Economic Choices

Economic Decisions of Individuals

Daniel McFadden

ECONOMIC CHOICES -- VERBAL NOTES 3/18/01

Daniel McFadden

SLIDE 1. The term "economics", in its original Greek, means "of the hearth", the ancient and practical science of household management. Over the millennia, the discipline has transformed itself into a grander enterprise, speaking sagely of the organization of economies, and admonishing capitalists and kings on incentives, constraints, and unintended consequences. I think of the public edifice of economics as being like the inflatable buildings that cover tennis courts in cold climates, entirely supported by air. Yet, the air has direction, and is the result of carefully designed and maintained mechanical equipment that provides stability and form. It is at this practical, mechanical level that the *science* is put into economic science. Here, outside the public eye, is where my research is done. Some of my work has direct policy implications, and most of it is motivated by the problems that applied economists face, but I leave the retailing of economics to others. These days, I am often asked "are we going into a recession" and "has the stock market bottomed out?" Asking me these questions is a bit like asking a designer of aircraft engines if a plane is ready to take off. I understand the principles involved, but you might not want to fly on my recommendation.

Since I am not a public figure, perhaps I should tell you a little about myself. My wife Beverlee and I have been married for 38 years, and we have three grown children, Nina, Robert, and Ray, and 3+ grandchildren. Beverlee's father was a professor of art at Carnegie-Mellon, and Beverlee continues her family's artistic tradition, working with large-format Polaroids and other photographic media. For recreation, we operate a small farm in the Napa Valley, sell figs and grapes, and make wine. I find the vineyard a nice, quiet place to think about economics. My mother, Alice Little, was a professor of architecture in the 1920's, at a time when it was still very difficult for women to progress in academia. She lived in Greenwich Village and raced cars as a hobby. My father, Robert McFadden, grew up in the mountains of North Carolina. He had only four years of formal education, but was a Latin scholar and a great lover of books. He was also a lightening calculator, so at age 14 he went to work for the local bank as their bookkeeper. My parents met when my mother was teaching for a term at the University of North Carolina. The jobs of both my parents were wiped out in the Great Depression, and I grew up on a farm deep in rural North Carolina, with lots of books and no electricity, much like life in California today. I had an independent streak as a kid, and would challenge my teachers and parents on politics, social customs, and religion. I enjoyed farm life, despite the hard work, and was very active in 4-H, winning state prizes for my geese and for my soil conservation projects. I thought of myself as clever rather than smart, and my ambition was to become a county farm agent, and perhaps a novelist. My parents taught me to lead a modest life, and instructed me that success created an obligation to share with those less lucky. That is why Beverlee and I gave the Nobel prize money to a charitable foundation rather than spend it on ourselves.

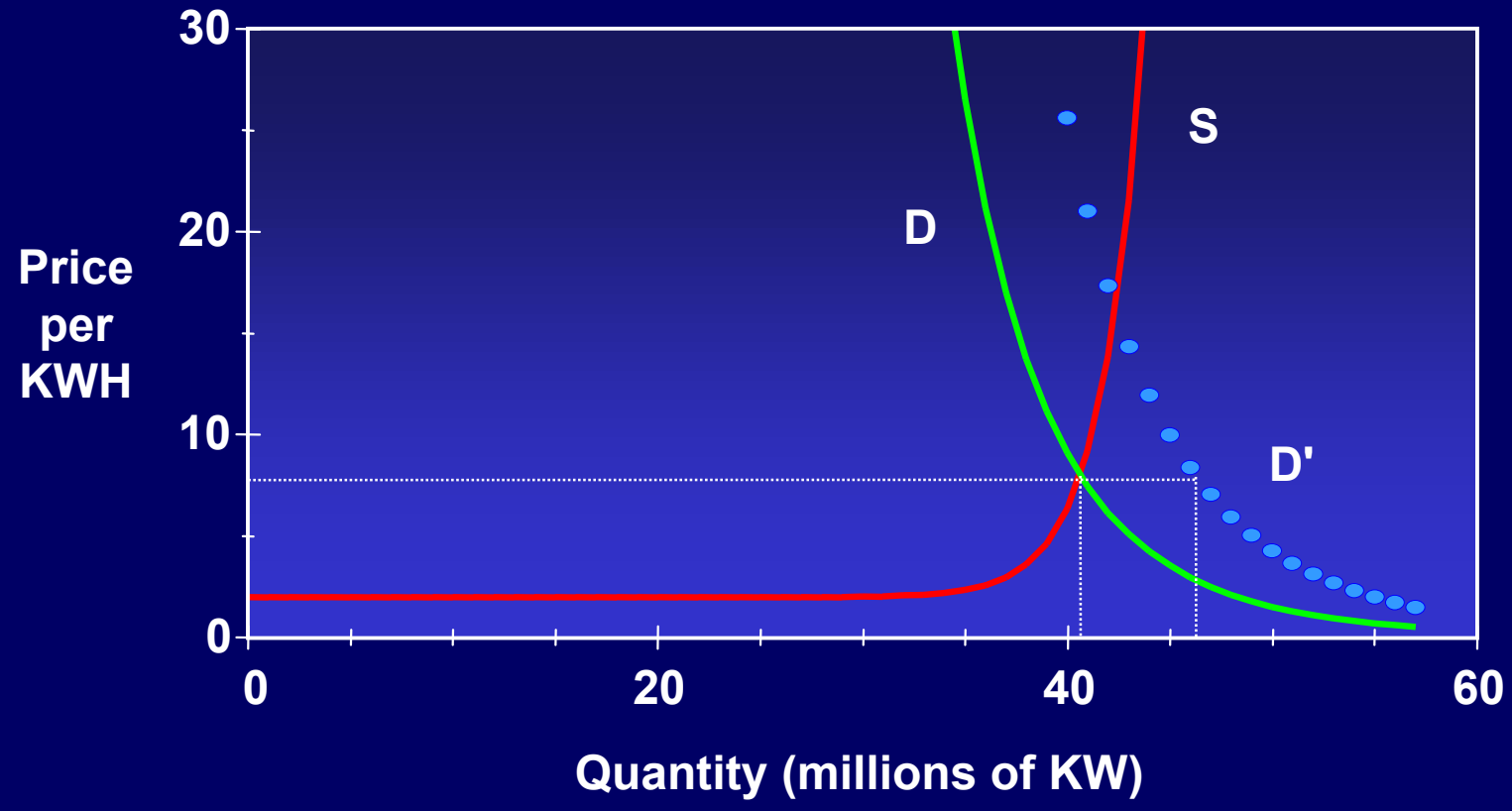
At age 16, I was suspended from high school for circulating a civil rights petition, and left home to work as a stripper. That's not as lurid as it sounds; I followed behind the milking machines on an uncle's dairy farm in Minnesota. From there, I gained admission by examination to the University of Minnesota. I believe that objective aptitude tests provide an important entry point to college, particularly for kids who do not conform to the social norms of their teachers.

