Experiment 1

Supply and Demand: The Apple Market

Objectives of This Experiment

In this experiment we expect that students will achieve the following:

- Become acquainted with the mechanics of a simple trading-pit environment.
- Learn to record experimental data and make simple statistical calculations with it.
- Learn to apply the concepts of competitive supply and demand to a very simple market.
- Learn to draw supply and demand curves corresponding to given market data, and to read market data from given supply and demand curves.
- Learn to compare results in an experimental market with the theoretical predictions of the competitive model.
- Begin to understand the benefit of having an abstract *theory* for predicting the effects of changes in the environment.
- Learn to test a proposed theory by confronting it with experimental data.

General Discussion

Students are given Personal Information Sheets that tell them their roles as suppliers or demanders in each of the two sessions of this experiment. In every round of trading, a supplier can sell either one bushel or none, and a demander can buy either one bushel or none.

In each round, suppliers and demanders are asked to move around the room and try to make a deal by agreeing on a price. A seller with Seller Cost $\$C$ who sells a bushel of apples for price $\$P$ will get profits of $\$P - \$C$, and a buyer with Buyer Value $\$V$ who buys a bushel of apples at price $\$P$ will get profits of $\$V - \$P$. When a demander and a supplier agree on a price, they must fill out a *sales contract* and deliver it to the *market manager* (the instructor or teaching assistant). As each contract is turned in, the market manager records the price, Buyer Value, and Seller Cost on the blackboard.

Detailed Instructions and Comments

Student preparation

If it is convenient, encourage students to prepare for the experiment by reading the instructions and working the Warm-up exercises from their textbook before coming to class. Though prior preparation is helpful, it is not essential. We have often run this experiment successfully at the first class meeting.

Personal Information Sheets and Sales Contracts

Distributing Information Sheets

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, we suggest that you clip together "six-packs" of sheets, containing one of each of the six types. Make enough of these six-packs 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

[1] Since some roles are more profitable than others, the personal information sheets are arranged so that students who get very profitable roles in one session will have unprofitable 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.

has a sheet. Make a note of the number of complete six-packs and the type of the last sheet that you distributed.

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.

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.

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.

The Trading Process

When there are no further questions, tell the class that the first trading round has begun. Encourage students to get out of their seats and move

around the classroom to make deals.[2] 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 price that they agree on, the supplier's Seller Cost, and the demander's Buyer Value. 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, Seller Cost, and Buyer Value on the blackboard, using a format similar to Table 1.1. Students who have not yet transacted are thus able to observe the transaction prices as they are recorded.[3]

Table 1.1: Blackboard Record of Transactions

Trade	Price	Seller Cost	Buyer Value
1			
2			
3			
4			
5			
...			

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 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.

[2]Some 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.

[3]Our experience is that students don't look at these as much as one might expect.

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 you 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.

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. 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. Of course in this experiment, as in future experiments, the instructor must realize that there is a tradeoff between scientific accuracy and the efficient use of students' time. More rounds per session are likely to result in prices that converge more closely to competitive equilibrium prices, but running several rounds with the same old setup is

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

likely to bore the students.

If this is a relatively small class, you can ask students to copy the record of transactions for the last round of this session into the appropriate table in the Lab Notes found in their textbooks. If this is a large class, it will be more convenient for the students if you wait until after class to record the results from the sales contracts and either post the results on the Internet or make them available in some other way.

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 Types

After both sessions of the experiment have been completed, you should report the number of buyers and sellers of each type in a table similar to Table Q.1.4. This may be written on the blackboard for students to copy or posted somewhere so that students can record this information at a later time.

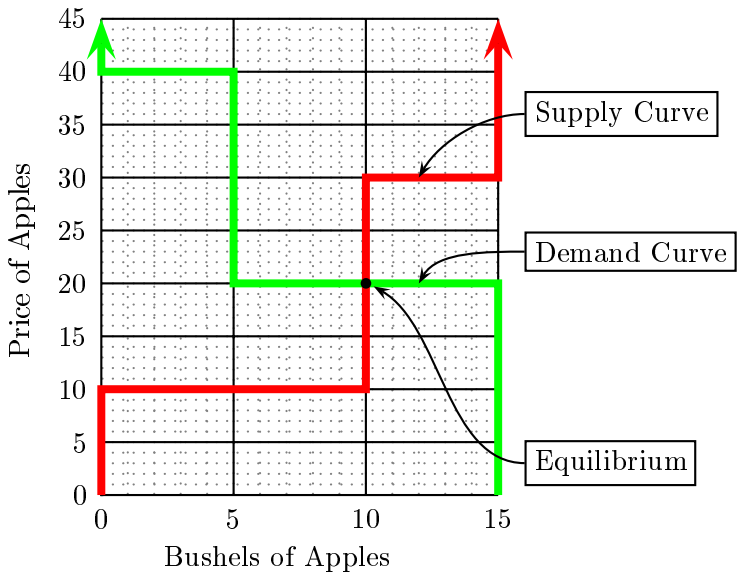
In the Quick Start section of these instructions, you will find tables that show the number of suppliers and demanders with each Buyer Value, given the number of complete six-packs distributed and the type of the last sheet handed out.

