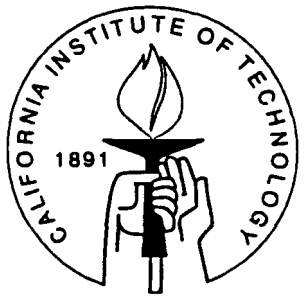
DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES
CALIFORNIA INSTITUTE OF TECHNOLOGY
PASADENA, CALIFORNIA 91125

RATIONAL INDIVIDUAL BEHAVIOR IN MARKETS AND SOCIAL CHOICE PROCESSES

Charles R. Plott



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Abstract

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This paper reviews a series of paradoxes that exist in the experimental economics literature. These paradoxes are instances in which otherwise accurate models of markets and social choice processes fail to capture the data of experiments. A loosely developed theory called *The Discovered Preference Hypothesis* is advanced in the paper as an explanation. Behavior seems to go through stages of rationality that begin with a type of myopia when faced with unfamiliar tasks. With incentives and practice, which might take the form of repeated decisions in the experimental work, (but might include play, banter, discussions with others, stages of commitment, etc.) the myopia gives way to what appears to be a stage of more considered choices that reflect stable attitudes or preferences (as opposed to the labile attitudes identified by psychologists). Social institutions are seen as playing a role in the attainment of a third stage of rationality in which individual decisions incorporate the rationality of others, or the lack of it, in their own decisions.

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Introduction

The focus on individual behavior in economics is derived from an interest in the behavior of groups as they are found in markets, committees, and social choice processes. For the most part, economists have not been interested in what goes on inside the heads of individuals. Thought or thought processes are seldom considered as part of the phenomena to be studied as a part of the science. Economics is primarily a study of choice behaviors and their properties as they become manifest in the context of specific organizational units. By contrast, psychological focus on the individual is derived from a long history of research on the nature of thought and thought processes. In contrast to economics, psychological research does not seem to have been defined by any particular social, institutional, or organizational constraints.

This essay is an attempt to integrate data and perspectives from these two, substantially different traditions, by introducing an observational theory that I will call the "discovered preference hypothesis." With the introduction of such a theory, two disclaimers are necessary at the very outset. Firstly, the perspective of the essay is distinctively economics. The objective is to improve models of economic and social choice processes. Contributions to psychology are neither attempted nor claimed. Secondly, the discovered preference hypothesis is more of a philosophy, or interpretation of data, than a clearly articulated theory from which precise quantitative propositions can be deduced. It is offered as a means of imposing some understanding on a very complex body of theory, and data generated by experimental economists and by psychologists.

Because of differences in the nature of data, as well as differences in scientific objectives, it would seem to be important to make a clear statement of what is known, and not known, by way of modeling. On one hand, there seems to be little debate about the power of models built on principles of rational choice, or on related concepts of purposeful choices, to predict the

[1]The support for this project provided by the National Science Foundation, is gratefully acknowledged.

behavior of groups of people, such as committees and markets. Models based on such principles are not free of error, which critics of economics are quick to reference, but the success of rationality based models in explaining what is observed in experimental markets and committees cannot be denied. No model, theory, or concept, from any other branch of science yields models with comparable breadth and accuracy when applied to the behavior of groups of humans. Other models and theories might have the capacity to explain deviations of the data from predictions of the rational choice model. Other models might have the capacity to explain choice behavior after patterns of decisions are observed; but, no other model has the demonstrated ability to produce the predictions in the first instance. Price formation in a market, the strategic behavior induced by market institutions, the power of an agenda, or the attractiveness of the equilibrium in committees operating under majority rule, cannot be explained by an appeal to principles of psychology. An understanding of supply and demand, and the nature of game theoretical choices, seem to be indispensable for the task. If principles of psychology have a role to play in explaining social choices, it must be to explain deviations from the general tendencies explained by the rational choice models.

On the other hand, with that strong endorsement of rational models out of the way, the remaining parts of this essay will be devoted to some strategically chosen paradoxes that exist if the endorsement is accepted. The "deviations from the general tendencies explained by the rational choice models" can be substantial. The problems involve much more than simply placing a period at the end of a sentence written by economic theory. Examples of the paradoxes (or problem areas) seem to be of two types. The first type consists of situations in which the choosing individual has little or no previous experience with the choice/decision task. In economics and in political science, practical examples abound and range from a decision to buy a house, choose a wife, or support a new form of political constitution. The class of such examples, which will be called "new tasks," abound in economics and they are precisely the type of phenomena on which psychologists have focused. The second class of examples encompasses situations in which the behavior of another individual is important to a given individual. Again, examples are numerous in economics and political science, and include phenomena like the stock market, problems of coordination, etc. This second class will be called "other agent" examples.

The purpose of the essay is, in part, to identify an observational theory that is lurking in the background of the behavior observed in the two classes of examples. For purposes of discussion, I will call it the **discovered preference hypothesis**. I think this hypothesis is often believed, but seldom stated, and thus it should be brought into the light where it can be examined and criticized. The theory is that rational choices evolve through three stages reflecting experience and practice. Stage one occurs when experience is absent. Untutored choices reflect a type of myopia. The individual is purposeful and optimizing, but exhibits limited awareness about the immediate environment or the possible longer run consequences of any acts that might be taken. Responses are "instantaneous" or "impulsive," reflecting whatever may have been perceived as in self interest at the instant. To an "outsider," such behavior could appear to have a substantial random component because inconsistencies among choices may be present. Systematic aspects of choices might exist, reflecting attention and perceptions, but they might not make sense when viewed from the perspective of a preference based model. Stage two is approached as repeated choices, practice, incentives (feedback), provide sobering and re-focusing experiences. Problems of the type found in the first class of examples are no longer present in the data. Choices begin to reflect and incorporate an awareness of the environment, and can be recognized by an "outsider" as a stable form of "strategy" or "decision." The full constancy of the rational model begins to find support in the data. However, problems of the sort contained in the second class of examples can still be detected. Stage three, the final stage, is one in which choices begin to anticipate the rationality reflected in the choices of others. The fact that others might be acting rationally, and the consequences of that rationality, as it works through the interdependent fabric of social institutions, become reflected in the choices of each agent.

The observational theory might not be as empty as it could seem on first glance. A little closer look suggests that it could be filled with enough substance to alienate everyone. The hypothesis suggests that attitudes like expectations, beliefs, risk aversion and the like, are **discovered,** as are other elements of the environment. People acquire an understanding of what they want through a process of reflection and practice. In a sense, they do not know what they want and it may be costly, or even unpleasant, to go through the process of discovery. Attitude discovery is a process of evolution which has a direction, and in the final stage results in the "discovery" of a consistent and stable preference. Thus, while the final

product of the process may be a preference-like object that is very familiar to economic theory, economists seem to have very little to say about decisions that are made while it is coming into existence. So, economists have little reason to be happy with the observational theory because it suggests that the basic model has only limited applicability. Economists have a need to look elsewhere, or at least a need to look deeper into the decision process.

On the other hand, the discovered preference hypothesis seems to be inconsistent with philosophy that is being used by psychologists, but there seems to be no inconsistencies with the data produced by psychologists. Psychologists tend to distinguish their work from what they call a "philosophy of articulated values," as opposed to a "philosophy of basic values," which the psychologists tend to embrace. The former, sometimes attributed to economists by the psychologists, would hold that people have well formed preferences or values.[2] Choices are then made by reference to these values, which themselves are stable. By contrast, psychologists see themselves as operating under a philosophy of basic values from which preferences might be viewed as "constructed." The construction depends upon the mode in which a response is called. Task and context are thought to influence the construction and, as a result, preferences are thought to be labile if, indeed, they can be said to exist at all. Of course, if no preferences exist, then there is no foundation for a theory of optimization and no foundation for a theory of strategic behavior and game theory. The idea of constructed preferences would seem to leave very little room for economics and seems to be substantially contradicted by the existence of economic models that are so powerful in applications.

If preferences are considered as having been "discovered," rather than "constructed," then room exists in the philosophy for the process of discovery to be influenced by the perceptions, attention, and the focus of individuals. The path of discovery could be influenced by the context of the situation, the initial conditions so to speak. Tversky, Sattath and Slovic (1988) articulate the paradox created by constructed preference theory well. "If different elicitation procedures produce different orderings of options, how can preferences and values be defined? And in what sense do they exist?" (p.383). The message suggested by the examples to be reviewed in the first section below is a possible answer to the question they pose. The

[2]This attribution is not correct. The economic literature contains many references to basic preferences, including preferences over attributes, from which other preferences are derived. The whole field of decision theory is devoted to a study of deductions from primitive notions of preferences to complex spaces of alternative acts.

effect of different problem frames is not so much to call forth different means of constructing attitudes, as it is to focus perceptions and attention to different features of the environment. The framing effects would then be interpreted as a filter, operating through attention and perception, which effects the information on which otherwise rational choices are made. In terms of the rational model, the framing effects would be the consequences of different information conditions and not the consequences of differently constructed preferences. Individuals' decisions (attitudes) might be labile at first; reflecting only a limited perception of the immediate environment. With practice and experience, under conditions of substantial incentives, and with the accumulating information that is obtained from the process of choice, the attitudes stabilize in the sense of a consistent decision rule, reflecting the preferences that were "discovered" through the process. The final preferences show no evidence of being labile.

Now, there are four facts that seem to go against the discovered preference hypothesis, as refined by the above paragraphs. (1) The stages of rationality are a property of an individual. Whether or not the stages exist at all may differ from individual to individual. Furthermore, the myopia of the first stage can return if the environment changes. (2) Some types of rationality may never be acquired naturally. In particular, the rationality that comes from an understanding of the rationality of others might be difficult for some people to comprehend without some help. (3) Help in acquiring one type of rationality (knowledge of the rationality of others) can come in the form of special social institutions. But, if one type of rationality can be fostered by social institutions, the other types might be fostered that way as well. So, the fact that market institutions are specifically involved in the examples to be discussed might be critical to the fact that rationality/stable attitudes/preferences evolve (or are discovered) in the first place.

