

Sample chapter from the
Instructor's Manual for
Experiments with Economics Principles

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What's It All About?

We got tired of it. Lecturing to sleepy students who want to “go over” material that they have already highlighted in their textbooks so that they can remember the “key ideas” until the midterm. We wanted to engage our students in *active learning*, to exploit their natural curiosity about economic affairs, and to get them to ponder the questions before we tried to give them answers. We found that conducting experiments in class, with discussions before, during, and after the experiments is an effective and enjoyable way of moving from passive to active learning.

We are distributing a sample chapter from our book, *Experiments with Economic Principles*, because we hope to persuade you to run more of our experiments in future classes. The book includes thirteen experiments that are designed to teach fundamental economic ideas. Among the topics treated are sales taxes, prohibition, minimum wages, monopoly, entry and exit, externalities, information, bargaining, comparative advantage, and auctions. Each chapter of *Experiments with Economic Principles* contains instructions for an experiment, a lab report in which students record and organize the experimental results, a discussion section that presents an economic theory which is illustrated by the experiment, and a homework section in which students refine their understanding of the theory. The book comes with an Instructor's Manual that provides detailed instructions and materials needed for running each experiment.

You can order the entire book to use either as a free-standing text or as a supplement to your current text. If you prefer to run only a few experiments from the book, you can order a custom-printed text that includes only the experiments of your choice.

We believe that you will find that classroom experiments are a powerful way to motivate economic theory and to help students to understand their economic environment. Students who have done these experiments in our classes are almost uniformly enthusiastic. They tell us they had much more fun than they do in “normal” classes and their performance on examinations

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suggest that they learned a lot.

We have put together a Web site where you can find additional resources for using *Experiments with Economic Principles*. This site includes a file of news clippings that show real-world applications of the economic principles presented in our experiments, a discussion forum for instructors, links to class Web pages of several instructors who are using the text, and an archive of results from previously conducted in-class experiments. You will find our Web page at the address:

<http://zia.hss.cmu.edu/miller/eep/eep.html>

If you have further questions, our e-mail addresses are:

tedb@econ.ucsb.edu (Ted Bergstrom) and

miller@zia.hss.cmu.edu (John Miller).

Introduction

This excerpt from the Instructor’s Manual contains instructions for running the market experiment described in a sample chapter from our book, *Experiments with Economic Principles*. Each student in the class needs a copy of the sample chapter (which was either bundled with their textbooks or downloaded from our web site).

In addition to detailed instructions for each experiment, the Instructor’s Manual offers a single page of “Capsule Instructions” that are designed to remind you at a glance of the steps needed to run the experiment. There is also a discussion of the predictions of competitive theory for the experiment as well as a detailed report of the outcome that we observed when we ran this experiment on a previous occasion.

At the end of the chapter, you will find copies of “Personal Information Sheets” and “Sales Contracts” that need to be photocopied in sufficient numbers to distribute to the class.

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Experiment 1

Supply and Demand

General Discussion

In this experiment, students play the roles of suppliers and demanders of apples. Students are given *personal information sheets* that tell them the roles they will play in each of two market sessions. Some students will be suppliers and some will be demanders. There are two types of suppliers, each of which has a different “Seller Cost.” There are also two types of demanders, each of which has a different “Buyer Value.” A supplier can sell *at most* one bushel of apples and a demander can buy *at most* one bushel of apples.

Suppliers and demanders are asked to move around the room and try to make a deal. A supplier with Seller Cost $\$C$ who sells a bushel of apples for price $\$P$ will get profits of $\$P - \C , and a demander with Buyer Value $\$V$ who buys a bushel of apples at price $\$P$ will get profits of $\$V - \P . When a supplier and a demander agree on a price, they fill out a “sales contract” and deliver it to the “market manager” (the instructor or teaching assistant), who records the price, Buyer Value, and Seller Cost on the blackboard for all to see. Typically, some students with high Seller Costs or low Buyer Values will be unable to find a profitable deal. In this case, they should be encouraged not to trade rather than trade at a loss.

Capsule Instructions for the Apple Market

Materials Needed:

- Personal Information Sheets of Types A–F in ordered packets of six (at least one sheet for each student who might come).
- Sales Contracts (at least two for each student in class).

Procedure:

- Distribute as many *complete* six-packs of Personal Information Sheets (one sheet per student) as possible, and then pass out the sheets (in order) from the remaining six-pack until everyone has a sheet.
- Explain trading procedures and payoffs to the class.
- Begin Session 1.
 - Open trading in round 1. As completed Sales Contracts are turned in, record price, Buyer Value, and Seller Cost on the blackboard.
 - After the first round, ask students if they have any questions.
 - Before the second round begins, remind students that they are still in Session 1.
 - Open trading in round 2. As completed Sales Contracts are turned in, record price, Buyer Value, and Seller Cost on the blackboard.
 - Ask students to copy sales information into their lab reports.
- Begin Session 2.
 - Remind students that they are now in Session 2.
 - Open trading in round 1. As completed Sales Contracts are turned in, record price, Buyer Value, and Seller Cost on the blackboard.
 - Open trading in round 2. As completed Sales Contracts are turned in, record price, Buyer Value, and Seller Cost on the blackboard.
 - Ask students to copy sales information into their lab reports.
- Announce the distribution of Buyer Values and Seller Costs for each session and ask students to copy this information into their lab reports.
- Collect Personal Information Sheets from all traders.

