Competitive Equilibrium and Classroom Pit Markets

Bradley J. Ruffle

Abstract: Efforts to show the relevance of economic concepts early in a student's education can prevent the "economics is not very useful" attitude from setting in. The author extends the work of Holt to describe a pit-market experiment used to illustrate the concept of competitive equilibrium. In addition to detailed instructions as to how to set up and conduct a pit-market experiment, the author discusses features of the data and provides accompanying materials, including software for the display of the data.

Key words: classroom experiment, competitive equilibrium, experimental economics, pit market
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Economic concepts are taught at such a level of abstraction that the student views these concepts as irrelevant to understanding real-world phenomena. Small efforts to show the relevance of economic concepts at the earliest stages of a student's training can prove invaluable to his or her outlook on the discipline. My aim in this article is to offer instructors a tool to convince students of the salience and relevance of one of economics most central and empirically robust concepts, that of competitive equilibrium.

I provide a detailed description of a market experiment used to display the power of the competitive equilibrium outcome. My own experience suggests that conducting this experiment early in an economics student's education, soon after teaching the concept of competitive equilibrium in introductory microeconomics, for example, goes a long way in preventing the "economics is not very useful or relevant" attitude from setting in.

The use of experiments in the classroom continues to expand beyond dedicated courses in experimental economics. An increasing number of nonexperimentalists are expressing interest in conducting experiments in elementary classes to demonstrate fundamental economic concepts. To serve this end, Bergstrom and Miller (2000) have written a textbook designed to illustrate elementary economics principles through experiments. Schotter (1997) provides an intermediate microeconomics textbook that emphasizes the use of classroom experiments. Delemeester and Brauer have compiled an extensive, annotated list of 122 class-

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room, hand-run experiments that are accessible online: http://www.marietta.edu/~delemeeg/games/. Similarly, Holt's (2000) "Y2K Bibliography of Experimental Economics" contains a section on classroom games. Several of the 91 classroom experiments listed originated in Holt's regular column of the same title that appeared in the *Journal of Economic Perspectives* from 1996 through 1999. In this column, Holt and co-authors elaborated on various classroom experiments designed to teach elementary as well as more advanced economic concepts. In one such column, Holt (1996) detailed a pit-market experiment designed to display the concept of competitive equilibrium. On the basis of its effectiveness in teaching the competitive equilibrium solution, Holt endorsed the pit-market trading exercise as his "clear first choice if [he] were limited to a single lecture in a microeconomics course at any level."

In this article, I build on the work of Holt (1996). My aim is to provide sufficient detail about all stages of the experiment (including the pre-experiment preparations, useful hints for conducting the experiment, postexperiment questions for discussion, and theoretical and empirical homework exercises) so that someone who has never conducted an experiment may feel confident in doing so. Moreover, given the widespread use of notebook computers, I have made available two files to conduct these pit-market experiments from notebook computers and to display the results along with a computer projector. The first file, an Excel spreadsheet, is set up to enter transactions during the experiment and automatically calculate the student's profits. For instructors wishing to conduct these experiments repeatedly or in large groups, this spreadsheet is particularly time saving. A second available piece of software displays the transactions from an experimental session and the supply and demand parameters employed in the session.

In the following section, I offer suggestions for experimental designs and lay out the experimental procedures as well as the supplies and manpower needed to conduct pit-market experiments. Then I provide ideas for a classroom discussion and homework exercises. I discuss two advanced topics concerning features of the data from pit-market experiments and competitive market experiments more generally.

EXPERIMENTAL DESIGN

The method employed in market experiments is known as induced-value theory and was first introduced by Chamberlin (1948) and developed by Smith (1962). The distinct advantage of this method is that it allows the experimenter to observe or, more precisely, to assign buyers' individual demand curves and sellers' supply curves. To do so, each buyer is informed (often through the distribution of cards explained subsequently) of his or her valuation for one or more units of production, that is, the maximum price he or she would be willing to pay for these units. To implement the buyers' valuations, the experimenter tells the buyers that they earn, either in points or in money, the difference between their valuation and the price on each unit purchased (their consumer surplus). Likewise, each seller is given one or more units of production, each with an associat-

ed cost. Sellers are told that they earn the negotiated price minus the cost on each unit they sell. After receiving their valuations and costs, students begin trading according to the rules of the pit market (Chamberlin 1948) or any other market institution.