The paper contains three sections. The first section is an elaboration of the first and second classes of behavior. The section consists of four examples in which the rationality of other agents is not important or difficult to understand. The second section of the paper consists of examples of problems of the third class in which common knowledge of rationality becomes important to the functioning of the economic situation or the social process. The third section contains examples in which social institutions play a special role in conveying the nature of rationality of other agents in the economy. Together, the three sections of the paper describe a pattern of evidence that demonstrates a need to modify standard economic theory. The

section also suggests why a hypothesis of discovered preference might be more applicable than a hypothesis of constructed preference.

I. NEW TASKS AND FAMILIAR TASKS : THE BEGINNING AND THE END OF AN EXPERIMENT

Under conditions of "substantial " incentives,[3] how does choice with an unfamiliar task compare with the choices of a familiar task? A natural setting is the beginning and the end of an experiment. The first part of an experiment almost always involves decisions with an unfamiliar task. It is not uncommon for a subject to turn to the experimenter and ask "what am I supposed to do?" The incentives are present, but frequently the subject has never done the task before. The experimenter simply reads the relevant portion of the instructions again. After the experiment has operated for awhile the people are familiar with the task. So, a comparison of behavior at the beginning and end of an experiment provides the data of interest.

Four examples are studied. The first three can be interpreted as "games" with dominant strategies. Therefore, according to pure theory, the choice should be the same, independent of any experience or familiarity with the task. The fourth example is taken from a more complex setting in which a subject is operating in a continuous market, but the behavior studied has a common sense element of simplicity.

The behavior exhibited in each of the examples can be interpreted as involving rather fundamental violations of rationality -- at first. However, with experience, the behavior becomes transformed into patterns that are more recognizable through the lens of preference and decision theory. If the early choices are interpreted as having been influenced by framing, then framing effects go away under the proper circumstances. The patterns of behavior ultimately look similar across individuals and are understandable in terms of theory. Thus, the framing in these examples could also be interpreted as reflecting a type of myopia, fostered by limited information, conditioned by the nature of perceptions and attention which, with experience under suitable incentives, does not persist. Thus, according to the observational theory, the discovered preference hypothesis, the violations

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[3]"Substantial" typically means that the individual has an opportunity to make about twice the amount that would be made in the individual's ordinary job.

of rationality might be more attributable to information and search rather than how a process of cognition works.

A. The Preference Reversal Phenomena

The preference reversal phenomena can be most easily understood by reference to Figure 1. Consider an individual faced with the possibility of playing one of the two lotteries represented by the pie charts. Lottery A yields a payoff of $ 4.00 with almost certainty, and a payoff of $0 with the small probability, as shown. Lottery B yields a payoff of $ 16.00, with a payoff of a little more than .33, and a payoff of $0, otherwise. Lottery A is frequently called the P bet, because the probability of winning something is large, and lottery B is called the $ bet, because the amount is large.

When individuals are asked to choose, a large percentage will choose lottery A. However, when asked how much they would pay for the right to play the lotteries, the same individuals will pay more for the right to play lottery B. The inconsistency of the behavior is apparent. The individual, when asked to state a preference in one way (Which would you choose?), lottery A is preferred but when asked to state preference in another way (Which is of greatest value to you?), lottery B is preferred.

This inconsistency is what psychologists have called the preference reversal phenomenon. It has been an important example of what many believe to be the labile nature of preferences and how preferences are systematically influenced by the context of decision. The inconsistency is systematic, in the sense that reversals one way (P bet is preferred when choice is the response mode, and $ bet is preferred when values are the response mode) are observed with substantially greater frequency than the opposite reversal ($ bet preferred under choice, and P bet valued higher). The preference reversal phenomenon is the asymmetry of the switching between the dollar bet and the P bet. The behavior is not simply random as it might be if individuals were only making mistakes.

Recent experiments conducted by Cox and Grether (1993), inquired whether the preference reversals could be observed in market settings. They implemented an experimental design that had elements of both experimental economics and psychology. The experiments involved measuring the preferences for individuals for lotteries that have been used many times in the psychology literature. The methods of preference elicitation were those

that have been used by psychologists, but Cox and Grether used experimental market institutions as well. In addition, they paid off on every decision, so no decision was made on hypothetical values. The levels of incentives were on the order of those typically used in economics, as opposed to experiments found in the psychology literature, where incentives have tended not to be as large as the incentives that have been used in economics and in social choice experiments. Thus, the conditions of the experiments contained elements that are usually present in experimental markets where the rational models are observed working well.

Cox and Grether first used methods of preference elicitation that have been used in the preference reversal literature. Choice data was acquired from pairwise choices of individuals. Preference data was acquired by application of the Becker, DeGroot, and Marschak procedure.[4] In addition, they used a second price auction (a market institution explained in the next section of this paper) to obtain pricing data and they used a English clock auction (at first glance it has essential features of the Dutch clock auction) to obtain the choice data. Cox and Grether describe this auction as follows: "In this auction, the price clock starts at the amount of the win state payoff in a bet and then decreases by five cents every second. Each subject must decide whether to choose to play the bet by exiting from the auction at the price showing on the clock, or to remain in the auction. The last subject remaining in the auction receives the amount of money on the price clock when the next-to-the-last subject chooses the bet. All of the other subjects play the bet." Thus, at each stage of the process, the individual has a choice between the money shown on the clock or the bet. When the bet is preferred to the money the individual removes himself/herself from the auction.[5]

The striking result of Cox and Grether is that the preference reversal phenomena is clearly observed at first under all experimental conditions (markets and incentives). Then, after replication and experience under conditions of incentives and market institutions, the reversal phenomena goes away. It is not the market setting alone that removes the reversals since reversals appear when people first participate in the markets. It is also not repetition alone (without incentives) that makes the reversals go away, since

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[4]For a detailed account of how this incentive compatible preference elicitation procedure is used , see Grether and Plott (1979).

[5]Some question always exists about whether the response mode was a "choice task" or a "pricing task." The fact the Cox and Grether replicate the reversal phenomenon seems to remove controversies of this nature. The data produced by the clock modes are those that are supposed to be produced by the choice modes.

the reversals persist in the market settings when the incentives are absent. However, a combination of the repetition in a market setting with incentives will provide an environment in which the preference reversal phenomena no longer exists. Furthermore, with repetition, the (stochastic) element of choices decreases in the sense that the number of intransitivities[6] in general goes down.

Briefly put, the Cox and Grether experiments exhibit the pattern suggested by the theory advanced in the opening section. The classical preference reversal can be seen as a product of inexperience and lack of motivation, and it goes away with experience in a market setting.

B. The Second Price Auction

The second price auction is a special auction in which the object is awarded to the highest bidder, but the price paid is the bid of the second highest bidder. If multiple units are sold, the bids are arrayed from the highest to the lowest . If K units are to be sold they are given to the K highest bidders, but all of the winners pay a price equal to the K+1 bid. If it is a selling auction, then the bids are arrayed from lowest to the highest, and the K winners all sell at a price equal to the K+1 bid.

From a game theoretic perspective the optimal strategy in a second price auction is obvious. Under a wide class of environments (independent private values) the optimal strategy is to bid the individual private value. That is, the optimal strategy is to "reveal" in the bid the "true" willingness to pay or "true" willingness to sell. Revelation is a dominant strategy. Yet, when confronted with the task, individuals typically do not choose the optimal. Bidding the value is a dominant strategy and not only is the logic clear, it should be clear at an intuitive level. But, the obvious is not necessarily reflected in behavior when individuals are first confronted with the task. However, after experience, as is the case with the other examples in this section of the paper, choices converge in the direction of the choices predicted by theory to be the optimum.

The data to be viewed are generated from a typical multiple unit second price auction as it is used in applications.[7] Values are drawn independently

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[6]The measure of the number of intransitivities is the same as that used by Tversky, Slovic, and Kahneman (1990).

[7]This means that the conditions of the theory are not faithfully imposed in this experiment. In particular, the buyers are acquiring more than one unit and a variable number of units is being sold. Thus, if one

for each agent from a uniform distribution with support [0,250] . If the value V is drawn for an individual then that individual can redeem the item for a value of V with the experimenter and keep as profit the difference between the price paid for the unit and the value. In the Cox and Grether research, discussed in the previous section, the items sold were lotteries so the "true" values are not known to the experimenter except perhaps through comparative measurements. In the example discussed in this section the values are known to the experimenter so deviations from true revelation can be observed.

Figure 2 displays the (V, bid) pairs. The * are data from the first three periods of the experiment, and the 0 are the data from the last three periods. Theory (essentially) maintains that all data should be on the 45^{o} line. Data above the line are "irrational" by any concept in economics. Data below the line could have some interpretations, but for purposes of discussion, here are not important. The important thing to observe is that the movement of the data between the first three and last three periods is toward the line. That is, the behavior of the agents exhibits increasing rationality over the course of the experience. The model is not a perfect predictor of what people do. For example, there is ample room for speculation about why people might have bid more than the value and why such phenomena should persist even so late in the experiment as the 17th period. Nevertheless, the model does predict the exact form of the responses and not only is the movement of the data in that direction, no other model generates predictions that are of equal accuracy.