Detailed Instructions and Comments

Time and Class Size

The experiment can be run comfortably within a 50-minute class period. In an 80-minute period, there is also time to help the students prepare their lab reports and to begin discussion of the results. We normally use the class period following the experiment to present the theory of competitive supply and demand, and to compare the results of the experiment to the predictions of the theory. (If you want to save more time for lecturing, you can omit Session 2 and just run Session 1.)

This experiment will run smoothly in classes ranging in size from 10-75 students. If you have a large lecture section and several smaller recitation sections run by teaching assistants, it is probably best to have the teaching assistants run the experiment in their section meetings and to discuss the corresponding theory in the large lecture. The experiment has, however, been run successfully in a class of 300 students. Methods that have been used for running the experiment in a very large class are discussed on our Web Site at the following address:

<http://zia.hss.cmu.edu/miller/eep/large.html>

Student preparation

If it is convenient, encourage your students to prepare for the experiment by reading the instructions and working the Warm-up exercises in their copies of the sample chapter (pages 1–4) before they come to class. Prior preparation is helpful, but it is not essential, since you will present the instructions again at the beginning of the experiment.

Transactions, Rounds, and Sessions

It is important to distinguish among *transactions*, *rounds of trading*, and *market sessions*. A *transaction* is a deal between a buyer and a seller, consummated in the form of a filled-in sales contract which is delivered to the market manager. A *round* of trading begins when the market manager declares trade to be open and ends when transactions cease. Rounds within a given session are repetitions of the same trading session with the same market fundamentals. Rounds are repeated to allow students a chance to revise

their behavior based on what they have learned about market opportunities from observing the prices at which others bought and sold in previous rounds. A market *session* typically includes two or more rounds of trading.

The first experiment is designed to include two different sessions. The difference between the two sessions is that different proportions of students are assigned to the various market roles. This difference changes the market demand and supply curves, as well as the competitive equilibrium price and quantity.

Personal Information Sheets and Sales Contracts

Distributing Information Sheets

This instructor's manual includes original copies of personal information sheets, which should be photocopied for distribution in class. The personal information sheets specify each student's role in each of the two market sessions. We have prepared six different types of personal information sheets, labeled A, B, C, D, E, and F.¹ To ensure that you distribute nearly equal numbers of each type of personal information sheets, you should clip together some "six-packs" of sheets, where each six-pack includes one sheet of each type. Make enough of these six-packs so that you have an information sheet for every student who might possibly come to class. Distribute as many complete six-packs as you can and then pass out the top sheets from the last six-pack until everyone has a sheet. Make a note of the number of complete six-packs and the type of the last sheet that you distribute.

Example:

If the most students who might come to class is 35, you would prepare 6 six-packs. If 33 students came to class, you would then distribute the entire contents of 5 six-packs and Types A, B, and C from the sixth.

Distribution of Supplier and Demander types in the Market

There are two kinds of suppliers and two types of demanders in each session. Low-cost suppliers have a Seller Cost of \$10 for a bushel of apples and high-cost suppliers have a Seller Cost of \$30. Low-value demanders have a Buyer

¹Since some roles are more profitable than others, we have arranged the personal information sheets so that students who get very profitable roles in one session will have less profitable roles in the other. We have also attempted to give as many people as possible a chance to be suppliers in one session and demanders in the other.

Value of \$20 for a bushel of apples and high-value demanders have a Buyer Value of \$40.

At the end of the experiment, you should announce the distribution of Buyer Values and Seller Costs in the classroom market. If the number of sheets distributed is a multiple of 6, then in Session 1, two-thirds of the suppliers will be low-cost suppliers and two-thirds of the demanders will be low-value demanders, while in Session 2, two-thirds of the suppliers will be high-cost suppliers and two-thirds of the demanders will be high-value demanders. The proportions will be slightly different if the number of students in class is not divisible by 6. If you use the six-pack method of distributing personal information sheets, the number of buyers and sellers of each type is determined by the number of full six-packs distributed, N , and the type of the last sheet handed out. For example, if you hand out 33 sheets, then $N = 5$ (since 5 full six-packs are distributed), and the last sheet distributed is of Type C. You can use Tables 1.1 and 1.2 to determine the distribution of Seller Costs and Buyer Values in each session. For example, in Session 1, when 33 sheets are distributed (and thus the last sheet is of Type C), the number of low-cost suppliers is $2N = 10$, the number of high-cost suppliers is $N = 5$, the number of high-value demanders is $N + 1 = 6$, and the number of low-value demanders is $2N + 2 = 12$.

