THE THRILL OF SIMPLICITY, THE AGONY OF REALISM: AN ASSESSMENT OF THE SPORT OF UTILITY THEORY

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ABSTRACT

This paper develops a pedagogical exposition of utility theory from its roots in classical theory to its newer forms. The theme of the exposition is that, in its simplest form, utility theory provides precise solutions to standardized behavioral traits of self-interest, but in its more realistic forms, real world complication can oppose the conclusions of the simple model. A possible framework for organization of the various utility theory extensions is presented. The world of utility theory is assessed in terms of Stigler's acceptance criteria, and conclusions are drawn about the usefulness and direction of utility theory.

INTRODUCTION

A framework for analysis of the choices made by individuals is a necessity for theorists who wish to understand a population of individuals and their behavior. The way to form an effective framework is to specify a model of reality based on a set of axioms that govern the population's behavior. The postulates that form the foundation for utility theory precisely characterize a simple form of 'rational' behavior. This set of conditions forms the analytical framework with which general statements can be formulated explaining choices ultimately made in the marketplace.

In an ongoing effort to better describe the choices made in various areas of economic activity, new assertions regarding, specifically, the over-simplicity of the basic theory of utility, and generally, of maximizing behavior, have appeared in much the same way that Keynes' revolutionary macroeconomic challenge occurred in the 1930's. In essence, Keynes observed that many real-world choices were made which were logical in their construction or apparent from observation, yet did not adhere to the axioms of classical microfoundational theory. As Keynes indicated, this can occur for a variety of reasons, some of which he identified and explored in developing his own macroeconomic General Theory (Keynes, 1964). In microeconomic theory, similar observations have been made for explaining behavior that appears rational, but seems unable to adhere to the axioms and properties of classical utility theory.

Often, an economist will assert that if a theory consistently explains or predicts well, there must be some kind of axiomatic foundation which governs the consistent behavior. The purpose for economists, therefore, should be to *discover* these governing axioms. Economists pursuing this purpose are counting on the premise that the factors affecting behavior have not yet been discovered. Those still pursuing that purpose after an initial theory is in place are counting on the premise that that the axioms have been analyzed incorrectly, that they are misstated, or that they are just plain wrong.

More recent work in microeconomics has revealed the position of classical utility theory as a rather extreme special case of a phenomenon found by many arguments to have much more complexity than the simple classical version. The purpose of this paper is to describe the current classroom presentation of the theory, present some of the efforts attempted to enhance the model, and to evaluate this effort in terms of generality, manageability, and congruence with reality.

THE BASIC UTILITY MODEL: THE THRILL OF SIMPLICITY

In its most basic form, utility theory serves as a means of ranking an individual's preferences by the level of appeal of available alternatives at a point in time. It also determines, among other things, the solution of variables endogenous to the model, such as the quantities of alternative products an individual will consume while maximizing utility under the restriction of a budget constraint. The rankings are based on axioms that describe 'economic rationality':

1. Completeness:	If A and B are any two situations, then only one of the following can be true: 1) A is preferable to B 2) B is preferable to A 3) An individual is indifferent between A and B (Indecision is not an option)
2. Transitivity:	If A is preferred to B, and B is preferred to C, then A must be preferred to C. An individual is assumed to fully understand the consequences of the choices to be made, and thus makes decisions that are internally consistent.

3. Continuity:	If A is preferable to B, then outcomes "suitably close" to A are preferable to B also. This axiom is necessary in order to analyze differential changes in income and prices which affect outcomes to a small degree but are not sufficiently large to affect the ordinal ranking of situations (compiled from: Copeland, Weston 1988, Kreps, 1990, Nicholson, 1989, Chiang 1984).

In the further development of utility theory, several other properties should be included. First, any utility function will be *order preserving*. We can even assign values to utility in order to provide a way of enumerating and ordering preferences. This is simply a matter of convenience and is only useful to the extent that it preserves preference ordering; in no way can one individual's utility be compared to any other individual's utility. Second, conditions affecting utility other than those under consideration are assumed to be constant; this is called *the ceteris paribus* assumption. Third, individuals are assumed to be able to make *rational* choices among a wide array of situations; to be able to compare any given situation on the basis of relative appeal at any specific point in time. Fourth, the very nature of one's utility is based on a wide variety of *factors that provide satisfaction both directly and indirectly*. For example, although income yields no direct utility, the security of having a sufficient amount of income could in itself provide satisfaction. Usually, economists prefer to limit the analysis to direct utility, which comes only from the spending of that income. This is understandable; often the information an analyst wishes to derive from utility theory is to find out what items on which individuals will spend income. Economists, however, have often extended the use of utility theory to include indirect versions, including utility of income, utility of current income relative to future income (time valuation), utility of consumption relative to leisure, and utility of certain benefits versus uncertain benefits.