One is tempted to claim that the evolution of behavior observed in the experiments is simply one in which subjects adopt an obvious rule of thumb. Is it the case that individuals are simply adopting a "linear rule of thumb" and reflect no rationality or strategic behavior at all? Existing data suggests that such a hypothesis can be rejected. The data are of two sorts. First, if the rules are changed from a second price auction to a first price auction then behavior changes accordingly and in ways predicted by game theory. Secondly, experimentation exists with cases in which the predictions of game theory are decidedly nonlinear. Chen and Plott (1992) inquired about the degree of complexity that must be present in rules of thumb in order that they be an improvement over the nonlinear rules that are deduced from the

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wants to see a clear test of the theory these data are not appropriate. Nevertheless, except for the "near extra marginal units" which should be those with the lowest values, the optimal strategy is to bid value. Bids should never be above value.

optimization principles of game theory. Analysis shows that if (piece wise) linear rules are going to be an improvement over the complex rules that are predicted by game theory, then the piece wise rules must be rather complex (have several strategically chosen "pieces"). None of the simple linear rules perform as well as does the game theoretic model. It seems fair to say that individuals are not adopting some simplistic rule, like a markdown rule, or a rule that would "guarantee" some profit level.

In summary, the second price auction data suggests that individual behavior in an unfamiliar task exhibits aspects of lability and randomness. With experience and incentives, the behavior takes a form that is more recognizable from a rational choice perspective. The example explored in the next section is a continuation of this thesis. The example is a little more complex and the nature of the "optimal" strategy is open to more questions but the general pattern, reported so far, will be reported there as well.

C. Contributions to Public Goods Provision

Experiments with public goods provision take the following form. Each individual in a group is given a function in the form of a table or graph that indicates the dollar payoff to him/her as a function of the group decision regarding the magnitude of some variable X. That is, each individual i is given a payoff function $f^i(X)$ and is tested on his/her ability to understand the function. If the group chooses a level of X, say X= 10, then individual receives a dollar payment from the experimenter equal to $f^i(10)$. The group choice of X is made by anonymous contributions to a fund to pay for the level of X. That is, if the contribution of individual i to the fund is x_i and if the per unit cost of the variable X is C, then the level chosen by the group is $X=(\sum_i x_i)/C$. The amount of dollars that individual i receives is the payoff from the level of public good provided, minus the amount of his/her own contribution to the provision. That is {net dollar payoff to i} = $f^i(X)-x_i$. The cases of interest are those in which the experience is repeated a number of times. With each repetition, the members of the group may or may not be the same, depending upon the purposes of the experiment.

The classical public goods problem, articulated by Samuelson, suggested that individuals have a dominant strategy not to voluntarily contribute to the provision of public goods. That is, the "rational " strategy is $x_i = 0$ for all i. The situation is not unlike the prisoner's dilemma in which the dominant strategy Nash equilibrium is not Pareto optimal. Experimenters desiring to explore the situation carefully, chose parameters for public goods experiments such that the dominance existed.

The data from experiments indicate that substantial contributions can be observed occurring during the first part of the experiments. With replication of periods and incentives the contributions do drop off, but the data from the initial periods in which contributions occur stand in sharp contrast to a theory of rational choice which holds that the level of voluntary contributions should be zero.

An attempt to save the rational model took the form of a theory that gives preferences themselves an endogenous component. The theory is that individuals have a "cooperative " nature. Their first instincts are to be "truthful " about what they want. According to this revised theory of rational choice, individuals "truthfully reveal" their most desired outcome and do what they can to make it happen. One could say that the "frame" is one in which cooperation through giving is an obvious thing to do, so people do it. For several years the data were accepted as having been explained by this theory of endogenous, or "home grown" attitudes.

It appears now, that the apparent support of this theory of truthful revelation is a consequence of the randomness of initial choice behavior supported by an artifact of the experimental design. All of the early experiments were similar. In particular, the optimal strategic (Nash) response under the parameters studied was a choice of zero contribution to the public good. Choices below zero were not permitted by virtue of the structure of the strategy space, and choices above zero were interpreted as reflecting cooperative/truthful responses. Stated this way, the potential for a misinterpretation of the behavior is obvious. Any pure randomness of responses, resulting from confusion, or lack of reflection, would show up as a positive contribution to the public good and would, thus, be counted as

that the data reveal Nash response with an error, has emerged as a competitor to the theory that people are naturally cooperative.

The data from the older literature cannot be used to untangle the two theories. However, the newer literature is more successful. The data from new public goods experiments suggests the hypothesis that the behavior of people, when initially confronted with the task, is neither cooperative nor truthful. Instead, the behavior first exhibited by people is consistent with the hypothesis that it reflects large random components derived from lack of decisiveness as an individual works his/her way through the information. As an individual gains experience with the task, considered decisions begin to emerge.

Unfortunately, there are not many papers to review. The possibility that random behavior could be misinterpreted as cooperative behavior has not gone without notice,[8] but the problem has not been a high priority among experimentalists.

The relevant experiments are those in which the Nash equilibrium is not on the lower boundary of the strategy set. In two papers[9] Nash equilibria on the upper boundary of the strategy set are studied. Under such parameters the Nash strategies are also the strategies that would be chosen under a cooperative strategy, or an "other regarding" strategy. Choices of contributions less than the Nash contribution must result from some other process of choice. In the first study (Saijo and Yamaguchi), the contributions are below the Nash (self interested) response, starting with the first period. While the choices are interpreted by the authors of the study as being "spiteful," the data also support the interpretation that the choices reflect a fundamental randomness. Of course, random elements would look virtually the same, so the two interpretations of the data cannot be separated. In the second study in which the Nash equilibrium is on the upper boundary(Palfrey and Prisbrey), the data are near the Nash equilibrium from

[8]The most recent review of the public goods experimental literature has a special section on this issue. See Ledyard (1995).
[9]Palfrey and Prisbrey (1993). Saijo and Yamaguchi (1992).

the very first period. As a result, little changes in individual behavior are observed over the course of the experiment.

In two additional papers[10] the Nash equilibrium was placed strictly on the interior of the strategy set. Random behavior could be on either side of the Nash response. Presumably, initial attempts to be cooperative would result in choices that begin with contributions above the Nash and then converge toward Nash with replication of the experience. In both studies decisions are on the non cooperative side of Nash at first, and then converge toward the Nash response after replication of experience.

Thus, all four of the studies suggest that responses have a substantial variance during the first periods. The variance can result in choices on either side of Nash and thus, can appear as either cooperative or as spiteful behavior. The variance falls over time and settles near the Nash response with repetition of the experience. The exception is the Palfrey and Prisbrey study in which the responses are near Nash from the start, do not have such a large variance at first, and do not change with repetition. Briefly put, none of these studies support the idea of "truthful" revelation as an overriding and general property of the initial responses of people in a public goods experiment.[11] Instead, the studies support the idea that what has appeared to be a tendency toward truthfulness is actually something else. The initial choices of individuals have a random component. With experiences and incentives, game theoretic principles tend to emerge.

D. The Continuous Double Auction and the *Hvatat* Phenomena

The next example is taken from markets that operate in continuous time. From a theoretical point of view, optimal behavior is unknown, but behavior is observed that is both systematic and difficult to rationalize with any concept of optimality other than what might result from a type of myopia. The example is particularly interesting because it demonstrates how market

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[10]Walker, Gardner, and Ostrom (1990). Andreoni (1993).

[11] The work of Isaac and Walker (1988a, 1988b) with very large groups, stands as a stark counter-example to this general proposition. Some speculation exists that experimental control (or the lack of it), over very large groups, is a contributing factor to the results. Isaac and Walker are continuing a research program designed to investigate all of such possibilities.

level phenomena can be effected by the decision behavior of one or two individuals who seem to be deviating from the ordinarily accepted rules of rationality.

As part of a process of establishing a program of experimental economics in Moscow, researchers began with a project of attempting to replicate phenomena that has been widely observed in laboratory economics in the west (Menshikov, Menshikova, and Plott, 1993). The project involved several different subject pools from Moscow, which participated in classical computerized multiple unit double auctions. The basic choice of parameters also involved a single upward shift of demand and supply that was not anticipated by the subjects. The purpose of the shift was simply to document the ability of the model to predict the actual time path of the market. The parameters also involved an asymmetry between demand and supply of a sort that ordinarily causes the observed prices to converge to equilibrium from above, and the experimental design also called for an occasional imposition of non binding price ceilings that are known to effect market dynamics.

The markets converged to the competitive equilibrium, but the surprising result from the experiments was that the price variance in some experiments was much higher than has been observed in the west. Furthermore, the expected features of market dynamics, the direction of convergence and the reaction to price ceilings, were not observed. Close scrutiny of the data resulted in the discovery of types of individual subject behavior that, upon reflection, has been observed in the west but not to such a pronounced extent.

Hvatat in Russian means "to grab." The individuals in these experiments had no experience with market economies and with the related rules. They grew up in an economy in which prices were frequently fixed at levels that were too low and, as a result, shortages were a part of daily experiences. The habits of the population included a propensity to acquire anything of value at any time that it was encountered, in hope that it could be used or traded for something else. If the act of acquisition was not quick (*hvatat*) someone else would have it and the opportunity would be gone. The term, *hvatat*, became applied to behavior in experiments because the Russian scientists saw the behavior in the experiments as analogous to behavior they observed in the society around them. The behavior is by no means

irrational, but it does reflect a special type of training or expectation on the part of the subjects.

Once the proper patterns of behavior had been identified, one naturally looked for similar patterns in data from the western markets and, once attention was so directed, examples were easy to find. The example to be considered here is a double auction experiment that was conducted with students from the California Institute of Technology. This market experiment is the same as many that have been conducted in the west and, except for a few details of the parameters, it is the same as the experiments that were conducted in Moscow.

The induced demand and supply functions are shown in Figure 3. The time series of contract prices is shown in Figure 4. The vertical axis is the price of the contract, and the horizontal axis measures clock time in seconds so the figure shows the seconds at which contracts took place. The horizontal lines represents the upper and lower bounds of the set of competitive equilibria for this simple market that are shown in Figure 3, at the intersection of the demand and supply curves.

