The Apple Market

A Sample Chapter from

Experiments with Economics Principles

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A Market Experiment

This experiment and discussion is a shortened version of the first chapter of our book *Experiments with Economic Principles*, published by McGraw Hill. The experiment runs smoothly in classes ranging from 12-70 students. You can run the experiment in larger classes, by organizing students into teams or by having some students observe and others participate. In a large introductory lecture with recitation sections, you can have the teaching assistants run the experiment in section meetings.

In this experiment, students get a first-hand experience of the forces of supply and demand in a small working market. They are asked to record the data from this market and to complete a "lab report." After students have done the market experiment and completed their lab reports, they should read the discussion section, which introduces the theory of competitive markets. This section explains how to draw "supply and demand curves" corresponding to the classroom market and how to use these curves to predict equilibrium prices and quantities. Having observed the experimental outcomes and the predictions made by the theory of competitive markets, they can evaluate the performance of the theory by comparing the actual outcomes in the experimental market with the predictions of the theory. The final part of the chapter has some "Home Work" that guides this comparison.

We are distributing this chapter because we hope to persuade you to use more of our experiments in future classes. *Experiments with Economic Principles* includes thirteen experiments intended to help students to absorb fundamental economic ideas. Among the topics treated are sales taxes, prohibition, minimum wages, monopoly, entry and exit, externalities, information, bargaining, comparative advantage, and auctions. You can order the entire book to use as a free-standing text or as a supplement to your current text, or if you want to run only a few experiments from the book, you can also order a custom-printed text that includes only the experiments of your choice. We believe you will find that classroom experiments are a powerful way to show students how economics can help them understand the way that markets work. 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 that they learned a lot.

In addition to providing copies of this experiment to your students, McGraw-Hill will send you a copy of the first chapter from our Instructor’s Manual. We urge you to look at the Instructor’s Manual for detailed instructions on conducting this experiment. The Manual also contains copies of the Personal Information Sheets which you need to photocopy and distribute to the class.

We have also set up a world wide web site where you can find more resources to be used in teaching this course, including links to class Web pages of several instructors who are using the text, an archive of news clippings related to our experiments, a discussion forum for users, and an archive of results of previously conducted in-class experiments. The address of the web site is http://zia.hss.cmu.edu/miller/eep/eep.html.

Experiment 1

Supply and Demand

An Apple Market

It is a sunny Saturday morning at the Farmers' Apple Market. You and your classmates have come to the Market to buy and sell apples. Your objective is to make as much profit as possible.

Buying and Selling

At the beginning of today's class, you will be given a personal information sheet that indicates whether you are a **supplier** or a **demander** in the market.

If you are a supplier, you may be able to make money by selling a bushel of apples to one of your classmates. You will find your **Seller Cost** for a bushel of apples listed on your personal information sheet. If you sell a bushel of apples for a price $\$P$, and your Seller Cost is \$C, then your **profit** is the difference, $\$P - \$C$. If you don't sell any apples, your profit is zero. Sometimes you may not find a demander who is willing to pay you as much as your Seller Cost. If this is the case, you are better off not selling your apples and taking zero profits rather than selling for a loss.

Example:

> A supplier has a Seller Cost of \$10 and she has one bushel of apples which she can sell. If she sells her bushel of apples for a price of \$16, she will make a profit of \$16-\$10=\$6. If she sells her bushel for \$30, she will make a profit of \$30-\$10=\$20. If she sells her bushel for \$7, she will make a *loss* of \$3. If she does not sell, her profit is zero.

If you are a demander, you may be able to make money by buying a bushel of apples from one of your classmates. The **Buyer Value** for owning a bushel of apples is found on your personal information sheet. If you buy a bushel of apples, your profit (or loss) will be the difference between your Buyer Value and the price you pay for the apples. If your Buyer Value is $\$V$, and you buy a bushel of apples for a price $\$P$, your profit will be $\$V - \$P$. If you don't buy any apples, your profit is zero. If you cannot find a supplier who is willing to sell you a bushel of apples for your buyer value or less, then you are better off not buying any apples and taking zero profits.

Example:

> A demander has a Buyer Value of \$40. If he buys a bushel of apples for \$16, he will make a profit of \$40-\$16=\$24. If he buys a bushel of apples for \$30, he will make a profit of \$40-\$30=\$10. If he buys a bushel of apples for \$45, he will make a *loss* of \$5. If he doesn't buy any apples, his profit is zero.

To make a purchase or sale, first find somebody who might be willing to make a deal with you. Suppliers can only make deals with demanders and demanders can only make deals with suppliers. When a supplier meets a demander, they can negotiate about the price in any way they wish. You don't have to reveal your Seller Cost or Buyer Value to your bargaining partner, but you can if you want.

When a supplier (seller) and demander (buyer) reach agreement on a price, they should fill out a *sales contract* and bring it to the market manager. *Only one sales contract should be turned in for each sale.* The sales contract will record the seller's and buyer's names or identification numbers, the price at which the sale was made, and a few other details about the sale. As sales contracts are brought to the market manager, the sales prices will be written on the blackboard where everyone can see them.

