverses as the decision gets closer. Such preferences are called time inconsistent. Time inconsistent behavior may lead individuals to deviate from prior optimal inter-temporal allocations in future time periods.

Besides a constant discount rate, the discounted utility model involves several additional assumptions. They include

- Integration of new prospects with existing plans: Individuals evaluate a new prospect by considering how accepting the prospect will affect consumption in all future periods. This assumption is a consequence of the effect that accepting the prospect alters the budget constraint. Such integration requires that individuals have well-formed plans for future consumption and reallocate future consumption every time a decision is made.
- Utility independence: Utility is the discounted sum of each period's utility. Aside from discounting, the distribution across time does not matter. This assumption rules out preferences for a flat or improving utility profile over a highly uneven utility profile.
- Consumption independence: Utility of consumption in any period is unaffected by consumption in any other period. Consumption independence rules out, for example, that an individual's preference between lobster and steak for dinner depends having steak last evening or expecting to have steak tomorrow evening.
- Stationary instantaneous utility: An individual's well being from an outcome in any time period is constant regardless of the time at which utility is evaluated. This assumption precludes changes in preferences over time.

Empirical evidence indicates that individuals do not behave in accordance with these assumptions either (see Frederick, Loewenstein, and O'Donohue 2002).

Departures from some of the assumptions of the expected utility model do not seem to be problematic. That individuals may prefer to spread consumption over time or allow variety to influence their choices for dinner today and in the future does not suggest irrational behavior. Failure to integrate new prospects in existing plans and hyperbolic discounting are more problematic.

New prospects alter the intertemporal budget constraint. To evaluate a new prospect, an individual must consider both the existing consumption plan and the optimal consumption plan if the prospect is accepted. This decision is difficult, but failure to integrate new prospects may preclude reallocations that equalize marginal consumption over time, resulting in suboptimal inter-temporal allocation of consumption. It seems more plausible that individuals consider many new prospects independently of existing consumption plans. Mental accounting may play a role in simplifying such evaluations.

Hyperbolic Discounting

Hyperbolic discounting has raised the most concern. As mentioned, higher valuation of present over future utilities may lead individuals to deviate from prior optimal inter-temporal allocations in future time periods. For example, individuals might postpone or abandon earlier plans for setting aside money in savings. As a consequence, individuals might not save enough for future expenses or retirement. Hyperbolic discounting has also been linked to behavior that can be or is harmful, such as procrastination and addiction (O'Donoghue and Rabin 1999), for instance.

Whether or not hyperbolic discounting is irrational is not clear. Individuals make numerous intertemporal choices, in most cases apparently without suffering great harm. In some cases, choosing a smaller proximate reward may be sensible, such as when future prospects, preferences, and resources are risky and uncertain or when the proximate reward ensures survival (Becker and Mulligan 2001, Smith 2005).²⁹ Individuals may exercise self control to prevent impatience from jeopardizing long-term plans. Individuals may also enter into contractual arrangements that obligate them to carry out long term plans (precommit).

Individuals have cognitive self control structures that provide them with the ability to direct thought and action to achieve internal goals. Activation of these cognitive control structures enables individuals to inhibit automatic processes that are susceptible to impulses.³⁰ Benhabib and Bisin (2005) model such a structure for a consumption/saving decision. The structure trades off impulsive immediate consumption with a saving rule requiring self-control for its implementation. Self-control requires actively maintaining attention to the saving rule. An individual facing temptations might yield to a temptation only if it does not perturb the saving plan too much and does not have large permanent effects on the prescribed wealth accumulation pattern. To be effective, the saving rule requires that the internal inhibitions become stronger the as the awareness of the cost of impulsive consumption increases.

²⁹ Hyperbolic discounting may have a biological basis. Hyperbolic discounting predicts animals' behavior in foraging and predation. Animals often choose a smaller reward if it is available sooner over a larger reward later, even though waiting for the larger reward would maximize their rate of energy intake. Some biologists have hypothesized that such discounting of the value of future rewards may be an adaptive response to the risks associated with waiting for delayed rewards. See Real and Caraco (1986), Green and Myerson (1996).

³⁰ See Miller and Cohen (2001) or Camerer, Loewenstein, and Prelec (2005) for a neurobiological description of cognitive control structures.

To enforce previous decisions, individuals sometimes precommit to future actions, such as having automatic contributions from pay to tax-deferred savings accounts or using instalment to purchase relatively expensive household durables (see Strotz 1956 or Laibson 1997, for example). Casual observation and empirical evidence indicates that individuals exercise self control through precommitment. Ariely and Wertenbach (2002) provide experimental evidence that in circumstances where time inconsistent behavior is costly, many individuals self-impose binding constraints to overcome perceived self-control problems. The evidence consists of two studies. One involved course requirements for papers, with one class being allowed to choose deadlines for each of three papers and the other being assigned three evenly spaced deadlines. A grade penalty was imposed for missing a deadline. When given a choice, most students choose deadlines before the end of the course: Only 12 of 51 students chose to submit all three papers on the last day of class. Comparing the performance of students in the two groups, Ariely and Wertenbach found that overall students in the no-choice class performed better than students in the free-choice class.³¹ However, the performance of students in the free-choice class that chose approximately evenly spaced deadlines was not statistically significantly different from the performance of students in the no-choice class. Together these findings suggested that some individuals did not set self-imposed deadlines optimally. Ariely and Wertenbach did not report the number of free-choice students for this test, but the chart of the frequency distribution of declared deadlines by week shows that declared deadlines clustered around evenly spaced intervals.

The second study involved a paid proofreading task, where participants were randomly assigned to three experimental groups: (1) self-imposed deadlines, (2) mandatory evenly spaced deadlines, and (3) an end of study period deadline. Payments were \$0.10 per of correctly identified error, and a \$1.00 penalty was imposed for missing a deadline. Results of the experiment indicated that the number of errors correctly detected, timely submissions, and payment amounts were greatest for the mandatory evenly spaced group and lowest for the end of study period deadline. Again, Ariely and Wertenbach found that performance for self-imposed evenly spaced deadlines were not statistically significantly different from mandatory evenly spaced deadlines. Thus, they concluded that individuals self-impose costly deadlines to overcome procrastination, that self-imposed deadlines improve performance, and that self-imposed deadlines are not always optimal (where optimal is defined as evenly spaced).

Significance of the New Behavioral Economics

That cognitive errors and time inconsistent discounting exist is well established in the behavioral literature. However, the significance of these phenomena is not clear. The mostly experimental evidence of these behavioral biases is not robust. The evidence is sensitive to the format, content, and context of the problems presented to study participants.

