DIVISION OF THE HUMANITIES AND SOCIAL SCIENCES

CALIFORNIA INSTITUTE OF TECHNOLOGY

PASADENA, CALIFORNIA 91125

THE EFFECT OF INTERTEMPORAL SPECULATION ON THE OUTCOMES
IN SELLER POSTED OFFER AUCTION MARKETS

Elizabeth Hoffman
Northwestern University

Charles R. Plott
California Institute of Technology

SOCIAL SCIENCE WORKING PAPER 241

THE EFFECT OF INTERTEMPORAL SPECULATION ON THE OUTCOMES

IN SELLER POSTED OFFER AUCTION MARKETS

Elizabeth Hoffman
Northwestern University

and

Charles R. Plott*
California Institute of Technology

Laboratory experimental research has demonstrated that the posted price market institution operates in simple markets to induce inefficiencies, price "distortions," and an income distribution which works to the disadvantage of those who face posted prices.[1] This discovery seems to be of considerable importance when viewed along with numerous examples of social policy which call for the establishment of posted prices as opposed to other modes of market organization. If indeed such effects of the posted price institution are found to persist in a variety of market environments some wide ranging policy reappraisals are in order.

This paper extends the investigation of the posted price institution to intertemporal markets in which trading speculators exist. Within the posted offer (bid) market the seller (buyer) is required to "post" an offer (bid) price at the beginning of a period which must hold for an entire trading period. The behavior of laboratory intertemporal markets is known to conform closely to the predictions of the intertemporal competitive model when the market is organized as an oral double auction.[3] At the outset of this research we hypothesized that the effects of the posted price institution observed in the stationary markets would not be observed in an intertemporal market with speculation. We suspected that speculators holding perishable goods for sale would not keep prices up by restricting supply. Fear of losing all but the salvage value on their unsold inventories would force them to undercut all other sellers, even at the risk of a loss at first. This action would quickly eliminate the previously observed price posting effect that prices in posted offer markets tend to be higher than those of the oral double auction.

The observed results reported below run counter to this _a priori_ conjecture. Prices in seller posted offer markets remain higher than equilibrium and market efficiencies tend to be lower than in comparable intertemporal speculative oral double auction markets. Thus the results from stationary markets carry over to the intertemporal case.

Subjects and Experimental Design

The procedures and parameters of the experiments are those used by Miller, Plott and Smith (1977), Experiment 1. This

allows some comparison across experiments. With the exception of the pricing institution the instructions are those used in the Miller, Plott and Smith Experiment 2. In each experiment subjects were designated as demanders (6), suppliers (6) or traders (2). Each experimental period was divided into two seasons -- a blue season and a yellow season. Demanders faced redemption values represented in Table 1 and suppliers faced the cost schedules represented there. Traders made money by buying in the blue season of a given period and selling in the yellow season of the same period (only). Neither demanders nor suppliers could speculate and the speculative activities of traders were restricted exclusively to carryover from the blue to the yellow season of the same period. It was as though unsold items spoiled at the end of the yellow season.

Application of the theory of induced preference and the competitive model yields the market demand and supply functions shown in Figure I. The competitive intertemporal equilibrium is $1.70 with 7 units "produced" each season and 4 units carried forward from the blue season to the yellow season by the traders.

In total two experiments and a pilot experiment (see Appendix) were conducted. Experiment 1 was conducted at Caltech. It consisted of ten periods under the posted price institution. Since the Miller, Plott, Smith experiments were drawn from this subject pool the results should be comparable. Experiment 2 was conducted at Pasadena City College. It consisted of eight

TABLE 1

SUBJECT INDEX AND LIMIT PRICES

Subject Number	Demander (D) or Supplier (S)	Blue Limit Prices		Yellow Limit Prices	
		1st Unit	2nd Unit	1st Unit	2nd Unit
1	D	2.00	1.10	2.45	1.55
2	D	1.85	.95	2.60	1.70
3	D	1.70	.80	2.75	1.85
4	D	1.55	.65	2.90	2.00
5	D	1.40	.50	3.05	2.15
6	D	1.25	.35	3.20	2.30
7	trader	open		open	
8	trader	open		open	
9	S	.80	2.45	.80	2.45
10	S	.95	2.30	.95	2.30
11	S	1.10	2.15	1.10	2.15
12	S	1.25	2.00	1.25	2.00
13	S	1.40	1.85	1.40	1.85
14	S	1.55	1.70	1.55	1.70

FIGURE 1

EXPERIMENT I*

INDUCED VALUATIONS
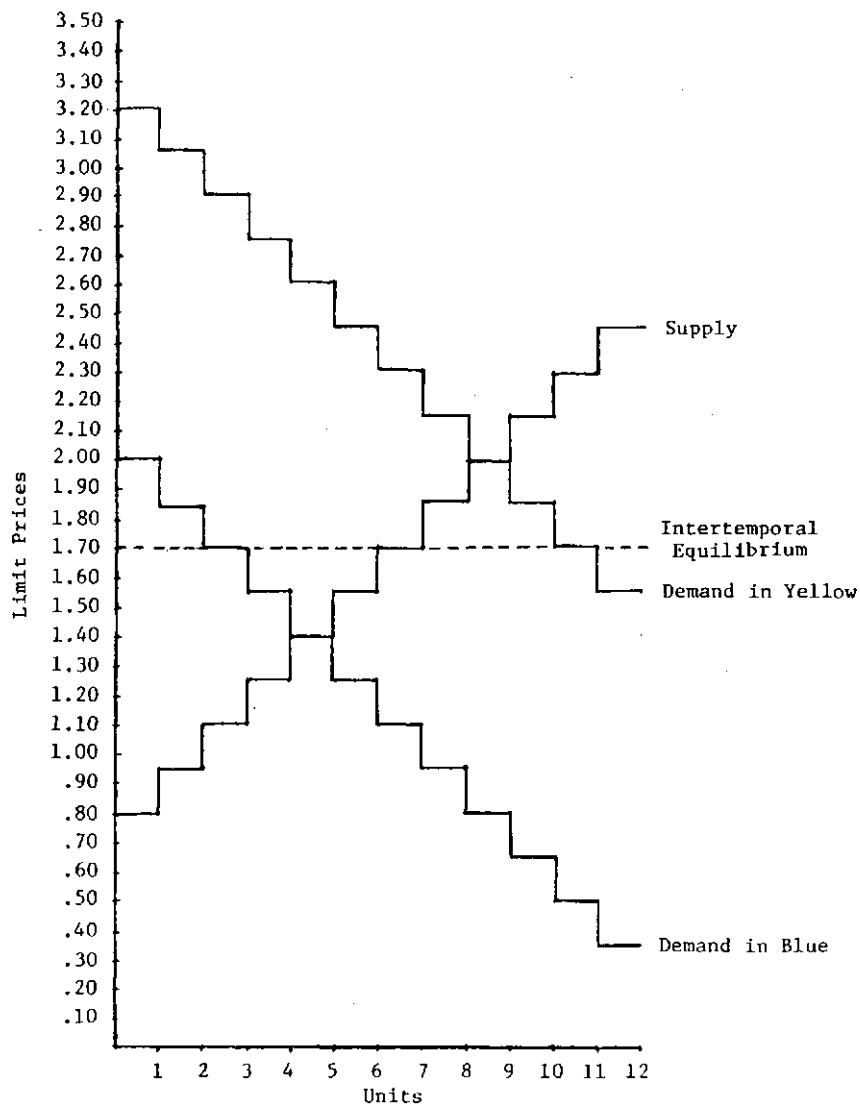
*Miller-Plott-Smith #1

periods of posted prices and then six periods under the oral double auction. The latter was intended as a control for possible subject differences since no speculation experiments had been conducted at Pasadena City College previously. The pilot experiment is not directly comparable since the parameters differed from experiments 1 and 2. It consisted of seven periods with the posted price institution followed by five periods with the oral double auction.

Subjects were undergraduate males and females recruited with announcements made in classes at the respective institutions. They were promised a minimum of $4 which was paid in addition to all earnings from participation in the market.