Other complicating factors include complementary products, substitute products, economic 'bads',or consideration of attributes of goods rather than the good itself as the direct provider of utility. Other characteristics present in the academic literature but specific to instructional and/or academic special cases are omitted here. In some applications, the additional assumption of perfect knowledge of all alternative choices is assumed.

The usual representation of consumer demand begins with a description of a 'good' as a bundle of economic products which together provide a positive level of satisfaction or utility (as opposed to an economic 'bad', which provides negative utility). As a result of this bundle being good, more of the bundle is preferable to less of the bundle. The next step is to introduce more than one good, usually presenting quantities of two goods graphed as good x and good y in a two dimensional diagram. This representation allows a mapping of points of combinations of the two goods from which the individual would derive the same level of utility, and defines an indifference curve. The negative of the slope of the indifference curve at a given point is called the marginal rate of substitution, which is assumed to be diminishing (or alternatively, well balanced bundles of goods are preferable to bundles which contain large portions of one good and little of the other good. This identifies strict convexity, which is equivalent to an assumption of diminishing marginal rate of substitution). The concept of diminishing MRS can also be approached from the standpoint of marginal utilities, without explicitly referring to the utility function.

The general shape of this indifference curve lends itself to further restriction to form ideal analytical models that have appealing characteristics, such as the Cobb-Douglas form. This particular utility function has a familiar mapping, is homothetic (each curve looks similar to the others because the slope at any point depends only on the ratio of one good to the other), and exhibits a simple proportional relationship between income and the quantities of good x and good y desired (Douglas, 1934).

In cases where indifference curves do not exhibit the characteristics of diminishing MRS, the solutions, when a budget constraint is employed, often do not present difficult analytical problems. For example, the case of perfect substitute goods implies that an individual will simply buy from the lowest price producer. Perfect complements imply a particular proportional relationship between two goods, and the solution will be in fixed quantities of both goods. For cases of more than two goods, a relatively simple mathematical adjustment for utility maximization (subject to a budget constraint) is required. Changes in income or in prices of the goods in question are not problematic for the familiar forms of utility theory; they involve shifts in the budget or isocost functions, and after such adjustments, solutions may be recalculated. The theory of utility as developed above serves as a very neat analytical tool that forms a sturdy base for much of microeconomics.

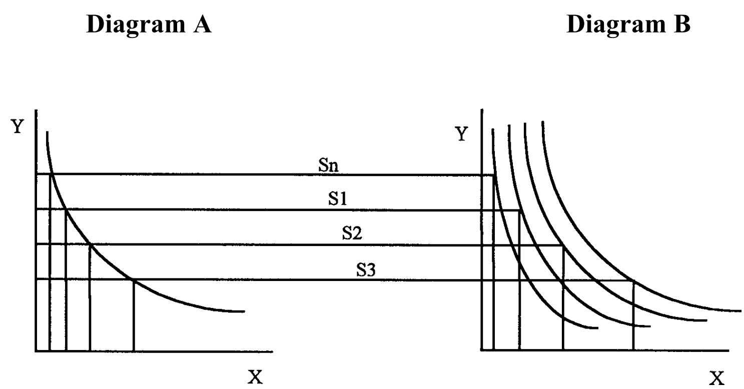
DEVELOPMENT OF LESS CONSTRAINED MODELS: THE AGONY OF REALISM

As we try to encompass more and more of reality into our model, we complicate the analytical framework of utility theory. This, in a way, defeats the purpose of developing a simple model; the original objective of drawing precise conclusions about a population of individuals must be balanced against the desire of the analyst to be accurate in describing the behavior on which those conclusions are drawn. At the root of the behavioral description are the axioms of utility theory. Are they reasonable? Are they necessary? And is there a better alternative to describing the general behavior of a population? To explore these possibilities it may be helpful to look at the manner in which analytical methods change when a variety of situations arise.