Even an untrained eye will notice that the prices tend to converge to near the competitive equilibrium. This is the power of the double auction that is observed universally. What the untrained eye might not notice is the variance of the market prices. The reader is asked to take on faith that the variability of prices in this market is high relative to most market experiments, whether conducted in the east or the west. Close examination of the data suggests that the variability seems to be due to the actions of a select few people. In particular, the contracts of seller number 10 in Figure 4, are filled in with black.

Figure 4 shows clearly that seller 10 managed to sell at the lowest prices almost every period. In fact, a study of the figure will show that all of the sales of seller 10 are below the average of the prices that existed in the market in any period. Relative to other sellers, and relative to the prices that existed in the market, seller 10 is performing poorly at making profits.

The pattern of behavior that leads to this relatively unprofitable behavior can be interpreted as having resulted from a type of myopia. First, this individual tends to react to the environment as opposed to acting on it. In order to see this property, examine Figure 5 which contains the activities of

seller 10. In the double auction sellers are free to send asks to the market which they hope some buyer will take and buyers send bids to the market. A contract can be made by the seller accepting the bid of a buyer or a buyer accepting the ask of some seller. The asks and the contracts of seller 10 are shown in the figure at the time when they occurred. The asks tendered by seller 10 are the diamonds and the contracts are the circles. A circle filled with black is a contract in which an ask of seller 10 was accepted by some bidder and the open circles are contracts in which seller 10 accepted a bid of some buyer. As is clear, seller 10, for the most part, accepts bids offered by buyers. In the entire experiment seller 10 had only three of his asks taken by a buyer. On all other occasions seller 10 accepted bids.

Secondly, the individual does not seem to understand how to be successful in acting within the environment. From Figure 5, the reader can see that the asks of seller 10 have a tendency to be "away from the market." This seller's asks, represented by the demands in the figure, are much too high to be accepted with any reasonable frequency. The asks tend to be unrealistic above the levels at which trades are taking place, and no well placed asks are tendered by the individual. In order to see this, study Figure 6 which displays the asks of seller 10 as black-filled diamonds, along with the asks of seller 9 whose pattern of asks are typical for the sellers and are shown as open diamonds. As can be seen, the asks of seller 9 are close to the competitive equilibrium and are strategically chosen to be close to the market, with a realistic expectation that one would be accepted. By contrast, the asks of seller 10 are all well removed above all the market activity.

Third, seller 10 tends to act quickly to "grab" opportunities with little regard to the opportunity cost or the possible consequences if considered over a "long" horizon. It is as if the individual sees an opportunity to make an instantaneous gain and grabs it with little regard for the benefits that might accrue to a more considered action. This type of quickness tends to be reinforcing because it prevents the individual from surveying what is happening in the environment and thereby tends to deflect attention from information that might result in a change in the behavior.

The quickness can be seen in all of the figures. Seller 10 tends to make trades in the first parts of all periods. Table 1 provides some descriptive statistics for sellers 6 and 10, both of whom have a tendency to trade at the low prices. The table gives the number of trades that occurred in the first thirty seconds of a (six minute) period and the number of trades that

occurred in the whole (six minute) period, for all sellers and for sellers 6 and 10 considered as a pair. On average, 31% of the total market volume occurs in the first 30 seconds of the six minute period. About 55% of the total volume of the six sellers that occurs in the first thirty seconds is due to two sellers alone, sellers 6 and 10 who sell 64% of their volume in these opening seconds. These two sellers are quick to unload their volume even though this is the time when prices are lowest, as can be seen by a return to Figure 4.

The pattern described is the following. The seller is quick to act. The seller accepts the terms offered by a buyer and is not aggressive in offering terms himself in the form of asks, and seldom places a successful ask. The individual reacts quickly to take what is offered without "negotiating" or considering what alternatives might be presented. It is interesting to note that this behavior is a consistent property of an individual and is not a property of a group, or the random behavior of members of a group. The Russians have called such individuals "rabbits" and theorize that people who are not so myopic develop characteristics of "wolves" who anticipate rabbit behaviors and set traps with selective bids. An attempt to identify "wolf" behavior would involve an excessive deviation from the general theme of this paper and so the idea will drop here. With or without the wolves, the rabbits tend to act less impulsively as time and experience take place. The price patterns tend to lose the variance and the whole system tends to converge to the equilibrium as predicted by the competitive model.

II. OTHER AGENTS AND THE PROBLEM OF KNOWLEDGE OF RATIONALITY

From time to time, over the years, complicated experiments have been conducted that did not work out exactly as expected, in theory. The perplexing aspects of the experiments were frequently reported as a curiosity, along with the other results that were understandable. Looking back over these experiments, in the light of the advance and refinements of experimental techniques, and a growing number and types of experiments, general patterns tend to suggest themselves. One such pattern seems to be due to a lack of understanding on the part of some agents, of the motivations, intentions, and behavior of other agents that are participants in the process. Formally, within the context of game theoretic models, the patterns seem to be due to the possibility that rationality is not common

knowledge. Six examples of possible cases can be listed that may prove to be cases.

A. Mixed Strategies

The observed lack of independence in mixed strategies is the first example. The aggregated choices of agents participating in conflicts, for which the game theoretic model has no pure strategy equilibrium, are well approximated by the mixed strategy equilibrium of the game. However, the strategies of an individual do not have the property of independence that is crucial for the security property that the mixed strategy is supposed to provide. If other players are believed to be fully rational, then the independence is necessary.

B. Agendas and Voting

The second example comes from agenda theory and the operation of committee processes. An agenda can be imposed as a partitioning of the options into subsets for discussion and voting . For example, if the options were indexed by the letters of the alphabet, then a motion could be that the group chose a vowel. If the motion passes then further motions are restricted to the set {(a, e, i, o, u)}. If the original motion fails, then (depending upon the exact wording of the original motion) the deliberations are restricted to the set of consonants, and additional motions will be to restrict that set. As the motions continue, sets are removed from further consideration until only one option is left. The agendas are usually applied to a finite set of options that are not labeled with letters or numbers, so the actual motions are typically something that would make sense to an ordinary human. The example is intended only to carry the intuition that an agenda is a refinement of partitions of a finite set, such that at the end of each branch is a single element. The committee process is then a series of votes, each of which will eliminate a set of options until only one option remains as the committee choice.

The influence of the agenda on committee decisions is well documented. It is possible to design agendas that can get the group to chose almost anything that the designer desires. The phenomena is not related to the classical cyclical majorities. Even if all members of the group have the same preference, the agenda designer can still have considerable power.

The power of the agenda seems to depend upon tight control of the information that individuals in the group have, and it depends upon aspects of " myopia " that the theory presupposes exists in individuals in the group. First, the theory assumes that the individual chooses randomly among three decision rules: (i) vote for the set that contains the most preferred option; (ii) vote against the set that contains the least preferred option; (iii) vote for the set that contains the highest average "payoff" of options. The data show that if individual decisions are restricted to these three rules then individuals are using different rules at each of the different stages of voting. Secondly, the theory assumes that the probability with which a decision rule is used is independent of past votes. That is, the theory treats individuals as if they have random features of behavior and that individuals completely ignore the behavior of others. The fact that others might be behaving rationally, and that the rationality of others has consequences for one's own voting behavior, is not part of the model.

Now, the agenda model was not developed to study rationality, or the lack of it in individuals or in groups. It was developed as a tool to manipulate groups and to help individuals understand the subtle ways that they might be manipulated by others. The model operates by letting the agenda designer deduce a probability over the outcomes that depends upon the agenda (and the behavioral probabilities used). Thus, the agenda designer can find the agenda that maximizes the probability that the group chooses some option that the designer wants chosen. Whether or not the lack of rationality in the model is aesthetically pleasing is not particularly important because the model works. It is an effective tool for the job for which it was invented. The assumed myopia on the part of voters is simply part of the machinery that helps it do its job.

C. Winner's Curse

The winners curse is another example in which knowledge of the rationality of others seems to be a missing element of individual decisions. The winners curse, first observed by Kagel and Levin (1986), occurs in what are called common value, first price auctions. Briefly put, and contrary to theory, in these auctions the winners repeatedly lose money. Furthermore, it does not seem to go away with experience.

A value of an object is randomly determined. For example, a value is drawn from $0 to $300 and the individual who buys the object can resell it to

the experimenter for the value drawn. Suppose the value of the object is V=$150. The value is unknown to all bidders at the time that bids must be tendered, but each individual is given a personal "clue" to the value. That is, for each individual a clue is drawn from a uniform distribution with support [V-E, V+E] where E is some constant known to all individuals. For example, suppose E =$30. If individual i is given the clue $140, then the individual knows that the true value of the object is somewhere in the interval [$170-$30, $170+$30] and must formulate a bid for the object based on that information, together with the knowledge that other individuals are receiving clues that are independently drawn from the same distribution.

The winner is the person that bids the highest and, almost without exception, the winner pays more for the object than the object is worth. The theory of bidding requires that the individual must realize that people with the highest clues are going to be the ones that bid the most. This follows from rationality. But, this means that the person with the highest clue will be the winner and, almost certainly, the person with the highest clue will have a clue that lies above the true value of the object. Thus, in bidding the individual must "scale back" the bid to condition on an appropriate order statistic. The individual must realize that if he/she has the highest bid, then he/she also has a clue that is greater than the value of the object. Kagel and Levin postulate that the winner's curse results from an inappropriate scaling back, if not a complete neglect of the consequences of the rationality of others.

D. Lemons in Markets

A fourth example comes from experiments that are designed to explore the possibility of markets for "lemons" - as in used cars, not fruit (Lynch, Miller, Plott, and Porter, 1986). In these experiments, sellers of an object have an option of delivering two different qualities of the thing. A seller can deliver a "super" grade, which is valued highly by the buyers, but also is costly to the sellers, or, the seller can deliver a "regular" grade that is less desirable to the buyers, but the cost is much less to the sellers.