Predictions of the Competitive Model

Supply and Demand Curves

Figures 1.1 and 1.2 show the supply and demand curves for each of the two sessions for a class of 30 students. In Session 1, there are twice as many low-cost as high-cost suppliers and twice as many low-value demanders as high-value demanders. In Session 2, the proportions are reversed for both suppliers and demanders. Although the numbers of demanders and suppliers of each type in your class are unlikely to be exactly the same as those shown here, the proportions will be similar enough so that the important qualitative features of competitive equilibrium will be the same.[5]

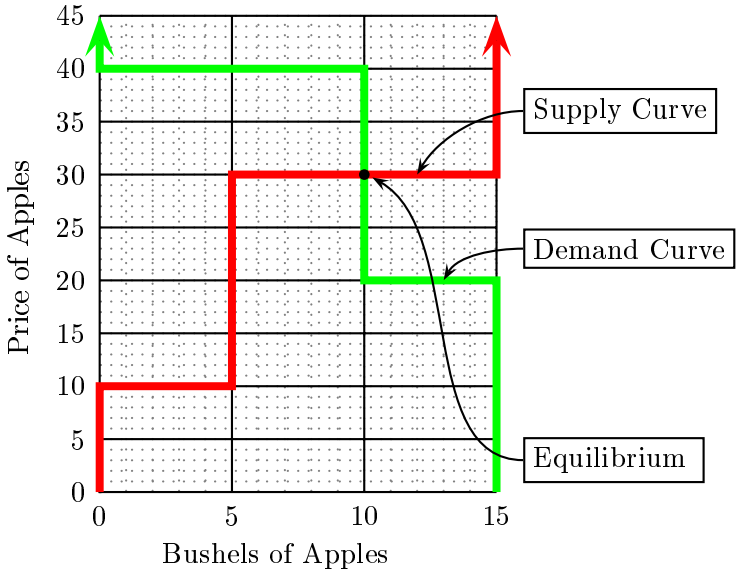
Figure 1.1: Supply and Demand in Session 1



The equilibrium price is $20 in the first round and $30 in the second. In equilibrium for the first round, all of the low-cost suppliers and none of the high-cost suppliers will sell apples. All of the high-value and some of the low-value demanders will buy apples. In equilbrium for the second round, all of the low-cost and some of the high-cost suppliers will sell apples. All of the high-value and none of the low-value demanders will buy apples.

[5]Students will be asked as part of their homework to draw the actual supply and demand curves, given the numbers of suppliers and demanders of each type in their classroom experiment.

Figure 1.2: Supply and Demand in Session 2



Quick Start for Experiment 1: The Apple Market

We have found that when we go to class, it is nice to have a set of capsule instructions to use as a quick reminder of what happens next. We also like to have information at our fingertips about how to calculate the distribution of Sellers Costs and Buyer Values.

This section also contains copies of the Personal Information Sheets and sales contracts and detailed instructions about how many to photocopy and bring to class.

Capsule Instructions: The Apple Market

- 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.
- Work through the Warm-up Exercises. Ask if students have any questions.
- Begin Session 1.
  - Open trading in Round 1. As completed Sales Contracts are turned in, record price, Seller Cost, and Buyer Value on the blackboard.
  - Discuss results of Round 1. Point out any trades where one party took a loss. Estimate average of recorded prices. Ask students who paid more or sold for less than average to think about whether they could hold out for a better price in the next round.
  - Ask if students have any questions about rules or procedures.
  - Before the second round starts, remind students that they are still in Session 1. (If you don't emphasize this, someone is likely to use the Session 2 information in this round.)
  - Open trading in Round 2. As completed Sales Contracts are turned in, record price, Seller Cost, and Buyer Value on the blackboard.*
- 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, Seller Cost, and Buyer Value on the blackboard.
  - Discuss results of Round 1.
  - Open trading in Round 2. As completed Sales Contracts are turned in, record price, Seller Cost, and Buyer Value on the blackboard.*
- Announce the distribution of Buyer Values and Seller Costs for each session.*
- Collect Personal Information Sheets from all traders.