For me, the university was an intellectual smorgasbord, and I stuffed myself. I worked two jobs, was active in student affairs, and at age 19 completed a B.S. in Physics with high distinction. I remained at Minnesota for graduate study, but my interests shifted as the result of working for some psychology professors who were developing personality tests. I became fascinated with the question of how people responded to tests, and what one might learn from their choices. I was able to transfer to an interdisciplinary Ph.D. program in the behavioral sciences sponsored by the Ford Foundation, and went to work as a research assistant in social psychology. Our experiments on the effect of mood-altering drugs on susceptibility to group pressure led directly to the committees on human subjects that now protect undergraduates. I found that my interest in mathematical models of decision-making behavior was best matched at Minnesota by two economists, Leo Hurwicz and John Chipman, and I made economics my specialty in order to work with them. I joined the University of California faculty in 1963. In 1978, after a long period where public higher education was under stress in California, I moved to MIT. In 1982, I was given the James R. Killian chair at MIT, named after MIT's former president and President Eisenhower's science advisor. I met Dr. Killian, and we discovered that my grandfather had been a mechanic in the cotton mill owned by his grandfather. When I related this coincidence to my friend Bob Solow, he replied "So much for social mobility in America. Two generations later, you are still a mechanic in Killian's mill." What this story illustrates is the amazing opportunities this country offers for success on your own merits, without legacies. I wish the playing field were as level for women and minorities as it was for me. I found the intensity of MIT very stimulating, but returned here in 1991 because of the research opportunities Cal offered. I love the atmosphere of Cal, with its diversity of students and academic programs. I also like the idea that it is *not* Stanford or Yale. The University has been unsettled in recent years by the elimination of affirmative action programs. My view is that the whole argument over diversity and affirmative action is misdirected. What we should be asking is why there are not enough university spaces to accommodate *all* those who can benefit. The right affirmative action program is one that turns away no student who would be better off in university than not.

The Nobel Prize in economics that I was awarded last fall was given for the "development of theory and methods for analyzing discrete choice." In the remainder of this talk, I will describe this work, and highlight some of its implications for individual decision-making. A "discrete" choice is a "yes/no" decision, or a selection of one alternative from a set of possibilities. Whether a manufacturer introduces a new brand of SUV or not, and whether an individual consumer decides to buy this new brand or some other vehicle, are discrete choices. The theory of discrete economic choice applies to any economic decision-maker, either a firm manager or an individual consumer, but I will talk only about consumers. I will also talk about how discrete choice analysis is used by economists to value and make recommendations on policy issues that affect your daily lives, such as air quality standards, social security reform, managing demand for electricity or for public transit, and the introduction of new consumer products such as SUV's and electric cars.

Electricity in California

Demand and Supply



SLIDE 2. There is an old saw that says that you can teach a parrot to be an economist; all he has to learn are the words "supply" and "demand". If you want your parrot to be a completely modern economist, you will also have to teach him the phrase "there's no such thing as a free lunch". The picture shows roughly what the supply and demand for electricity looked like in California last year and this year. This market is currently reminding us that there is no such thing as a free lunch, particularly when Texas generators eat your lunch.