Experimental Results

Figures 2 and 3 show the time series of transaction prices for both experiments. Figure 4 reproduces Miller, Plott, and Smith's Experiment 2 for comparison. As can be seen in the figures and in Table 1 the observed tendency for price to be higher than equilibrium in stationary markets with posted offers carries over to the case of markets with intertemporal traders. The mean distance from (above) equilibrium price in both of the posted offer experiments is always over three times the mean distance in the double auction experiments (i.e. .120 and .097 vs. .026 and .01).

While all markets are "equilibrating," the rate of convergence seems slower with the posted price institution. For example, in all double auction markets, all trades after the second year are within

FIGURE 2
EXPERIMENTAL RESULTS
EXPERIMENT I
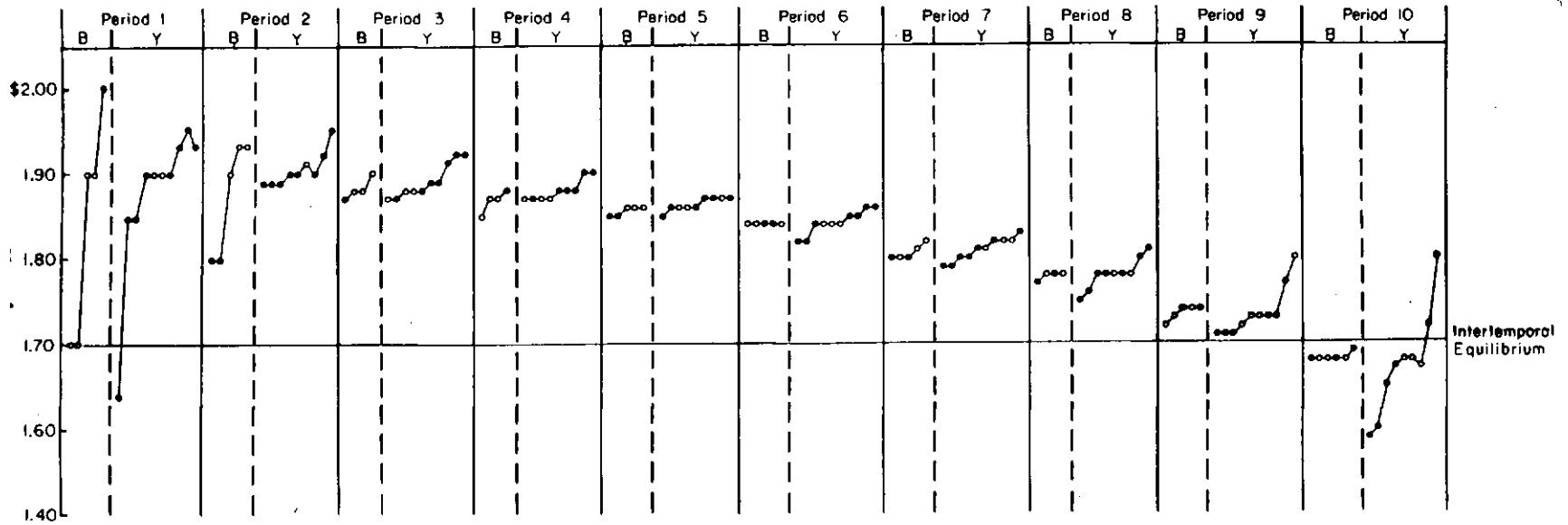
KEY
o one agent was a trader
● neither agents were traders
B blue period season
Y yellow period season

FIGURE 3
EXPERIMENTAL RESULTS
EXPERIMENT II

FIGURE 4

MILLER-PLOTT-SMITH EXPERIMENT 2

INDUCED SCHEDULES AND RESULTS
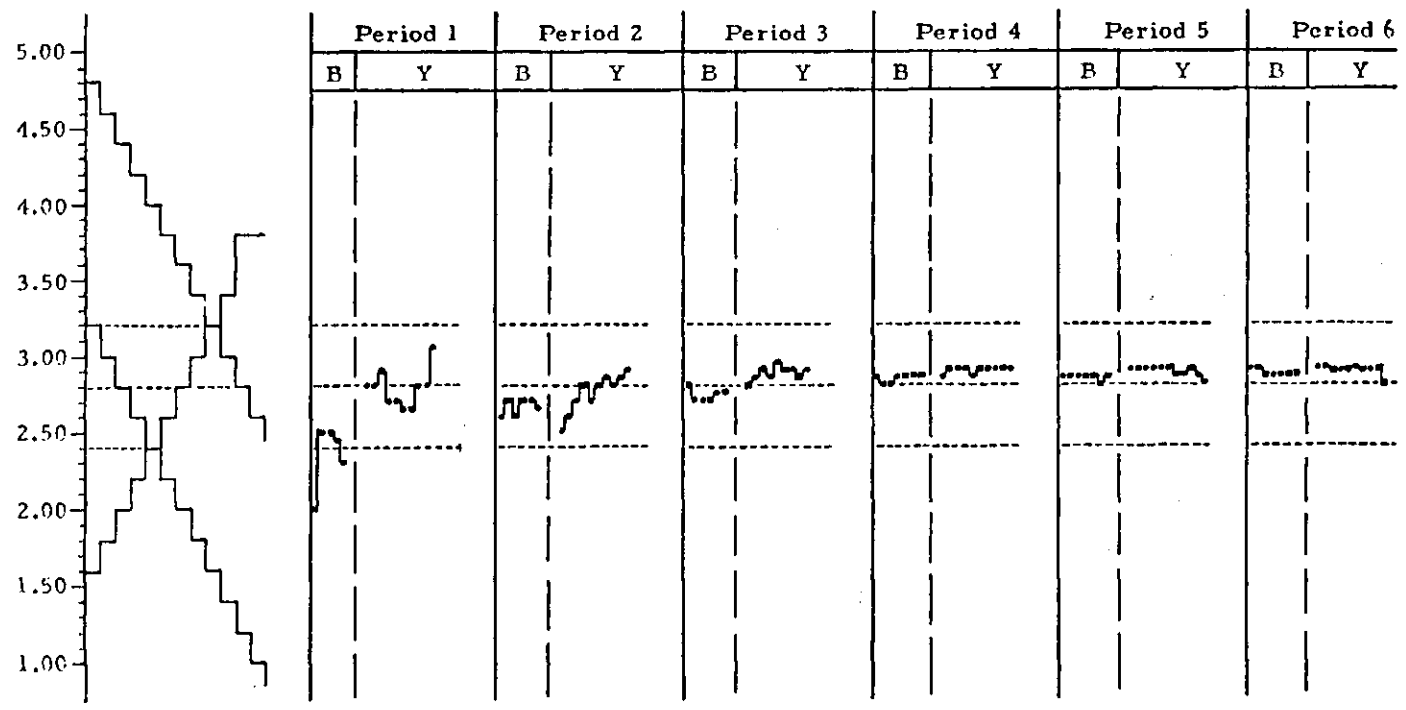
Key: ▪ one of the contracting parties was a trader
       • neither contracting party was a trader

Source: R. M. Miller, C. R. Plott, and V. L. Smith. "Intertemporal Competitive
         Equilibrium, an Empirical Study of Speculation." Quarterly Journal of
         Economics 91 (1977): 603.