Table 1.1: Distribution of Agent Types in Session 1

Type of Last Sheet	A	B	C	D	E	F
Low-Cost Supplier	$2N$	$2N$	$2N$	$2N+1$	$2N+1$	$2N$
High-Cost Supplier	N	N	N	N	$N+1$	N
High-Value Demander	$N+1$	$N+1$	$N+1$	$N+1$	$N+1$	N
Low-Value Demander	$2N$	$2N+1$	$2N+2$	$2N+2$	$2N+2$	$2N$

Table 1.2: Distribution of Agent Types in Session 2

Type of Last Sheet	A	B	C	D	E	F
Low-Cost Supplier	N	$N+1$	$N+1$	$N+1$	$N+1$	N
High-Cost Supplier	$2N+1$	$2N + 1$	$2N+1$	$2N+1$	$2N+1$	$2N$
High-Value Demander	$2N$	$2N$	$2N+1$	$2N+1$	$2N+2$	$2N$
Low-Value Demander	N	N	N	$N+1$	$N+1$	N

If you are planning to record students' winnings in this experiment,

we suggest that you ask students to write their identification numbers (or names) on their sheets and turn them in at the end of the experiment.²

Sales Contracts

You will need a stack of *sales contracts* which can be photocopied from the original included in this manual. Each transaction between a buyer and a seller must be recorded on a sales contract. The number of transactions in a single round of trading will be smaller than half of the number of students in the class. Since you will have about four rounds, you should have at least two contracts for each student in the class. If you make extras, they will not go to waste, since sales contracts will be used in several other experiments.

We have found that it is better not to distribute sales contracts in advance. Instead, we suggest that you make a stack or two of sales contracts available in the front of the room, where buyer-seller pairs who have agreed on a price can fill them out before handing them to the market manager.

First Session—Round 1

Before Trading Starts

After distributing personal information sheets, briefly explain the rules of trading and the way that profits of buyers and sellers are calculated. Then work through the Warm-up exercises in the students' instructions with the class. Ask if there are any questions.

Remind students of the following:

- They can not buy or sell *more than* one bushel of apples in a round.
- They do not *have to* make a trade. It is better to make no trade than to trade at a loss.
- Each pair of traders should turn in only *one* sales contract for their transaction.
- Students should return to their seats after they have traded and turned in a sales contract.

²If students recorded their buyer values and seller costs accurately on their sales contracts, the instructor would not need to collect their personal information sheets, but occasionally students make mistakes in entering their costs or values on the sales contracts. And of course if there were no independent check on one's type, some students might be tempted to engage in fraud.

The Trading Process

When there are no further questions, tell the class that the first trading round has begun. Students should be encouraged to get out of their seats and move around the classroom to make deals.³ Suppliers should seek demanders, and demanders should seek suppliers. When a supplier and a demander reach an agreement, they should come to the front of the room and pick up and fill out a sales contract, on which they record their identification numbers, the agreed-upon price, the demander’s Buyer Value, and the supplier’s Seller Cost. They should then bring the sales contract to the market manager. As each sales contract is turned in, the market manager (or an assistant) records the price, Buyer Value, and Seller Cost on the blackboard, using a format similar to Table 1.3. Students who have not yet transacted are thus able to observe the transaction prices as they are recorded. (Our experience is that students don’t look at these as much as one might expect.)

Table 1.3: Blackboard Record of Transactions

Trade	Price	Buyer Value	Seller Cost
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

Typically, trading proceeds briskly and few students are inclined to wait and watch the record of trades on the blackboard. There is an early flurry of trade and then trading activity comes to a halt (usually within 5 minutes

³Some instructors may find it convenient to designate an area of the classroom as a “trading pit” and ask students to come to this area to make trades.

for a class of 50 students). In the first round of Session 1, there may be a few students who don't yet get it and who haven't been able to make a trade, even though opportunities for profitable trades are still available. Occasionally, after all other transactions have been recorded, two persons may be "deadlocked" in an argument about the price. If this seems to be taking too much time, you may want to call the attention of other students to this impasse. Someone will probably make a competing offer, leading to a quick conclusion of trading. When trading has stopped, you should declare that this round of trading is over. Because this is an entirely new experience to students, Round 1 of Session 1 will probably take twice as long as future sessions.

After Trade Stops

After trading stops, calculate (at least approximately) the average price of trades made in Round 1 and report this information to the class. Then staple together all of the sales contracts collected from Round 1, stacked roughly in the order that you collected them.

After the round is over, ask the students to look at the list of transactions and see whether anyone lost money in trading.⁴ If they find such a transaction, point out that nobody needs to make a money-losing trade, since one can always get a zero profit by not trading. Before starting another round, ask the students to think about whether, in the light of the information about trading prices in the first round, they could have found a better deal than they did in the first round.