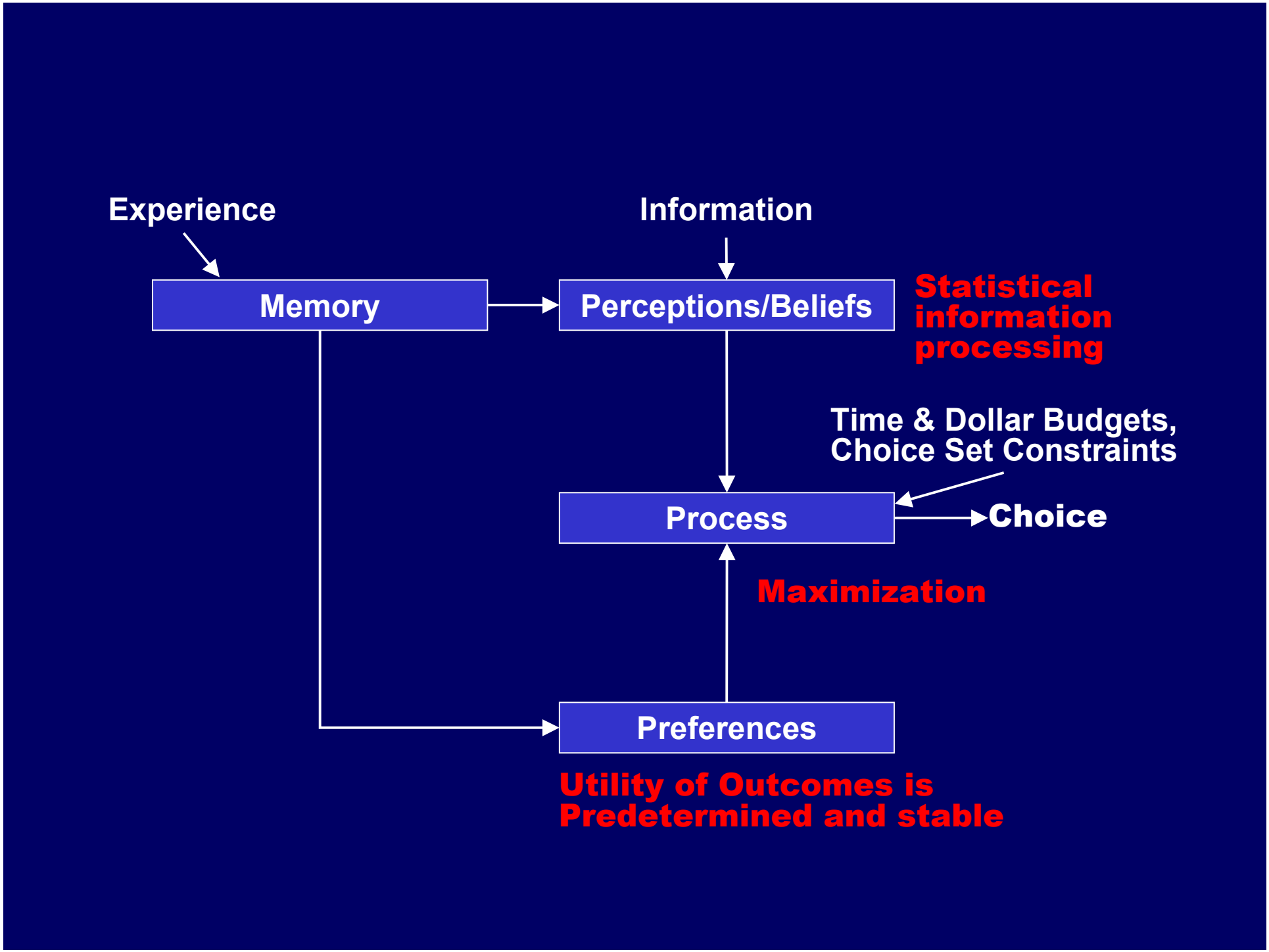
People who are unable to learn the words "supply" and "demand" are called *politicians*. Liberal politicians think that supply and demand *cause* greed; while conservative politicians think that supply and demand *excuse* greed. What economists know is that you can always rely on greed as a motivation for human behavior. Supply and demand can harness greed in the common interest; this is Adam Smith's "invisible hand". In operation, the invisible hand lacks a public relations arm, and does not keep its finger on the pulse of the public. Allocating resources through supply and demand can be painful and unnerving. Politicians react by trying to repeal the law of supply and demand, as Governor Davis is now trying to do for electricity, but greed usually finds a way to unhinge political solutions to resource allocation problems. It is the recognition that greed is always with us that makes economics the dismal and useful science that it is.

Consumer decision-making matters to economists because consumers determine the demand side of supply and demand. For example, to predict the impacts of various programs which may be introduced to trim electricity consumption this summer, you need to understand how much and how quickly consumers will moderate electricity use in the face of higher prices. There are no painless ways to deal with the electricity crisis, but Sacramento's policy of disguising the real cost of electricity by freezing retail prices and covering the difference through government subsidies, is dangerously misguided. This policy discourages conservation and plays into the hands of those Texas generators. It is worse than just inefficient; it puts the whole California economy at risk. Voluntary conservation will not work: the incentives are wrong, and moral fiber is strongest when it is not cut by self-interest. Allowing supply and demand to operate, particularly by using real peak energy prices to encourage large users to conserve electricity or sell power back to the system, is the effective way to limit demand when it matters.

It is sometimes said that economists know the price of everything and the value of nothing. Of course, this is hyperbole — we don't know the price of everything. Despite this, economists are called upon to attach values to policies such as air quality standards. This leads to a second reason that economists are interested in consumer behavior. For social valuation, economists rely on the concept of "the greatest good for the greatest number", originally put forth by Jeremy Bentham in 1775. Each consumer gains utility from the integration of life's pleasures and pains, and social value is determined by the sum of the utilities of all consumers. Then, to measure social value, economists have to measure the utilities of individual consumers. As an aside, I should tell you that Jeremy Bentham had himself stuffed when he died in 1843, and today he sits in a glass case in University College London. Every year, in accordance with the dictates of his will, he is wheeled into the meeting of the college fellows. It is said that he improves both the intellectual level and liveliness of any group of economists he joins.

Because economists have no window to the soul, they must infer the utilities required for Bentham's calculus from choices that people make. I can illustrate how these valuation tools are used. By studying how people's decisions to purchase bottled water respond to the quality of tap water, economists can place a value on safe drinking water. This week George W. Bush rescinded an EPA decision to reduce arsenic limits on drinking water to the level recommended by the World Health Organization. By comparing the

extra profits that mining companies will gain from this decision with the cost of lost wages and health care for the preventable cancer cases that will also result, or with consumer's willingness-to-pay for safe water, the wisdom of this policy can be evaluated. For Mr. Bush, life apparently begins at conception and ends at birth.