Some of the problems presented to participants of experimental studies likely do not reflect the problems actually experienced by most individuals in making decisions under uncertainty, and participants in experimental studies may not use the same decision processes that they use in making actual decisions. Experimental problems often appear more similar to test questions than choices that consumers actually face in the markets. Hypothetical situations are likely perceived as such by study participants. There is little cost to making an error and not much reward for efforts to provide a correct

³¹ All students submitted papers on time.

response. Therefore, participants in experiments likely do not make great efforts to analyse the problems.³²

Individuals may be predisposed to impulsive behavior but they also have the capacity to exert self-control to implement forward-looking plans. Self-control requires actively maintaining attention to the plan. An individual facing an impulse might yield to the impulse if it does not perturb the plan too much. To be effective, self-control requires that the internal inhibitions become stronger as the awareness of the cost of impulsive behavior increases. It is not clear that participants exert the same cognitive efforts in experimental situations that they exert in actual situations where commitments in money and duration are great, past experience and information are insufficient or obsolete, and outcomes of previous decisions are regarded as unsatisfactory.

Statistical, logical, or other rational models of decision-making may not necessarily be the appropriate norm for evaluating decisions (Samuels, Stich and Faucher 2004). Another concept of rationality is behavior aimed to achieve one's goals or objectives.³³ Heuristics often perform as well but require less information to implement than rules based full information and weighing of alternatives. Such heuristics may efficiently facilitate achievement of goals in an environment of limited and costly information.

It seems reasonable to conclude that individuals sometimes do make cognitive mistakes. We cannot conclude that all, most or even a large part of human decisions are influenced by cognitive biases, however. Assessing decisions requires understanding of the cognitive process and the environment in which the decision is made. Research in evolutionary psychology has contributed to this understanding and deserves to be taken seriously. Precise and falsifiable models that predict specific circumstances that elicit various heuristics are needed. To date, the applications of theories have been to relatively simple problems. Theories on use of specific heuristics in consumer credit decisions or cognitive biases arising from such use have not been tested.

Empirical evidence indicates that consumers generally use credit to finance purchases of relatively expensive consumer durable goods, not to smooth consumption. In doing so, behavioral concepts such as pre-commitment and mental accounts may be used to manage behavior. Some research suggests that these psychological considerations also influence consumers' credit behavior. The extent to which cognitive biases and time inconsistent discounting affect actual credit decisions is not known at this time.

³² Smith (1991) noted, "...the subjective cost of exploring options and figuring out what to do must be part of the problem of rational choice as experienced by the decision maker. Decision cost is the cost of concentration, attention, information acquisition, thinking, monitoring, checking, deciding, and acting—all the things one does to realize a decision. When the benefits are small, the decision cost may not be worth it, or the decision cost incurred may be, rationally, correspondingly small so that the pain fits the pleasure, marginally speaking, although the typical subject will not consciously think about it in such terms (p. 888)."

³³ Katona's (1975) view of rationality discussed in a previous section of this paper conforms to this concept.

Rationality of Credit Card Debt

The development and general adoption of credit cards have stimulated further questioning of the rationality of consumer credit use. Particularly influential in the debate is an article by Professor Lawrence Ausubel (1991), in which he hypothesizes that consumers are insensitive to credit card interest rates because they deceive themselves that they will not borrow on their credit cards.

The Ausubel Hypothesis

In a controversial article, Ausubel (1991) proposed that consumer irrationality in credit card use was a reason for what he saw as an apparent failure of competition in the market for general purpose credit cards in the 1980s. In his view, the manifestation of the failure of competition was stickiness of interest rates on general purpose, bank type credit cards. The Federal Reserve's reported average of the most common interest rates on issuers' general purpose credit card plans varied within a range of about one percentage point in width during most of 1980s, but Ausubel's estimate of the cost of funds to card issuers varied within a range of about four percentage points. Based on a regression analysis indicating that movements in the cost of funds explained only a very small, albeit statistically significant, proportion of movement in general purpose credit card interest rates, Ausubel argued that credit card rates were nearly constant and largely unresponsive to costs, showing, in his view, a lack of competition.

Stickiness of rates was obvious at the time, but the cause was more controversial. Ausubel argued that stickiness of interest rates on credit cards arose from consumer irrationality that renders a large class of borrowers insensitive to these rates. To reach this conclusion, he proposed a model of the credit card market with high and low-risk credit card borrowers. In positing this dichotomous view of credit card users, Ausubel ignored a third type of bank card customer, so called "convenience" customers, who use bank cards only as a transaction medium; these latter card holders pay balances in full at the end of the month to avoid finance charges. Because they do not incur finance charges, they would not likely be sensitive to interest rates. But the existence of a group of convenience customers in itself does not explain why credit card issuers would not change interest rates for others who use the cards for longer term credit.

Ausubel argued that the low-risk borrowers do not intend to borrow but find themselves repeatedly doing so anyway. Since these borrowers do not intend to borrow, they do not seek out or respond to offers of lower interest rates. In contrast, he contended, the high-risk borrowers fully intend to borrow. High-risk borrowers are willing to pay high bank card interest rates because they are high risk and have few alternatives. But since they expect to pay interest, they are responsive to lower interest rates if available, and, therefore, they are more likely to respond to a lower interest rate than low risk card holders. Given these two types of borrowers, creditors competing on the basis of interest rates would attract mostly the less profitable higher risk borrowers if they lowered their interest rate. As a result of this "adverse selection," bank card issuers would be reluctant to reduce interest rates to attract new customers, who would be disproportionately higher risk.

Ausubel acknowledged that search and switching costs could also cause interest rates to be sticky. Search and switching costs include the costs of finding and identifying (other) cards with low interest rates, the time and effort in applying for a new card, the possibility of rejection, uncertainty about the size of the new credit limit, and the waiting time between application and receipt of the card. Certainly some search and switching costs characterized the credit card market of the 1980s that was Ausubel's subject, but he doubted that the search and switching costs provided a full explanation for sticky credit

card rates. He argued that the premiums paid on sales of portfolios of credit card accounts by one card company to another in the 1980s by far exceeded the costs credit card companies would have had to pay to induce consumers to switch to their cards. Therefore, he contended, the sales premium on the portfolios sold must reflect the expectation of supranormal profits from interest insensitive customers.

Ausubel's adverse selection model relies crucially on the assumption that a large group of consumers do not intend to use the cards for long term credit, and so they are insensitive to interest rates, but they repeatedly use the cards for credit anyway. Otherwise, if the large majority of card holders were actually interest sensitive, new firms entering into the card business and aggressive competitors already in the industry would compete for their business by offering lower rates.

In his analysis, Ausubel based his assumption on several observations. First, he suggested that borrowing at the prevailing credit card interest rates was in itself irrational: "The proclivity of consumers to borrow at these high rates suggests a substantial breakdown in optimizing behavior among credit card holders" (Ausubel 1991, pp. 71-72). He contended that rational behavior would cause many of these lower risk consumers to shop for lower priced credit cards, use lower priced types of credit, or abstain from further credit use. They did not do so, and, in his view, this showed there was irrational inertia among consumers, leading to insufficient competition for their business.