First Session—Later Round(s)

When the first round of trading is completed, the market manager should ask students again if they have any questions about the rules of trading. The market manager should now tell students that they are going to try the same market again, and that everyone will play the same market role as they did in the first session, but that this time they will have some experience in the market, and therefore may have a better idea of what choices to make. Ask those who made trades to compare the price they paid or received to the average price in Round 1.

⁴Since the record on the blackboard lists only prices, Buyer Values, and Seller Costs, you can determine this without identifying (and embarrassing) the person who made the loss.

Before you begin Round 2, emphasize that this is a second round of the *first* session and *not a new session*. Buyer Values and Seller Costs in this second round remain the same as they were in the first round of the session. Repeat this reminder at least one more time than you think is necessary. Most students hear you the first time. But you want to catch the ones who didn't. Tell students to begin Round 2.

Depending on time available and the extent to which prices seem to be converging to the predicted competitive price, the instructor may want to run more than two rounds. In classroom experiments, there is always a tradeoff between scientific accuracy and efficient use of the students' time. You will usually get closer convergence to competitive equilibrium outcomes if you run more rounds of a session, but students are likely to be bored by too many repetitions. After the market manager has declared that the round just completed is the last round of the current session, students should copy the record of transactions for the round into the table provided in their lab reports for the Last Round of the current session.

Session 2

At the beginning of Session 2, the market manager should remind students that they must now look at their Personal Information Sheets to determine the roles that they will play in Session 2. This is also a good time to ask whether students have any more questions about the workings of this market experiment.

Distribution of Supplier and Demander Types

After both sessions of the experiment are completed, remember to report the number of buyers and sellers of each type, since students will need this information in order to complete their homework. If you recorded the number of complete six-packs that you distributed and the type of the last sheet passed out, you can use Tables 1.1 and 1.2 to find the number of buyers and sellers of each type who participated in Sessions 1 and 2. Then you can write this information on the blackboard in a form similar to Table 1.4. Alternatively, if you collect all of the personal information sheets after class, you can use this information to find the number of participants of each type who participated in each session. You can then post the number of buyers and sellers of each type.⁵

⁵We have found it useful to tell students that they will receive credit for attending the class only if they sign their names or ID numbers on their personal information sheets and

Table 1.4: Distribution of Types

Type of Trader	Number in Session 1	Number in Session 2
Low-Cost Supplier (SC=\$10)		
High-Cost Supplier (SC=\$30)		
High-Value Demander (BV=\$20)		
Low-Value Demander (BV=\$40)		

It is possible, in principle, to determine the distribution of agent types by asking buyers and sellers of each type in turn to raise their hands, but our experience is that hand-raising surveys are often time-consuming and confusing. Perhaps as revenge for the tedium they have endured in high school, students are remarkably adept at subverting hand counts. Some are likely to be daydreaming at the time you ask for a show of hands, some raise their hand at the wrong time, and some are able to suspend their arms in an indecipherable position halfway between up and down.

Predictions of the Competitive Model

The numbers of demanders and suppliers of each type in a class of 30 are recorded in Table 1.5. In Figures 1.1 and 1.2, we draw the supply and demand curves for a class of 30 students.

Table 1.5: Buyer Values and Seller Costs in a Class of 30

Type	Session 1	Session 2
Low-Cost Supplier	10	5
High-Cost Supplier	5	10
High-Value Demander	5	10
Low-Value Demander	10	5

The demand and supply curves that apply to the experimental market in your class will, of course, depend on the number of students in your

turn them in at the end of the class. In case any confusion arises during class about the number and types of information sheets passed out, you can use the turned-in sheets to verify this information. You can also use these sheets to check the actual Buyer Value or Seller Cost of any student who turns in a Sales Contract that seems to be muddled.