The instructor will want to construct the supply and demand curves ahead of time. Unless the precise number of students that will show up for the experiment is known, one should prepare a number of designs in advance to accommodate different numbers of subjects. As long as designs with extreme earnings inequalities at the competitive equilibrium are avoided, prices and quantities are very likely to converge to the competitive outcome. Smith (1962, 119–20) first showed that convergence is inhibited in designs with a perfectly elastic curve.

I offer suggestions for designs in which the number of trading pairs varies from 8 to 15 in Table 1. The supply and demand parameters for 12 pairs of traders are displayed in Figure 1. All of the designs in Figure 1 and Table 1 produce a two-unit vertical overlap of the aggregate supply and demand curves. In other words, there exists a two-unit competitive price range with a unique competitive quantity. Instructors who prefer a design with a unique competitive price prediction may achieve it either through a unique crossing point of the supply and demand curves or a horizontal overlap. The problem with these alternatives is that the traders who earn zero profit on the purchase or sale of their unit at the competitive price have no incentive and will not trade this unit, thereby inhibiting convergence to the competitive quantity, possibly the competitive price.

The instructor can use a deck of playing cards, designating the black cards as the sellers' costs and the red cards as the buyers' valuations, as suggested by Holt (1996). Having the cards made, however, allows increased flexibility in the choice of design and, does not limit valuations and costs to the range of 1 to 10. At the very least, the deck should be laminated to prevent students from bending

TABLE 1
Distributions of Costs and Valuations

Cards		Number of pairs of sellers and buyers							
Sellers' costs	Buyers' valuations	8	9	10	11	12	13	14	15
11	53	1	2	2	2	2	2	2	2
16	48	1	1	1	2	2	2	3	3
21	43	1	1	1	1	2	3	3	3
26	38	1	1	2	2	2	2	2	3
31	33	2	2	2	2	2	2	2	2
36	28	2	2	2	2	2	2	2	2

Note: Suggestions for experimental designs. The first two columns under the heading "Cards" indicate the values of the cards to use for the sellers' costs and buyers' valuations. The entries indicate the number of cards to include in the deck for each specified value when the number of subject pairs (between 8 and 15) is as shown.

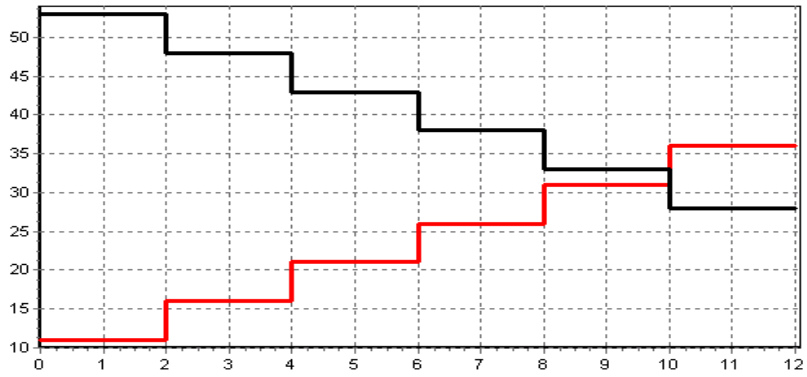


FIGURE 1. Parameter graphs for 12 pairs of traders.