Generalization of Preferences

Suppose we accept a more general definition of individual preference. Instead of limiting situations to being "preferable to" other situations, we relax preference to a weaker version: "is preferred or is equally preferable to". Any two situations can now have a common extreme element. This defines the difference between "strict preference" and "weak preference" (Kreps, 1990, pp. 22-26). Indifference, then, would appear to be defined as the 'equally preferable' situation, although this implies a strange indifference map. For the definition of weak preference to hold, an indifference curve could be represented by a group of situations (S1, S2, S3,...Sn) whereby each situation can be ranked in terms of weak preference, and yet it is possible for S1, the highest-ranked situation, to be equally preferable to Sn, the lowest ranked situation (diagram A). On the other hand, the same set of situations could simultaneously be represented by differing levels of utility (diagram B). The mere existence of this strange indifference result would imply an infinite number of solutions, unless factors explaining the weakness of preference could be identified and included in the model.

Diagrams A and B
Strict Preference Versus Weak Performance



Cyclical Preferences

Imagine another situation in which an individual is unable to rank preferences in an ordinal ranking (such that A is preferred to B and B is preferred to C but, strangely, C is preferred to A). If you doubt the possibility of such a scenario, just ask a child their preferences for Christmas presents every day for a month prior to Christmas. With no visible change in information, often in the same breath, the child's preference will cycle around choices that are all appealing but, through some unknown process, are not ordinally ranked. This indecisive behavior could be the result of a wide variety of manifestations. This baffling scenario can be mirrored in other situations as well. Although from a modeling point of view it may appear impractical to assume an axiomatic basis for behavior other than rationality, a theorist might seek explanations other than those implied by the model in cases of inconsistency such as this.

Modeling Uncertainty

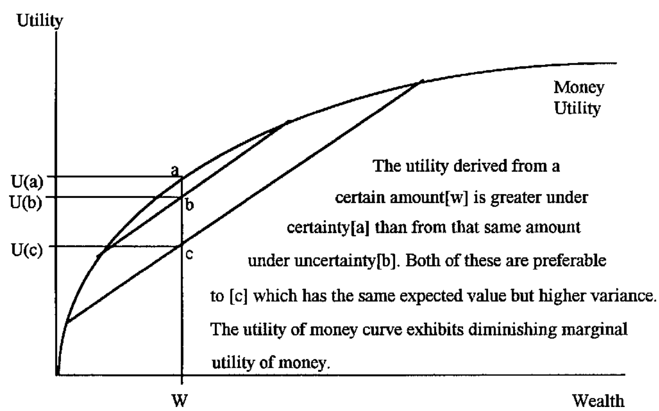
In reality, individuals make decisions based on uncertain future situations, without formal thought about probabilities of outcomes. Often there is no choice but to go ahead and make decisions, even if complete information does not exist (where it is assumed that one makes a decision subject to bounded rationality) or the decision doesn't result in an optimal utility outcome, ex-post. Uncertainty can take several different forms within the realm of utility theory. One of the most basic effects is the ambiguity in preference due to the possibility of deviations from expectations. Preferences become dependent on a variety of factors which, while still describing a single time period, are no longer known with certainty.

Because of this, preference may not be abundantly clear. A modeler would have to make allowances for indecision (if no information is valid on which to base a decision) or introduce a soluble element based on probability distributions (if useful information is expected to surface before a decision is made) or, if possible, based on contingencies .

Uncertainty can also take the form of a simple choice between a certain outcome and an uncertain, but statistically predictable, outcome when that choice is available to an individual. The well-known development of this concept is the utility for money. It begins with the premise that more money is preferred to less money, or the assumption of a strictly increasing utility function. The second premise is that a unit of money at a lower level of income will increase utility to a greater degree than the same unit of money at a higher level of income (or that the marginal utility of money is decreasing). This assertion has some profound results, characterized by 'risk averse' behavior.

This simply means that a certain outcome (with no variation) of a particular value V (point a) is preferred to a fair gamble (with variation) with an expected value V. For example, would an individual prefer receiving $10 with certainty or would he or she prefer a *gamble* with a .5 probability of receiving $5 and a .5 probability of receiving $15? The expected value of both outcomes is $10 (point W) and the only difference is that with the gamble, there is risk (variation about the mean) involved. An individual who is risk averse (has a decreasing marginal utility of money), would prefer the certain $10 payoff (point a) than the gamble with the same expected value (points b and c), because the $10 payoff would yield a higher level of utility than the gamble (diagram C). This result has been helpful in pricing insurance and in estimating demand for financial assets (Von Neumann, Morgenstern, 1944).