When you have completed your transaction and turned in your sales contract, please return to your seat. **In any single round of trading, you are not allowed to buy or sell more than one bushel of apples, but you can choose not to trade if no profitable trades are available.**

Transactions, Rounds, and Sessions

A *transaction* is a single deal between a buyer and a seller and is completed when the buyer and seller give a filled-in sales contract to the market manager. A *round* of trading begins when the market manager declares trading to be open and ends when there are no more transactions to be made between willing buyers and sellers. A market *session* can include two or more *rounds* of trading. After the first round of trading is completed, we will often conduct one or more additional rounds within the same session. In later rounds of a session, everyone has the same Buyer Value or Seller Cost as in the first round. The reason that we sometimes have more than one round of trading in a session is that in later rounds, buyers and sellers know what happened in earlier rounds and may use this information to decide what prices to ask or offer. After a round of play is completed, you should look at the record of transactions on the blackboard to see whether you can expect to get a better price in the next round by seeking a new trading partner and/or by holding out for a more favorable price.

Your role as a buyer or seller and your Seller Cost and Buyer Value do not change as you move from one round to another within the same session. When you start a new session, you will have a new role, as described on your Personal Information Sheet.

Some Advice to Traders

Even if you are normally a shy person, let your "trading personality" be more flamboyant. Shrinking violets, though charming in many situations, are likely to miss profitable trading opportunities. To maximize your profits, you should approach trading aggressively. Don't be afraid to shout or gesture for attention. Let people know how much you are willing to pay or the price at which you are willing to sell. When you think that you could get a better price than someone offers you, do not hesitate to propose a price that you like better.

Remember that you don't have to deal with the first person you encounter. Different people have different Buyer Values and Seller Costs. If someone can't or won't offer you a favorable price, be ready to shop around for a better deal with someone else.

If you haven't yet made a trade, you should keep an eye on the prices of previous transactions that are posted on the blackboard. This may give you some idea of what price to demand or what price to offer in your own negotiations.

Keep in mind that you want to "Buy low, Sell high." Demanders make greater profits, the lower the price they have to pay for apples. Suppliers make greater profits, the higher the price they can get for their apples.

Remember that it is better to make no trade at all than to trade at a loss.

Warm-up Exercise

Suppose that a supplier with a Seller Cost of $20 meets a demander who has a Buyer Value of $40.

- If this supplier sells a bushel of apples to this demander for a price of $35, how much profit will the supplier make? ________ and how much profit would the demander make? ________ How much is the total profit obtained by both traders? (Find this by adding the buyer's profits to the seller's profits) ________
- What is the *highest* price of apples that would permit both the seller and the buyer to make a profit of $1 or more? ________ If this price is charged, how much is the sum of buyer's profits plus seller's profits? ________.
- What is the *lowest* price of apples that would permit both the seller and the buyer to make a profit of $1 or more? ________ At this price, how much is the sum of buyer's profits plus seller's profits? ________.

NAME ______________________ SECTION______

Lab Report–Experiment 1

Records of Market Transactions

What to record and calculate

Record *price*, the supplier's *Seller Cost*, and the demander's *Buyer Value* for each transaction in the last round of each of the two trading sessions on Tables L1.1 and L1.2. In these tables, calculate and record **seller's profit**, **buyer's profit**, and **total profit** for each transaction. For any transaction, the seller's profit is $P - C$, where P is the price and C is the seller's Seller Cost. The buyer's profit is $V - P$, where V is the buyer's Buyer Value and P is the price. Total profit in a transaction is the sum of the seller's profit and the buyer's profit.

You can use the information in Tables L1.1 and L1.2 to complete Tables L1.3, and L1.4, which summarize the results of the classroom experiment. Find the **mean** (average) price by adding all the prices posted during the round and dividing by the number of transactions.

After the close of each market session, the market manager will announce the distribution of suppliers' Seller Costs and demanders' Buyer Values of all the participants in the market (including those who did not trade as well as those who made trades). You should copy this information into Tables L1.5 and L1.6.

Table L1.1: Transactions in the Last Round of Session 1

Transaction	Price	Buyer Value	Seller Cost	Buyer's Profit	Seller's Profit	Total Profit
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Table L1.2: Transactions in the Last Round of Session 2

Transaction	Price	Buyer Value	Seller Cost	Buyer's Profit	Seller's Profit	Total Profit
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Table L1.3: Summary of Results in Session 1

Mean Price	
Number of Transactions	
Total Profits of All Buyers	
Total Profits of All Sellers	
Total Profits of All Traders	

Table L1.4: Summary of Results in Session 2

Mean Price	
Number of Transactions	
Total Profits of All Buyers	
Total Profits of All Sellers	
Total Profits of All Traders	

Table L1.5: Distribution of Types in Session 1

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier			
High-Cost Supplier			
High-Value Demander			
Low-Value Demander			