Experience
Information
Memory
Perceptions/Beliefs
Statistical information processing
Time & Dollar Budgets, Choice Set Constraints
Process
Choice
Maximization
Preferences
Utility of Outcomes is Predetermined and stable

SLIDE 3. For a long time, economists took it to be self-evident that choices maximized utility. A 1912 economics textbook put it like this:

> "An object can have no value unless it has utility. ... Doubtless people are sometimes foolish, and buy things, as children do, to please a moment's fancy; but at least they think at the moment that there is a wish to be gratified."

In the middle of the 20th century, economists began a more careful and more quantitative formulation of the ideas of utility and its maximization. A distinction was drawn between *utility*, which was viewed as something intrinsic and stable, and *demand*, which was viewed as the result of maximization of utility subject to the budget that constrained the consumer's purchases. Economists developed a *standard model*, shown in the slide, for the economic decision-making process.

A further simplification, particularly used in empirical studies, was to assume that demand at the level of a market looked just like the demand of one representative consumer, writ large. In 1955, 4.5 percent of all births were to unmarried women. An economist of that era would have said that the representative mother was 4.5 percent unmarried. Clearly, economists needed to learn the facts of life. Choices such as pregnancy were being made at the *extensive* margin, "yes" or "no", rather than at the *intensive* margin, "how much".

In the 1960's, the situation began to change. Earlier, economists usually had access only to government data collected at the market or national level, but with the advent of punch cards and computers, it became feasible to collect and analyze data on individual firms and consumers. These data forced economists to confront head-on the fact that different people placed in the same economic situation did not all behave in the same way, and this variation in behavior appeared to come from variation in their preferences. It was not enough to try to describe them in terms of one representative consumer, or use this approximation to predict what they would do if economic policy changed. This was particularly obvious for the discrete choices which appeared frequently in individual consumer data.

When I arrived in Berkeley as a new assistant professor in 1963, I had begun a research program on the economics of electricity generation, and was developing ideas on how to describe the variations in the operation of different plants. In 1965, a Berkeley graduate student, Phoebe Cottingham, asked me how she might analyze her thesis data in a different area, freeway routing choices by the California Department of Highways. This led me to consider the problem of economic choice among discrete alternatives. The problem was to devise a computationally tractable model of economic decision making that yielded choice probabilities for each alternative in a finite feasible set. It was natural to think of highway department decision-makers as maximizing preferences that varied from one bureaucrat to another. To tackle this problem, I drew on a classical psychological study of perception, Thurstone's *Law of Comparative Judgment*. In this theory, the perceived level of a stimulus equals its objective level plus a random error. The probability that one object is judged higher than a second is the probability that this alternative has the higher perceived stimulus. When the perceived stimuli are interpreted as levels of satisfaction, or utility, this can be interpreted as a model for economic choice in which utility levels are random, and observed choices pick out the alternative that has the highest realized utility level. This connection was made in the 1950's by the economist Jacob Marschak, who called this the random utility maximization hypothesis, abbreviated to *RUM*.

Another psychologist I relied on was Duncan Luce, who in 1959 introduced an axiom that simplified experimental collection of psychological choice data by allowing choice probabilities for many alternatives to be inferred from choices between pairs of alternatives. Marschak showed that choice probabilities satisfying Luce's axiom were consistent with the RUM hypothesis.

For Cottingham's problem, I proposed an econometric version of the Luce model in which the utilities of alternatives depended on their measured attributes, such as construction cost, route length, and areas of parklands and open space taken. I called this a *conditional* or *multinomial logit model*, and developed a computer program to estimate it. Cottingham completed her thesis before the program was working, but I was eventually able to use the model to analyze her data. I concluded that CALTRANS in the 1960's was a bureaucracy that was primarily concerned with minimizing construction costs, and gave little weight to the environmental, social, and political consequences of its decisions.

The formulas and mathematical theorems associated with my solution to Cottingham's problem are at the core of the research cited by the Nobel committee. They coincide with a turning point in economics, which today is far more empirical and quantitative than it was 40 years ago. I was recently asked how difficult it was to come up with these ideas, and whether I anticipated the reputation they would achieve. The answer to the first question is that the concepts were easy, a matter of a few hours or days of work, but I came well-prepared so that I only had to recognize that the elements in front of me could be jiggled a little and plugged together. But I would also say that ideas are easy to conceive and hard to nurture to maturity. It took 10 years of research to bring the conceptual basics to the point where the breadth of their value to economics was recognized. As to whether I anticipated the significance of this work when I was doing it, the answer is that I recognized that the problem was potentially quite important, but didn't think my solution was anything special, and didn't even try to publish it in a major journal.

I think of making research contributions as being like dropping stones in a river. Most are washed away, or pushed to one side, but occasionally one will hit in just the right spot and start a process that changes the course of the river. Later, someone may look back, and say "that's the one that did it". In truth, the research process is much more agglomerative. The stone that turns the current required the support of one underneath; and if one stone does not divert the river, the next one may. The Nobel prize makes science seem like an athletic contest, with celebrities and stars. I understand that at gatherings of Nobel laureates the concentration of egos can indeed approach critical mass. However, in the end, science is about the accumulation of ideas, not about cults of personality.