***Note*: The supply and demand curves for 12 pairs of traders are based on the parameters displayed in Table 1.**

or otherwise making the cards distinguishable from one another. I would nonetheless suggest that the instructor get his or her own set of cards professionally made at a printing shop. Buy two different colors of cardboard paper. The file cards.doc in the Forms directory of the downloadable file offers a template from which the cards may be printed onto the colored paper. After printing the cards with the desired numbers on them, have the paper cut into cards of identical size; laminate the finished cards.

EXPERIMENTAL PROCEDURE

Supplies and Manpower

A few preparations are required before entering the classroom to conduct a pit-market experiment. All of the required forms can be downloaded from my Web site (http://econ.bgu.ac.il/facultym/bradley/pitmarket.zip). The following supplies are needed to conduct these experiments: instructions (included), personal record sheet (included), transactions sheets (included), notebook computer (not included!), Excel spreadsheet (included), cost and valuation cards (template included), stickers, stopwatch, a classroom with portable chairs and tables to create an open space in the middle, blackboard and chalk or whiteboard and marker, and envelopes in which to enclose the subject payments (optional).

To conduct these experiments with a group of 16–30 students, the instructor will need two to four helpers, depending on the volume of transactions at the competitive equilibrium. In the absence of research assistants, the instructor may ask for volunteers from the class. An odd number of students automatically makes available one student as an assistant.

Two persons are required to record the transactions at two transaction booths. One person stands at the blackboard. In addition to keeping track of the time and announcing periodically the time remaining in each period, this person collects the transaction sheets from the booth operators, writes each transaction price on the board as he receives it, and passes the sheet on to the helpers seated at the computer. One (usually the instructor) or ideally two people are seated in front of a notebook computer. One person dictates the details of each transaction as it arrives to the person seated in front of the computer who types in the details in the Excel spreadsheet. (To preview the layout of the spreadsheet, see Table 2 and the following discussion.)

Procedures

Before the students arrive for the experiment, create a large open space in the middle of the classroom. Set up two transaction desks at the front of the room near the board, and a nearby table to install the notebook computer.

When the students arrive, divide them into an equal number of buyers and sellers. Because friends typically sit beside one another, dividing the class in half once the students are seated prevents friends from trading with friends. Pass out the instruction sheet along with the personal record sheet to each participant. Unless the instructor and all of the helpers know all of the participants' names, each participant should be assigned an identity number. While the students are reading the instructions, distribute stickers of one color, say blue, to the buyers. On the sticker is written the buyer's identity number, beginning with 101 through 115 (prepared ahead of time), depending on the number of pairs. Sellers receive stickers of a different color, say purple, with their identity numbers from 201 through 215 (depending on the number of pairs) written on the sticker. Ask students to place their stickers on their chests so that their identity numbers are visible. After students have read the instructions, the experimenter reads them aloud and answers any questions. The profit calculations, the fact that the seller does not incur the cost of his or her unit if it is not sold, and the fact that students are free to negotiate with whomever they like from the opposite side of the market (identifiable by the sticker color) are all points worth emphasizing.

When the instructor is ready to begin the first period, two helpers distribute the cost and valuation cards to the students. After everyone has received a card, the timekeeper announces the beginning of the first period. At this point, students enter the pit and begin negotiating with one another.[1] When a buyer and a seller agree upon a price, they come to one of the transaction desks, turn in their respective cards face down, and report their agreed-upon price to the transaction booth operator. It is a good idea if the booth operator repeats the transaction price aloud so that both parties to the transaction hear this price. This avoids any confusion or misunderstanding between the two parties about the agreed-upon price. Both parties return to their seats and fill in their personal record sheets, and the booth operator records the price, the transacting parties' cards, and identity numbers on the transactions sheet. After filling in the details of the transaction, the booth operator hands the transaction sheet to the person standing at the board who writes the