Diagram C: Money Utility and Uncertainty



Perhaps a slightly different approach to modeling uncertainty is called for in situations where preferences are contingent upon certain events or circumstances. It seems that two possibilities could arise: one, that a decision could be postponed until after the event occurred or two, that a decision must be made in the present time period for one reason or another. In the latter case, an example might be the availability of an investment whose outcome is contingent on an event, such as an investment in a company whose rate of return depends on the acceptance or rejection of a large contract. If the contract is accepted, the return on the investment would be larger and if rejected, the return would be small or negative. Usually such an investment would not be offered at the same price to an individual before and after the event. As such, the decision could not be postponed and the individual, if the investment is to be undertaken, must invest quickly.

In reaction to just this type of situation, the market makers for securities have invented hedging tools in order to reduce the risk of low or negative return, such as the issuance of options or warrants. Here again, it appears that a decision can be made based on a less questionable future by the application for the utility of money. Because investors have different risk preferences, another investor might be willing to pay the first party to agree to sell his investment in the future at a specified price. This is the essence of a stock option. The owner of the investment would have a hedge against downside risk and the owner of the option would have the possibility of a huge profit should the stock price increase above the exercise price of the option.

Still another uncertainty model may be built upon strategic concerns. Suppose two options are available for choice, one maximizing individual one's utility, the other maximizing individual two's utility, each choice being suboptimal for the other. The consequences of failure to agree on one choice or another is that no option will be chosen and, therefore, no utility will be gained by either party. For whatever reason, as illogical as it may be, sometimes the parties may fail to agree, neither one gaining anything. This is one of many examples of noncooperative games, which often reflect the more complex circumstances of economic interest in the real world. A variety of solutions may exist for noncooperative games, such as strict dominance, successive strict dominance, weak dominance, maximizing solutions, hedging solutions, backwards inductive solutions, or Nash equilibria (Kreps, 1990).

A solution to a noncooperative game can even take the form of utility maximization for both (or all) parties involved, both forms of analysis producing the same result. The deviations from the basic forms of these situations can be infinite, as an infinite number of combinations of circumstances may be stated as conditions for the game. Some questions about the usefulness of these uncertainty models remain, however. Although very complex situations can be modeled, it is unknown at present how this can be used to obtain useful information about populations. The most useful role of specific games is their ability to explain or predict behavior (or, as the case may be, explain or predict indecision and suboptimality) in situations too complex or too specific to be modeled well by simpler models.

Utility Interdependencies

Like it or not, isolation tank results often don't predict environmental behavior. As we are social animals, very rarely are our utility preferences totally independent of others' utility preferences. For some reason, the fact that the next door neighbor just upgraded from a carport to a three-car automatic door heated and air-conditioned garage and workshop complex, seems to affect our own satisfaction with our own 'carport.'

This and other effects, although not directly developed by comparing utilities, is typical of bandwagon, snob, and Veblen effects summarized by Liebenstein. The bandwagon effect describes the tendency for people to desire and item because, presumably, everyone else desires it. The snob effect is the tendency for people to desire an item for its exclusivity, and the Veblen effect is the tendency for people to desire an item for its high price tag. The changes in utility implied by this behavior are assumed to be reflected directly in the demand functions faced by firms (Liebenstein, 1948, pp. 165-201).

Interrelated Utilities

Often, the decisions made by microeconomic agents are the result of the related utility assessments of more than one individual. Some examples of this kind of situation are committee decisions, societal choices, partnership decisions, choices made by married couples, or choices resulting from agency relationships. The complications introduced by these possibilities can be tremendous; in each case, the mere fact that differing values, beliefs, and morals are present is enough to build a specific model of extreme magnitude. Consider, for example, the view of the utility of a choice made by a politician. The candidate who presented an image, a set of morals, and campaign promises, who supposedly represents the consensus view of his district or representative group, who has selfish tendencies, and who is tempted by choices which break the rules of the game, must summarize all of these preference scenarios into specific political decisions.

Consider the committee (or partnership, or marriage) decision, which is a result of a "game" which may involve radically different preference rankings, dominant individual preferences, different outcome evaluations, and/or different thought processes. Consider the agency relationship, where an individual or group of individuals represent another individual or group of individuals in making decisions that are supposedly in the best interest of the group represented. Although any and all of these constructions of convenience, of necessity, of consequences, or of codependence are present in society, few can be summarized using well behaved utility models (designed to draw generalities about populations). Most are specific and unique in nature, and often the observed results are far from what one might expect from rational, utility maximizing populations.