Axiom of Revealed Stochastic Preference (ARSP)

- **Choice probabilities are RUM-consistent if and only if for any finite sequence of events where an event is defined by a feasible set and a choice from it, the sum of the choice probabilities for these events does not exceed the maximum number of these events consistent with a single preference order.**

Example: $P_{\{B,U\}}(B) + P_{\{U,S\}}(U) + P_{\{S,B\}}(S) \leq 2$

Violated by $3/4 + 1/2 + 4/5 = 2.05 > 2$

SLIDE 4. This slide gives a hint of the technical side of my research. This is a necessary and sufficient condition for choice probabilities to be consistent with random utility maximization. If you have recently polished up your knowledge of the geometry of Polish spaces, you may recognize that this is a corollary of the Hahn-Banach theorem. For everyone else, let me just say that it has some practical consequences. For example, consider preferences of high school students among the three universities Berkeley, UCLA, and Stanford. The condition states that the sum of the probabilities that Berkeley is ranked ahead of UCLA, UCLA is ranked ahead of Stanford, and Stanford is ranked ahead of Berkeley cannot exceed 2. The reason for this is that one of the alternatives must be the worst of the three in any preference order, and thus never chosen, so that at most two of the three events in this list can occur. The probabilities at the bottom of the slide violate this condition, and are therefore inconsistent with random utility maximization. Of course, it would be tempting to say that any positive probability of picking Stanford over Berkeley is already evidence of irrationality, but then you and I know more than these poor benighted high school students.

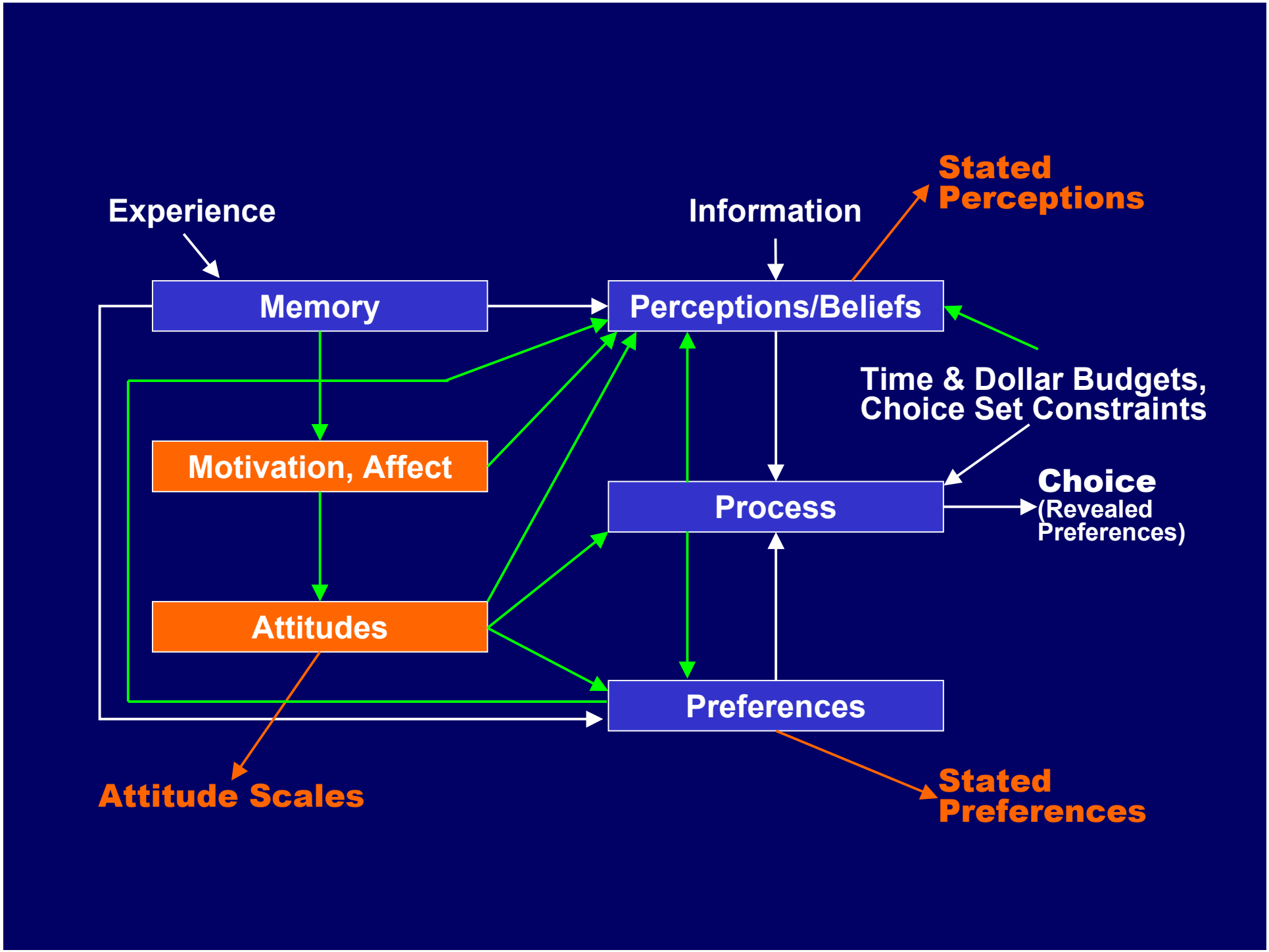
This axiom has an interesting connection to gambling. Suppose the probabilities are the prices of lottery tickets that pay a dollar if the corresponding event occurs. If you hold a combination of tickets that violate one of the inequalities, then you are guaranteed to lose, no matter what happens, and your opponent is said to hold a *Dutch book* against you. If you are a regular gambler, in Las Vegas or on NASDAC, you would be well advised to check that you have not purchased a Dutch book.

Beginning in 1970, I had an opportunity to apply discrete choice analysis to travel decisions, including commute mode choice, and frequency, timing, and destination of shopping trips. I organized a large research project at Berkeley, with support from the National Science Foundation, to develop tools for transportation planning based on microeconometric analysis of individual travel decisions. We studied BART, which was then under construction, as a natural experiment to test and refine discrete choice methods. We collected data on the travel behavior of a sample of individuals in 1972, prior to the introduction of BART, and estimated models that were then used to predict the behavior of the same individuals in 1975 after BART began operation.