Second, he noted apparent inconsistencies in behavior among card holders. About half of credit card holders responding to Federal Reserve Board-sponsored consumer surveys at the time reported that they always or nearly always paid their bank or retail credit card balances in full. In contrast, he reported that a survey of large bank card issuers indicated that on average only about one-quarter of active card holders pay in full and three-quarters owe finance charges at a given time. Ausubel argued that this discrepancy between the actual account behavior from credit card issuers and reported behavior from consumer surveys, with a smaller percentage actually paying in full than saying they do so, suggests that many consumers repeatedly borrow despite the intention to pay in full.³⁴

Third, he also noted evidence from credit card marketers that consumers' responses to changes in annual fees on card plans at that time were much greater than to commensurate changes in interest rates. This observation, he suggested, is difficult to reconcile with the frequency of consumers owing interest on their credit card accounts. It seemed to him that if interest accrued every month, it should be more important to consumers than annual fees that applied only once in twelve months. Again Ausubel regarded the observation as evidence supporting his assumption that many consumers do not intend to use their cards for credit but find themselves doing so anyway.

Finally, he cited other examples of credit using behavior that he considered inconsistent with rational choice. The examples involved conscious choices of credit that was not the lowest cost credit available, and pre-commitments of income to various areas by some consumers in order to avoid impulsive purchases using credit cards. Two of the three examples that Ausubel provided were anecdotal, however, rather than from systematic gathering of evidence. The only statistical evidence was from a study two decades earlier that found that a considerable percentage of consumers choosing a high-cost

³⁴ Apparently, Ausubel's data turn out to have been not good enough for him to draw strongly the conclusions he reported in this area. It is true that a large proportion of cardholders revolve their accounts, but it appears they are not always the same consumers. The proportion of cardholders who revolve continuously is actually much lower, more in line with the survey proportions. See Chapter 6 for more recent data and discussion on consumer payment performance. Using the 1989 Survey of Consumer Finances, Cargill and Wendel (1996) raise essentially the same point.

source for automobile loans would have qualified for a loan from a lower cost source and were aware of nearby lenders offering lower cost credit. While interesting, that study did not involve credit card use.

Ausubel extended his views in a second paper (Ausubel 1999) using experimental data on consumers' card behavior from a large credit card issuer. In the study, he explored consumers' credit card choices in response to preapproved credit card solicitations and the subsequent borrowing behavior of consumers accepting offers. The experiments involved varying within solicitations mailed to consumers the level and duration of reduced introductory interest rates and the level of post-introduction interest rates and then looking at the results of the experiment. The data are unusual in that they involve actual consumer choices among a variety of related offerings, not merely responses to hypothetical alternatives.

Much of Ausubel's second study concerns evidence on the impact of adverse selection on credit supply.³⁵ But his second study also investigated elements of consumer demand permitted by the experimental design format. They included such issues as sensitivity of consumers to variations in introductory interest rates (often called teaser rates) and post-introductory rates together with related duration of introductory rates.

Ausubel derived "implied" dollar demand curves for variations in the offered interest rates. Thinking about his discussion in graphical terms, the horizontal axis measures the acceptance rate of each offer (accepting respondents per 100,000 solicitations associated with a given rate offer). The vertical axis measures the average dollar amount of finance charges that borrowers would have incurred in the first 21 months after account opening if they had chosen the next highest or next lowest interest rate but borrowed the same amount over the period. For example, based on the actual amounts borrowed during the first 21 months, borrowers choosing the 5.9 percent introductory rate would have saved on average \$10.21 if they paid the next lowest (4.9 percent) rate, and borrowers choosing the 4.9 percent introductory rate would have incurred on average an additional \$13.07 had they paid the next highest (5.9 percent) introductory rate. Ausubel calculated the dollar impact of the difference between a 4.9 and 5.9 percent introductory rate as the average of these two values (that is, $(10.21+13.07)/2$).³⁶ For each set of variations in interest rates (experiments), he calculated a point on an implied demand curve and found that the implied demand curve was downward sloping, a result that is consistent with rationality and suggests economic rationality.

Ausubel first compared an implied demand curve for four different introductory interest rates with one for five different post-introductory rates. The implied demand curve for introductory rates was flatter than the implied demand curve for post-introductory rates, suggesting that borrowers were more responsive to differences in introductory rates than dollar-equivalent post-introduction rates.

Using the same procedure as the first exercise, he then compared the implied demand curve for different introductory rates (4.9-7.9 percent for six months) with implied demand curves involving higher introductory rates for longer periods of time (6.9 percent for 9 months versus 7.9 percent for 12

³⁵ He observed that those responding to an offer had, on average, riskier characteristics and subsequently performed worse than the whole pool of consumers receiving the particular offer, based upon the underlying credit reports of both groups.

³⁶ An assumption behind this calculation is that amounts borrowed would be the same for both interest rates. This assumption probably produces an overestimate of the dollar impact since quantity demanded is normally inversely related to price. Amounts borrowed at the higher interest rate would be lower than amounts borrowed at the lower interest rate, making the difference in finance charges smaller than his measurement.

months). The curve for differences in the introductory rate for the short period was flatter than either of the two curves involving extensions of the duration. This suggested that consumers were more responsive to the level of introductory rates than dollar equivalent extensions of duration.

Finally, he compared options involving low introductory rates for a short period of time (for example, 4.9 percent for 6 months) to options involving higher introductory rates for a longer period of time (for example, 5.9 percent for 9 months). The offer with the lowest introductory rate (4.9 percent for 6 months) had the highest acceptance rate, but based on actual balances for the first 13 months of new accounts, this account had a higher effective interest rate than two offers that involved higher introductory interest rates for a longer period of time (5.9 percent for 9 months and 7.9 percent for 12 months). He found that borrowers choosing a lower interest rate for a shorter period would have paid on average less if they had chosen an offer with a higher introductory interest rate for a longer period of time. This outcome was due to the more rapid jump to the full rate for the shorter term offer. But because the lower introductory rate offers were accepted more frequently than those higher introductory rate offers, Ausubel argued that this finding provides substantial support for his hypothesis that consumers are prone to underestimate their future use of credit and therefore make suboptimal choices of credit cards. The evidence is perhaps not as strong as Ausubel suggested, however. As measured, the difference in response rates between the lowest and highest introductory rate was quite small, just 0.00129 (0.129 percentage points). And, his calculations also indicated that many borrowers chose the right offer relative to their future outcome. These borrowers presumably did not underestimate their future borrowing.

Thus, borrowers may be more sensitive to variations in introductory rates than to either dollar-equivalent post introductory rates changes or the duration of introductory rates. Ausubel interpreted both of these results as inconsistent with rational behavior and as evidence supporting his earlier hypothesis that consumers systematically underestimate future credit card borrowing. Nonetheless, strictly in terms of the traditional economic model of rational choice, much of what Ausubel reported is consistent with traditional economic rationality; namely, more consumers responded to lower priced offers than to higher priced offers.