Table L1.6: Distribution of Types in Session 2

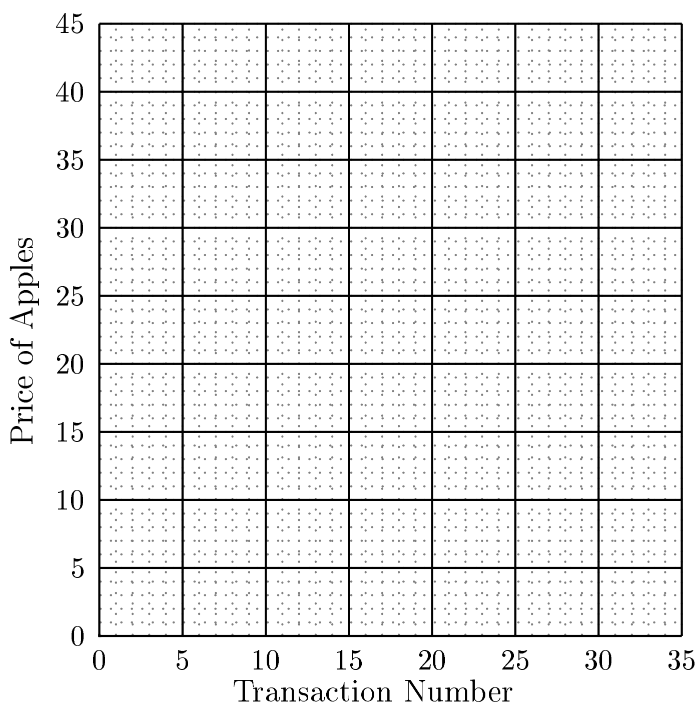
Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier			
High-Cost Supplier			
High-Value Demander			
Low-Value Demander			

Graphing the Time Sequence of Prices

When you are looking for logical patterns in a mass of numerical information, it is often useful to draw a graph. One way to present the results of the experiment is to show the transaction prices from Tables L1.3 and L1.4 on a graph, in the order in which they were recorded. This can be done by representing the price on the vertical axis and the order of the transaction on the horizontal axis. The axes for such a graph are drawn for you below.

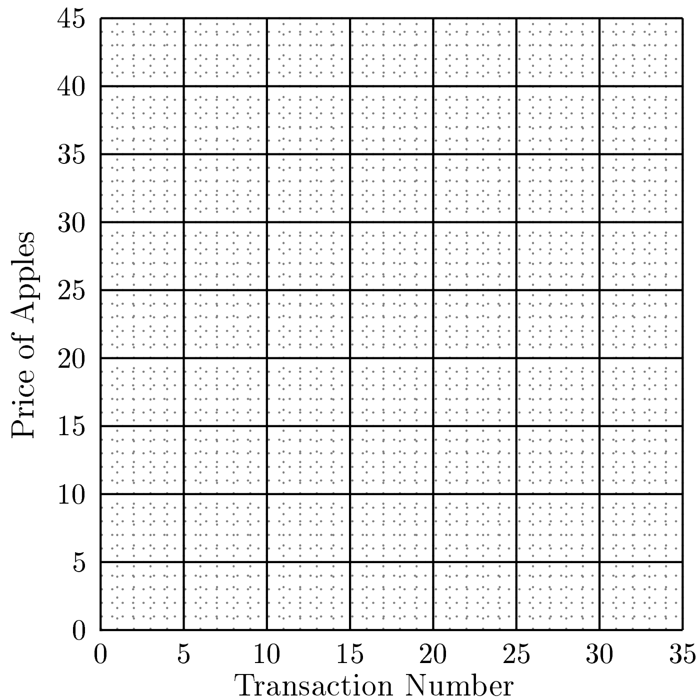
■ In Figures L1.1 and L1.2, plot the outcomes of the last round of each session. To make this plot, use the numbers that you entered in Tables L1.1 and L1.2. Plot the point $(1, P_1)$, where P_1 is the price in the first transaction.[1] Then plot the point $(2, P_2)$ where P_2 is the price in the second trade, and so on, plotting in sequence the price of each trade in the round. Now use a blue marker to draw a line connecting these marks.

Figure L1.1: Paths of Prices in Session 1



[1] The notation (X, Y) stands for the point on the graph that is located at a horizontal distance of X from the left side of the graph and at a vertical distance of Y from bottom of the graph.

Figure L1.2: Paths of Prices in Session 2



■ Which of the following is closest to the mean price in the last round of Session 1?

- The High-Cost Suppliers' Cost
- The Low-Cost Suppliers' Cost
- The High-Value Demanders' Value
- The Low-Value Demanders' Value

■ Which of the following is closest to the mean price in the last round of Session 2?

- The High-Cost Suppliers' Cost
- The Low-Cost Suppliers' Cost
- The High-Value Demanders' Value
- The Low-Value Demanders' Value

Discussion D1

Supply and Demand

In Search of a Theory

We have a mystery on our hands. In the Apple Market, prices seem to be closing in on certain values. But what determines the values to which prices converge?

It would be really nice to have a *theory* that predicts outcomes, not only for the specific market that we observed experimentally, but for a variety of markets under widely varying conditions. We would like a theory that allows us to answer questions like:

- If every supplier's Seller Cost increases by \$10, will the market price increase by exactly \$10, by less than \$10, or by more than \$10?

- Suppose that the government decides to pay \$10 to every person who buys a bushel of apples. Such a payment is called a **subsidy** to apple consumption. Will suppliers absorb some or all of the subsidy by increasing their prices, or will demanders get all of the benefits from the \$10 subsidy?

- If bad weather reduces the quantity of apples that each producer could supply, what will be the effect on the price of apples and what will happen to total revenue of suppliers?

Economists have just such a theory. It is known as **supply and demand theory**, or more formally as **competitive equilibrium theory**. This theory offers answers to the above questions and to many others. These answers are often quite useful and surprising. Of course, a theory that predicts market outcomes will not be much good if these predictions are badly wrong. Therefore it is important to see whether supply and demand theory does a good job of predicting the outcomes of our experiments. If the theory does well in these experimental environments and continues to do well as we add more elements of realism, then we can put some credence in its predictions for actual markets. If this simple theory does not perform well, then we must look for a better theory.