TABLE 2

MEAN PRICES AND EFFICIENCIES BY TRADING SEASON

Trading Season

Experiment	1 B Y	2 B Y	3 B Y	4 B Y	5 B Y	6 B Y	7 B Y	8 B Y	9 B Y	10 B Y
I. Posted Offer										
Mean Price	$1.84 1.88	1.86 1.91	1.88 1.89	1.87 1.88	1.86 1.86	1.84 1.84	1.81 1.81	1.78 1.78	1.73 1.73	1.68 1.67
Efficiency	52.7	73.2	80.8	75.6	88.1	96.0	87.2	87.2	89.6	97.0

	1 B Y	2 B Y	3 B Y	4 B Y	5 B Y	6 B Y	7 B Y	8 B Y
II. Posted Offer								
Mean Price	1.94 1.96	1.84 1.85	1.79 1.81	1.76 1.79	1.75 1.78	1.74 1.77	1.74 1.76	1.73 1.73
Efficiency	47.0	70.0	86.0	84.8	89.3	89.7	87.8	91.8

	9 B Y	10 B Y	11 B Y	12 B Y	13 B Y	14 B Y
Double Auction						
Mean Price	1.70 1.75	1.73 1.74	1.73 1.73	1.72 1.72	1.72 1.72	1.72 1.72
Efficiency	89.3	77.5	99.4	92.2	98.4	99.3

	1 B Y	2 B Y	3 B Y	4 B Y	5 B Y	6 B Y
III. Miller-Plott-Smith Experiment 1						
Mean Price	1.36 1.76	1.70 1.78	1.72 1.75	1.74 1.70	1.70 1.69	
Efficiency Double Auction	95.7	98.8	100.0	93.0	100.0	
IV. Miller-Plott-Smith Experiment 2						
Mean Price	2.35 2.76	2.66 2.75	2.74 2.88	2.84 2.89	2.84 2.88	2.87 2.88
Efficiency Double Auction	88.8	99.5	99.5	94.4	94.9	94.4

TABLE 3

TRADER EARNINGS EXCLUDING COMMISSIONS BY TRADING PERIOD

Experiment	Period									
	1	2	3	4	5	6	7	8	9	10
I Posted Offer	-$3.30	-1.87	.12	.17	.16	.15	.17	.10	.13	.14

Experiment	Period							
	1	2	3	4	5	6	7	8
II Posted Offer	-$3.50	-1.85	.31	.10	.24	.35	.24	.23

Experiment	Period					
	9	10	11	12	13	14
II (continued) Double Auction	.03	.09	.22	.14	.17	.25

Experiment	Period					
	1	2	3	4	5	6
III Miller-Plott-Smith Experiment 2	.90	.60	.44	.55	.67	.25

ten cents of equilibrium. In contrast the mean price remains more than ten cents above equilibrium until the eighth year in Experiment 1. By year three the mean price of Experiment II is within ten cents of equilibrium but trades continue to occur as much as fifteen cents above the equilibrium in the sixth year (blue season). Unfortunately the evidence we can advance is necessarily impressionistic. Since we have neither a dynamic theory nor a large number of independent trials, systematic measurement is not possible. Thus we leave the question of relative adjustment speed open with only a conjecture that price adjustment under the posted price institution is "slower."

Efficiency (Table 2) is lower for posted price markets than for the oral double auction. With very few exceptions efficiency of periods in the double oral auction dominates those for the posted offers. Average efficiency across all posted offer periods is 81.88 percent while it is 95 percent for the oral double auctions. Thus the relative inefficiency of the posted offer institution characteristic of stationary markets is also characteristic of intertemporal markets with speculators.

Table 3 suggests that traders caused no special problems. They behaved substantially as one might have expected under competitive conditions. Each period their total profits were near zero or negative thus indicating a willingness to dig into their commissions in order to make a sale. Despite this competitive behavior, however, the experimental results do not indicate any influences of the traders which would exaggerate or dampen the particular influence of the posted price institution.

The fact that their profits were substantially negative during the beginning periods of the posted price markets may suggest something about the entry circumstances of speculators under the posted price institution. This possibility aside, however, speculators' activities simply served to equate prices between the blue and yellow seasons as predicted by the model.

Conclusions

This research indicates that in a seasonal market in which sellers post prices, the existence of intertemporal speculators does not alter the results that prices in posted offer markets tend to be higher than the prices in an oral double auction. Efficiency tends to be lower in posted offer markets and we conjecture that convergence in posted offer markets tends to be slower than in a double auction.

The exact reason for these price dynamics still remains a mystery. In an intertemporal market, speculators act only to equate prices between seasons by increasing demand in the low demand periods and supply in the high demand periods. They do not affect the institutionally induced price structure. Whatever the ultimate explanation of the "high" posted offer prices, we now know that the key is not in some feature distinguishing a stationary from a speculative environment.

APPENDIX 1

          In addition to the two experimental sessions reported in
the text we conducted one pilot experiment at Pasadena City College.
We report it in the Appendix because, due to a copying error, the
demand and supply schedules used were different from those used in the
other two experimental sessions. The result was that this experimental
session is the first market experiment for which no theoretical
equilibrium exists. Since there is no equilibrium it is difficult
to interpret the results, but we offer them for comparison with those
reported in the text.

          Table A-1 and Figure A-1 respectively show the limit
prices and the supply and demand functions. The dotted line in
Figure A-1 indicates the intertemporal supply function. Notice
that at $2.10 only six units will be supplied, even though nine
units will be demanded. However, if the price jumps to $2.20
eight units will be supplied, but only seven units will be
demanded. If the marginal unit in blue is traded and carried
over, then the marginal unit in yellow cannot be traded. However,
it will trade if the marginal unit is not traded in blue. Thus,
neither price yields an equilibrium quantity. Because units can
only be traded in integer amounts, a price between $2.10 and $2.20
will not yield an equilibrium quantity either.

          Suppose we assume, however, that agents act to maximize
the take from the experiment. Payments to buyers and sellers

TABLE A-1
PILOT EXPERIMENT
LIMIT PRICES

Subject Number	Demander or Supplier	Blue Limit Prices 1st Unit	2nd Unit	Yellow Limit Prices 1st Unit	2nd Unit
1	D	2.00	1.10	2.45	1.55
2	D	1.85	.95	2.60	1.70
3	D	1.70	.80	2.75	1.85
4	D	1.55	.65	2.90	2.00
5	D	1.40	.50	3.05	2.15
6	D	1.25	.35	3.20	2.30
7	trader	open		open	
8	trader	open		open	
9	S	1.60	3.80	1.60	3.80
10	S	1.80	3.60	1.80	3.60
11	S	2.00	3.40	2.00	3.40
12	S	2.20	3.20	2.20	3.20
13	S	2.40	3.00	2.40	3.00
14	S	2.60	2.80	2.60	2.80

FIGURE A-1
INDUCED VALUATIONS*
PILOT EXPERIMENT

Limit Prices

4.00
3.90
3.80 — Supply
3.70
3.60
3.50
3.40
3.30
3.20
3.10
3.00
2.90
2.80
2.70
2.60
2.50
2.40
2.30
2.20 — Approximate
2.10   Equilibrium
2.00
1.90
1.80
1.70
1.60
1.50 — Demand in Yellow
1.40
1.30
1.20
1.10
1.00
.90
.80
.70
.60
.50
.40 — Demand in Blue
.30
.20
.10

1 2 3 4 5 6 7 8 9 10 11 12

Units
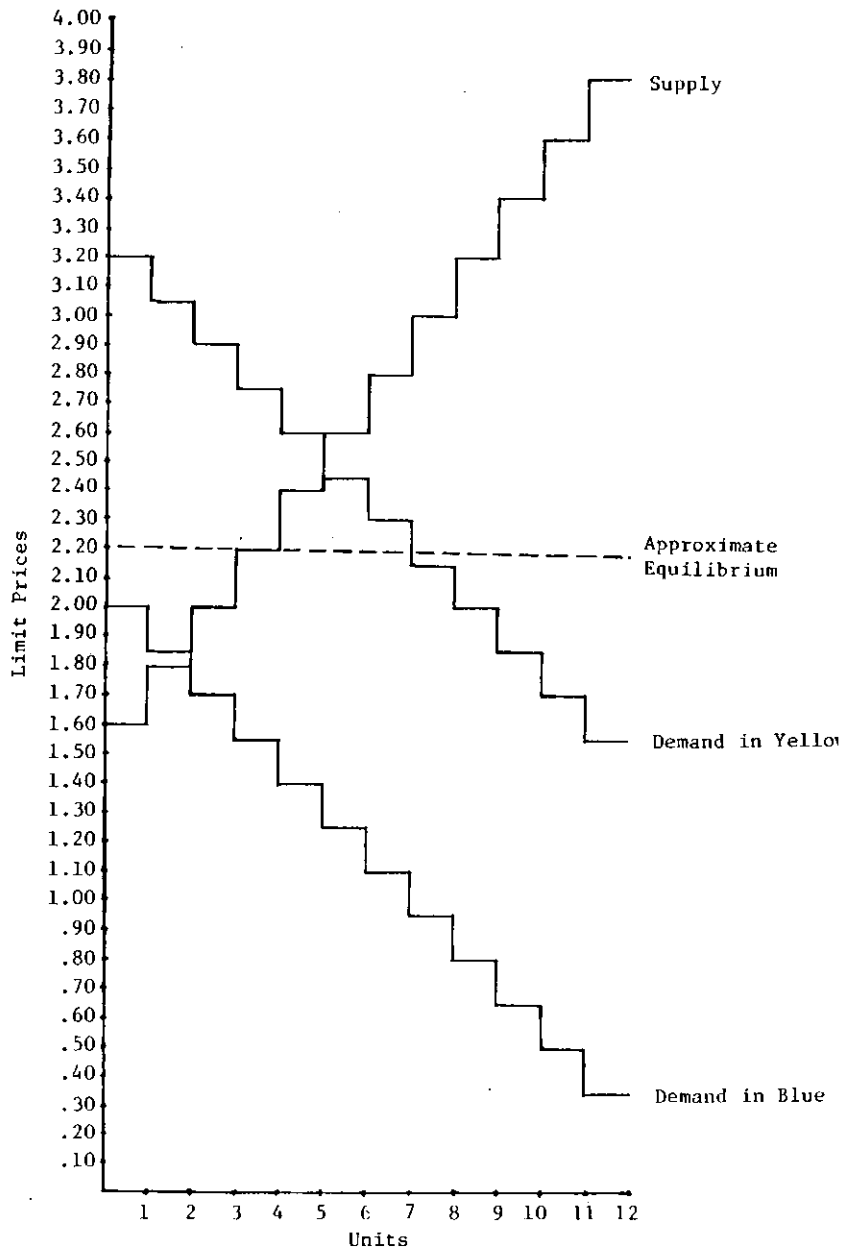
*Demanders: Miller-Plott-Smith #1
 Suppliers: Miller-Plott-Smith #2