Figure 1.1: Supply and Demand in Session 1

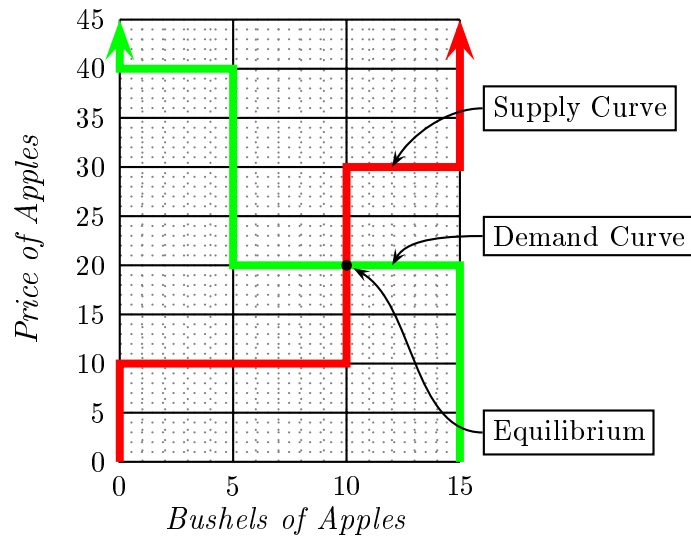
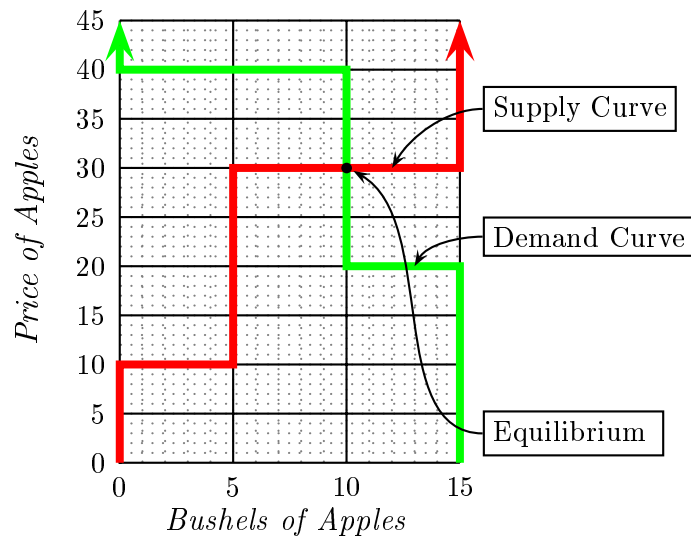


Figure 1.2: Supply and Demand in Session 2



class. In their home work exercises, students are asked to draw supply and demand curves that apply to their own classroom experiment. Although the competitive equilibrium predictions of quantities will depend on the size of your class, the “qualitative” nature of equilibrium will be similar for all classes of 10 or more students. For all classes larger than 10, the competitive equilibrium price will be \$20 per bushel in Session 1 and \$30 per bushel in Session 2. In Session 1, in competitive equilibrium, all of the low-cost suppliers and none of the high-cost suppliers sell apples, while all of the high-value demanders and some of the low-value demanders buy apples. In Session 2, in competitive equilibrium, all of the high-value demanders and none of the low-value demanders buy apples, while all of the low-cost suppliers and some of the high-cost suppliers sell apples.

Report 1.R

The Apple Market Experiment

Our first experience with running the apple market experiment was at the University of Michigan in Winter 1995. Neither the instructor nor the students had previous experience with this kind of experiment. A total of 27 students participated. The experiment ran smoothly in just under 50 minutes and the results after two rounds of each session were strikingly close to competitive predictions.

Distribution of Types of Agents

Session 1

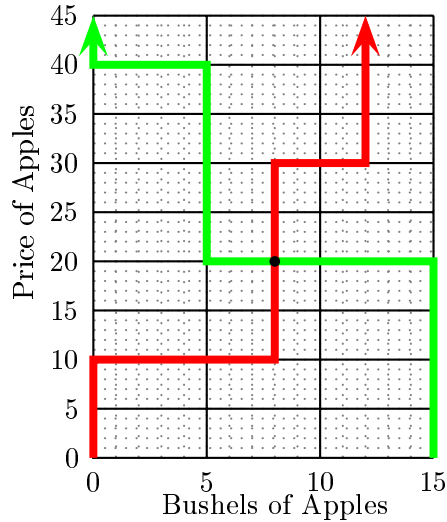
The number of students of each type who participated in Session 1 of this experiment is given by Table 1.R.1.

Table 1.R.1: Number and Types of Agents—Session 1

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier	8	█	10
High-Cost Supplier	4	█	30
High-Value Demander	5	40	█
Low-Value Demander	10	20	█

Figure 1.R.1 shows the competitive supply and demand curves that apply in this market environment.

Figure 1.R.1: Supply and Demand—Session 1



Competitive equilibrium theory predicts that in this session the price will be \$20 and there will be 8 transactions. In competitive equilibrium, all 8 of the low-cost suppliers sell apples and none of the high-cost suppliers sell any apples. In equilibrium, all 5 of the high-value demanders buy apples and 3 of the low-value demanders also buy apples.

Session 2

The number of students of each type who participated in Session 2 of this experiment is given in Table 1.R.2.

Table 1.R.2: Number and Types of Agents–Session 2

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier	5	█	10
High-Cost Supplier	9	█	30
High-Value Demander	9	40	█
Low-Value Demander	4	20	█

Figure 1.R.2: Supply and Demand –Session 2

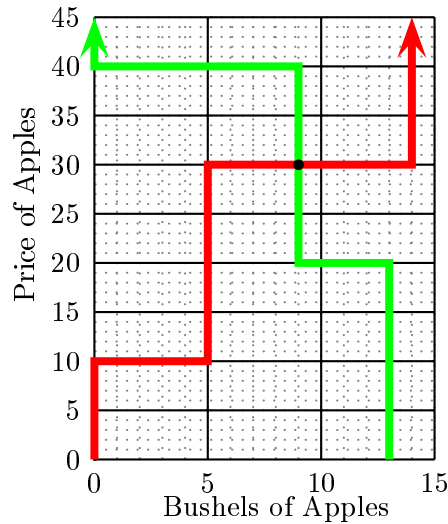


Figure 1.R.2 shows the competitive equilibrium supply and demand curves for Session 2. In competitive equilibrium for Session 2, the price is \$30 and there are 9 transactions.