A Model of Competitive Markets

In our classroom experiment, particularly in the early rounds, some sellers were able to get higher prices for their apples than others. Some sellers were lucky enough to be offered a relatively high price by the first buyer they ran into. Similarly, some buyers were able to find a seller who would sell cheaply and others could only find sellers who insisted on a high price. Every participant in the market would like to get the best deal possible, but different participants will have different ideas about what is possible. To describe all market participants' beliefs about the prices at which they can trade and their luck about whom they meet would be an overwhelmingly complicated task, even for this simple market.

Instead of trying to describe this complex reality in full detail, let's try to make a simplified *model* of competitive markets. The art of good modeling in economics, as in all of science, is to find the "right" simplifications. The model should remove enough complication from the actual situation to allow us to analyze and predict outcomes, without removing so much reality that it seriously distorts our predictions about the way the market will behave. We are looking for a manageable model of markets that makes good predictions of the outcomes that we observe in experimental markets and in actual markets of the commercial world. Specifically, we would like a model that predicts the average price and the number of transactions in a market using the information that we have about the Buyer Values and Seller Costs of the market participants.

An effective way to simplify this problem is to assume that all demanders buy apples at the same price and all suppliers sell apples at the same price. For the first rounds of trading, this assumption is not very accurate, but in later rounds, as traders become better informed about the prices at which they can expect to buy and sell, the differences between prices paid for apples by different people tend to disappear.

If there were just one price for apples, those suppliers who could make a profit at this price would sell apples and those who would make a loss would not sell any apples. Similarly, those demanders who could profit by buying apples at the prevailing price would buy and those who would lose money would not buy. At this price, it will be possible to satisfy everybody's wishes only if amount of apples that demanders want to buy is *the same* as the amount of apples that suppliers want to sell. At an arbitrarily chosen price, there is no reason to expect that demanders would want to buy the same amount that suppliers would want to sell. But as we will see, there will be *some* price at which the total amount of apples that demanders are willing to buy is equal to the total amount of apples that suppliers are willing to sell. This price, at which "supply equals demand," is known as the **competitive equilibrium price** and the number of units bought and sold at this price is known as the **competitive equilibrium quantity**.

Graphing Supply and Demand

Supply curves and **demand curves** are the main tools that we use to study competitive equilibrium. The supply curve tells us the total amount of a good that suppliers would want to sell at each possible price. We can draw a supply curve if we know each supplier's Seller Cost. In this experiment, since each supplier supplies at most one unit, the number of units that suppliers will be willing to supply at any price P is equal to the number of suppliers whose Seller Costs are less than or equal to P.

The demand curve tells us the total amount of a good that buyers would want to buy at each possible price. We can draw this curve if we know each demander's Buyer Value. In this experiment, each demander buys either one bushel of apples or no apples and thus the total number of bushels that demanders are willing to buy at any price P is equal to the number of demanders whose Buyer Values are greater than or equal to P.

We can show the way that the interaction of suppliers and demanders determines the outcome in a market by drawing the supply and demand curves on the same graph. Competitive equilibrium prices and quantities are found where the supply curve crosses the demand curve.

An Example

We will use a specific example to show how to draw supply and demand curves and find equilibrium prices and quantities. In this example:

- There are 10 high-cost suppliers, who have Seller Costs of 25 dollars a bushel.

- There are 20 low-cost suppliers, who have Seller Costs of 5 dollars a bushel.
- There are 15 high-value demanders, who have Buyer Values of 30 dollars for a bushel of apples.
- There are 15 low-value demanders, who have Buyer Values of 10 dollars for a bushel of apples.

This information is summarized in Table D1.1

Table D1.1: Distribution of Types–Example Market

Type of Agent	Number of Agents	Cost	Value
Low-Cost Supplier	20	5	
High-Cost Supplier	10	25	
High-Value Demander	15		30
Low-Value Demander	15		10

Making a Supply Table

A **Supply Table** shows the number of bushels of apples that suppliers would offer at each possible price. We can construct a Supply Table for the example market using the information in Table D1.1.

Table D1.2: Supply Table–Example Market

Price Range	Amount Supplied
$P < \$5$	0
$\$5 < P < \$25$	20
$P > \$25$	30

In the example market, low-cost suppliers have a Seller Cost of $5 a bushel and high-cost suppliers have a Seller Cost of $25 a bushel. At any price below $5 a bushel, every supplier who sold a bushel of apples would lose money because it costs every supplier at least $5 to produce a bushel of apples. Therefore at prices below $5, nobody would want to supply any apples, so the total number of bushels supplied to the market would be zero. We therefore enter 0 as the amount supplied in the first line of Table D1.2.

If the price, P, is between \$5 and \$25, the 20 low-cost suppliers can each make money by selling a bushel of apples, since their costs are only \$5. But the high-cost suppliers would lose money if they sold apples for any price that is below \$25, since it costs them \$25 to produce a bushel of apples. Therefore at prices between \$5 and \$25, the 20 low-cost suppliers will each sell a bushel of apples, but the high-cost suppliers won't sell any apples. The total quantity of apples supplied at prices between \$5 and \$25 must be 20 bushels, and so we enter 20 as the amount supplied in the second line of the Supply Table.