including commissions are $6.75 at $2.10, $6.95 at $2.20, and $6.85 at $2.30. Therefore, assuming participants maximize the payments, we take $2.20 as an approximate equilibrium price.

Figure A-2 shows the experimental results for this pilot, and Table A-2 summarizes the mean prices each trading season. The detailed data are in Appendix 3. Notice that even when there is no clear equilibrium the tendency remains for posted offer prices (the first seven periods) to remain higher than double auction prices (the last five periods). Further, as Table A-2 shows, efficiency is lower under the posted offer institution than under the double auction in all but one trading period. Finally, Table A-3 shows that trader earnings were negative in five out of the seven posted offer trading periods. Thus, despite the unusual circumstances under which this pilot was conducted, all the results summarized in the body of the paper are replicated.

FIGURE A-2
EXPERIMENTAL RESULTS
PILOT EXPERIMENT
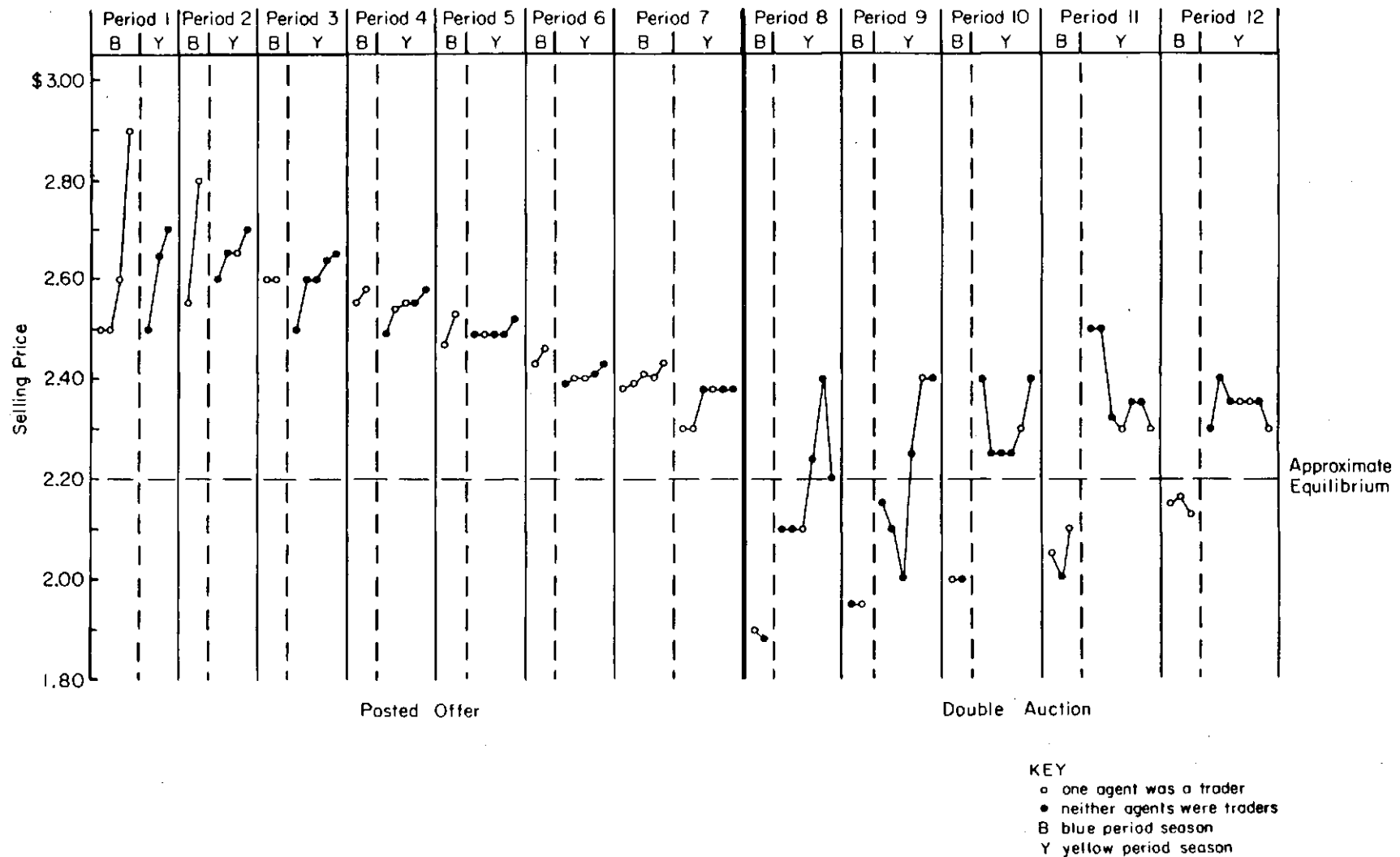
TABLE A-2

MEAN PRICES AND EFFICIENCIES BY TRADING SEASON

PILOT EXPERIMENT

TRADING SEASON

Posted offer	1		2		3		4		5		6		7	
	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y	B	Y
Mean Price	$2.62	2.62	2.68	2.65	2.60	2.60	2.56	2.54	2.50	2.50	2.44	2.41	2.40	2.35
Efficiency	< 0		< 0		0		89.2		44.7		80.6		63.5	
Double Auction	8		9		10		11		12					
	B	Y	B	Y	B	Y	B	Y	B	Y				
Mean Price	1.90	2.19	1.95	2.22	2.00	2.31	2.05	2.37	2.15	2.34				
Efficiency	79.1		89.9		89.9		95.7		99.6					

TABLE A-3

TRADER EARNINGS

PILOT EXPERIMENT

I. Earnings by Trading Year

	Trading Year						
	1	2	3	4	5	6	7
Posted Offer	-$10.50	-2.65	-5.20	+.06	-2.50	+.01	-2.53

	Trading Year				
	8	9	10	11	12
Double Auction	.25	.50	.35	.55	.71

II. Total Earnings

	Earnings	Optimum Earnings	% of Optimum
Posted Offer	-23.31	1.05	< 0
Double Auction	2.36	.75	315%

APPENDIX 2

INSTRUCTIONS

General

   This is an experiment in the economics of market decision making. Various research foundations have provided funds for this research. The instructions are simple and if you follow them carefully and make good decisions you might earn a considerable amount of money which will be paid to you in cash.

   In this experiment we are going to simulate a market in which some of you will be buyers, some of you will be sellers, and some will be traders in a sequence of market years. Each year consists of two seasons, one of which will be called the "blue season" and the other the "yellow season." Attached to the instructions you will find a sheet, labeled buyer, seller, or trader, which describes the value to you of any decisions you might make. You are not to reveal this information to anyone. It is your own private information.