Comparing Ausubel's implied demand curves for variations in introductory rates with those for variations in the other terms suggests that the difference in finance charges between the alternatives are generally relatively small. For example, the difference between the finance charge for an introductory interest rate and the finance charge with post-introductory rate was at most \$60 to \$70 dollars in finance charges over a period of 21 months. And in the comparisons involving tradeoffs between lower introductory rates for a shorter period of time and higher introductory rates for a longer period of time, borrowers choosing the shorter introductory rates would have saved less than \$15 over 13 months. To the extent that the set of experimental offers reflect options at the time of choice, differences of these magnitudes over a year or more suggest that errors arising from any bias favoring low introductory rates are likely to be small for many consumers.³⁷

The implied demand curves are based on assumptions that consumers could have chosen any one of the experimental options and as mentioned would have borrowed the same amounts if they had chosen the next higher or the next lower price option. Consumers may not have been presented with the next higher or next lower price options at the time they chose the account, however. One does not know

³⁷ See Cargill and Wendel (1996), p. 381 for similar discussion.

what solicitations these consumers received or whether they took any actions to find alternatives. Thus, support for the underestimation hypothesis is probably not as strong as it appears at first glance.

To be sure, Ausubel's analyses do suggest that consumer decisions may involve factors other than extensive consumer calculations regarding the lowest cost. This is not especially surprising. As discussed earlier, behavioral research on consumer decisions has shown that complete consistency with the assumptions of economic theory likely is lacking in many consumer decisions. And behavioral research suggests also that complete consistency is not necessarily irrational.

Since Ausubel's analyses, additional evidence on consumers' sensitivity to credit card interest rates and ability to choose credit card contracts that are consistent with their borrowing intentions has become available.

Consumers' Sensitivity to Credit Card Interest Rates

Gross and Souleles (2002) obtained data from credit card companies that enabled them to examine sensitivity of bank card borrowing over the period of a year to changes in interest rates and credit limits. The data consisted of monthly panel data of several thousand individual bank card accounts from several different lenders in 1995. The data included information from monthly statements, credit bureau reports, and credit applications. Some of the largest bank card issuers in the United States were among the lenders.

The dependent variable was the change in debt from one month to the next. The explanatory variables were either increases in credit limits or changes in interest rates in preceding months and monthly time dummies to account for seasonality, business cycle, trends in debt, and aggregate interest rates. Results of estimation indicated that increases in credit limits produce immediate increases in debt. The response was strongest for accounts starting near their limit, but statistically significant increases were also observed for accounts starting well below their credit limit. Increases in debt for accounts starting near their limit can be explained by binding liquidity constraints (credit rationing). The increases in debt for accounts starting well below their limit cannot, however.

Gross and Souleles provided a plausible explanation for increases in debt for accounts starting well below their limit by looking at utilization rates (the ratio of debt to the credit limit). Using utilization as the dependent variable instead of debt, they found that after an initial drop in utilization following an increase in the credit limit, consumers quickly increase borrowing, returning to their original utilization within a relatively short period of time. This behavior was true for accounts starting near their limit as well as accounts starting well below their limits. This finding suggests that consumers may have target utilization rates, which may arise from behavioral rules of thumb about appropriate amounts of borrowing or from precautionary motives for maintaining a reserve of available credit.³⁸

³⁸ Analyzing data from the Survey of Consumer Finance, Castronova and Hagstrom (2004) found that consumers hold a certain fraction of their credit limits as debt and that this fraction does not vary systematically in the population. Consumers' demand for credit limits was responsive to income, the interest rate on the card with the highest balances, and demographic characteristics. They interpreted these results as consistent with Gross and Souleles's (2002) hypothesis that consumers have a precautionary motive for unused credit card limits.

Results of regressions for changes in interest rates indicated that borrowing was sensitive to interest rates. Estimates of the interest rate elasticity were about -0.8 in the short term and about -1.3 in the long term. In other words, an increase in the interest rate produces a nearly proportionate decline in borrowing within a short period of time and eventually a greater than proportionate decline in borrowing.

Gross and Souleles also examined responses to temporary teaser rates for new accounts and for balance transfer offers, which have become a ubiquitous part of competition in the bank card market since the 1990s. They found that large decreases in interest rates, such as those typically occurring when a teaser rate is taken, have stronger effects than small decreases. They also found that large decreases in rates had greater effects than the large increases, which follow upon the expiry of teaser rates. Thus, temporary teaser rates would produce a rise in debt, a result that helps explain card issuers' widespread use of teaser rates.

Using changes in balances on other credit cards (from credit bureau reports) as the dependent variable, Gross and Souleles were able to investigate the extent to which increases in interest rates cause consumers to shift balances to other accounts. They found that balances on other accounts do rise when the interest rate on an account rise, but the rise in balances on other accounts is less than half the decline in the balance on the account whose interest rate has risen. Thus, while some balances are shifted to other accounts, an increase in the interest rate still causes a large decrease in debt overall.

Overall, the evidence does not support Ausubel's (1991) conclusion that credit card borrowers are insensitive to credit card prices. Both Ausubel's (1999) own experimental results showing that more consumers responded to lower price bank card offers than higher price offers and Gross and Souleles's (2002) findings that an increase in the interest rate reduced balances in an account and caused a shift in balances to other accounts are consistent with downward sloping demand curves and rational behavior. Consumers do not always act in a fully optimal manner, however. As mentioned, Ausubel's (1999) found that consumers may be more responsive to teaser rates than equivalent reductions in post-introductory rates or the duration of the introductory rate, and Gross and Souleles found that teaser rates produce temporary increases in debt. These results certainly suggest that consumers do not calculate precisely and may respond differently when price changes are framed in different ways. That much of the teaser-rate induced increases in debt were temporary suggests that consumers' actions do not tend to be contrary to their intentions, contrary to Ausubel's hypothesis. Instead, consumer responses to teaser rates appear to be short-term increases in debt in response to short-term reductions in price. As such, these responses may well be utility increasing, even if not utility maximizing.

Further Evidence on the Rationality of Consumers' Credit Card Behavior

Results of a large-scale experiment undertaken by a bank produce further evidence that consumers are sensitive to credit card interest rates and that based on subsequent behavior their choices involving tradeoffs between interest rates and annual fees on new accounts are usually cost minimizing (Agarwal, Chomsisengphet, Liu, and Souleles 2005). Agarwal, Chomsisengphet, Liu, and Souleles analyzed results of a program by "a large bank" that offered consumers a choice between credit card contracts, one with a fee but a low fixed interest rate and another with no fee but a higher fixed rate. The offer included the option to switch contracts after the initial choice.

These authors found that the majority of consumers made the “right” choice based on their subsequent card use behavior, suggesting the majority understood the likelihood of their future use of the card to add debt and chose the lowest cost card under the circumstances. Consumers who chose to pay an annual fee in order to obtain a lower interest rate (perhaps because planned to use the card for debt purposes) more frequently revolved balances and borrowed greater amounts than consumers who chose a higher interest rate and no fee.