K. J. Arrow has even developed separate axioms for the formulation of social preferences from the point of view that an infinite number of utility solutions can develop depending on the way in which decisions are arrived at in a particular situation. For a solution to be feasible, it must meet the characteristics of: 1.complete ordering (completeness) 2.responsiveness to individual preferences (reflects the preferences of the individuals whose utilities are interrelated) 3.nonimposition (social preferences are not imposed independently of individual preferences) 4.nondictatorship (social preferences are not determined by only one individual) 5.independence of irrelevant alternatives. Arrow then asserts that in general, it is impossible to meet all of these criteria in constructing social preferences. This is known as the 'Arrow Impossibility Theorem' (K.J. Arrow, 1951 [Henderson, Quandt, 1980, p 312]).

Less constrained models represent some of the anomalies of the current state of utility theory. As we encompass more of reality into our models, we complicate the analytical framework; we also strive for a more applicable model to accurately describe observed behavior.

THE ESSENCE OF AN EMERGING CONSENSUS

Stigler (1965) presents "A Theory of Economic Theories" with three criteria for wide acceptance of an economic development. They are:(pp. 148-53)

1. Generality
2. Manageability
3. Congruence with Reality

Stigler (1965) asserts that a successful theory is almost always more general than the preceding theory. Although there have been exceptions to this argument, particularly in macroeconomic theoretical development, it is reasonable to expect that if a conclusion can be reached in a less restrictive manner, it would probably have more appeal to theorists who desire to accurately describe.

The ability to bring a theory to use in analyzing specific problems is a desirable quality for a successful theory. This is especially important in a field such as economics, which often involves mathematical complications or extensions to less obvious applications in making models generally applicable. A popular argument within economics is on the one hand, the more closely a model reflects reality, generally the greater the likelihood of wide acceptance by theorists. Intuitive assertions are accepted only to the point of belief and agreement, in an academic discipline where empirical evidence is often required as proof. On the other hand, the more closely reality is reflected, the less likely a simple (restricted to simplicity for the sake of precise conclusions) axiomatic foundation is readily applicable.

With these criteria in mind, we can assess the likelihood that development of any of the aforementioned complications to the analytical framework of utility theory will become an integral part of mainstream economic thought. All three of these criteria are generally applicable to economic theories. The third criterion, congruence with reality, may convince us to look at the possibility that the rational basis for utility theory could be inadequate for general application in the real world. The following section examines each of the relaxed constraints previously discussed, evaluating them according to these criteria

UTILITY APPLICATIONS

The strange indifference curves resulting from weak preference rankings (diagrams A and B) represent a direct inconsistency with the axiom of transitivity. While this axiom could still hold true for rankings involving no question of equality of ranking, the possibility exists for an individual to rank situations in a way that is internally inconsistent. Changing from strict to weak preference would therefore appear to support the analytical framework of utility theory, but in specific cases where we allow simultaneous existence of preferable or equally preferable choices, the analytical framework collapses because of its inability to explain this anomaly. While meeting the criterion of congruence with reality and greater generality, the inclusion of weak preferences as part of a utility theory does not appear to be a very manageable development.

Cyclical preferences are another source of inconsistency which precludes the existence of not only transitivity but also the axiom of completeness. Utility theory simply does not allow for the possibility of an individual being unable to ordinally rank cyclical outcomes. Again, while meeting the criteria for generality and congruence with reality, the inclusion of the possibility of cyclical preferences undermines the integrity of the axiomatic foundation of utility theory.

Considerable strides have been made in the modeling of (statistically predictable) risk within the realm of utility theory. One of the most common approaches is to form probability distributions about expected (mean) outcomes and use these as a numerical proxy for utility. Although there are numerous measurement and statistical problems under certain circumstances, probability distributions do not appear to undermine the basic axioms of utility theory. Also, if used in a static model and considered the only basis for ordinal rankings (ignoring variance), expected values are order preserving, the property of choice among a wide variety of situations is still intact, and expected values would appear to embrace both direct and indirect versions of utility functions. One property, the ceteris paribus property, is not binding in a static model strictly using expected values, because factors affecting the variation from expectations are not required to be constant; they account for the variation about the mean, which does not affect ordinal rankings.