At prices above \$25, all of the high-cost suppliers *and* all of the low-cost suppliers can make money by selling apples. Since there are 10 high-cost suppliers and 20 low-cost suppliers, the total amount supplied at prices above \$25 is 30 bushels. Therefore we enter 30 as the amount supplied in the last line of the Supply Table.

Making a Demand Table

We can construct a *Demand Table* for this market in much the same way. The Demand Table shows the number of bushels of apples that demanders want to buy at all possible prices.

The highest Buyer Value for a bushel of apples is \$30. If the price is above \$30, no buyer will want to buy any apples. So for all prices above \$30, the number of bushels demanded is 0. We record this fact in the first line of Table D1.3.

Table D1.3: Demand Table–Example Market

Price Range	Amount Demanded
$P > \$30$	0
$\$10 < P < \$30$	15
$P < \$10$	30

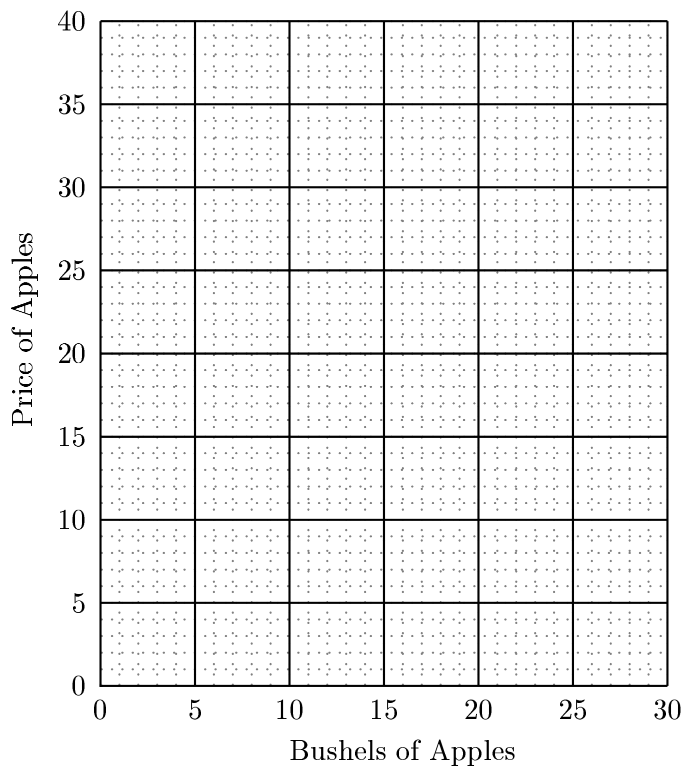
If the price of apples is between \$10 and \$30, then all 15 of the high-value demanders can make profits by buying a bushel of apples. But low-value demanders will lose money if they buy apples. So at prices between \$10 and \$30, the total demand for apples is 15 bushels, and we write 15 as the amount demanded in the second line of Table D1.3.

If the price of apples is below \$10, then all of the high-value demanders and all of the low-value demanders can make a profit by buying apples. There are 15 high-value demanders and 15 low-value demanders, so that total demand for apples at any price below $10 is 30 bushels. Therefore we enter 30 as the amount demanded in the bottom line of Table D1.3.

Drawing Supply and Demand Curves

The supply and demand tables will help you to graph a supply curve and a demand curve. The first step is to draw a pair of axes, with *price of apples* measured on the vertical axis and *quantity of apples* measured on the horizontal axis. This has been done in Figure D1.1 below.

Figure D1.1: Supply and Demand for Apples



Drawing the Supply Curve

A **supply curve** shows the total number of apples that sellers would be willing to sell at each possible price. Price is shown on the vertical axis and quantity (number of units) supplied is shown on the horizontal axis. To determine the quantity that will be supplied at any price, first find the price on the vertical axis, then move horizontally across the graph until you reach the supply curve, and then read directly downward to find the quantity supplied. We will make a practice of drawing supply curves in red. (Your graphs are will be much easier to read if supply and demand curves are different colors.)

As we see from the Supply Table, at prices below \$5, the amount of apples supplied is 0. Thus the supply curve must show that at these prices no apples will be supplied. This means that the supply curve includes a vertical line that follows the vertical axis from the origin $(0, 0)$ up to the point $(0, 5)$ where price is \$5 and quantity is 0. Draw this line segment.

At any price between \$5 and \$25, the total quantity supplied is 20 bushels. Therefore the supply curve includes a vertical line segment drawn from the point $(20, 5)$ up to the point (20,25). Add this line segment to your graph.

At prices above \$25, we see from the Supply Table that the quantity supplied is 30 bushels. Therefore the supply curve includes a vertical line starting at the point $(30, 25)$ and going straight up to the point $(30, \text{one zillion})$. We don't want you to run out of ink drawing one line, so just draw a line segment from the point $(30, 25)$ to the top of the box.

Your supply curve so far contains three red vertical line segments. But we haven't yet answered the question of what happens at a price of exactly \$5 or of exactly \$25. At a price of \$5, all of the high-cost suppliers would lose money if they sold any apples. At a price of \$5, the low-cost suppliers won't *make* any money by selling apples, but they won't *lose* any money either. They will be *indifferent* between selling and not selling. Since at a price of \$5, each of the 20 low-cost suppliers would be satisfied with supplying any quantity between 0 and 1 bushel, we can say that at a price of \$5, suppliers in total would be willing to supply any quantity of apples between 0 and 20 units. We show this fact by adding a horizontal segment at a price of \$5 on our supply curve. On the graph, this segment is a line from the point $(0, 5)$ to the point $(20, 5)$.