Agarwal, Chomsisengphet, Liu, and Souleles found that 60.0 percent of the consumers who remained with their initial choice made an optimal choice.³⁹ The likelihood of making an optimal choice was much greater for consumers who did not pay a fee (79.0 percent) than for consumers who pay a fee (44.5 percent). That the frequency of errors was much higher for those who paid an annual fee can be explained by the magnitude of the potential cost of the mistake. The potential cost is limited to the amount of the fee, which was a small dollar amount (on average about \$20) for consumers who paid the fee.⁴⁰ In contrast, the potential cost for borrowers who did not pay a fee depends on the amount of borrowing. Thus, the cost of making an error could become quite large with frequent or large amounts of debt. These findings suggest that many borrowers who could not or did not want to estimate future borrowing very precisely may have chosen contracts that limited the cost of mistakes to a small dollar amount. Those who chose contracts with potentially large costs, being much more likely than not to have chosen the right contract, apparently were aware of their (limited) future borrowing.

Consumers who initially chose not to pay an annual fee were more likely to switch as the net savings from paying the fee increased, and consumers who initially chose to pay the fee were less likely to switch as net savings increased. Of the small percentage (3.4 percent) of consumers who eventually switched accounts, nearly all made a suboptimal choice initially and had corrected their mistake by switching.

Agarwal, Chomsisengphet, Liu, and Souleles concluded that most consumers made cost minimizing choices of credit card contracts. Further, they reported that the probability of making the wrong choice declines with the size of the potential error, and “those who made larger error in their initial contract choice were more likely to subsequently switch to the optimal contract” (Agarwal, et al. 2005, p. 5). It is hard to reconcile these results with the hypothesis of consumer insensitivity toward rates. These authors do note, however, that a “small minority of consumers persists in holding substantially sub-optimal contracts without switching” (Agarwal, et al. 2005, p. 5).

In another study Agarwal, Driscoll, Gabaix, and Laibson (2008) provide evidence that credit card holders’ behavior is sensitive to late, over limit, and cash advance fees. In their data, which were obtained from a large bank, they observed that when consumers incurred these fees, they incurred the fees most commonly soon after opening an account. Subsequently, the incidence of these fees declined, falling by 75 percent during the first four years of account life. To explain this behavior, Agarwal, Driscoll, Gabaix, and Laibson suggested that consumers often learn about fees by incurring them or having incurred a fee, consumers are more careful in managing their accounts. Consumers learn from their mistakes and take steps in the future to avoid making a mistake again. In the case of late payments, for example, they found that incurring a late payment fee reduced the probability of a late payment in the next month by

³⁹ A choice that turns out to be a mistake ex post may not be a mistake ex ante. Consumers may experience unexpected expenses or shortfalls in income that cause them to borrow when they initially had not intended to borrow.

⁴⁰ The annual fees on cards ranged from \$10 to \$24.

44 percent. They also found that a recent fee payment had a larger effect than more distant fee payments.

The findings of Agarwal, Driscoll, Gabaix, and Laibson suggest that consumers may not consider all available information in opening accounts or always manage their accounts carefully. That alone does not indicate that consumers' behavior is not rational. That consumers learn from experience and correct their behavior after mistakes is consistent with rationality, where rationality is viewed as taking actions to achieve objectives.

In sum, evidence from analyses of actual credit card behavior indicates that consumers are sensitive to price, consistent with the predictions of economic theory. When a credit card company increases the interest rates on an account, consumers reduce new charges, reduce existing balances, and shift charges to other credit card accounts; and over the course of a year, they reduce total credit card balances from the level before the price increase. Based on subsequent account use, consumers generally make cost minimizing choices trading off interest rates and annual fees when choosing new credit card accounts. When they make mistakes, the mistakes are usually relatively small. If mistakes are large, consumers generally correct the mistakes. Although some consumers do not correct large mistakes, persistent large mistakes are not the rule. Analyses of credit card behavior based on survey data also suggest that consumers are sensitive to cost and do not incur costly mistakes (Zinman 2007, 2009). Survey data indicate that by far most consumers believe that credit cards provide a useful service (Durkin 2000). Consumers whose choices are inconsistent with their interests are unlikely to evaluate a product positively. Analyses of actual behavior in the credit card market does not support a hypothesis that credit market failures arising from behavioral biases are persistent.

Effectiveness of Disclosures

Passage of the Truth in Lending Act in 1968 marked the beginning of an extensive expansion of the federal government's role in consumer protection for financial services.⁴¹ In subsequent years, Congress passed the Real Estate Settlement and Procedures Act (1974), Consumer Leasing Act (1976), Electronic Fund Transfer Act (1979), and Truth in Savings Act (1991), which involved primarily information disclosure regulation. Laws such as the Equal Credit Opportunity Act (1974 and 1976) and the Fair Credit Reporting Act (1971), which involved mainly substantive regulation of lender behavior, also contained significant disclosure requirements. Truth in Lending and most other federal disclosure regulations have been amended many times since their initial passage. Amendments generally require additional disclosures.

Disclosure regulations are based largely on perceptions of problems. Regulations reflect numerous, sometimes vague, and not always consistent goals. Durkin and Elliehausen (2010) note, for example, 38 different goals that various parties have advanced at one time or another for Truth in Lending. Some are vague, "promote wise credit use" or "enhance economic stabilization," for instance. Others seem inconsistent, such as "simplify information processing" and "satisfy consumers' right to know." Disclosures are complicated legal documents, in part because of the extensive requirements and severe legal consequences for failure to comply. Disclosures are not designed to facilitate consumers' decision-

⁴¹ The National Commission on Consumer Finance (1972) noted that information disclosure regulation did not originate with the federal government. Most state laws contained requirements that lenders include disclosures of various credit terms in contracts.

making. Empirical research has played only a limited role in assessing the problem, designing the disclosure, or assessing effectiveness.

Much of the empirical evidence on the effects of disclosure regulation concerns effects of Truth in Lending and was conducted in the years following implementation of the law. The evidence, which an earlier section of this paper reviews, concerns awareness of annual percentage rates, use of information about credit terms, and shopping behavior. The effectiveness of disclosures was not examined, but indirect evidence indicating that by far most consumers consider Truth in Lending statements as complicated raises questions about the effectiveness of disclosures.

Recently two economists at the Federal Trade Commission studied the effectiveness of Truth in Lending disclosures for mortgages (Lacko and Papalardo 2007). The objective of the study was to investigate how well consumers understand current disclosures and whether better disclosures could improve consumers' understanding of mortgage terms. Federal Trade Commission staff developed a prototype disclosure based on prior in-depth interviews with 36 consumers who recently obtained mortgages, agency experience in designing consumer disclosures, and problems encountered in deceptive lending cases investigated by the Federal Trade Commission. The principles for designing the form were that the form needed to contain information on key terms, the format and language should be easily understood, and less important information should be excluded.

Tests were conducted with 819 recent mortgage borrowers in 12 different locations. Half of the participants received current disclosures, and the other half received prototype disclosures. Tests included both prime and subprime borrowers. Lacko and Pappalardo tested disclosures for both simple fixed-rate purchase loans and more complex fixed-rate refinance loans involving terms such as interest only payments, balloon payments, prepayment penalties, optional mortgage insurance, no escrow, and zero cash due at closing.