TABLE 2
A Record of All Transactions from Periods 3 to 7

Period	Transaction	Price	Seller i.d.	Cost	Buyer i.d.	Valuation	Seller profit	Buyer profit	Average price	Median price	Variance
3	1	30	206	11	108	53	19	23			
3	2	28	205	11	110	53	17	25			
3	3	32	208	21	109	38	11	6			
3	4	32	207	31	104	43	1	11			
3	5	30	209	26	107	33	4	3			
3	6	28	210	26	105	38	2	10			
3	7	30	202	16	106	48	14	18			
3	8	33	204	31	103	33	2	0	30.38	30.00	3.41
4	1	30	201	11	103	53	19	23			
4	2	32	207	11	107	53	21	21			
4	3	30	205	21	108	38	9	8			
4	4	35	203	31	109	48	4	13			
4	5	31	202	26	106	43	5	12			
4	6	31	206	16	104	38	15	7			
4	7	31	204	26	110	33	5	2			
4	8								31.43	31.00	2.95
5	1	31	210	11	104	53	20	22			
5	2	30	208	16	107	38	14	8			
5	3	33	203	26	110	53	7	20			
5	4	31	206	11	109	43	20	12			

5	5	33	201	26	103	48	7	15			
5	6	32	204	21	102	33	11	1			
5	7	32	205	31	105	38	1	6			
5	8	32	209	31	101	33	1	1	31.75	32.00	1.07
6	1	30	209	11	105	53	19	23			
6	2	32	202	26	107	53	6	21			
6	3	32	210	21	109	43	11	11			
6	4	33	207	11	103	38	22	5			
6	5	34	206	16	110	48	18	14			
6	6	33	205	26	102	38	7	5			
6	7	32	203	31	108	33	1	1			
6	8								32.29	32.00	1.57
7	1	32	203	21	103	53	11	21			
7	2	33	210	26	107	38	7	5			
7	3	32	206	26	105	48	6	16			
7	4	33	207	11	106	53	22	20			
7	5	32	208	11	101	43	21	11			
7	6	32	202	16	104	38	16	6			
7	7	32	201	31	110	33	1	1			
7	8	32	204	31	109	33	1	1	32.25	32.00	0.21

Note: A session with a competitive quantity of 8 and a competitive price range of 31–33. High quantity and price variance in periods 1 and 2 lead to opening trades between the highest-value buyers and lowest-cost sellers in periods 3 and 4. With the subsequent stabilization and convergence of prices and quantities, the last trades in period 7 occur between the two pairs of marginal traders.

price under the appropriate period number. The sheet is then passed on to the person seated in front of the computer who enters the transaction in the Excel spreadsheet.[2] After typing in the transaction, cross it out on the transaction sheet.

With the fast-paced, simultaneous negotiations that characterize trading in the pit market, three minutes more than suffice for a period, even for large groups of students. (Double-auction experiments, described in Wells [1991], can require up to five-minute periods.) The timekeeper watches the clock and announces that one minute has elapsed, one minute remains, and 30 seconds remain. At the end of the period, ask those students who did not trade to turn in their cards. Before proceeding to the next period, separate and count the cost and valuation cards to ensure that all students returned their cards.

To avoid misunderstandings, the instructor will want to decide and make clear to all students until what point a transaction will be accepted. My own rule is that after the period has ended, no further negotiations are permitted. However, those transactions that have been negotiated but not yet recorded (because of a lineup at one of the transaction booths) are valid.

Finally, I have found that six rounds are sufficient for prices to converge to the competitive price range. Allow 45 minutes for a six-round experiment, including the instructions.

A FEW POINTERS

If a student trades a unit at a negative profit, before beginning the next period, it is advisable either to inform the student aloud that his or her profit from the trade is negative or to ask to speak with the student and inform him or her privately. It is important to catch errors: more often than not one of the helpers has recorded the student's cost or valuation incorrectly so that the student's actual profit is positive.

You may choose to disallow collusive discussions among students between or during periods, as Holt (1996) suggests. With a larger group of, say, 24 or more students, my experience indicates that attempts at collusion break down quickly, often within the same period in which they were begun. Thus, the advantage of permitting collusion is that failed attempts at collusion facilitate your subsequent task of convincing students of the robustness of the competitive solution. However, in smaller groups, particularly if the participants know and trust one another, collusion can be successful. I report elsewhere (Ruffle 2002) a highly successful case of seller price collusion in a pit market with nine pairs of classmates who knew one another well.