Given the parameters chosen for the experiment, only supers would be produced and sold in the market if the quality of the commodity was known to the buyer at the time of the sale. The regulars are the lemons. Several different conditions of information have been studied but, for purposes of the discussion here, the interesting experiments are those in which the

quality was unknown to the buyer at the time of the sale. The quality was determined after the sale by the seller. Furthermore, there were never discussions between the buyer and the seller, and the buyer did not know the identity of the seller at the time of the sale or at any time after that.

The incentives of the seller under such conditions is clear, at least from the point of view of the theory. The seller has an incentive to offer at a high price hoping that the buyer will think that the seller will deliver a super and take the deal, and then the seller will deliver a regular. Buyers, understanding the motivation of the sellers, will never assume that the seller will deliver a super and only engage in deals that will be profitable if a regular is delivered. The net result should be that only regulars are delivered at prices that fully reflect the fact that only regulars will be delivered. The market will be filled with "lemons" and sold at prices that reflect the fact that the buyers know that they are buying lemons.

When the buyers first encounter the situation, many pay the high prices as if they were buying a super quality and knew it. This phenomena occurred in all subject pools of the experiments. The buyers did not apply the rationality logic contained in the paragraph above. On the other hand, sellers responded as anticipated by theory. Only regulars were delivered by the sellers. The experience after the first period or two, fostered a dramatic change of behavior in the buyers. Buyers would find caution immediately and prices would drop. In some subject pools the prices would cave immediately after the first period to near the price that would exist if buyers knew for certain that a regular would be delivered. However, in one subject pool, the prices would drop after the first period but, even after eight periods, prices were still too high, suggesting that the buyers really did not understand the seller's motivations. Buyers were simply treating the market as a lottery in which some probability of a super existed. After several experiences in such markets, different days of experimentation -- each involving several periods, the behavior of the buyers began to reflect an understanding of the motivations of the sellers. Such an understanding was not immediate by virtue of buyers having reasoned their way through the situation. For some subjects it took a lot of experience and time. The rationality was not common knowledge.

E. The Centipede Game

The centipede game is a process in which two individuals participate in a finite sequence of moves. The options at each move include two amounts of money {x,y} with x>2y. The chooser can take one (the highest) of the amounts of money, leaving the other amount for the other person and, thereby, ending the game; or, he/she can pass the choice back to the other person. If the choice is passed back, both amounts of money double and the second person has the choice. The game continues for a finite and known number of stages.

The only game (perfect information, Nash) theoretic solution is for the first chooser to take the money and stop the game. If both individuals are rational, then the logic of backward deduction can be applied. Working backward at each stage, the logic is that if the game reaches that stage then it should stop there. The logic works back to the beginning of the game.

The centipede game shown at the top of Table 2 was studied by McKelvey and Palfrey (1992). The game started with the amount {$.40, $.10} and if it continued to the final stage the amounts would have grown to {$25.60, $6.40}. The data are partitioned into two sets according to the experience that the subject had with the game. Each subject played the game ten times with ten different people. The results of the first 5 games are at the top of the page and the results of the second 5 games are at the bottom.

Each game could have involved seven choices. The table indicates the number of games that had terminated at a given stage. For example, in the first five games no game terminated at the first choice. The probability of termination goes up as the stage increases. For example, if a game reached the 4th stage the probability of termination at that stage was .43. However, in the second five games, after individuals had experienced the first five, the probability of termination if the game reached the 4th stage was .65.

Notice, that even in the second ten games, only 1% of the games terminated at the first move. The tendency to terminate moves forward as individuals gain experience, but it would appear that the presumption of common knowledge of rationality cannot be supported by these results.

F. Bubbles in Asset Markets

The final example in this section is from experiments motivated by financial markets. Consider an asset with a fifteen period life. Each period of its life it pays a dividend drawn with equal probability from the set {$.60, $.28, $.08, $.00}. Since the expected value of the dividend is $.24 each period, the draws are independent, and the life is fifteen periods, the fundamental value of a unit of the asset is $3.60 before the first dividend is paid. The fundamental value then drops by $.24 each period because of the payment of the dividend and the consequent reduction in the number of dividends left to be paid.

The dividend structure is common knowledge. Each subject is tested for understanding and has a chart in front of him/her from which the fundamental values can be read. The charts are explained publicly. Furthermore, at the end of each period the individuals record the fundamental values when computing the value of what they hold. There should be no misunderstanding about the values of the dividends or the fundamental value of the asset.

At the beginning of the experiment each individual is given an endowment of the asset and/or cash, so securities can be bought or sold as the individual might want. The market is a computerized double auction at California Institute of Technology and the subjects were knowledgeable about the operations of an electronic market.

The time series of trades are contained in Figure 7. The prices are on the vertical axis and time in seconds is on the horizontal. The two line sloping from upper left to lower right bound the possible values. The lower line is the fundamental value that starts at $3.60 and falls by $.24 each period. The upper line represents the maximum possible dividends. That is, the line represents the value of the asset if it paid the maximum possible each period of the remaining periods of its life.

The time series of trades is dramatic. Prices move quickly through the fundamental expected value, stabilize with a slight inflation. The high prices continue until the fourteenth period when a violent market crash occurs. Prior to the crash, prices were above even the maximum that could be paid by dividends. This behavior is in stark contrast to a very natural theory which maintains that by applying backward deduction, depending upon the

rationality of all people at each step, the price should have been approximately the fundamental value in each period. However, if an individual thinks that the price will stay high across any two periods it will pay to buy the asset, collect the dividend, and sell the asset back for what was paid for it. The dividend will thus be obtained for free.

If people do not think that all other people are rational then it might pay to speculate. According to Smith, Suchanik, and Williams (1988), the backward induction tends to work after subjects have experience with each other. They maintain that common knowledge of rationality is acquired by observation and experience. The problem is directly related to the "swing back hypothesis" that was first observed by Forsythe, Palfrey, and Plott (1982).

The problem with other minds and other people is beginning to surface as economic theory and experiments begin to explore deeply into situations of asymmetric information. Social processes have the capacity to integrate information that is known only privately and is disbursed throughout the economy. Common knowledge of rationality is a cornerstone of how such processes might work. Experimental work suggests that this is the most difficult level of rationality and cannot be found reliably in many people and may be acquired only through experience.

On the other hand, perhaps rationality is not common knowledge because rationality is not a fact. Some people may behave in strange ways for the reasons outlined in this paper. If that is the case, then how can the models be modified to account for it? Experimentalists have begun to explore the implications of the idea advanced by Kreps, Milgrom, Roberts, and Wilson (1982). The hypothesis that irrationalities exist, and that a known probability exists that you may be involved with such a type, has begun to be systematically integrated into the behavioral models. That probability is then treated to the complete menu of rationality in a striking analysis by El-Gamal, McKelvey, and Palfrey (1993) and El-Gamal, McKelvey, and Palfrey (1994).

III. SPECIAL INSTITUTIONS AND THE SOCIAL FORMATION OF RATIONALITY

Economists and political scientists typically study social behavior in a framework of institutions. The special role that these institutions play in shaping rational choice may be more important than is commonly understood. It could be that the social institutions reflect, and may even be built from internal process that shape outward forms of rationality. The thesis advanced here is that social institutions must help individuals, as a group, overcome three problems: (i) myopia, (ii) a problem of perception that is closely related to myopia, and (iii) a problem related to the public nature of rationality. The instruments that work, in the sense of fostering efficient interactions, have solved or contribute to the solution of those three problems.

Four examples of such institutions are closely related to the examples explored in the section above. Each institution calls attention to the information that it contains. There is nothing subtle about the signal that is conveyed. Each institution carries information about the preferences of some other agent, or group of agents, in the system. Each institution involves a complete account of the fact the individual whose preferences are suggested is prepared to act on those preferences. If the institution is functioning properly, little is left to the imagination about what might be going on in the other person's mind.

In agenda process and committees, in the absence of the possibility of a caucus, or other institutions that allow meetings of subgroups, a critical institution is the straw vote on issues that are scheduled to be voted upon later. Now, straw votes can involve cheap talk, but under conditions in which information about the preferences are restricted to no other source, the talk is not cheap. If the agenda is tightly controlled, then committee members have no opportunity to form coalitions, or even to determine if other people exist who might be willing to coordinate strategies. Straw votes are a way in which individuals can find each other and signal intent. In committee experiments straw votes are thought to undo much of the power of the agenda. The advice to those who are using the agenda for purposes of manipulation is to avoid straw votes. In essence, the straw vote changes the order of the agenda by letting people know now what will happen when the subsequent stage of decision is reached. The straw vote

helps the individual solve the backward induction problem, but because of the possibility of cheap talk, it is not an ideal vehicle.

The lemons problem, described as the fourth example in the section above, can be solved by the institution of enforceable warranties. Express warranties, if offered by the seller, and if enforceable, will do the trick. The seller guarantees that if a lemon (a "regular" in the language of the experiment) is delivered, it will be replaced by a high quality item (a "super") at no cost to the buyer. The buyer, seeing the pre-commitment by the seller and knowing the interest of the seller is to deliver a non-lemon, will buy as if the quality of the item is known. In effect, the buyer is accepting the rationality of the seller and is using that knowledge to form his/her own decisions. The prices will reflect the certainty. The sellers will not deliver lemons and the system will be removed from the inefficient lemons equilibrium. Thus, the express warranty performs a function in the system of changing the strategy of the seller and letting the buyer know that it is in the interest of the seller to change.