Experimental Results

Session 1

Tables 1.R.3 and 1.R.4 record the transactions that took place in the two rounds of Session 1.¹

¹Although students are required only to record the results of the last session of each round, here we report the results of both rounds of each session.

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Table 1.R.3: Record of Transactions—Session 1, Round 1

Trade	Price	Buyer's Value	Seller's Cost
1	29	40	10
2	20	40	10
3	32	40	30
4	18	20	10
5	20	20	10
6	15	20	10
7	18	40	10
8	35	40	30
9	19.75	20	10
10	19.75	20	10

Table 1.R.4: Record of Transactions—Session 1, Round 2

Trade	Price	Buyer's Value	Seller's Cost
1	19	20	10
2	25	40	10
3	18	20	10
4	25	40	10
5	21	40	10
6	15	20	10
7	19	20	10
8	19.5	20	10
9	35	40	30
10	30.01	40	30

Session 2

Tables 1.R.5 and 1.R.6 record the transactions that were made in the two rounds of Session 2.

Table 1.R.5: Record of Trades—Session 2, Round 1

Trade	Price	Buyer's Value	Seller's Cost
1	30	40	10
2	20	40	10
3	32	40	30
4	35	40	30
5	24	40	10
6	20	40	10
7	32	40	30
8	30.75	40	30
9	18	20	10
10	32	40	30

Table 1.R.6: Record of Trades—Session 2, Round 2

Trade	Price	Buyer's Value	Seller's Cost
1	30	40	10
2	21	40	10
3	25	40	10
4	30.5	40	30
5	31	40	30
6	20	40	10
7	32	40	30
8	26	40	10
9	30.01	40	30

Comparing Theory and Experiment

Tables 1.R.7 and 1.R.8 compare the competitive equilibrium predictions with the actual experimental outcomes for the two sessions. In both sessions

prices were close to the predicted levels. In Session 2 the average prices deviated a bit more from equilibrium than they did in Session 1. (Students may have anchored their price expectations on the outcome of Session 1, which might account for the size and direction of the deviation.) In both sessions the actual quantity sold was slightly higher than the competitive equilibrium prediction.

The “efficiency” of a market is defined as the percent of the maximum possible profits actually earned by the traders. Since the maximum possible profits are given by the total profits in competitive equilibrium, the efficiencies of the last round of the two sessions were 89% (160/180) and 95% (180/190) respectively. It is impressive to see how this higgledy-piggledy market organized trading so as to realize a very high percentage of the potential gains from trade.

Table 1.R.7: Predictions and Outcomes in Session 1

	Competitive Prediction	Outcome Round 1	Outcome Round 2
Average Price	20	21.9	20.3
No. Low Cost Sellers	8	8	8
No. High Cost Sellers	0	2	2
No. High Value Buyers	5	5	5
No. Low Value Buyers	3	5	5
Number of Transactions	8	10	10
Total Profits	\$180	\$160	\$160

Table 1.R.8: Predictions and Outcomes in Session 2

	Competitive Prediction	Outcome Round 1	Outcome Round 2
Average Price	30	27.1	27.6
No. Low Cost Sellers	5	5	5
No. High Cost Sellers	4	4	5
No. High Value Buyers	9	9	9
No. Low Value Buyers	0	0	1
Number of Trades	9	9	10
Total Profits	\$190	\$190	\$180

Related Experimental Literature

The apple-market experiment is essentially the same as that used by Professor E.H. Chamberlin [1] in experiments run in his Harvard classroom, 50 years ago. These experiments stimulated Vernon Smith [2] to develop a whole new area of applied economics, based on experimental markets in the laboratory. Smith describes his inspiration for this work in a delightful passage of an essay “Experimental Economics at Purdue,” which can be found in *Papers in Experimental Economics* [3].

“Experimental economics started at Purdue in the late fall of 1955 . . . I had insomnia one night, and for reasons that entirely escape me, in the dead of night I found myself thinking about the classroom experiment that Ed Chamberlin used to perform with the Harvard graduate students to ‘prove’ the impossibility of perfect competition. I didn’t take Chamberlin’s course, . . . but I did observe and participate in Ed Chamberlin’s little ‘experiment.’ The scuttlebutt among the Harvard graduate students was that the whole exercise was sort of silly . . .