If the instructor observes price convergence to the competitive equilibrium before the number of allotted rounds, he or she may wish to try a different treatment. The possibilities are limited only by time and the instructor's imagination. For instance, a price ceiling or a price floor can be imposed, or the balance of the number of buyers and sellers can be altered. By changing the relevant distributions of cards, the instructor may vary the shape (elasticity) of the supply or demand curve, or shift either the supply or demand curve or both. Changes or shifts in supply and demand curves may be announced or unannounced. If

announced, the instructor can motivate the shift of a curve by explaining that it is the result of the introduction of a tax a subsidy, or a change in technology or consumers' tastes.

A word of caution: The larger the change in the competitive price between back-to-back treatments, the more periods you should allow for convergence *ceteris paribus*. It is common to observe anchoring effects in these markets, in which one side of the market is able to resist, through tenacious negotiations, sudden and substantial price fluctuations. In such cases, convergence to the competitive equilibrium is gradual, taking place over several, perhaps many, periods.

CLASSROOM DISCUSSION AND EXERCISES

Whether the instructor chooses to conduct these pit-market experiments before or after introducing supply and demand is a matter of preference. I prefer to conduct them immediately following the lecture on competitive equilibrium in an introductory microeconomics course.[3] I usually begin by showing students the results of the experiment in the form of a transactions graph, like those displayed in Figures 2 and 3 (discussed below). I also write down as two separate rows the buyers' valuation cards and sellers' costs used in the experiment. I then ask students to explain why prices converged to the particular observed outcome.[4] Expect to hear answers such as: the average of all valuations and costs, an equitable price at which buyers' and sellers' earnings are equated, and the price at which total profits are maximized.[5] Write each answer on the board and then have students vote on which answer they believe to be the correct one. Even if a student offers the correct answer, the competitive equilibrium price, this answer very rarely receives the most votes, even in advanced undergraduate classes!

The task now is to demonstrate the logic underlying competitive market forces and convergence to the competitive equilibrium. The realization that competitive forces moved prices toward the competitive price captures students' attention. The instructor may wish to take advantage of their attentiveness to demonstrate other elementary economics concepts. Along these lines, many theoretical and empirical exercises are available in the Forms directory in the file available for downloading at my Web site. Many of these questions may be adapted for classroom discussion. The instructor may introduce or review the topics of utility, consumer and producer surplus, demand and supply elasticity, and monopoly pricing after revealing to students the supply and demand parameters from the experiment in which they participated. For the empirical exercises, distribute the raw data (in the form of Table 2) from the experiment in which the students participated, or post it on the course Web site. Students may be asked to compute the market efficiency in each period and may be led to the conclusion that the market reaches full efficiency (i.e., the entire available consumer and producer surpluses are captured) when the competitive quantity is traded. In addition, students can calculate the variance and standard deviation of transaction prices by period and be subsequently taught that decreased price variance accompanies convergence to the competitive outcome. In an advanced