Two examples of special institutions can be taken from financial markets. The first example is a futures market which addresses the problem of bubbles and crashes, demonstrated in the section above. The bubble seems to be due to an incapacity of the system to support a process of backward induction. If some individual is "confused," then he/she might buy in one of the final periods, even if prices are "too high." That possibility, at any stage, will circumvent the backwards induction process. A futures market solves that problem. The purchase and sale of futures contracts signals intent and commitment at the later stages of the game. An individual participating in the early periods of the market, who sees that the futures market is low for the later periods, knows that the spot price will be low when the future time arrives.[12] Thus, the information about futures prices or, more specifically, information about the plans of other agents in the market, that would otherwise not become known until the future date arrived, are brought to the present by the instrument. The futures price is prominent and calls attention to itself. The meaning of the futures price is not difficult to ascertain. It is a sale now for delivery in the future. There is no speculation about what people might do in the future because they have already pre-committed to those decisions. The rationality is revealed.

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[12]Analysis of institutions, like futures markets, must be sensitive to special features that might exist with some variations of the institution. In some markets, futures contracts must be covered. An individual cannot be "short." Speculation that the short position is too large can itself be a source of speculation and will interact with the market in ways that will prevent the backward induction process.

The second example from finance is technical but it is worthy of mention. It is known that compound securities can have difficulties in achieving "state revealing" rational expectations equilibria. Decomposition of the compound security into state contingent, "Arrow-Debreu" securities solves the problem. Under conditions of a single compound security, market prices do not necessarily reveal the state. However, if the compound security is decomposed into equivalent Arrow-Debreu securities the state is revealed almost instantaneously. The problem of state revelation with a single compound security can also be solved if adequate preference information about agents in the economy is publicly available, and if the agents have adequate experience. The process of revelation is slow as experience is accumulated. Whereas, if the state contingent commodities are used, the system moves to efficiency almost immediately. Since the state contingent securities are similar to options, the result leads to a renewed interest in the functions of options in financial markets.

IV CONCLUDING REMARKS

The general thesis of this paper is that rationality can be understood as a process of discovery, the discovered preference hypothesis. Behavior seems to go through stages of rationality that begin with a type of myopia when faced with unfamiliar tasks. With incentives and practice, which take the form of repeated decisions in the experimental work, (but might include play, banter, discussions with others, stages of commitment, etc.) the myopia gives way to what appears to be a stage of more considered choices that reflect stable attitudes or preference (as opposed to the labile attitudes identified by psychologists). Social institutions are seen as playing an important role in the attainment of a third stage at which individual decisions might incorporate the rationality of others, or the lack of it.

The dialog that has been taking place in the literature has involved a search for a manifestation in markets of the effects of preference lability that psychologists have identified in the study of individual choices. In Sections I and II several such effects were identified. Even the behavior of the double auction market process contains elements of the effects of idiosyncratic features of individual choices. The *hvatat* phenomena does effect the market. However, these labile aspects of choice seem to yield to another mode of behavior and suggest that the lability is due more to perception and

information processing, as opposed to some fundamental aspect of the way that cognition works.

The final stage of rationality can be facilitated by special institutions. But, if institutions can play such a role in forming rationality at the market, or at the group level, a possibility exists that institutions operating at the level of the individual could be important, as well. Perhaps the stability of market processes themselves are heavily dependent upon institutions of one sort or another. The striking results of Gode and Sunder (1993), who demonstrate that markets populated with randomly behaving agents, still contain elements of convergence and efficiency. In other words in the context of the double auction institution, with the supporting institutions of a budget constraint and equal access to the market, agents can act with substantial arbitrariness and the process will still maintain power to exhaust much of the gains from trade. For some purposes, the minimal addition of institutional constraint might be adequate to foster acceptable economic and political behavior, even in the absence of the full rationality contained in models of such processes.

Table 1
Units Traded by Period by Segment of Period
Select Individuals

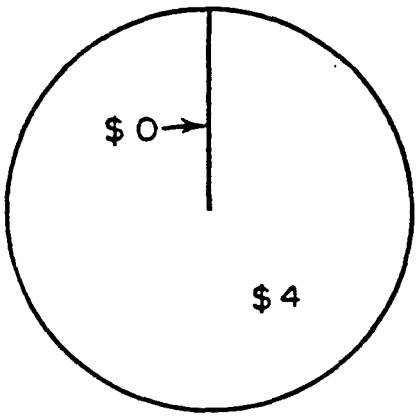
	Period							
	1	2	3	4	5	6	7	Total
1st 30 seconds Total Volume	5	8	9	6	8	10	7	53
6. 10 Volume	4	5	4	2	4	5	5	29
Period Total Volume	22	19	21	21	22	20	19	143
6. 10 Volume	7	6	5	6	8	6	7	45

Table 2
Decisions in Centipede Game

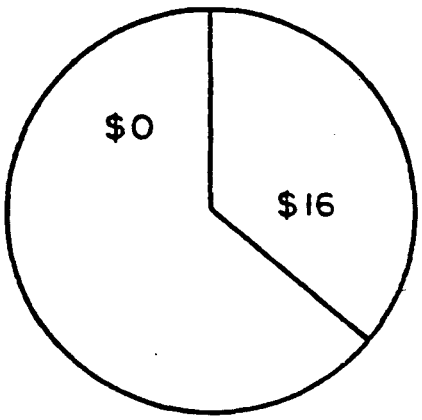
$ Amounts of Money	.40 .10	.80 .20	1.60 .40	3.20 .80	6.40 1.60	12.80 3.20	25.60 6.40
Choosing Individual	1	2	1	2	1	2	1
Trials 1–5							
# of People Choosing	145	145	137	112	64	16	4
Number of Terminations	0	8	25	48	48	12	
Probability of Termination	0	.06	.18	.43	.75	.81	
Trials 6–10							
# of People Choosing	136	134	124	93	33	10	1
# of Terminations	2	10	31	60	23	9	
Probability of Termination	.01	.07	.25	.65	.70	.90	