So there I was, wide-awake at 3 a.m., thinking about Chamberlin’s ‘silly’ experiment. He gave each buyer a card with a maximum buying price for a single unit, and each seller a card with a minimum selling price for one unit. All of us were instructed just to circulate in the room, engage a buyer (or seller), negotiate a contract, or go on to find another buyer (or seller) and so on. If a buyer and a seller made a contract, they were to come to Chamberlin, reveal the price of the exchange, turn in their cards, and he would post the price on the blackboard for all to see. When it was all over, he would reveal the implicit supply and demand schedules, and we would learn the important lesson that supply and demand theory was worthless in explaining what had happened; namely that prices were not near the equilibrium, and neither was the quantity exchanged.

The thought occurred to me that the idea of doing an experiment was right, but what was wrong was that if you were going to show that competitive equilibrium was not realizable . . . you should choose an institution of exchange that might be more favorable to yielding competitive equilibrium. Then when such an equilibrium failed to be approached, you would have a more powerful result. This led to two ideas: (1) . . . why not use

the double oral auction procedure, used on the stock and commodity exchanges? ... (2) ... why not conduct the experiment in a sequence of trading 'days' in which supply and demand were renewed to yield functions that were daily flows?...

The following January, I carried through my insomniacal plan. ... I am still recovering from the shock of the experimental results. The outcome was unbelievably consistent with competitive price theory. If these results are to be believed, what was being knocked down was Chamberlin's hypothesis of the unattainability of supply-and-demand theory. But the results *can't* be believed, I thought. It must be an accident, so I will take another class and do a new experiment with different supply-and-demand schedules.

In a series of carefully controlled laboratory experiments, Smith found that with a wide variety of shapes of supply and demand curves, the outcomes of the experiments are strikingly close to those predicted by supply-and-demand theory, usually by the second or third round of trading within a session. The papers describing this work have been collected and published in [3].

Our apple-market experiment differs from those of Chamberlin and Smith in having only two types of demanders and two types of suppliers, rather than "staircase" demand and supply curves with several types of demanders and suppliers. We follow Chamberlin, rather than Smith, in conducting the experiment in a trading-pit environment rather than a double-oral auction mediated by an auctioneer. We follow Smith, rather than Chamberlin, in running more than one round of trading with the same Buyer Values and Seller Costs .

Bibliography

- [1] E. H. Chamberlin. An experimental imperfect market. *Journal of Political Economy*, 56(2):95–108, April 1948.
- [2] Vernon Smith. An experimental study of competitive market behavior. *Journal of Political Economy*, 70(2):111–137, April 1962.
- [3] Vernon L. Smith. *Papers in Experimental Economics*. Cambridge University Press, Cambridge, 1991.

Experiment 1.S

Personal Information Sheets and Sales Contract: The Apple Market

There are six different kinds of personal information sheets for this experiment. You should photocopy enough copies so that each student gets one sheet. In each session there are four types of agents—two types of suppliers and two types of demanders. We have prepared six different types of personal information sheets, labeled as A, B, C, D, E, and F. Make up enough “six-packs” of sheets, containing one sheet of each of the six types, so that you have at least one sheet for every student who might possibly come to class. Distribute as many complete six-packs as you can and then pass out the top sheets from the last six-pack until everyone has a sheet. Make a note of the number of six-packs and the type of the last sheet you distribute.

You will also need a stack of sales contracts, which can be photocopied from the originals included in this manual. You should have at least two sales contracts for each student in the class. (These are printed three contracts to a page, so the sales contract pages must be cut apart before class.) If you make extras they will not go to waste, since the same kind of sales contracts will be used in several other experiments.

TYPE A

Student ID Number _____

The Apple Market

Personal Information Sheet

Please hand this sheet in at the end of the session.

Session 1

In this trading session you are an *Apple Demander*. Your *Buyer Value* is \$40. If you buy a bushel of apples for price $\$P$, your profit is $\$40 - P$. If you don't buy any apples, your profit is 0.

In the table below, if you bought apples, record the price that you paid and calculate your profits. If you did not buy any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Buyer Value	40	40	40
(2) Price Paid			
Profit (= Line (1)–Line (2))			

Session 2

In this trading session you are an *Apple Supplier*. Your *Seller Cost* is \$30. If you sell a bushel of apples for price $\$P$, your profit is $\$P - 30$. If you don't sell any apples, your profit is 0.

In the table below, if you sold apples, record the price at which you sold your apples and calculate the profit you made. If you did not sell any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Price Received			
(2) Seller Cost	30	30	30
Profit (=Line (1)–Line (2))			

TYPE B

Student ID Number _____

The Apple Market

Personal Information Sheet

Please hand this sheet in at the end of the session.

Session 1

In this trading session you are an *Apple Demander*. Your *Buyer Value* is \$20. If you buy a bushel of apples for price P , your profit is $20 - P$. If you don't buy any apples, your profit is 0.