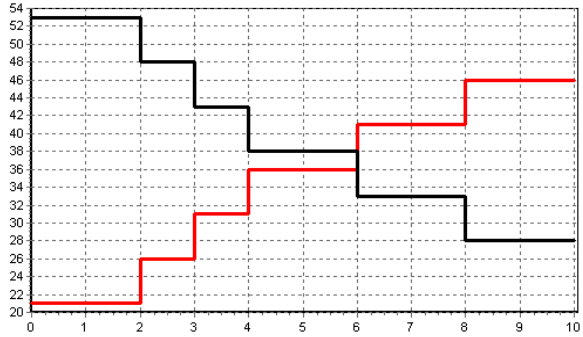


FIGURE 2a. Supply and demand curves used for e

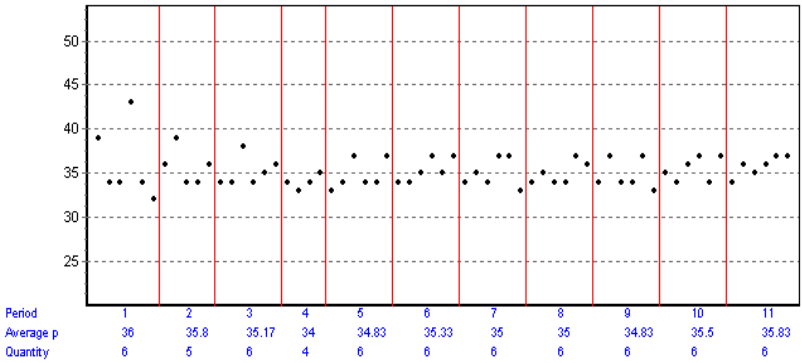
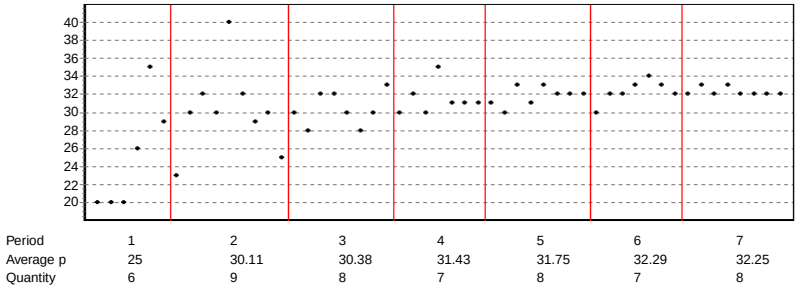


FIGURE 2b. Slow price convergence from below.

***Note*: Transactions data based on the design in Figure 2a. The exceptionally slow price, but not quantity, convergence of this session attests to the negotiating strength of the buyers.**

economics class with a background in econometrics, you can sharpen students' understanding of various possible interpretations of convergence by asking them to perform the Ashenfelter-El Gamal linear regression analysis on the data. Noussair, Plott, and Riezman (1995; 1997) illustrate this regression model as well as the notions of strong and weak convergence. In my 2002 manuscript, I applied this regression model to pit-market data and tested for the direction of convergence.

After convincing students that competitive forces along with the profit-maximization motive funneled prices to the competitive level, I remind them of the assumptions underlying the perfect competition model. Depending on the textbook, these may include a large number of both producers and consumers, the absence of government intervention, the inability to collude or form cartels, and full information. It is then illuminating to discuss the relevance of each one of these assumptions to the experiment in which they participated. For instance,



Period	1	2	3	4	5	6	7
Average p	25	30.11	30.38	31.43	31.75	32.29	32.25
Quantity	6	9	8	7	8	7	8

FIGURE 3. Session with high initial price and quantity variance.

***Note*: Transactions data from a session with very high initial price and quantity variance. By period 7, the session has converged tightly to the competitive price of 31–33 and the competitive quantity of 8.**

textbooks are not at all precise about what constitutes "a large number" of both producers and consumers. The numbers of buyers and sellers in your particular experiment shed light on this issue. Students had only private information regarding their own cost or valuation card. The full-information assumption therefore seems unnecessary (Smith [1962] first made this point). Having permitted students to collude in the experiment, I then devote considerable time to discussing the observed failure of collusion in these markets and, thus, why its prohibition need not be included among the necessary conditions for perfect competition.