Results of tests indicated that current and prototype disclosures failed to convey key loan terms to many borrowers. For current disclosures, 87 percent of participants could not correctly identify total up-front charges; 74 percent could not identify charges for optional credit insurance; and 68 percent could not identify the presence of a prepayment penalty. Participants had problems not just with terms of complex mortgages. Fifty-one percent of participants could not correctly identify the loan amount; 32 percent could not identify the interest rate; and 23 percent could not identify closing settlement charges. Responses of subprime borrowers were similar to those of prime borrowers for both simple and complex loans.

Participants understood prototype disclosures much better than current disclosures. Increases in correct responses were 66 percentage points for up-front charges, 43 percentage points for optional credit insurance, 24 percentage points for the presence of a prepayment penalty, 37 percentage points for loan amount, 12 percentage points for the interest rate, and 15 percentage points for settlement charges. Lacko and Pappalardo's findings demonstrate that credit disclosures can be improved.

Behavioral research can help avoid regulatory mistakes and contribute to more effective disclosures. Evidence also suggests that disclosures can worsen market outcomes. Providing wrong, irrelevant, difficult to comprehend, or excessive information can reduce consumers' ability to make utility

increasing decisions.⁴² Simply adding more disclosures to already confusing disclosures is not likely to be effective. New disclosures should be carefully designed and tested before they are implemented.

Conclusions

Behavioral research indicates that consumers do not always make the cognitive efforts required for an extensive decision process. Individuals often take shortcuts, simplify, and use heuristics. Cognitive effort tends to be reserved for situations where commitments in money and duration are great, past experience and information are insufficient or obsolete, and outcomes of previous decisions are regarded as unsatisfactory. In situations where consumers have previous experience and are satisfied with past decisions, consumers often make choices with little further deliberation.

That cognitive biases and time inconsistent discounting exist is well established in the behavioral literature. Some research suggests that these psychological considerations influence consumers' credit behavior. The extent to which cognitive biases and time inconsistent discounting affect actual credit decisions is not known at this time.

The experimental evidence supporting cognitive biases and time inconsistent discounting is sensitive to the format, content, and context of the problems presented to study participants. When problems are framed differently the results sometimes contradict previous findings. Experimental problems often appear more similar to test questions than choices that consumers actually face in the markets. Hypothetical situations are likely perceived as such by study participants. And it seems unlikely that participants in experimental studies view the consequences of their choices as very important even when they are paid or their course grade may be affected. Individuals may be predisposed to impulsive behavior but they also have the capacity to exert self-control to implement forward looking plans. Self-control requires actively maintaining attention to the plan. An individual facing an impulse might yield to the impulse if it does not perturb the plan too much. To be effective, self-control requires that the internal inhibitions become stronger as awareness of the cost of impulsive behavior increases. It is not clear that participants exert the same cognitive efforts in experimental situations that they exert in actual situations where commitments in money and duration are great, past experience and information are insufficient or obsolete, and outcomes of previous decisions are regarded as unsatisfactory.

Empirical evidence indicates that consumers generally use credit to finance purchases of relatively expensive consumer durable goods, not to smooth consumption. In doing so, behavioral concepts such as pre-commitment and mental accounts may be used to manage behavior. Such concepts may not be optimal in the sense of global utility maximization, but they may be sensible when future prospects, preferences, and resources are uncertain.

Evidence from analyses of actual credit card behavior indicates that consumers are sensitive to price, consistent with the predictions of economic theory. When a credit card company increases the interest rates on an account, consumers reduce new charges, reduce existing balances, and shift charges to other credit card accounts; and over the course of a year, they reduce total credit card balances from the level before the price increase. Based on subsequent account use, consumers generally make cost minimizing choices trading off interest rates and annual fees when choosing new credit card accounts. When they make mistakes, the mistakes are usually relatively small. If mistakes are large, consumers generally correct the mistakes. Although some consumers do not correct large mistakes, persistent

⁴² For further discussion, see Durkin and Elliehausen (2010).

large mistakes are not the rule. Analyses of credit card behavior based on survey data also suggest that consumers are sensitive to costs and do not incur costly mistakes. And by far most consumers believe that credit cards provide a useful service and are satisfied with their dealings with credit card companies. Thus, neither behavioral nor conventional evidence provides much support for the conclusion that market failure is pervasive.

Disclosure regulations such as Truth in Lending are based largely on perceptions of problems in credit markets. Regulations reflect numerous, sometimes vague, and not always consistent goals. Required disclosures commonly reflect politicians', lawyers', and economists' beliefs about solutions to problems. Disclosures necessarily have been designed to implement these solutions, not to facilitate consumers' decision-making. Empirical behavioral (or other) research has played only a limited role in assessing problems, designing disclosures, or assessing effectiveness of disclosures. Policymakers, researchers, and industry share responsibility for these deficiencies.

Available evidence indicates that credit disclosures are often confusing and that many consumers do not understand specific disclosures. These findings do not imply that disclosure policies are not useful. Studies show that consumers believe that interest rates and charges are among the most important credit terms, are aware of annual percentage rates (even if they do not understand the mathematics), and do not believe obtaining information on account terms is very difficult to obtain. Truth in Lending almost certainly contributed to these findings (both negatively and positively). Limited evidence suggests that disclosures could be improved. Evidence also suggests that disclosures can worsen market outcomes. Providing wrong, irrelevant, difficult to comprehend, or excessive information can reduce consumers' ability to make utility increasing decisions. Behavioral research can help avoid regulatory mistakes and contribute to more effective regulation, which enhances the performance of markets and improves individual outcomes.