The official forecast of BART patronage in 1973 was that it would carry 15 percent of all commute trips in the Bay Area. We predicted 6.3 percent. The actual share in 1975 turned out to be 6.2 percent, so we did well. There were some systematic errors in our predictions, particularly by access mode, but even taking this into account, our study provided strong evidence that disaggregate RUM-based models could outperform conventional methods. Our procedures were also more sensitive to the operational policy decisions facing transportation planners. On the basis of our research, and other studies of the effectiveness of RUM-based travel demand analysis, these methods have been widely adopted for transportation planning around the world.

The obvious similarities between the travel demand problem and other applications such as education and occupation choices, demand for consumer goods, and location choices have also led to adoption of these methods in a variety of studies of choice behavior of both consumers and firms. They have been particularly useful in organizing data collected in market research studies, and are used to forecast the demand for new consumer products, and the impact on demand of changes in product prices and features. There have also been major improvements in techniques for discrete choice analysis over the past three decades. Telling you about this would be like hearing from your dentist about how his drills and adhesives have gotten better. I will spare you these details.

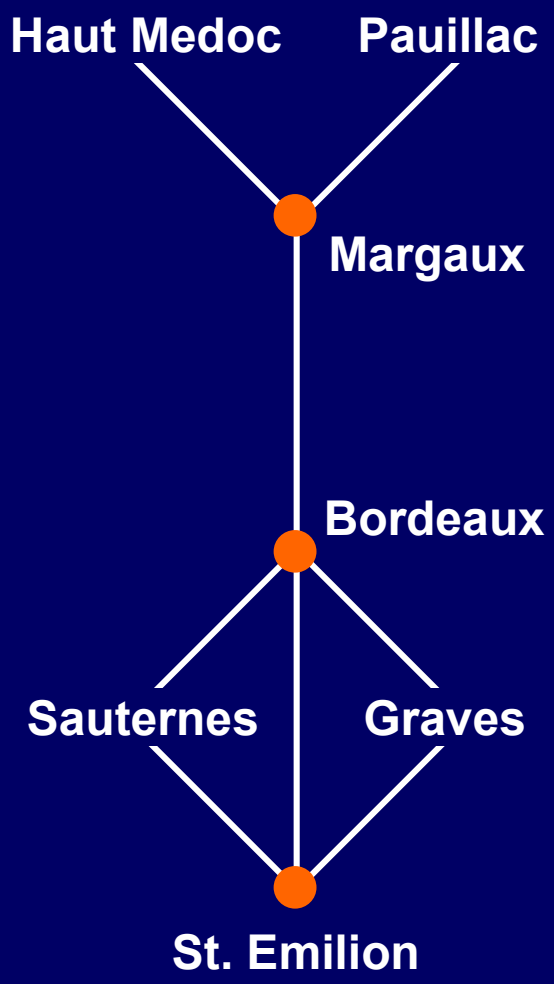
An example of a problem where discrete choice analysis has been useful is the issue of the demand for non-polluting vehicles in California. The law currently on the books requires that five percent of vehicles sold in the state have zero emissions, and there has been a contest between the state and manufacturers who claim that this can be achieved only with major subsidies for the non-polluting vehicles. Using market research methods and discrete choice analysis, my associates have been able to quantify the subsidies required to meet the mandate, and provide the ingredients for the "greatest good for the greatest number" calculation to determine if this mandate is in the public interest. The picture that emerges is that while consumers are positive about clean air, and not particularly negative about the idiosyncratic features of zero emission vehicles, they are not willing to pay substantially more for a clean vehicle than they are for a standard one. Then, it is necessary to subsidize the higher cost of manufacturing clean vehicles. This subsidy must ultimately come from consumers, whether its source is government revenues or manufacturer receipts, but there is an interesting distributional issue of whether it is bourne entirely by Californians, or spread across all vehicle purchasers worldwide. A lot more work will be done in this area, but one conclusion that will clearly survive is that there are much more effective ways to meet clean air standards than through zero emission mandates. A fundamental problem is that the prices of gasoline and vehicles do not include the costs of the pollution and congestion they produce. The most direct way to get the incentives right is to place environmental taxes on these products. Then, consumers and manufacturers will gravitate to more fuel-efficient, less polluting vehicles.


Experience
Information
Stated Perceptions
Memory
Perceptions/Beliefs
Time & Dollar Budgets, Choice Set Constraints
Motivation, Affect
Process
Choice
(Revealed Preferences)
Attitudes
Preferences
Attitude Scales
Stated Preferences

SLIDE 5. Discrete choice analysis grounded in the economic theory of random utility maximization has proven quite successful in terms of its usefulness and accuracy in forecasting the impacts of economic policy, but it is being challenged by a line of research originating in cognitive psychology that is causing economists to re-examine their standard model of choice behavior. This research shows that the individual is less organized, and more adaptive and imitative, than the standard model requires. Psychological descriptions of decision-making are both colorful and intuitive. In the words of the psychologist Danny Kahneman, "Economists have preferences; psychologists have attitudes." *Affect* and *motivation* are key determinants of attitudes; and also influence the *perceptions* that feed into the choice process. The economists' calculus of utility assessment and maximization is reduced to one of many factors in the decision-making environment, with an influence that may be overridden by context effects, emotion, and errors in perception and judgment.