At a price of \$25, all 20 of the low-cost suppliers will want to supply, and the 10 high-cost suppliers would just break even. At this price, each of the 10 high-cost suppliers is willing to supply any amount between zero and one unit. So at a price of \$25, the total quantity supplied can be any amount between 20 and 30 bushels. This implies that the supply curve includes a horizontal segment at a price of \$25. This segment runs from the point $(20, 25)$ to the point $(30, 25)$.

Drawing the Demand Curve

Now that you have drawn a supply curve, it is time to draw a **demand curve.** The demand curve shows the total quantity of apples that demanders would like to buy at each possible price. Like the supply curve, the demand curve consists of vertical and horizontal line segments. You can use the Demand Table to draw the demand curve, much as you used the Supply Table to draw the supply curve. You can probably do this without reading the rest of this section, but in case you get stuck, you will find detailed hints on how to draw the demand curve on the "Lookup Page," which is found on page 20. (We suggest that you try to draw your the supply and demand curves for this example before you peek at the Lookup Page. After you have tried, you can check to see if you got it right.)

Finding Equilibrium Price and Quantity

The **competitive equilibrium price** for a good is the price at which the total amount that suppliers want to sell is equal to the total amount that demanders want to buy. The quantity that is supplied and demanded at the competitive equilibrium price is the **competitive equilibrium quantity**. If you have drawn the supply curve and the demand curve on a graph, how can you find the competitive equilibrium price? Before reading the answer which appears below in small print, see if you can figure it out for yourself.

> **Answer:** Remember that the quantity demanded or supplied at any price is found by locating the price on the vertical axis and reading across until you reach the demand or supply curve. If at some price, supply equals demand, it must be that at this price, the supply curve and the demand curve are touching each other. Thus to find the competitive equilibrium price, simply draw the supply curve and the demand curve and find where they cross. If the two curves intersect at a single point, then you can read across to the vertical axis to find the competitive equilibrium price and down to the horizontal axis to find the competitive equilibrium quantity. (Sometimes the demand curve and supply curve may overlap at more than one point. In this case, there will be more than one competitive equilibrium price and/or quantity.)

If you look at the supply and demand graph that you drew, you can see that at any price higher than the competitive equilibrium price, suppliers want to sell more apples than demanders want to buy. At any price lower than the equilibrium price, demanders want to buy more apples than suppliers are willing to sell. But at the competitive equilibrium price, suppliers want to sell exactly as many apples as demanders want to buy.

■ In this example, if you have drawn your supply and demand curves correctly, they will cross each other at exactly one point. At the point where the two curves cross, the price is $__________ and the quantity is __________ bushels.

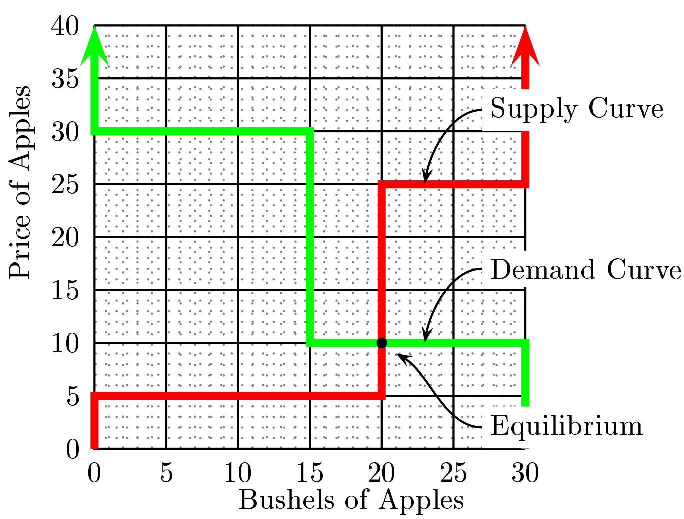
Lookup Page for Supply and Demand Curves

Hints on Drawing the Demand Curve.

The highest value that anybody puts on apples is 30, so we know that at prices above 30, nobody is going to want to buy apples. Therefore you can use your green pen to mark a vertical line extending from the point (0,30) to the top of the box. At prices greater than 10 but less than 30, all of the high demanders, who have Buyer Values of 30, will want to buy a bushel of apples, but none of the low demanders, who have Buyer Values of only 10, will want to buy. There are 15 high-value demanders, so total demand at any of these prices is 15. This means that the demand curve includes a vertical segment running from (15,10) to (15,30). At prices below 10, everybody will want to buy one bushel. There are 30 demanders in all, so that total demand will be 30 bushels. The demand curve, therefore, includes a vertical segment running from (0,30) to (10,30).

At a price of exactly 30, the 15 high-value demanders are just indifferent between buying or not. Total demand could be anything between 0 and 15. Therefore the demand curve includes a horizontal segment running from (0,30) to (15,30). At a price of exactly 10, the 15 high-value demanders will all want to buy one unit. The 15 low-value demanders will be just indifferent between buying and not buying, so at this price, demand can be anything between 15 and 30. Therefore the demand curve includes a horizontal segment running from (15,10) to (30,10).