Specific Instructions to Buyers

   During each market season you are free to purchase up to two units of the commodity. For the first unit that you buy during a trading season you will receive the amount listed in row (1) marked 1st unit redemption value; if you buy a second unit you will receive the additional amount listed in row (5) marked 2nd unit redemption value.

The profits from each purchase (which are yours to keep) are computed by taking the difference between the redemption value and purchase price of the unit bought. Under no conditions may you buy a unit for a price which exceeds the redemption value. In addition to this profit you will receive a 5 cent commission for each purchase. That is :

   [your earnings = (redemption value) - (purchase price)

   + .05 commission]

Suppose for example that you buy two units and that your redemption value for the first unit is $200 and for the second is $180. If you pay $150 for your first unit and $160 for the second unit, your earnings are:

   $ earnings for 1st = 200-150 + .05 = 50.05

   $ earnings for 2nd = 180-160 + .05 = 20.05

   total $ earnings = 50.05 + 20.05 = 70.10

The blanks are for recording your profits. The purchase price of the first unit you buy during the first season should be recorded on row (2) at the time of purchase. You should then record the profits on this purchase as directed on rows (3) and (A). At the end of the period record the total of profits and commissions on the last row on the page. Subsequent seasons should be recorded similarly. In each season any units purchased must be used for redemption in that season.

Specific Instructions to Sellers

   During each market season you are free to sell up to two

units of the commodity. The first unit that you sell during a trading season you obtain at a cost of the amount listed on the attached sheet in the row (2) marked cost of 1st unit; if you sell a second unit you incur the cost listed in the row (6) marked cost of 2nd unit. The profits from each sale (which are yours to keep) are computed by taking the difference between the price at which you sold the unit and the cost of the unit. Under no conditions may you sell a unit at a price below the cost of the unit. In addition to this profit you will receive a 5 cent commission for each sale. That is:

[your earnings = (sale price of unit) - (cost of unit)

+ .05 commission]

Your total profits and commissions for a season, which are yours to keep, are computed by adding up the profit and commissions on sales made during the season.

Suppose for example your cost of the first unit is $140 and your cost of the second is $160. If you sell the first unit at $200 and the second unit at $190, your earnings are:

$ earnings for 1st = 200 - 140 + .05 = 60.05

$ earnings for 2nd = 190 - 160 + .05 = 30.05

total $ earnings = 60.05+30.05 =90.10

The blanks on the table are for recording your profits. The sale price of the first unit you sell during the 1st season should be recorded on row (1) at the time of sale. You should then record the profits on this sale as directed on rows (3) and (4). At the

end of the period record the total of profits and commissions on the last row on the page. Subsequent periods should be recorded similarly.

Specific Instructions to Traders

As a trader you are able to buy units in the blue season for resale in the yellow season. You are free to buy and sell as many units as you desire but you can only sell units which you have already purchased. Units purchased in the blue season of any given year can only be "carried over" and sold in the yellow season of the same year. You cannot purchase units during any yellow season or sell units during any blue season and units carried over from the previous blue season in one year cannot be carried over to the following year. There can be no carryovers between years as there is between the blue and yellow seasons of a given year. Your earnings are determined by the difference between the price you pay for units and the price you receive upon reselling them. You will also be paid a 5 cent commission for each unit sold. In addition you are given a $3 capital endowment. Your total earnings then consist of your capital endowment plus any profits on trades plus all commissions minus any losses on trades.

At the time you purchase units during the blue season you are to record the price you paid for the unit in the row labeled "purchase price (blue season)." The price received for each unit sold during the following yellow season should be entered in the row labeled "sale price (yellow season)" for that unit. At the end

of the yellow season of each year all units you have in inventory, that is all unsold units, are automatically sold at a price of $0. It is as though the commodity spoils after the end of the yellow season and cannot be carried over to the next year. The profit or loss from each transaction is computed by taking the difference between the sale price and the purchase price. In addition you receive a 5 cent commission for each unit sold in the yellow season. That is

[your earnings = (sale price) - (purchase price) + .05 commission].

Suppose for example that you buy two units in the blue season and you pay $200 for the first unit and $150 for the second unit. If you then sell the first unit for $210 and the second unit for $220 in the yellow season your earnings are

$ earnings for 1st = 210 - 200 + .05 = 10.05

$ earnings for 2nd = 220 - 150 + .05 = 70.05

total $ earnings   =10.05+70.05   =80.10

You are to calculate your profits in the space provided on your trading sheet and at the end of each year you are to record your total profits for that year in the last row of the last page of your trading sheet.

Market Organization

The market for this commodity is organized as follows. The market will be conducted in a series of years, each consisting of a blue season followed by a yellow season. Each season lasts for

5 minutes. At the beginning of each blue season each seller will write on the appropriate slip of paper the price at which he will sell his units during that season. When all sellers have submitted prices they will be written on the board. Then, when the experimenter gives the signal, buyers and traders may raise their envelopes to gain access to the floor by random choice. At the beginning of each yellow season each seller and trader will write on the appropriate slip of paper the price at which he will sell his units during that season. When all sellers and traders have decided on prices they will be written on the board. Then, when the experimenter gives the signal, buyers may raise their envelopes to gain access to the floor to accept specific seller or trader offers. Ties will be decided by random choice. In both seasons sellers (and traders when appropriate) have the right to limit quantities at the posted prices. Except for the acceptances of seller or trader offers and the negotiation of quantities, you are not to speak to any other subject. You are free to make as much profit as you can.

Are there any questions?

APPENDIX 3

Posted Offers, Competitive Bids and Offers, and Contracts

Experiment 1

Posted Offer

Period	Season	Seller	Posted offer	Buyer
1	B	14	1.70	8
		14	1.70	8
		13	1.90	7
		13	1.90	7
		9	2.00	1
		10	2.30	none
		11	2.13	none
		12	2.00	none
1	Y	11	1.64	5
		14	1.85	5
		14	1.85	8
		12	1.90	4
		7	1.90	4
		7	1.90	4
		9	1.90	1
		13	1.93	3
		10	1.95	6
		13	1.93	6
		8	2.20	none
2	B	14	1.80	2
		14	1.80	1
		12	1.90	8
		11	1.93	7
		11	1.93	7
		9	2.00	none
		10	1.95	none
		13	1.95	none
2	Y	13	1.89	4
		13	1.89	4
		11	1.89	6
		14	1.90	6
		9	1.90	1
		8	1.91	3
		14	1.90	5
		12	1.92	5
		10	1.95	2
		7	2.00	none
3	B	13	1.87	1
		14	1.88	7
		14	1.88	7
		9	1.90	8
		10	1.92	none
		11	1.92	none
		12	1.92	none
3	Y	8	1.87	3
		11	1.87	3
		7	1.88	4
		7	1.88	4
		9	1.88	5
		13	1.89	5
		13	1.89	1
		12	1.91	2
		14	1.92	6
		14	1.92	6
		10	1.95	none

Experiment 1

Posted Offer

Period	Season	Seller	Posted offer	Buyer
4	B	11	1.85	8
		13	1.87	7
		13	1.87	7
		12	1.88	1
		9	1.89	none
		10	1.89	none
		14	1.90	none
4	Y	7	1.87	2
		11	1.87	4
		8	1.87	4
		7	1.87	6
		14	1.88	6
		9	1.88	1
		14	1.88	3
		13	1.90	5
		13	1.90	5
		10	1.91	none
5	B	11	1.85	2
		9	1.85	1
		14	1.86	7
		14	1.86	7
		13	1.86	8
		10	1.87	none
		12	1.87	none
5	Y	12	1.85	2
		14	1.86	1
		7	1.86	5
		7	1.86	5
		14	1.86	4
		10	1.87	4
		9	1.87	6
		8	1.87	6
		11	1.87	3
		13	1.89	none
6	B	10	1.84	7
		13	1.84	7
		9	1.84	1
		14	1.84	2
		11	1.84	8
		12	1.85	none
6	Y	14	1.82	1
		14	1.82	4
		13	1.84	4
		7	1.84	6
		7	1.84	6
		8	1.84	2
		11	1.85	3
		12	1.85	3
		9	1.86	5
		10	1.86	5