Experimental evidence and self-reported decision protocols support the view that heuristic rules are the proximate drivers of most human behavior. In contrast to the process of forming value trade-offs to reduce multiple attributes to a unidimensional utility criterion, as visualized in the standard model, rule-governed action can be pictured as a quasi-legal process of constructing a satisfying interpretation of the choice situation. The primary mental activity involved in this process is the exploration of analogies and distinctions between the current situation and other canonical choice situations in which a single rule or principle unambiguously applies. These processes go under the names "editing" and "confirmatory hypothesis testing". The question remains as to whether rules themselves develop in patterns that are broadly consistent with RUM postulates. This is a vital scientific concern for economists. If there are preferences behind rules, then it is possible to recover them and correctly evaluate economic policies in terms of these underlying preferences. It not, economics will have to seek a new foundation for this task. While many psychologists argue that behavior is far too sensitive to context and affect to be usefully related to stable preferences, I am less pessimistic. The first reason for my optimism is that many behavioral deviations from the economists' standard model can be attributed to perceptual illusions, particularly in the way that we process information, rather than a more fundamental breakdown in the pursuit of self-interest. The second is that many of the rules we do use are essentially defensive, protecting us from mistakes that perceptual illusions may induce.

Perception and Illusion



SLIDE 6. Consider a simplified road map of the wine-producing regions near Bordeaux.

Bordeaux appears to be closer to St. Emilion than to Margaux. However, you will immediately recognize that this is a version of the classical Muller-Lyer optical illusion in which the distances are actually the same. Even after you are reminded of this, St. Emilion looks closer. Could this illusion affect behavior? In fact, St. Emilion is more crowded than Margaux. However, I suspect this is the result of other wine-lovers illusions than mass misreading of maps. We learn to be suspicious of our perceptions. We may see things cock-eyed, but we adopt conservative behavioral strategies that prevent us from deviating too far from our self-interest.

What does this perceptual analogy imply for students of economic decision-making? The economist's standard model, like "the eye is a camera" model of vision, is not universally valid, and needs to be enhanced to account for important cognitive illusions. On the other hand, psychology and brain science have not yet produced their own standard model of decision-making behavior, and until they do, I believe that the economists' standard model with suitable enhancements will remain the best platform for most studies of economic policy.

I will give examples in which individuals sometimes make decisions that deviate strikingly and systematically from the predictions of the economists' standard model. One family of phenomena come from what are called *availability* effects, where responses rely too heavily on readily retrieved information, and too little on background information. Information processing is distorted by what are called *regression* and *superstition* effects, in which we are too quick to attribute elaborate causal patterns to coincidences, and attach too much permanence to fluctuations, failing to anticipate regression to the mean. For example, stock market pundits never admit that price changes may be the result of unexplained random fluctuations in the arrivals of buyers and sellers. Instead, they will say "the market fell today due to profit-taking" or supply some other story for the day's events. You too can be a stock market pundit. The next time the market goes up, just say to yourself "profit-giving caused the market to rise today."

An important example of a cognitive anomaly in decision-making is the phenomenon of *anchoring*, in which responses to questions are pulled toward numerical cues contained in the questions. A psychological explanation for anchoring is that a prompt creates in the subject's mind, at least temporarily, the possibility that the uncertain quantity could be either above or below the prompt. This could result from a cognitive process in which the subject treats the question as a problem-solving task and seeks an appropriate framework for "constructing" a correct solution. The availability of the prompt gives it undue influence. I will describe an experiment that shows anchoring is, at the least, a problem for measurement of preferences in economic surveys.