Source: Richard D. McKelvey and Thomas Palfrey

Figure 1



A
P-Bet



B
$-Bet

Figure 2
Values and Bids in a Second Price Auction
Cason and Plott, 1993

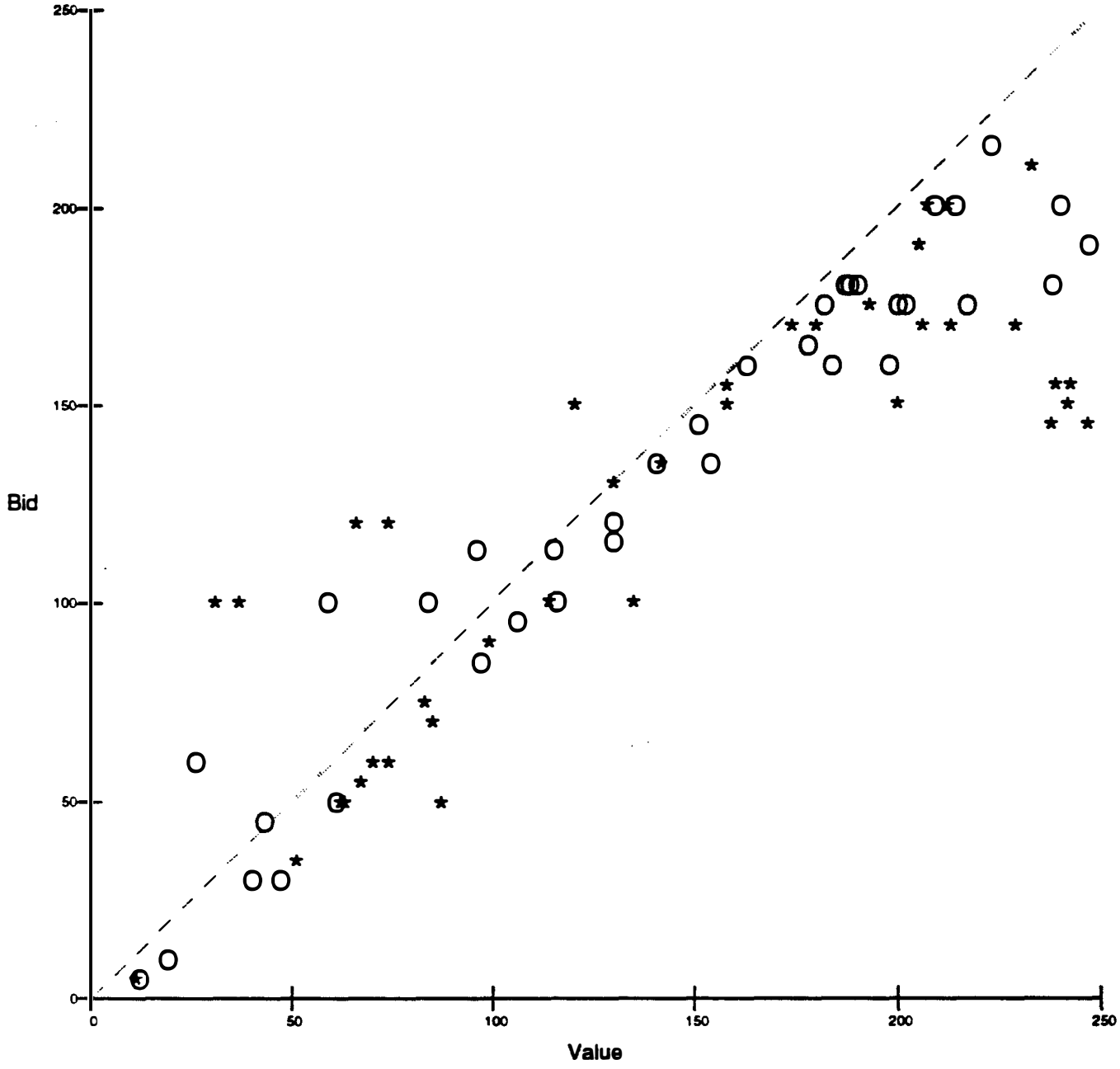


Figure 3
Demand & Supply

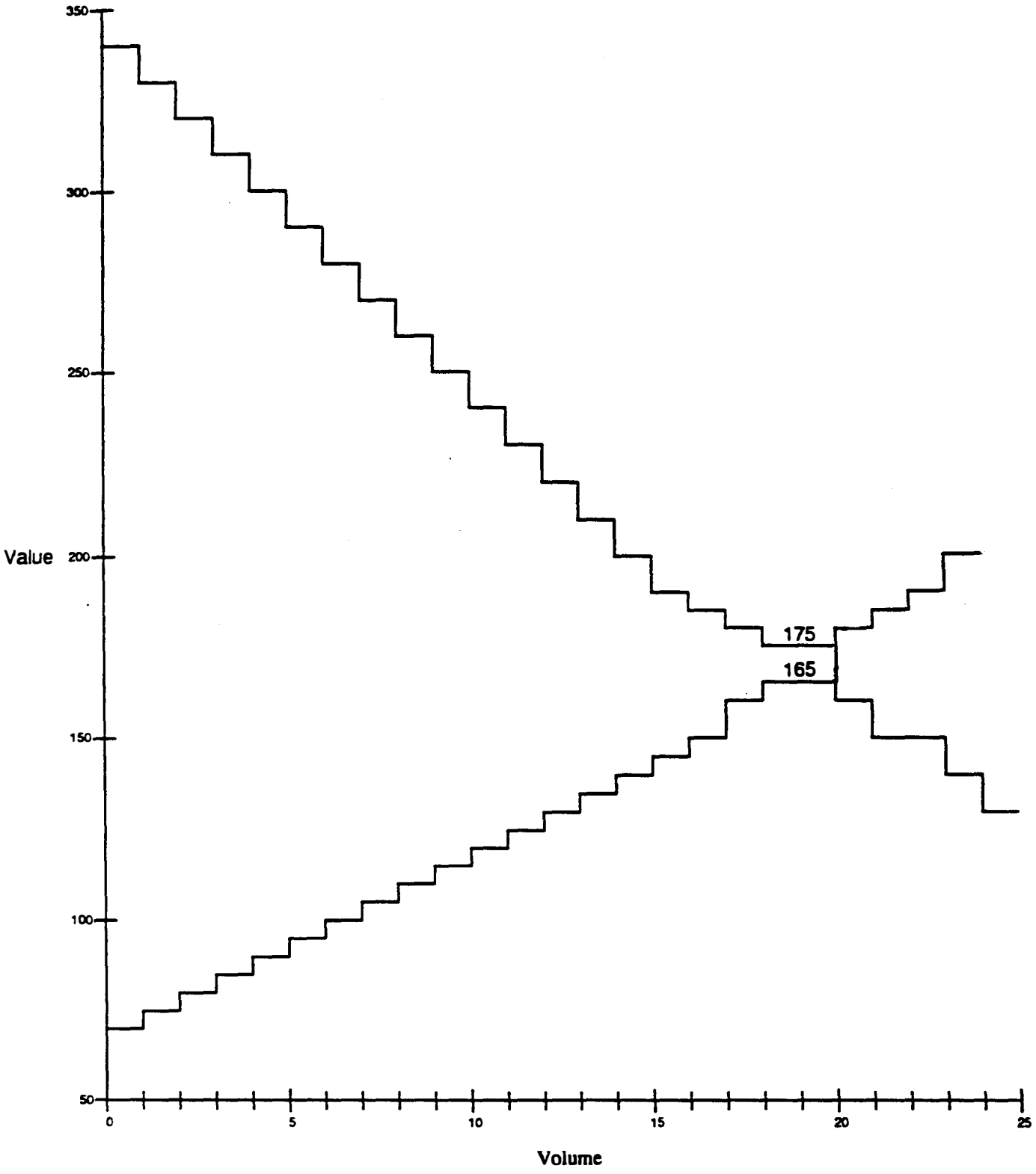


Figure 4
All Contracts

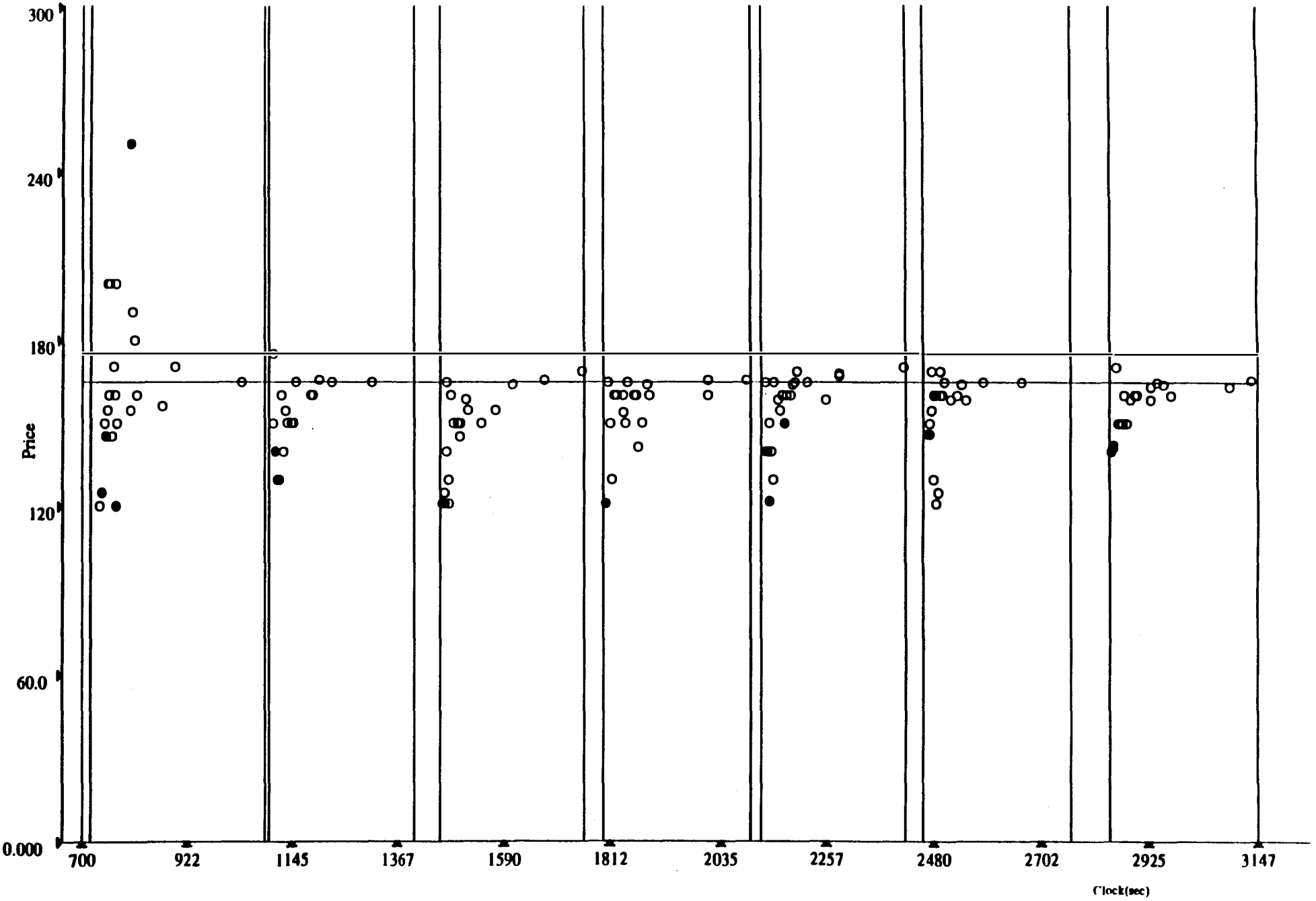