The items marked * denote data that students should copy into their lab notes, either during class or from information that the instructor will post after class.

Distribution of Types

Record the following information after you distribute the P.I. sheets:

Number of complete six-packs distributed (=N) _____

Type of Last P.I. sheet distributed _____

Use this information and Tables Q.1.2 and Q.1.3 to determine the number of suppliers and demanders of each type present in the classroom. After trading is over, post the results in a table like Table Q.1.4

Table Q.1.2: 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 Q.1.3: 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

Table Q.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=$40)		
Low-Value Demander (BV=$20)		

What to Post for Students' Lab Notes

In order to do their homework, students will need the following information:

- For the last round of each session, a list of the price, the seller's Seller Cost, and the buyer's Buyer Value in each transaction. Students should enter this information in Tables 1.4 and 1.5 of their Lab Notes.[6]
- The information that you entered in Table Q.1.4 on the distribution of Buyer Values and Seller Costs. Students should copy this into Tables 1.6 and 1.7 of their Lab Notes.[7]

[6] It is nice, but not essential, for this information to be entered in the order in which the sales contracts were turned in. In small classes, this information can be copied from the blackboard. In large classes, it is often preferable to stack the sales contracts from each session and use them later to prepare these lists for posting after class.

[7] If there was any confusion or chaos in the distribution of sheets, you can recalculate these distributions by collecting all of the Personal Information sheets after class and determining the distribution of Buyer Values and Seller Costs from the number of sheets of each type that were turned in.

Materials to Be Photocopied

Personal Information Sheets

We have prepared six different types of personal information sheets, labeled A, B, C, D, E, and F. You should photocopy enough copies so that each student gets one sheet. To ensure that you distribute nearly equal numbers of each type of personal information sheets, we suggest that you make up "six-packs" of these sheets, containing one sheet of each of the six types. 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.

Sales Contracts

You will also need a stack of sales contracts, which can be photocopied from the originals included here. You should have about three sales contracts for each student in the class. (These are printed three contracts to a page, so the pages should be cut in three before class.) If you make extras, they will not go to waste, since the same kind of sales contracts can be used in 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.

If you bought apples, record the price you paid and the profit you made in the table below. If you did not buy any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2
Price Paid		
Profit ($= \$40 - P$)		

.....

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.

If you sold apples, record the price and the profit you made in the table below. If you did not sell any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2	Round 3
Price Received			
Profit ($=P - \$30$)			

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.

If you bought apples, record the price you paid and the profit you made in the table below. If you did not buy any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2
Price Paid		
Profit ($= \$20 - P$)		

.....

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.

If you sold apples, record the price and the profit you made in the table below. If you did not sell any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2	Round 3
Price Received			
Profit ($=P - \$10$)			

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.

If you bought apples, record the price you paid and the profit you made in the table below. If you did not buy any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2
Price Paid		
Profit ($= \$20 - P$)		

.....

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.

If you bought apples, record the price you paid and the profit you made in the table below. If you did not buy any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2	Round 3
Price Paid			
Profit ($= \$40 - P$)			

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.

If you sold apples, record the price and the profit you made in the table below. If you did not sell any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2
Price Received		
Profit ($=P-\$10$)		

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.

If you bought apples, record the price you paid and the profit you made in the table below. If you did not buy any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2	Round 3
Price Paid			
Profit ($= \$20-P$)			

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.

If you sold apples, record the price and the profit you made in the table below. If you did not sell any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2
Price Received		
Profit ($=P-\$30$)		

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.

If you bought apples, record the price you paid and the profit you made in the table below. If you did not buy any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2	Round 3
Price Paid			
Profit ($= \$40-P$)			

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.

If you sold apples, record the price and the profit you made in the table below. If you did not sell any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2
Price Received		
Profit ($=P-\$10$)		

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.

If you sold apples, record the price and the profit you made in the table below. If you did not sell any apples, mark an X under Price and 0 under Profit.

Record of Prices and Profits

	Round 1	Round 2	Round 3
Price Received			
Profit ($=P-\$30$)			

Sales Contract: *Session* _____ *Round* _____

Price _____

Seller's ID _____ *Seller Cost* _____

Buyer's ID _____ *Buyer Value*_____

Sales Contract: *Session* _____ *Round* _____

Price _____

Seller's ID _____ *Seller Cost* _____

Buyer's ID _____ *Buyer Value*_____

Sales Contract: *Session* _____ *Round* _____

Price _____

Seller's ID _____ *Seller Cost* _____

Buyer's ID _____ *Buyer Value*_____