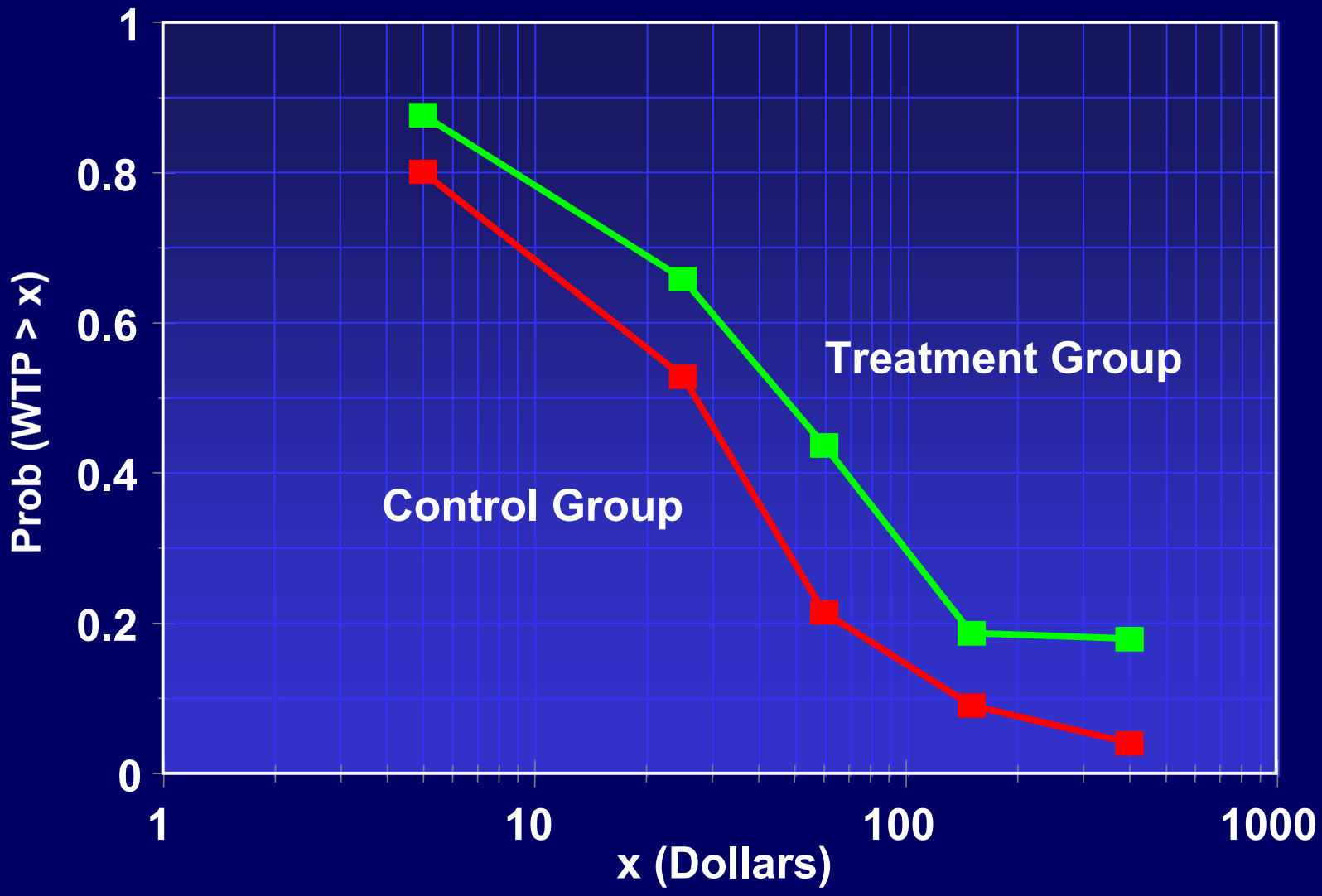
Willingness to Pay

What value would your household place on saving about 50,000 seabirds each year from offshore oil spills?

- **Several million seabirds living off Pacific coast**
- **Few people see them**
- **Small oil spills kill estimated 50,000+ seabirds per year**
- **Solutions to prevent deaths expensive, extra funds required**
- **Usually not possible to force tanker companies to pay**
- **Public money would have to be spent yearly to save the birds**

SLIDE 7. A study published by Danny Kahneman, Karen Jackowitz, and myself in 1998 asked subjects recruited from visitors to the Exploratorium to state their willingness to pay to save off-shore seabirds from small oil spills; the salient features of the problem were presented in a preamble that is summarized in the slide. Subjects were assigned randomly to control and treatment groups. The control group was given an open-ended question asking for the most their household would be willing to pay per year in extra federal or state taxes to save 50,000 birds annually. The treatment groups were prompted by a dollar amount, first asked if they would agree to pay this amount, and then asked the maximum amount they would pay. The numerical prompt was varied across several levels set by experimental design. If subjects conform to the economists' standard model, their preferences are innate and will not be anchored to numerical prompts contained in the question.

Willingness to Pay for Seabirds



SLIDE 8. In fact, the response patterns suggest the prompt creates an "anchor" for the construction of preferences. This figure shows the differences in response frequencies for the control and treatment groups. The anchoring effects are large, and statistically significant. Comparing open-ended and follow-up responses, the median WTP in the control group is $25, and median WTP in the treatment group varies from $10 at a prompt of $5 to $50 at a prompt of $400. The "yes/no" responses also show an anchoring effect, with higher pluralities for "yes" at higher prompts. These produce a non-parametric estimate of $167 for mean WTP in the treatment group, compared with a mean of $64 in the control group, again statistically significant. Put another way, the effect of a one dollar increase in the prompt is to increase mean response by 28 cents.

This experiment was hypothetical, and subjects were aware that their responses would have no direct monetary consequences. The valuations coming from this experiment, extrapolated to all California adults, indicate that we would be willing to pay about $26,000 per seabird saved. That is out of line with many of the other environmental tradeoffs that we make. A natural question for economists to ask is whether such deviations from the standard model will appear in market choices where real money is changing hands. Market research suggests that they can. For example, it is a practice of retailers when selling a product with a good margin to enhance its appeal by positioning a clearly inferior product at almost the same price, creating the cognitive illusion that the target product is a particular bargain. The next time you are in a supermarket, look at the pricing of the house brand and the no-name generic. You will find that the house brand looks like a bargain.

Currently, I am collecting data on consumer decision-making through a facility called the Internet Virtual Laboratory, which can be accessed from my web page. I invite you to visit and answer our questions. In a study of asset management practices of the elderly, we have asked a sample of retirees from the University of California about how they would respond if they won one million dollars in the California Lottery. A feature of this lottery is that the winners are either paid in equal installments spread out over 20 years, but which terminate if the winner dies, *or* are paid in a smaller lump sum. The average of the minimum lump sums our subjects would accept rather than the 20 year payout was $528K. Economically, this number is about right, being quite close to the amount that invested now in low-risk long-term corporate bonds would finance a 20 year payout of one million dollars. However, our subjects' responses effectively denied the possibility that they might die before a 20-year payout period was finished, an unrealistic assumption for retirees. This pattern is consistent with our findings from other surveys that people systematically underestimate the probability of dying, perhaps because psychologically they are unable or unwilling to visualize this outcome. This translates into asset management behavior in which retirees scrimp too much, holding onto assets that they are very unlikely to need to finance future consumption and intended bequests.

What lies ahead for discrete choice analysis? While it has shown itself to be capable of giving good answers to a broad array of policy questions, some possibilities for development of the approach are still to be realized. The potentially important roles of information processing, perception formation, and cognitive illusions are just beginning to be explored, and behavioral and experimental economics are still in their adolescence. The economic theory of consumers will be enriched by behavioral evidence. I believe that the RUM hypothesis for decision-making, modified to give a much larger role for the role of experience and information in the formation of perceptions and expression of preferences, will be able to explain most economic choice behavior in the field and in the laboratory. If so, then this framework can continue to be the method of choice for microeconometric analysis of consumer behavior and the consequences of economic policy.