The utility for money has been explored extensively by theorists and there appear to be few problems in applying the concept of risk aversion to utility theory. in fact, this concept has become the basis for financial asset pricing models, demand models for insurance products, and for explaining risk averse behavior observed in financial markets. The indirectness of the utility function for money as a provider of satisfaction has not resulted in prohibitive complications. Not only is utility theory enhanced as a more general model, it also better explains real world markets while still retaining manageability. The market participants themselves have invented tools to manage uncertainty, including options, warrants, and futures. Currently, utility theory and other theories are being used to analyze and evaluate these instruments. Although the mathematical process is growing more complicated, it appears that utility theory is still intact as a foundation for many of these models that pool individual uncertainties or provide for forward contracts, or are hospitable to hedging properties.

Strategic concerns, another way that uncertainty can surface in the real world, appear to be beyond the general applicability of the simple framework of utility theory, simply because so many factors and circumstances may be introduced into the model. Although useful in analyzing specific cases, strategic analysis (or noncooperative game theory) does not comply with the simple calculus of utility theory. On the basis of generality, strategic analysis incorporates many more real world situations than utility theory can, but conclusions usually are imprecise and not applicable to other situations. The degree of manageability, it seems, would be a subjective assessment; the economist might argue that strategic analysis results in an infinite number of possible solutions and ambiguity in its conclusions, whereby the strategic analyst might assert that flexibility and accuracy, whether intuitive or not, are needed more than a decision based on a precise but inaccurate model. Although there are some key differences in strategic analysis and game theory, the application is quite similar; both are used for specific cases that may be quite complicated and totally unfit for simpler models of behavior.

Utility interdependencies have been intuitively explained in relation to demand. The curious results in demand analysis should be reflected in the utility curves that support demand theory. For example, the utility function for a 'bandwagon product' would be a function not only of the attributes inherent in the product itself but also would be positively related to the size of the market for such a good. The 'snob' effect is a reversal of the bandwagon relationship between demand and market size, where utility is a function of the attributes of the product and a negative function of market size. The 'Veblen' effect encompasses utility as a function of product attributes and as a positive function of price, which defines conspicuous consumption. The adjustments of utility functions to accommodate these effects are not complicated ones, and they add to the applicability of the utility model to a greater number of situations. It would appear from the three criteria for wide acceptance of a model that these effects are easily accepted. Liebenstein does not present the manifestations in utility theory exhibited here, but is keyed to demand and observable results. These applications to utility theory follow traditional lines of thought from utility to demand analysis.

Interrelated utilities form a special kind of problem for the axioms of utility. One of the basic postulates of utility is that one individual's utility cannot be compared or measured relative to another individual's utility. According to the 'rationality' of behavior, an individual would only enter a condition of cooperative decision making if it were possible to achieve a greater level of utility. If this rationality is generally applicable, the only relationships attainable would be ones of greater utility for both (all) parties involved. One could even argue that convenience, necessity, consequences, or codependence all provide inherent utility and that a situation of interrelated utilities complements the axioms of utility; that utility is simply difficult to comprehend and measure. We should have difficulty, however, in defining just which type of utility is to be maximized. When and how does an individual decide to sacrifice his own utility to maximize the utility of the group as a whole (Davidson, Davidson 1988)? What happens if conflict occurs? These questions are unlikely to be answered in the limited scope of utility theory. Most utility interrelationships are specific in nature and would not easily be explained by a general model. If a model were to be constructed to reflect these conditions, it may well be so analytically complicated that it is impractical to construct for all but the most rewarding uses.

CONCLUSION

What type of consensus may eventually emerge concerning the usefulness of the axiomatic version of utility theory? It is obvious that as we encompass more and more of reality into our model, we complicate its analytical framework. Many of the changes discussed are manageable adaptations and they extend the explanatory or predictive ability of the model. Others, such as introducing weak preference or cyclical preference, appear to undermine its axiomatic foundation.

It seems likely that successful analysts depend not only on a restrictive theory of behavior but also realize the importance of a wider range of conditions and anomalies of the real world which affect economic events. One thing is certain: as long as observed behavior is seemingly unexplained by current economic models, economists will strive to explain them in terms of a new set of axioms and postulates which describe the general behavior characteristics underlying these observable results.

It also seems reasonable to expect that the strict assumptions associated with simple constructs might be relaxed to form a more general model encompassing a greater range of cases, enhancing, if not the predictive ability of utility theory, the explanatory ability of microeconomic analysis.

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