Experiment 1

Posted Offer

Period	Season	Seller	Posted offer	Buyer
7	B	14	1.80	2
		12	1.80	8
		14	1.80	1
		13	1.81	7
		10	1.82	7
		9	1.82	none
		11	1.83	none
7	Y	14	1.79	4
		14	1.79	4
		9	1.80	5
		12	1.80	5
		13	1.81	6
		8	1.81	6
		11	1.82	2
		7	1.82	3
		7	1.82	3
		10	1.83	1
8	B	9	1.77	2
		11	1.78	8
		14	1.78	1
		14	1.78	7
		10	1.79	none
		12	1.79	none
		13	1.79	none
8	Y	12	1.75	1
		13	1.76	5
		14	1.78	5
		9	1.78	3
		7	1.78	3
		14	1.78	6
		8	1.78	6
		10	1.80	2
		11	1.81	4
9	B	13	1.72	7
		10	1.73	7
		14	1.74	2
		12	1.74	8
		14	1.74	1
		9	1.75	none
		11	1.77	none
9	Y	13	1.71	3
		14	1.71	3
		14	1.71	4
		8	1.72	4
		7	1.73	6
		7	1.73	6
		9	1.73	1
		12	1.73	5
		10	1.77	5
		11	1.80	8

Experiment 1

Posted Offer

Period	Season	Seller	Posted offer	Buyer
10	B	11	1.68	1
		14	1.68	7
		9	1.68	7
		12	1.68	2
		10	1.68	8
		13	1.69	3
10	Y	12	1.59	1
		14	1.60	5
		13	1.65	5
		9	1.67	6
		7	1.68	6
		7	1.68	3
		8	1.67	3
		11	1.72	2
		10	1.80	4

Experiment II — Posted Offer

Period	Season	Seller	Posted offer	Buyer
1	B	14	1.75	2
		14	1.75	8
		13	2.00	8
		11	2.25	7
		9	5.00	none
		10	3.30	none
		12	2.50	none
1	Y	14	1.75	4
		14	1.75	4
		11	1.85	1
		12	2.00	3
		12	2.00	6
		13	2.05	6
		13	2.05	3
		7	2.20	2
		8	2.50	none
		9	2.50	none
		10	2.50	none
2	B	10	1.75	8
		14	1.80	8
		14	1.80	8
		11	1.90	7
		12	1.95	1
		9	2.35	none
		13	2.09	none
2	Y	8	1.75	4
		8	1.75	4
		8	1.75	1
		10	1.80	5
		14	1.80	5
		14	1.80	2
		13	1.99	3
		13	1.99	6
		11	2.00	6
		7	2.00	none
		9	2.00	none
		12	2.00	none
3	B	14	1.65	2
		12	1.74	7
		11	1.85	8
		10	1.90	1
		9	1.95	none
		13	1.99	none
3	Y	12	1.70	6
		14	1.70	6
		7	1.80	3
		9	1.80	3
		14	1.70	2
		11	1.85	7
		13	1.86	4
		13	1.86	4
		10	1.90	5
		8	1.95	5
4	B	14	1.70	3
		14	1.70	1
		9	1.80	2
		10	1.80	8
		12	1.80	8
		11	1.83	none
		13	1.90	none
4	Y	14	1.70	1
		14	1.70	3
		12	1.79	3
		11	1.79	2
		8	1.80	4
		8	1.80	4
		9	1.80	5
		13	1.85	5
		13	1.85	6
		10	1.85	none

Experiment II — Posted Offer

Period	Season	Seller	Posted offer	Buyer
5	B	12	1.69	1
		14	1.75	2
		14	1.75	7
		10	1.75	7
		11	1.79	8
		9	1.85	none
		13	1.85	none
5	Y	13	1.70	2
		14	1.75	2
		14	1.75	6
		12	1.78	6
		7	1.79	3
		7	1.79	3
		10	1.79	4
		11	1.80	4
		8	1.80	1
		9	1.85	5
6	B	14	1.65	2
		12	1.68	8
		10	1.75	8
		11	1.75	8
		13	1.79	7
		9	1.85	1
6	Y	14	1.65	4
		11	1.78	4
		7	1.78	1
		12	1.78	3
		8	1.78	3
		8	1.78	2
		8	1.78	5
		13	1.79	5
		10	1.80	6
7	B	12	1.69	2
		10	1.74	8
		11	1.74	8
		14	1.75	7
		14	1.75	7
		13	1.79	1
		9	1.85	none
7	Y	8	1.73	3
		8	1.73	3
		10	1.74	5
		14	1.75	5
		14	1.75	1
		13	1.76	6
		12	1.77	6
		11	1.77	2
		7	1.78	4
		7	1.78	4
		9	1.80	none
8	B	12	1.69	1
		14	1.72	8
		14	1.72	8
		10	1.74	8
		9	1.75	7
		11	1.75	7
		13	1.77	2
8	Y	14	1.77	5
		14	1.72	5
		11	1.72	3
		8	1.72	3
		8	1.72	1
		8	1.72	6
		7	1.75	6
		13	1.75	4
		7	1.75	4
		9	1.75	2
		10	1.76	none
		12	1.77	none

Experiment II — Double Auction

Period	Season	Number	Bid	Offer	Taker
9	B	12		1.69	8
		11		1.72	
		7	1.70		13
		11		1.70	2
		3	1.70		
		1	1.73		10
		3	1.70		
9	Y	2	1.69		
		12		1.73	3
		3	1.75		10
		11	1.72		14
		2	1.71		7
		13		1.74	4
		8		1.73	4
		9		1.75	6
		5	1.73		11
		2	1.70		
		5	1.74		
		6	1.75		
		12		2.00	
		5	1.80		14
		13		1.85	6
10	B	9		1.75	1
		4	1.50	1.77	
		13			
		2	1.69		
		7	1.70		
		12		1.76	
		10		1.74	2
		8	1.73		13
		11		1.73	
		12		1.72	7
		3	1.70		11
10	Y	9		1.80	
		8		1.76	
		6	1.74		7
		3	1.70		
		2	1.73		12
		5	1.75		14
		4	1.75		11
		3	1.74		10
		4	1.74		8
		1	1.74		13
		6	1.75		
		5	1.77		
		3	1.80		
11	B	1	1.72		13
		9		1.75	7
		14		1.75	
		3	1.70		
		10		1.73	8
		12	1.72		7
		2	1.72		11
		8	1.73		14
		7	1.71		
		13		1.86	
11	Y	6	1.73		7
		5	1.73		12
		1	1.73		13
		2	1.72		14
		4	1.73		8
		7		2.76	
		6	1.75		9
		7		2.75	3
		4	1.74		10
		3	1.74		8
		5	1.74		14
		2	1.69		11
		11		1.65	

Experiment II — Double Auction

Period	Season	Number	Bid	Offer	Taker
12	B	10		1.75	
		1	1.72		12
		8	1.73		10
		8	1.72		9
		1	1.72		13
		2	1.69		14
		9		1.75	
		7	1.71		11
		3	1.65		
		7	1.70		
		8	1.71		
12	Y	6	1.68		
		4	1.70		11
		7		1.72	1
		8		1.72	6
		5	1.72		10
		1	1.70		
		5	1.73		8
		2	1.72		14
		9		1.75	1
		6	1.74		13
		3	1.74		14
		3	1.75		
		12		1.80	3
13	B	10		1.80	
		7	1.71		
		7	1.70		
		13		1.75	
		10		1.74	1
		14		1.79	
		11		1.74	
		2	1.72		12
		7	1.71		9
		7	1.72		13
		11		1.72	8
		7	1.71		14
		3	1.70		
13	Y	5	1.73		9
		2	1.71		11
		3	1.71		14
		7		1.73	3
		5	1.72		12
		13		1.74	
		8		1.72	6
		1	1.73		7
		4	1.72		13
		10		1.73	4
		7		1.74	
		2	1.70		
		7		1.73	6
14	B	14		1.80	
		8	1.73		9
		12		1.74	
		2	1.71		14
		3	1.70		
		10		1.74	
		11		1.72	1
		7	1.71		12
		8	1.72		10
		7	1.70		
		13		1.73	
		7	1.71		13
		8	1.71		
14	Y	4	1.70		9
		5	1.71		14
		11		1.72	6
		1	1.72		8
		6	1.73		8
		7		1.73	5
		2	1.72		14
		7		1.74	3
		13		1.74	
		2	1.70		
		12		1.73	3
		13		1.73	4
		10		1.73	
		2	1.70		
		10		1.72	
		2	1.69		10
		1	1.55		