Collusion most often begins after a few rounds of play; students from one side of the market, say, the buyers, agree among themselves not to buy above some price well below the transaction prices observed in the previous period.[6] When the round begins, the colluding buyers remain seated. The experimenter calls out that one minute has elapsed. The buyers continue to remain seated. With the announcement that only one or half a minute remains, buyers begin to stir. Typically, the buyer with the highest valuation reasons to himself that to throw away his high card and earn zero would be a shame and that he would prefer to break the collusive agreement and cash in on his card. He rises from his seat, approaches the other side of the room and negotiates a price above the agreed upon price. Upon observing that this buyer has broken the collusive agreement, another high-value buyer stands up and negotiates a transaction with a seller. A couple of defectors are usually sufficient for the collusion to unravel. The enthusiastic negotiations characteristic of pit markets resume and collusion is not discussed in the next round. The collusion has broken down in the same period in which it began.

FEATURES OF THE DATA FROM PIT-MARKET EXPERIMENTS

Negotiating Abilities and Slow Price, But Not Quantity, Convergence

Dozens of studies have confirmed the robustness of convergence to the competitive equilibrium under a variety of conditions. Davis and Holt (1993) provide

a thorough survey. Nonetheless the price dynamics of every experiment are unique, and it does infrequently happen that a session does not converge, even after numerous periods. Prices can appear stuck in a range outside the competitive equilibrium. Shocks to the supply and demand schedules typically loosen prices so that they converge to the new equilibrium. More frequent than no convergence is slow convergence. Sometimes 10 or more periods are required before prices enter the competitive range because of the negotiating ability of one side of the market, usually the buyers.

The experimental data displayed in Figure 2b provide an interesting example of exceptionally slow price, but not quantity, convergence.[7] This session consists of 10 pairs of traders. The supply and demand curves for this session appear in Figure 2a. The competitive price range is between 36 and 38, with a competitive quantity of six units.

In period 1, prices exhibit typically high variance. In periods 2–5, buyers bring prices down below the competitive range: 34 is the modal transaction price in each of these periods. That notwithstanding, the competitive quantity of six units is traded from period 5 onward, suggesting relatively high price variance; that is, in every period from period 5 onward two transactions occur at a price of 37 to permit the two marginal sellers with costs of 36 to trade their units at a positive profit.[8]

That the remainder of the transaction prices persist at a price below the competitive range (despite the two publicly observable transactions at 37 each period) attests to the buyers' negotiating strength in this session.[9] In fact, it is only in the final period that the median price reaches 36, the lower bound of the competitive range. By the average price measure, this session still has not converged by period 11, falling short by a mere 0.16 units.

The data in Figure 3 provide an additional example of relatively strong buyers. The data come from an experiment involving the parameters in Table 1, with 10 pairs of traders.[10] The competitive price range for this session is 31 to 33, with a competitive quantity of eight units.

All but one of the six transaction prices are well below the competitive range in period 1. However, prices progressively rise from one period to the next, whereas the price variance generally declines. Six periods are required before the average price converges, from below, to the competitive range.

Order of Transactions

Next I investigate the specific transactions of this session in more detail. Time permitting, a common feature of the data the instructor may choose to demonstrate (in more advanced classes) and one your students will remember concerns the order of transactions within a period. Holt (1996, 199) points out that

> the most profitable trades often occur first. After the high-value buyers and low-cost sellers are out of the picture, the final haggling is typically among those with a smaller potential surplus and those who will find it impossible to trade at all.

Indeed, the data in Table 2 and Figure 3 (from the session discussed previ-

ously) illustrate an elegant example of this regularity. A record of all transactions between periods 3 and 7 inclusive is shown in Table 2. Each row indicates the details of the transaction. The rows are arranged according to the order in which the transactions took place. Each row contains the transaction price, the i.d. number (201 to 210) of the seller who sold the unit along with his cost, followed by the i.d. number (101 to 110) of the buyer who purchased the unit along with his valuation. The seller's profit (price minus cost) and the buyer's profit (valuation minus price) are displayed in the next two columns. Finally, the average and median prices as well as the price variance of all transactions in a period are displayed.