Figure 5
Asks and Contracts of Seller 10

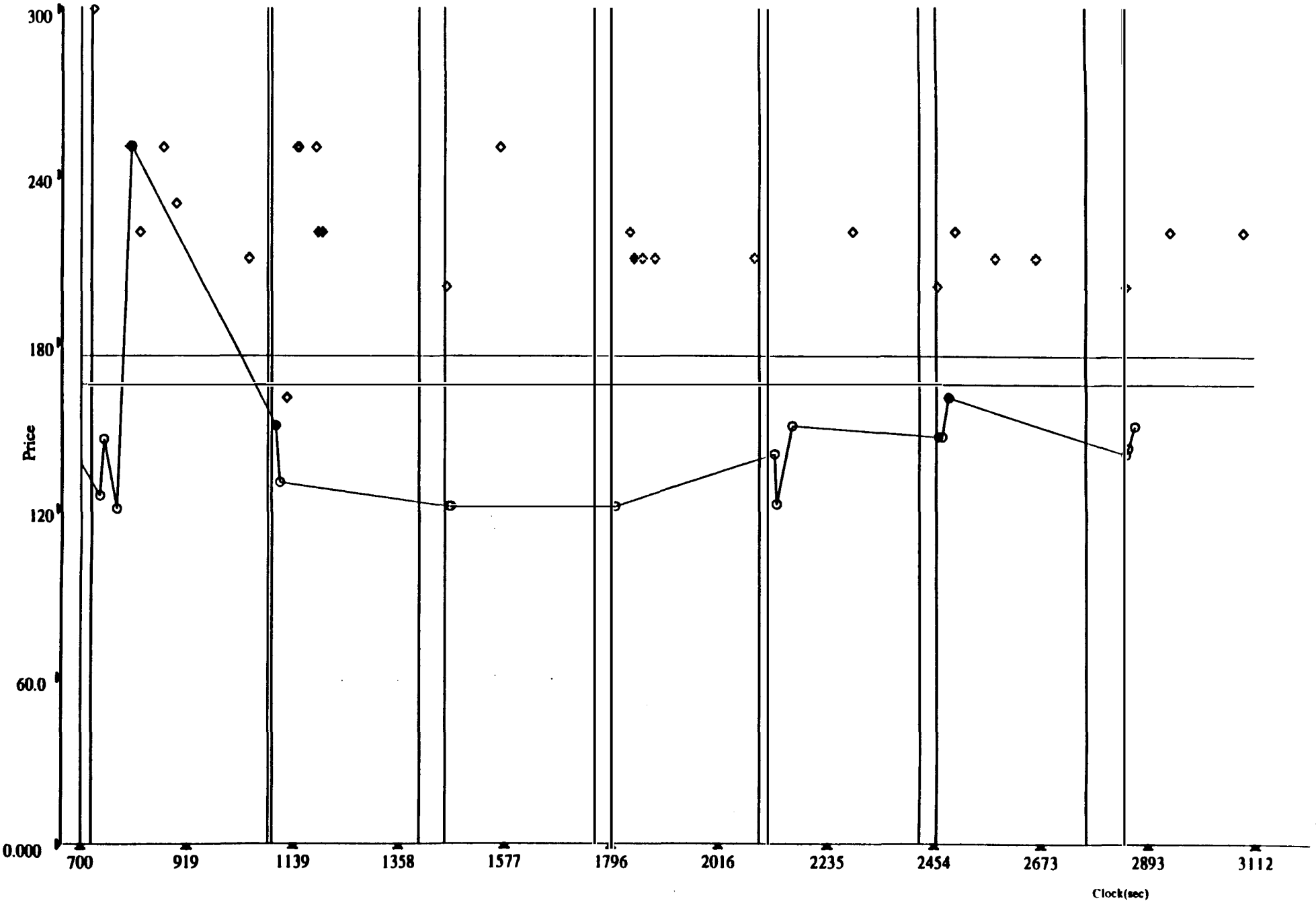


Figure 6
Asks of Sellers 9 and 10

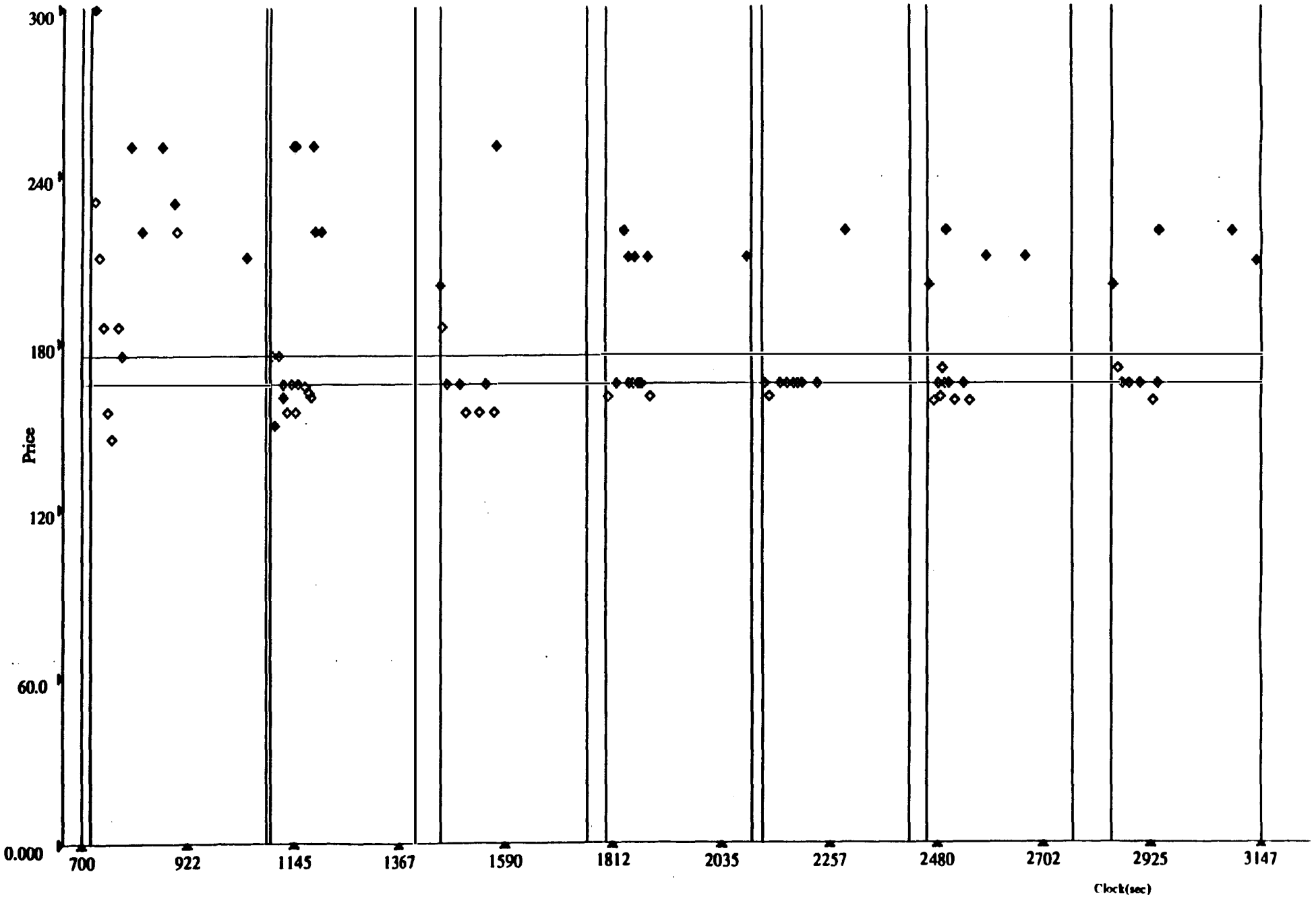
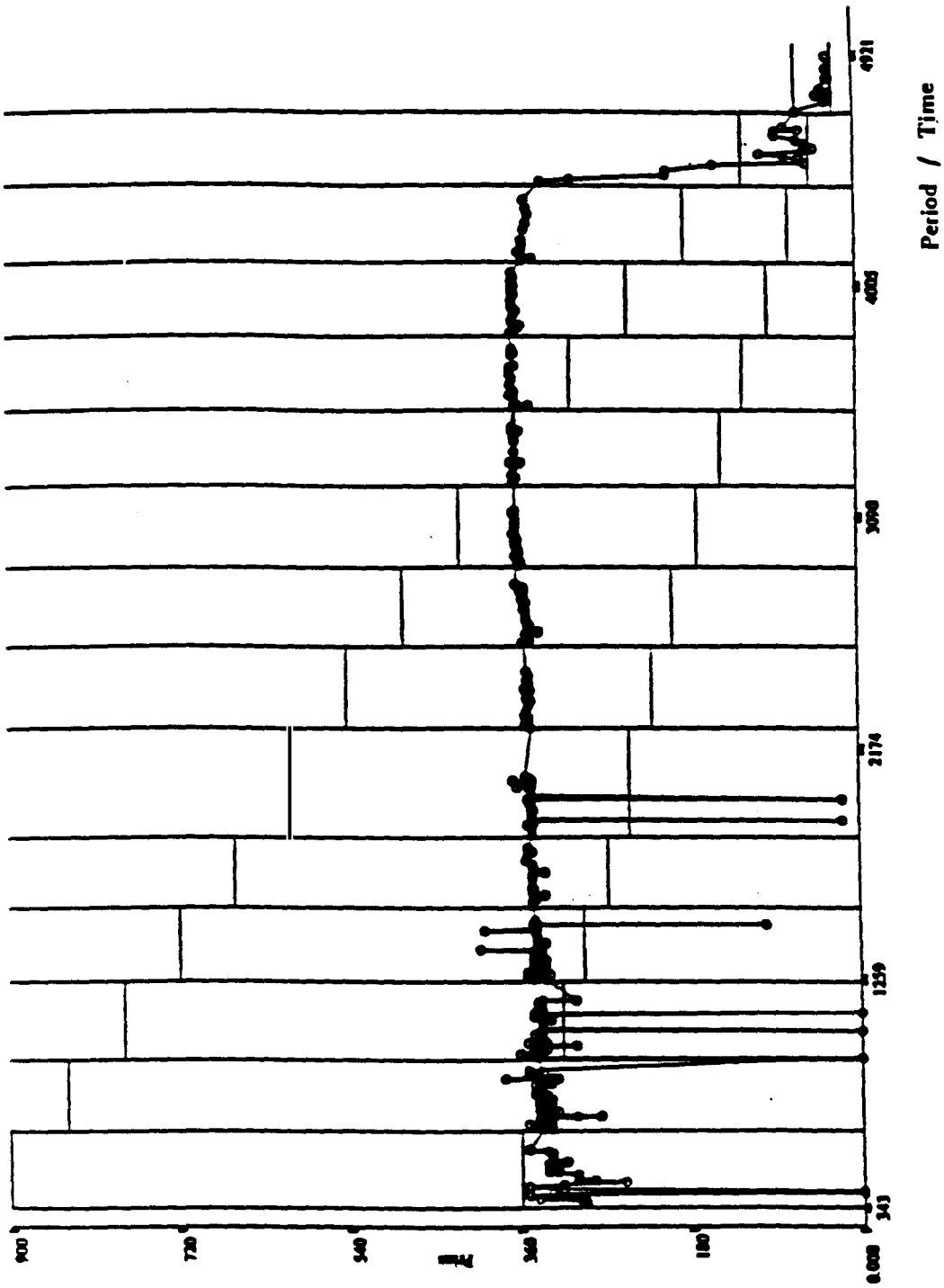


Figure 7
Asset Market Price Time Series



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