Pilot Experiment — Posted Offer

Period	Season	Seller	Posted offer	Buyer
1	B	9	2.50	8
		12	2.50	8
		10	2.60	7
		13	2.90	7
		11	4.00	none
		14	5.00	none
1	Y	13	2.50	6
		12	2.65	3
		11	2.70	3
		7	3.00	none
		8	2.90	none
		9	3.00	none
		10	4.75	none
		14	3.00	none
2	B	9	2.55	7
		12	2.80	8
		10	2.80	none
		11	2.80	none
		13	3.20	none
		14	2.90	none
2	Y	9	2.60	5
		13	2.65	6
		7	2.65	3
		12	2.70	4
		8	2.85	none
		10	3.80	none
		11	2.75	none
		14	2.75	none
3	B	10	2.60	7
		12	2.60	7
		9	2.65	none
		11	2.65	none
		13	3.10	none
		14	2.70	none
3	Y	12	2.50	2
		9	2.60	4
		14	2.60	3
		11	2.64	6
		13	2.65	5
		7	2.65	none
		10	3.80	none
4	B	10	2.55	7
		9	2.58	6
		11	2.59	none
		12	2.59	none
		13	3.05	none
		14	2.80	none
4	Y	10	2.49	6
		8	2.54	3
		7	2.55	5
		11	2.55	2
		9	2.58	6
		12	2.56	none
		13	2.65	none
		14	2.60	none
5	B	10	2.47	7
		12	2.53	7
		9	2.55	none
		11	2.57	none
		13	2.57	none
		14	2.60	none
5	Y	9	2.49	6
		7	2.49	6
		10	2.49	3
		13	2.49	5
		11	2.52	2
		12	2.55	none
		14	2.60	none
6	B	10	2.43	8
		11	2.46	8
		9	2.48	none
		12	2.48	none
		13	2.49	none
		14	2.60	none

Pilot Experiment — Posted Offer

Period	Season	Seller	Posted offer	Buyer
6	Y	10	2.39	3
		8	2.40	4
		8	2.40	4
		9	2.41	5
		12	2.43	2
		11	2.47	none
		13	2.48	none
		14	2.60	none
7	B	12	2.38	8
		10	2.39	8
		11	2.41	7
		9	2.40	7
		13	2.43	7
		14	2.60	none
7	Y	7	2.30	6
		7	2.30	4
		11	2.38	3
		8	2.38	1
		9	2.38	5
		11	2.38	2
		10	2.38	none
		12	2.39	none
		13	2.31	none
		14	2.60	none

Pilot Experiment — Double Auction

Period	Season	Number	Bid	Offer	Taker
8	B	12		2.36	
		11		2.34	
		10		2.33	
		9		2.32	
		11		2.29	
		10		2.25	
		2	.50		
		8	2.20		
		5	.40		
		2	.39		
		11		2.24	
		10		2.20	
		11		2.15	
		9		2.10	
		10		1.95	
		1	1.50		
		2	1.40		
		5	1.39		
		9		1.93	
		10		1.92	
		1	1.75		
		2	1.50		
		5	1.00		
		1	1.85		
		9		1.90	7
		10		1.89	1
		2	1.50		
		5	1.39		
		7	1.38		
		7	1.36		
8	Y	2	2.10		11
		10		2.10	3
		1	2.00		
		7		2.10	1
		9		2.05	
		5	2.00		
		2	1.90		
		5	1.89		
		3	1.85		
		2	1.50		
		5	1.49		
		6	2.00		
		2	1.50		
		1	1.48		
		2	1.47		
		5	1.46		
		6	2.10		
		2	1.43		
		17		2.24	6
		13		2.40	6
		9		2.20	4
		5	2.15		
		4	1.95		
		5	1.94		
		2	1.50		
		5	1.49		
		4	1.90		
		5	1.89		
		2	.50		
		5	.49		
		4	2.00		
		5	2.10		

Pilot Experiment — Double Auction

Period	Season	Number	Bid	Offer	Taker
9	B	11		2.30	
		10		2.25	
		2	1.80		
		2	1.50		
		9		2.20	
		11		2.35	
		10		2.15	
		1	1.85		
		2	1.49		
		5	1.40		
		1	1.90		
		9		2.00	
		7	1.80		
		11		2.10	
		2	1.35		
		5	1.39		
		4	1.50		
		10		2.05	
		11		2.03	
		10		2.00	
		3	1.95		10
		7	1.95		
		11		2.05	
		9		1.95	7
		2	1.50		
		11		2.10	
		4	1.50		
		13		2.40	
		11		2.10	
		7	1.90		
		7	1.95		
		11		2.05	
		7	1.50		
9	Y	2	2.15		11
		1		2.10	10
		6	2.00		
		3	2.00		9
		4	2.00		
		5	2.15		
		12		2.25	3
		13		2.40	
		5	2.35		
		2	1.50		
		5	2.40		7
		4	2.25		
		11		3.50	
		11		3.40	
		2	1.40		
		6	2.00		
		13		2.40	
		6	2.10		
		5	1.75		
		6	2.15		
		4	2.30		
		13		2.40	4
		6	2.30		
		5	2.00		
		2	1.50		
		6	2.30		
		5	1.99		
		6	2.30		
10	B	1	1.75		
		11		3.50	
		10		3.00	
		11		2.90	
		10		2.89	
		2	1.74		
		1	1.80		
		11		2.10	
		1	1.85		
		9		2.05	
		5	1.40		
		1	1.90		
		7	2.00		9
		11		2.09	
		1	1.93		
		11		2.05	
		1	1.95		
		1	2.00		10
		11		2.04	

Pilot Experiment — Double Auction

Period	Season	Number	Bid	Offer	Taker
10	Y	6	2.00		
		2	2.40		10
		11		2.50	
		3	2.15		
		5	2.10		
		11		2.25	3
		1	2.25		9
		5	2.25		12
		5	2.20		
		2		2.30	6
		13	2.00		
		5	2.00		
		11		3.50	
		1	1.50		
		5	1.95		
		6	2.25		
		13		2.41	
		5	2.10		
		6	2.30		
		5	1.80		
		4	2.00		
		5	2.01		
		6	2.35		
		13		2.41	
		6		2.40	13
		6		2.30	
11	B	1	1.90		
		11		2.50	
		5	1.35		
		10		2.35	
		11		2.34	
		10		2.25	
		7	1.95		
		8	2.00		
		11		2.20	
		7	2.05		10
		10		2.19	
		11		2.15	
		1	2.00		9
		8	2.00		
		11		2.15	
		7	2.05		
		11		2.14	
		7	2.10		11
		8	2.10		
11	Y	5	2.50		9
		2	2.50		13
		1	2.30		
		11		2.50	
		6	2.30		
		7		2.50	
		1	2.30		
		11		2.48	
		10		2.40	
		7		2.38	
		1	2.32		10
		6	2.30		
		6	2.30		7
		11		2.40	
		7		2.40	
		11		2.33	4
		3	2.35		12
		5	2.00		
		11		3.40	
		1	1.50		
		6	2.15		
		5	1.95		
		7		2.50	
		6	2.15		
		5	2.00		
		7		2.40	
		6	2.20		
		7		2.35	
		6	2.25		
		7		2.30	6

Pilot Experiment — Double Auction

Period	Season	Number	Bid	Offer	Taker
12	B	11		2.30	
		1	1.90		
		8	2.10		
		11		2.25	
		7	2.10		
		8	2.15		9
		10		2.20	
		11		2.24	
		10		2.20	
		7	2.15		
		7	2.16		10
		11		2.20	
		1	2.00		
		7	2.05		
		11		2.18	
		7	2.07		
		11		2.13	
		7	2.10		
		11		2.15	
		7	2.13		
		11		2.14	
		7	2.12		
		7	2.13		11
12	Y	5	2.30		9
		11		2.50	
		3	2.25		
		6	2.25		
		1	2.30		
		5	2.00		
		2	2.40		11
		4	2.30		
		3	2.31		
		10		2.38	
		6	2.35		10
		1	2.35		8
		3	2.35		7
		6	2.30		
		4	2.35		12
		6	2.30		7
		7		2.50	
		13		2.41	
		7		2.40	
		7		2.38	
		7		2.35	
		7		2.34	
		7		2.33	

FOOTNOTES

Fred Williams, "Effect of Market Organization on Competitive
Equilibrium: The Multiunit Case," Review of Economic
Studies 40 (1973): 97-113; C. R. Plott and V. L. Smith,
"An Experimental Examination of Two Exchange Institutions,"
The Review of Economic Studies 45 (1978): 113-53.