References

- Agarwal, Sumit, Souphala Chomsisengphet, Chunlin Liu, and Nicholas S. Souleles. "Do Consumers Choose the Right Credit Contracts?" Working Paper, Federal Reserve Bank of Chicago, December 18, 2005.
- Agarwal, Sumit, John C. Driscoll, Xavier Gabaix, and David Laibson. "Learning in the Credit Card Market." Working Paper 13822. Cambridge: National Bureau of Economic Research, February 2008.
- Ariely, Dan and Klaus Wertenbach. Procrastination, Deadlines, and Performance: Self-Control by Precommitment. *Psychological Science*, 13 (May 2002): 219-24.
- Ausubel, Lawrence M. "The Failure of Competition in the Credit Card Market." *American Economic Review*, 81 (March 1991): 50-81.
- Ausubel, Lawrence M. "Adverse Selection in the Credit Card Market." Working Paper, University of Maryland (June 17, 1999).
- Barr, Michael S., Sendhil Mullainathan, and Eldar Shafir. "Behaviorally Informed Home Mortgage Credit Regulation." In *Understanding Consumer Credit*, E. S. Belsky and N. P. Retsinas, eds. Brookings Press, 2009.
- Becker, Gary S. and Casey B. Mulligan. "The Endogenous Determination of Time Preference." *Quarterly Journal of Economics*, 116 (August 1997): 729-58.
- Bendor, Jomathan Brodie, Sunil Kumar, and David A. Siegel. "Satisficing: A 'Pretty Good' Heuristic." *The B.E. Journal of Theoretical Economics*, 9 (2009): 1-36. www.bepress.com/bejte/vol9/iss1/art9.
- Benhabib, Jess and Alberto Bisin. 2005. Modeling Internal Commitment Mechanisms and Self-Control: A Neuroeconomic Approach to Consumption-Saving Decisions. *Games and Economic Behavior*, 52 (2005): 460-92.
- Blackwell, Roger D., Paul W. Miniard, and James F. Engel. *Consumer Behavior*. Fort Worth, Texas: Dryden Press, 2006.
- Böhm-Bawerk, Eugen von. *Capital and Interest, a Critical History of Economical Theory*. London and New York: Macmillan and Co., 1890.
- Borges, B., D.G. Goldstein, A. Ortmann, and G. Gigerenzer. "Can Ignorance Beat the Stock Market?" In *Simple Heuristics that Make Us Smart*, Gerd Gigerenzer and Peter M Todd, eds. New York: Oxford University Press, 1999.
- Camerer, Colin, George Loewenstein, and Drazen Prelec. "Neuroeconomics: How Neuroscience Can Inform Economics." *Journal of Economic Literature*, 43 (March 2005): 9-64.
- Cargill, Thomas F. and Jeanne Wendel. "Bank Credit Cards: Consumer Irrationality versus Market Forces." *Journal of Consumer Affairs*, 30 (Winter 1996): 373-89.

Castronova, Edward and Paul Hagstrom. "The Demand for Credit Cards: Evidence from the Survey of Consumer Finances." *Economic Inquiry*, 42 (April 2004): 304-18.

Cosmides, Leda. and Tooby, J. "Are Humans Good Intuitive Statisticians After All? Rethinking Some Conclusions from the Literature on Judgment under Uncertainty." *Cognition*, 58, 1 (1996), 1-73.

Danielian, N.R. Theory of Consumer Credit, *American Economic Review*, 19 (September 1929): 393-411.

Day, George S. and William K. Brandt. "A Study of Consumer Credit Decisions: Implications for Present and Prospective Legislation." In *National Commission on Consumer Finance: Technical Studies*, Vol. I. Washington, US Government Printing Office (1973).

Deutscher, Terry. "Credit Legislation Two Years Out: Awareness Changes and Behavioral Effects of Differential Awareness Levels. In *National Commission on Consumer Finance: Technical Studies*, Vol. I. Washington, US Government Printing Office (1973).

Durkin Thomas A. "Credit Cards: Use and Consumer Attitudes, 1970-2000." *Federal Reserve Bulletin*, (September 2000): 623-34.

Durkin, Thomas A. and Gregory Elliehausen, *1977 Consumer Credit Survey*. Washington: Board of Governors of the Federal Reserve System, 1978.

Durkin, Thomas A. and Gregory Elliehausen. *Truth in Lending: Theory, History, and a Way Forward*. New York: Oxford University Press (2010).

Durkin, Thomas A., Gregory Elliehausen, Michael E. Staten, and Todd Zywicki. *Consumer Credit and the American Economy*. New York: Oxford University Press, 2010 (forthcoming).

Elliehausen, Gregory. *Consumer Use of Tax Refund Anticipation Loans*. Monograph No. 37. Washington: Georgetown University, McDonough School of Business, Credit Research Center, 2005.

Elliehausen, Gregory. Consumers' Use of High-Price Credit Products: Do They Know What They Are Doing? Working Paper 2006-WP-02. Indiana State University, Networks Financial Institute, (May 2006).

Elliehausen, Gregory. *An Analysis of Consumers' Use of Payday Loans*. Washington: George Washington University, Financial Services Research Program, (2009).

Fama, Eugene F. "Market Efficiency, Long-Term Returns, and Behavioral Finance." *Journal of Financial Economics*, 49 (1998): 283-306.

Fiedler, Klaus. The Dependence of the Conjunction Fallacy on Subtle Linguistic Factors. *Psychological Research*, 50, (1988): 123-29.

Fisher, Irving. *The Theory of Interest : As Determined by Impatience to Spend Income and Opportunity to Invest It*. New York: Macmillan Company, 1930

Frederick, Shane, George Loewenstein, and Ted O'Donoghue. "Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature*." 40 (June2002): 351-401.

Gabaix, Xavier and David Laibson. Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets. *Quarterly Journal of Economics*, (May 2006): 505-40.

Gigerenzer, Gerd. "Why the Distinction between Single-Event Probabilities and Frequencies Is Important for Psychology (and Vice Versa)." In *Subjective Probability*, G. Wright and P. Ayton, eds. New York: John Wiley, 1994.

Gigerenzer, Gerd and Henry Brighton. "Homo Heuristicus: Why Biased Minds Make Better Inferences." *Topics in Cognitive Science*, 1 (2009): 107-43.

Gigerenzer, Gerd and Ulrich Hoffrage. "How to Improve Bayesian Reasoning Without Instruction: Frequency Formats." *Psychological Review*, 102 (1995): 684-704.

Gigerenzer, Gerd and Daniel G. Goldstein. "Betting on One Good Reason: The Take the Best Heuristic." In *Simple Heuristics that Make Us Smart*, Gerd Gigerenzer and Peter M Todd, eds. New York: Oxford University Press, 1999.

Green, Leonard and Joel Myerson. "Exponential versus Hyperbolic Discounting of Delayed Outcomes: Risk and Waiting Time." *American Zoologist*, 36 (September 1996): 496-505.

Griffiths, Thomas L and Joshua B. Tenenbaum. "Optimal Predictions in Everyday Cognition." *Psychological Science*, 9 (September 2006): 767-73.

Gross, David B. and Nicholas S. Souleles. "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence from Credit Card Data." *Quarterly Journal of Economics*, 117 (February 2002): 149-85.

Juster, F. Thomas and Robert P. Shay. *Consumer Sensitivity to Finance Rates: An Empirical and Analytical Investigation*. Occasional Paper 88. New York: National Bureau of Economic Research, 1964.

Hertwig, Ralph and Gerd Gigerenzer. "Frequency and Single-Event Judgments." Unpublished manuscript, 1993.

Hertwig, Ralph and Gerd Gigerenzer. "The 'Conjunction Fallacy' Revisited: How Intelligent Inferences Look Like Reasoning Errors." *Journal of Behavioral Decision Making*, 12 (1999): 275-305.

Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. "Experimental Tests of the Endowment Effect and the Coase Theorem." *Journal of Political Economy*, 98 (1990): 1325-48.

Kahneman, Daniel, Jack L. Knetsch, and Richard H. Thaler. "Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias." *Journal of Economic Perspectives*, 5 (Winter 1991): 193-206.

Kahneman, Amos and Daniel Tversky. "Prospect Theory: An Analysis of Decision Under Uncertainty." *Econometrica*, 47 (March 1979): 263-92.