Figure D1.2: Supply and Demand–Example 1



NAME ______________________ SECTION_______

Home Work–Experiment 1

The way that scientists evaluate theories is to compare their predictions to outcomes in the real world. You are now ready to begin to evaluate supply and demand theory by comparing its predictions with the actual outcomes in your own classroom market. You have learned how to draw supply and demand curves for a market when you are given the distribution of Buyer Values and Seller Costs. For your home work, we ask you to draw supply and demand curves for the distribution of Buyer Values and Seller Costs that appeared in your classroom experiment. When you have drawn these curves, you will be able to find the equilibrium prices and quantities predicted by the competitive theory for each classroom market session. Now you can compare the theoretical predictions of prices and quantities with the actual transaction prices and number of transactions that were observed in your classroom.

Predictions of Supply and Demand Theory

Supply and Demand Tables

Copy Tables L1.5 and L1.6 of your lab report into Tables H1.1 and H1.2. With this information, you can fill in the Supply and Demand Tables[1], H1.3 and H1.4 for Session 1 and H1.5 and H1.6 for Session 2.

Table H1.1: Distribution of Types in Session 1

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier			
High-Cost Supplier			
High-Value Demander			
Low-Value Demander			

[1]Recall that Supply Tables and Demand Tables were introduced on pages 14 and 15.

Table H1.2: Distribution of Types in Session 2

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier			
High-Cost Supplier			
High-Value Demander			
Low-Value Demander			

Table H1.3: Supply Table-Session 1

Price Range	Amount Supplied
$P < \$10$	
$\$10 < P < \$30$	
$P > \$30$	

Table H1.4: Demand Table-Session 1

Price Range	Amount Demanded
$P > \$40$	
$\$20 < P < \$40$	
$P < \$20$	

Table H1.5: Supply Table-Session 2

Price Range	Amount Supplied
$P < \$10$	
$\$10 < P < \$30$	
$P > \$30$	

Table H1.6: Demand Table–Session 2

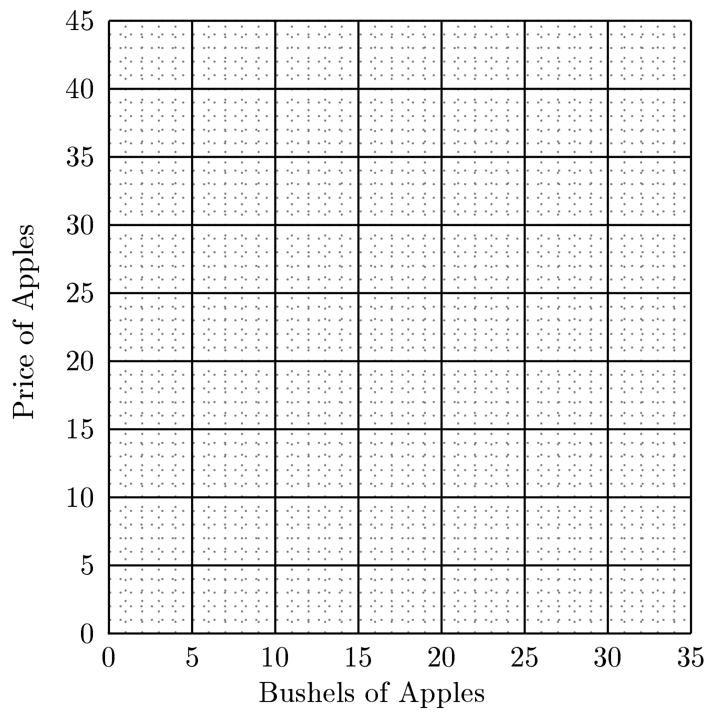
Price Range	Amount Demanded
$P > \$40$	
$\$20 < P < \$40$	
$P < \$20$	

Equilibrium Prices, Quantities, and Profits

Supply and demand theory makes detailed predictions about what will happen in each session of the apple market experiment. The theory predicts prices, quantities, profits, and the types of suppliers and demanders who will sell and buy. The tools that you use to make these predictions are supply and demand curves.

On the axes in Figure H1.1, use the information from the Session 1 Supply and Demand tables to draw a (red) supply curve and a (green) demand curve for the market in Session 1.

Figure H1.1: Supply and Demand for Apples, Session 1



Predictions for Session 1

■ In Session 1, the competitive equilibrium price is $__________ and the number of bushels of apples that would be sold in competitive equilibrium is __________.

■ At the competitive equilibrium price for Session 1: Will low-cost suppliers make a profit by selling apples?__________ Will high-cost suppliers make a profit by selling apples?__________

■ At the competitive equilibrium price for Session 1: The number of low-cost suppliers who sell apples is __________ and the number of high-cost suppliers who sell apples is __________.

■ At the competitive equilibrium price for Session 1: Each low-cost supplier makes a profit of $__________ and the total amount of profit made by *all* low-cost suppliers is $__________. Each high-cost supplier makes a profit of $__________and the total amount of profit made by *all* high-cost suppliers is $__________.

■ At the competitive equilibrium price for Session 1: The *total* amount of profit made by *all* suppliers is $__________

■ At the competitive equilibrium price in Session 1: Will high-value demanders make a profit by buying apples? __________ At this price, will low-value demanders make a profit, a loss, or just break even by buying apples?____________________

■ At the competitive equilibrium price in Session 1: The number of *high-value* demanders who buy apples is __________. The *total* number of demanders of all types who buy apples is __________. Therefore the number of *low-value* demanders who buy apples is __________.