In the table below, if you bought apples, record the price that you paid and calculate your profits. If you did not buy any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Buyer Value	20	20	20
(2) Price Paid			
Profit (= Line (1)–Line (2))			

Session 2

In this trading session you are an *Apple Supplier*. Your *Seller Cost* is \$10. If you sell a bushel of apples for price P , your profit is $P - 10$. If you don't sell any apples, your profit is 0.

In the table below, if you sold apples, record the price at which you sold your apples and calculate the profit you made. If you did not sell any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Price Received			
(2) Seller Cost	10	10	10
Profit (=Line (1)–Line (2))			

TYPE C

Student ID Number _____

The Apple Market

Personal Information Sheet

Please hand this sheet in at the end of the session.

Session 1

In this trading session you are an *Apple Demander*. Your *Buyer Value* is \$20. If you buy a bushel of apples for price P , your profit is $20 - P$. If you don't buy any apples, your profit is 0.

In the table below, if you bought apples, record the price that you paid and calculate your profits. If you did not buy any apples, mark an X for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Buyer Value	20	20	20
(2) Price Paid			
Profit (= Line (1)–Line (2))			

Session 2

In this trading session you are an *Apple Demander*. Your *Buyer Value* is \$40. If you buy a bushel of apples for price P , your profit is $40 - P$. If you don't buy any apples, your profit is 0.

In the table below, if you bought apples, record the price that you paid and calculate your profits. If you did not buy any apples, mark an X for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Buyer Value	40	40	40
(2) Price Paid			
Profit (= Line (1)–Line (2))			

TYPE D

Student ID Number _____

The Apple Market

Personal Information Sheet

Please hand this sheet in at the end of the session.

Session 1

In this trading session you are an *Apple Supplier*. Your *Seller Cost* is \$10. If you sell a bushel of apples for price $\$P$, your profit is $\$P - 10$. If you don't sell any apples, your profit is 0.

In the table below, if you sold apples, record the price at which you sold your apples and calculate the profit you made. If you did not sell any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Price Received			
(2) Seller Cost	10	10	10
Profit (=Line (1)–Line (2))			

Session 2

In this trading session you are an *Apple Demander*. Your *Buyer Value* is \$20. If you buy a bushel of apples for price $\$P$, your profit is $\$20 - P$. If you don't buy any apples, your profit is 0.

In the table below, if you bought apples, record the price that you paid and calculate your profits. If you did not buy any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Buyer Value	20	20	20
(2) Price Paid			
Profit (= Line (1)–Line (2))			

TYPE E

Student ID Number _____

The Apple Market

Personal Information Sheet

Please hand this sheet in at the end of the session.

Session 1

In this trading session you are an *Apple Supplier*. Your *Seller Cost* is \$30. If you sell a bushel of apples for price $\$P$, your profit is $\$P - 30$. If you don't sell any apples, your profit is 0.

In the table below, if you sold apples, record the price at which you sold your apples and calculate the profit you made. If you did not sell any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Price Received			
(2) Seller Cost	30	30	30
Profit (=Line (1)–Line (2))			

Session 2

In this trading session you are an *Apple Demander*. Your *Buyer Value* is \$40. If you buy a bushel of apples for price $\$P$, your profit is $\$40 - P$. If you don't buy any apples, your profit is 0.

In the table below, if you bought apples, record the price that you paid and calculate your profits. If you did not buy any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Buyer Value	40	40	40
(2) Price Paid			
Profit (= Line (1)–Line (2))			

TYPE F

Student ID Number _____

The Apple Market

Personal Information Sheet

Please hand this sheet in at the end of the session.

Session 1

In this trading session you are an *Apple Supplier*. Your *Seller Cost* is \$10. If you sell a bushel of apples for price $\$P$, your profit is $\$P - 10$. If you don't sell any apples, your profit is 0.

In the table below, if you sold apples, record the price at which you sold your apples and calculate the profit you made. If you did not sell any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Price Received			
(2) Seller Cost	10	10	10
Profit (=Line (1)–Line (2))			

Session 2

In this trading session you are an *Apple Supplier*. Your *Seller Cost* is \$30. If you sell a bushel of apples for price $\$P$, your profit is $\$P - 30$. If you don't sell any apples, your profit is 0.

In the table below, if you sold apples, record the price at which you sold your apples and calculate the profit you made. If you did not sell any apples, mark an *X* for Price and record a Profit of 0.

Record of Prices and Profits

	Round 1	Round 2	Round 3
(1) Price Received			
(2) Seller Cost	30	30	30
Profit (=Line (1)–Line (2))			

Sales Contract

Price _____

Buyer Value _____

Seller Cost _____

Session _____

Buyer's ID _____

Seller's ID _____

Round _____

Sales Contract

Price _____

Buyer Value _____

Seller Cost _____

Session _____

Buyer's ID _____

Seller's ID _____

Round _____

Sales Contract

Price _____

Buyer Value _____

Seller Cost _____

Session _____

Buyer's ID _____

Seller's ID _____

Round _____