Katona, George. *Psychological Economics*. New York: Elsevier Scientific Publishing, 1975.

- Katona, George and Eva Mueller. "A Study of Purchase Decisions." In *Consumer Behavior: The Dynamics of Consumer Reaction*, L. H. Clark, ed. New York: New York University Press, 1954.
- Krynski, Tevye R. and Joshua B. Tenenbaum. The Role of Causal Models in Reasoning under Uncertainty. In *Proceedings of the 25th Annual Conference of the Cognitive Science Society* (2003).
- Lacko, James M. and Janice K. Pappalardo. *Improving Consumer Mortgage Disclosures: An Empirical Assessment of Current and Prototype Disclosure Forms*. Staff Report. Washington: Federal Trade Commission, 2007.
- Laibson, David. "Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics*, 112 (May 1997): 443-77.
- Lawrence, Edward C. and Gregory Elliehausen. A Comparative Analysis of Payday Loan Customers. *Contemporary Economic Policy*, 26 (April 2008): 299-316.
- Loomes, Graham, Chris Starmer, and Robert Sugden. "Do Anomalies Disappear in Repeated Markets." *Economic Journal*, 113 (March 2003): C153-66.
- Lynch, John G., Jr. and Gal Zauberman. "When Do You Want It? Time, Decisions, and Public Policy." *Journal of Public Policy and Marketing*, 25 (Spring 2006): 67-78.
- Macki, Dean M. "The Growth of Consumer Credit and the Household Debt Service Burden." In *The Impact of Public Policy on Consumer Credit*, T. A. Durkin and M. E. Staten, eds. Boston: Kluwer Academic Publishers, 2002.
- Malkiel, Burton G. "The Efficient Market Hypothesis and Its Critics." *Journal of Economic Perspectives*, 17 (Winter 2003): 59-82.
- Miller, Earl K. and Jonathan D. Cohen. "An Integrative Theory of Prefrontal Cortex Function." *Annual Review of Neuroscience*, 24 (2001): 167-202.
- National Commission on Consumer Finance. *Consumer Credit in the United States*. Washington: US Government Printing Office, 1972.
- Oaksford, Mike, and Nick Chater. "Rational Explanation of the Selection Task." *Psychological Review*, 103 (1996): 381-91.
- O'Donoghue, Ted and Matthew Rabin. "Doing It Now or Doing It Later." *American Economic Review*, 89 (March 1999): 103-24.
- Plott, Charles R. "Rational Individual Behavior in Markets and Social Choice Processes: The Discovered Preference Hypothesis." In *Rational Foundations of Economic Behavior*, K. A. Arrow, E. Colombatto, M. Perlman, and C. Schmidt, eds. New York: St. Martins Press, 1996.
- Plott, Charles R. and Kathryn Zeiler. "The Willingness to Pay-Willingness to Accept Gap, the 'Endowment Effect,' Subject Misconceptions, and Experimental Procedures for Eliciting Validations." *American Economic Review*, 95 (June 2005): 530-45.

Prelec, Drazen and George Loewenstein. "The Red and the Black: Mental Accounting of Savings and Debt." *Marketing Science*, 17 (1998): 4-28.

Rae, John. *The Sociological Theory of Capital*. London: Macmillan, 1905 [1834].

Real, Leslie and Thomas Caraco. "Risk and Foraging in Stochastic Environments." *Annual Review of Ecology and Systematics*, 17 (1986): 371-90.

Samuels, Richard, Stephen Stich, and Luc Faucher. "Reason and Rationality." In *Handbook of Epistemology*, I. Niiniluoto, M. Sintonen, and J. Wolenski, eds. Dordrecht: Kluwer, 2004.

Samuelson, Paul A. "A Note on Measurement of Utility." *Review of Economic Studies*, 4, (February 1937): 155-61.

Seligman, Edwin Robert Anderson. *The Economics of Installment Selling*. 2 vols. New York: Harper & Brothers, 1927.

Shay and Brandt (1973). "Public Regulation of Financial Services: The Truth in Lending Act." In *Regulation of Consumer Financial Services*, A. A. Heggstad, ed. Cambridge, MA: Abt Associates, 1979, 163-274.

Schoemaker, Paul J.H. "The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations." *Journal of Economic Literature*, 20 (June 1982): 529-63.

Simon, Herbert A. "Invariants of Human Behavior." *Annual Review of Psychology*, 41 (1990): 1-19.

Smith, Vernon L. "Rational Choice: The Contrast between Economics and Psychology." *Journal of Political Economy*, 99 (August 1991): 877-97.

Smith, Vernon L. "Behavioral Economics Research and the Foundations of Economics." *Journal of Socio-Economics*, 34 (2005): 135-50.

Soman, Dilip . "Effects of Payment Mechanism on Spending Behavior: The Role of Rehearsal and Immediacy of Payments." *Journal of Consumer Research*, 27 (March 2001): 460-74.

Soman, Dilip . "The Effect of Payment Transparency on Consumption: Quasi-Experiments from the Field." *Marketing Letters*, 14 (October 2003): 173-83.

Soman, Dilip and John T. Gourville. "Transaction Decoupling: How Price Bundling Affects the Decision to Consume." *Journal of Marketing Research*, 38 (February 1998): 30 – 44.

Stigler, George. "The Economics of Information." *Journal of Political Economy*. 69 (June 1961): 213-25.

Strotz, R.H. "Myopia and Inconsistency in Dynamic Utility Maximization." *Review of Economic Studies*, 23 (1955-1956): 165-80.

Thaler, Richard H. "Toward a Positive Theory of Consumer Choice." *Journal of Economic Behavior and Organization*, 1 (1980): 39-60.

Thaler, Richard H. "Some Empirical Evidence on Dynamic Inconsistency." *Economics Letters*, 8 (1981): 201-7.

Thaler, Richard H. "Mental Accounting and Consumer Choice." *Marketing Science*, 4 (Summer 1985): 199-214.

Thaler, Richard H. and Shlomo Benartzi. "Save More Tomorrow: Using Behavioral Economics to Increase Employee Saving." *Journal of Political Economy*, 112 (2004): S164-S187

Thaler, Richard H. and Eric J. Johnson. "Gambling with House Money and Trying to Break Even: The Effects of Prior Outcomes on Risky Choice." *Management Science*, 36 (June 1990): 643-60.

Tversky, Amos and Daniel Kahneman. "Judgment Under Uncertainty: Heuristics and Biases." *Science*, 185 (1974): 1124-31.

Tversky, Amos and Daniel Kahneman. "The Framing of Decisions and the Psychology of Choice." *Science*, 211 (1981): 453-8.

Tversky, Amos and Daniel Kahneman. "Extensional versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment." *Psychological Review*, 90 (1983): 293-315.

Zinman, Jonathan. "Household Borrowing High and Lending Low Under No Arbitrage." Working Paper. Dartmouth College, April 19, 2007.

Zinman, Jonathan. "Debit or Credit." *Journal of Banking and Finance*, 33 (2009): 358-66.