■ At the competitive equilibrium price for Session 1: Each high-value demander makes a profit of $__________ and the total amount of profit made by *all* high-value demanders is $__________. Each low-value demander makes a profit of $__________ and the total amount of profit made by *all* low-value demanders is $__________

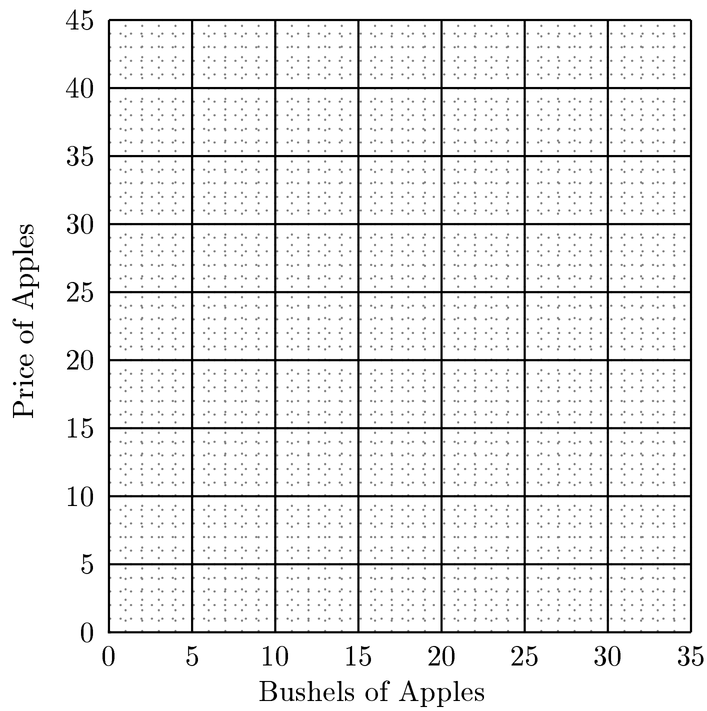
- At the competitive equilibrium price for Session 1: Total profits of *all* demanders are $__________

- At the competitive equilibrium price for Session 1: Total profits made by *all* market participants (including suppliers and demanders) are $_______________

Predictions for Session 2

On the axes in Figure H1.2, use the information from the Session 2 Supply and Demand tables to draw a (red) supply curve and a (green) demand curve for the market in Session 2.

Figure H1.2: Supply and Demand for Apples, Session 2



The supply and demand curves that you drew in Figure H1.2 will help you to answer the following questions about the predictions of competitive equilibrium theory for the market held in our classroom in Session 2.

■ The competitive equilibrium price for Session 2 is $__________ and the number of bushels of apples sold in competitive equilibrium is __________.

■ At the competitive equilibrium price for Session 2: Will high-value demanders make a profit by buying apples? __________ Will low-value demanders make a profit by buying apples? __________

■ In competitive equilibrium for Session 2: The number of high-value demanders who buy apples will be __________ and the number of low-value demanders who buy apples will be __________.

■ At the competitive equilibrium price in Session 2: Will low-cost suppliers make a profit by selling apples? __________ Will high-cost suppliers make a profit, a loss, or just break even by buying apples? ____________________

■ In competitive equilibrium for Session 2: The number of low-cost suppliers who sell apples will be __________ and the number of high-cost suppliers who sell apples will be __________.

Comparing Theory with Experimental Outcomes

Now that you have worked out the predictions made by competitive equilibrium theory for the outcomes in Sessions 1 and 2, it is time to compare these predictions with the actual outcomes in the market experiments. Because the conditions of the theory are simplified from the actual market environment, we would not expect the theoretical predictions to exactly correspond to the outcomes. The theory will have to be evaluated on how closely it *approximates* actual outcomes.

■ Fill in Table H1.7 to evaluate the performance of competitive equilibrium theory in predicting the outcome of the last round of Session 1. If you have completed the home work section "Predictions for Session 1," you have already worked out all of the answers that you need to complete the first column of the table. (The competitive prediction of "average price" is just the competitive equilibrium price.) To fill in the second column of the table, you can use the information in Table L1.1 of your lab report to find the average price, the number of sellers and buyers of each type who made trades (since not everybody makes trades, this is not necessarily the same as the number of persons of each type present in the class), the total number of transactions, and total profits of all traders in the last round of Session 1.

Table H1.7: Predicted and Actual Outcomes–Session 1

	Competitive Prediction	Outcome in Experiment
Average Price		
Number of Low-Cost Sellers		
Number of High-Cost Sellers		
Number of High-Value Buyers		
Number of Low-Value Buyers		
Number of Transactions		
Total Profits of All Traders		

■ Fill in Table H1.8 to evaluate the performance of competitive equilibrium theory in predicting the outcome of the last round of Session 2. The home work section "Predictions for Session 2" guides you to most of the answers you need for the first column. However, we leave it to you to work out the competitive prediction for Total Profits in the last line of the table, using the same method that you applied to find Total Profits in Session 1.

■ How well would you say that the competitive theory does in predicting the outcome of the market? If the correspondence is not exact, what do you

Table H1.8: Predicted and Actual Outcomes–Session 2

	Competitive Prediction	Outcome in Experiment
Average Price		
Number of Low-Cost Sellers		
Number of High-Cost Sellers		
Number of High-Value Buyers		
Number of Low-Value Buyers		
Number of Transactions		
Total Profits of All Traders		

think accounts for the difference between actual and predicted outcomes?