J. T. Hong and C. R. Plott, "Implications of Rate Filing for
Domestic Dry Bulk Transportation on Inland Waters: An
Experimental Approach," Social Science Working Paper # 164
(Pasadena: California Institute of Technology, 1977).

R. M. Miller, and C. R. Plott, and V. L. Smith, "Intertemporal
Competitive Equilibrium, An Empirical Study of Speculation,"
Quarterly Journal of Economics 91 (1977): 599-624.

The experimental parameters are not exactly the same. The
demand and supply functions in the Miller, Plott, and Smith
Experiment 2 are slightly steeper (.05 per unit) and the curves
are displaced by a constant.

210   Ferejohn, John A. and Grether, David M., "Stable Voting Procedures and the Theory of Social Choice."

211   Miller, Gary J., "Municipal Incorporation Under LAFCO: A Critical View."

212   Packel, Edward W., "Transltive Permutation Groups and Equipotent Voting Rules."

213   Jaskow, Paul L. and Noll, Roger G., "Regulation In Theory and Practice: An Overview."

214   Ferejohn, John A.; Grether, David M.; Matthews, Steven A.; and Packel, Edward W., "Continuous Binary Decision Procedures."

215   Koppes, Clayton R., "Public Water, Private Land: Origins of the Acreage Limitation Controversy, 1933-1953."

216   Hahn, Robert, "Need for Power: Regulating Electricity Demand by Source."

217   Al-Adhadh, Nairn H., "Chance Constrained Model of Water Reservior: Bounds on the Long-Run Distribution of the Water Stock."

218   Al-Adhadh, Nairn H., "Chance Constrained Dynamic Programming Model of Water Reservior with Joint Products."

219   Al-Adhadh, Nairn H., "The Decline of Competition in Congressional Elections: Mayhew May Still Be Right!"

220   Al-Adhadh, Naim H. and Hinich, M. J., "A Spatial Model of Leftist Ideological Shifts in Arab Politics."

221   Al-Adhadh, Nairn H., "The Effect of a Random Planning Horizon on Production and Investment for Petroleum Reservior — A Note on Kuller'8 and Cumming's Model."

222   Payne, Peter L., "The Early Scottish Limited Companies, 1856-1895: An Historical and Analytical Survey."

223   Plott, Charles R., "The Application of Laboratory Experimental Methods to Public Choice."

224   Ledyard, John O., "The Paradox of Voting and Candidate Competition: A General Equilibrium Analysis."

225   Miller, Gary J., "Home-Owners, Renters, and Bureaucrats: A Redistributional Analysis of Municipal Incorporation."

226   Fiorina, Morris P., "Legistative Facilitation of Government Growth: Universalism and Reciprocity Practices in Majority Rule Institutions."

227   Burness, H. Stuart and Quirk, James P., "The Theory of the Dam: An Application to the Colorado River."

228   Burness, H. Stuart and Quirk, James P., "Water Law, Water Transfers and Economic Efficiency: The Colorado River."

229   Wilde, Louis L., "Consumer Behavior Under Imperfect Information: A Review of Psychological and Marketing Research As It Relates To Economic Theory."

230   Page, Talbot; Haris, Robert; and Bruser, Judith, "Removal of Carcinogens from Drinking Water: A Cost-Benefit Analysis."

231   McKelvey, Richard D.; Ordeshook, Peter C, and Ungar, Peter, "Condidtions for Voting Equilibria in Continuous Voter Distributions."

232   Burness, H. Stuart and Quirk, James P., "Capital Gains and the Economic Theory of Corporate Finance."

233   Kousser, J. Morgan, "Making Separate Equal: The Integration of Black and White School Funds in Kentucky, 1882."

234   Miller, Gary J. and Plott, Charles R., "Revenue From Sealed-Bid Auctions: Experiments With Competitive and Discriminative Processes."

235   Schwartz, Alan and Wilde, Louis L., "Intervening in Markets on the Basis of Imperfect Information: A Legal and Economic Analysis."

236   Bates, Robert H., "Pressure Groups, Public Policy, and Agricultural Development: A Study of Divergent Outcomes."

237   Bates, Robert H. and Hopkins, Roy, "The Commercialization of Agriculture and the Rise of Rural Political Protest in Black Africa."

238   Cass, David and Majumdar, Mukul, "Efficient Intertemporal Allocation, Consumption-Value Maximization and Capital-Value Transversality: A Unified View."

239   Rogerson, William, "Aggregate Expected Consumer Surplus as a Welfare Index with an Application to Price Stabilization."

240   Miller, Gary J., "Metropolitan Fragmentation and Decentralized Control of Revenue Resources."

228 Burness, H. Stuart and Quirk, James P., "Water Law, Water Transfers and Economic Efficiency: The Colorado River."

229 Wilde, Louis L., "Consumer Behavior Under Imperfect Information: A Review of Psychological and Marketing Research As It Relates To Economic Theory."

230 Page, Talbot; Harris, Robert; and Bruser, Judith, "Removal of Carcinogens from Drinking Water: A Cost-Benefit Analysis."

231 McKelvey, Richard D.; Ordeshook, Peter C, and Ungar, Peter, "Conditions for Voting Equilibria in Continuous Voter Distributions."

232 Burness, H. Stuart and Quirk, James P., "Capital Gains and the Economic Theory of Corporate Finance."

233 Kousser, J. Morgan, "Making Separate Equal: The Integration of Black and White School Funds in Kentucky, 1882."

234 Miller, Gary J. and Plott, Charles R., "Revenue From Sealed-Bid Auctions: Experiments With Competitive and Discriminative Processes."

235 Schwartz, Alan and Wilde, Louis L., "Intervening in Markets on the Basis of Imperfect Information: A Legal and Economic Analysis." Forthcoming in Pennsylvania Law Review.

236 Bates, Robert H., "Pressure Groups, Public Policy, and Agricultural Development: A Study of Divergent Outcomes."

237 Bates, Robert H., "The Commercialization of Agriculture and the Rise of Rural Political Protest in Black Africa." Forthcoming chapter to be published in Raymond Hopkins, Donald Puchala, and Rose Talbot, eds., The Politics of Agricultural Development and Rural Modernization.

238 Cass, David and Majumdar, Mukul, "Efficient Intertemporal Allocation, Consumption-Value Maximization and Capital-Value Transversallty: A Unified View."

239 Rogerson, William, "Aggregate Expected Consumer Surplus as a Welfare Index with an Application to Price Stabilization."

240 Miller, Gary J., "Metropolitan Fragmentation and Decentralized Control of Revenue Resources."

241 Hoffman, Elizabeth and Plott, Charles R., "The Effect of Intertemporal Speculation on the Outcomes in Seller Posted Offer Auction Markets."

242 Cass, David; Okuno, Masahiro, and Zllcha, Itzhak, "The Role of Money in Supporting the Pareto Optimality of Competitive Equilibrium in Consumption-Loan Type Models."

243 Takekuma, Shin-Ichi, "A Support Price Theorem for the Continuous Time Model of Capital Accumulation."

244 Fiorina, Morris P., "Short and Long-Term Effects of Economic Conditions on Individual Voting Decisions."

245 Grether, David M., "Bayes Rule as a Descriptive Model: The Representativess Heuristic."

246 Brock, William A., "Some Remarks on Monetary Policy in a Overlapping Generations Model."

247 Klein, Burton H., "The Slowdown in Productivity Advances: A Dynamic Explanation."

248 Page, Talbot, "An Actuarial Approach to Zero-Infinity Dilemmas."

249 Mishan, Ezra, and Page, Talbot, "The Methodology of Cost Benefit Analysis - with Particular Reference to the Ozone Problem."

250 Klein, Burton H., "Ocean Mining Policy: A Dynamic Approach."