Precisely as Holt suggests, the highlighted trades in periods 3 and 4 of Table 2 show that the early trades in these periods occur between the highest-value buyers and the lowest-cost sellers. To understand this phenomenon, I return to the transactions of the first two periods in Figure 2b. Transaction prices in periods 1 and 2 reveal extremely high price variance (38.4 and 22.86, respectively). Furthermore, the quantity traded fluctuates from 6 to 9 units. (Recall that the competitive quantity is 8.) These price and especially quantity volatilities render traders nervous about being unable to trade their units. Those with the largest potential surplus have the most to lose. As a result, these anxious traders quickly find one another and compromise on a price.

With prices and quantities showing considerably more stability in period 4, this phenomenon weakens beginning in period 5 when the first two trades are no longer between the highest-value and lowest-cost traders. In period 4, most transaction prices fall within the competitive range and already by period 3, 7 or 8 units trade in every subsequent period. Thus, the highest-value and lowest-cost traders' risk of not trading is substantially reduced, thereby allowing them to be more patient in closing transactions. Even more interesting are the traders involved in the two last trades in period 7 (Table 2). The four marginal traders find the precise price, 32, that allows each of them to trade at a profit. Each of the four traders earns 1 unit of profit on his or her transaction.

One often-heard critique of economics experiments is that the monetary incentives are insufficient to motivate students to exert themselves to solve the decision task. By contrast, the minimal profit earned on the two last trades shows just how highly motivated students can be; all four of them continued to negotiate to earn one unit of profit (a meager 12 U.S. cents in this particular paid experiment). Even if the instructor does not observe the last trades among the marginal traders, the data will reveal small realized profits on transactions in which the marginal traders are involved; this is a prerequisite to convergence to the competitive quantity. The point to be made is that this pursuit of profit maximization aids in convergence to the competitive equilibrium and lends it its sway.

CONCLUDING REMARKS

The centrality of the notion of competitive equilibrium to microeconomics cannot be overstated. Its underlying logic involving the concepts of excess sup-

ply and demand, competitive market forces, and profit maximization reflects basic economic thinking. A classroom experiment to demonstrate the relevance of competitive equilibrium can move it from the realm of the abstract to the realistic in the student's mind. I have described an experiment designed to accomplish just that. By providing detailed instructions at all stages of the experiment, I try to guide the instructor through conducting a pit-market experiment. With this in mind, I have made many accompanying materials available in a downloadable file. Among these materials are two pieces of user-friendly software, one to help record the transactions during the experiment and the other to display the transaction prices series in the form of a graph. May our students think more like economists!

NOTES

1. Rachel Croson has reminded me that in cultures more reserved and less gregarious than that of Israel, students may initially require a little verbal prompting to encourage them to negotiate with one another. She also suggests counting down the seconds to the start of the period to build up students' anticipation.
2. If the instructor is short on helpers, he or she may wish to have transacting parties report directly to the computer where the transaction details are entered. The transactions booths, however, make the recording of transactions far less chaotic and provide a hard copy of all transactions.
3. Alternatively, Wells (1991) who discusses a double-auction experiment suggests conducting the experiment before the formal presentation of supply and demand.
4. Holt (1996, 198) recommends this same method to initiate discussion as well as an approach using questions that lead students to the concept of the competitive equilibrium.
5. Of course, for a symmetric supply and demand parameterization, none of these answers is incorrect. However, none of them *explains why* prices converge to the competitive range. For this reason, the instructor may choose to employ a slightly asymmetric design.
6. That the discussion of collusion is often initiated by the lowest-valuation buyer (who has the least to lose) is an amusing observation.
7. This is the tax (on the sellers) treatment from session *tax10s11* of Ruffle (2002).
8. In period 8, only one trade occurred at 37; one seller settled for a profit of zero and sold his unit at a price of 36.
9. Smith and Williams (1982, 115) also note the relative strength of buyers in experimental markets and attribute it to students' disproportionate lifetime experience as buyers rather than as sellers.
10. These are the first seven periods of the baseline (presubsidy) treatment from session *sud10s2* reported in Ruffle (2002).

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