

# Using In-Class Experiments to Teach Principles of Microeconomics

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## Abstract

This manuscript provides a summary of a “hands-on” and “active-learning” approach to teaching ECONOMICS 113, a general education course in the Social Science section of the University Core Curriculum. The approach revolves around a weekly in-class experiment that allows the study of many of the topics and concepts we believe to be central to the study of microeconomics and some of the important social and economic issues of the day. The pedagogy seems to make many basic microeconomic principles accessible to a wide range of students, nearly all of whom are majoring in something other than economics.

Following are some of the advantages to using this approach to teaching microeconomic principles (elaboration on these points begins on page 14):

- The students are “engaged”
- A lot of student-to-student teaching-and-learning occurs
- Economics is brought to its simplest level, the level of the individual decision-maker
- The pedagogy *is* the scientific method of experimentation alongside theory
- Attendance is better
- Examinations are *not* multiple choice
- Homework answers are unique to each section every semester

Toward the end of a semester, some students usually ask one or both of two questions:

- What other courses do I teach?
- What other economics courses use in-class experiments?

Is this pedagogy something we wish to consider for principles of microeconomics, ECONOMICS 240?

## Introduction

The primary purpose of this manuscript is to provide a summary of how I have been teaching ECONOMICS 113 for the past four years. ECONOMICS 113 is general education course in the Social Science section of the University Core Curriculum (<http://www.siu.edu/~corecurr/>). It is a “hands-on” and “active-learning” approach to instruction, which is favored by educational theorists. Further, it seems to be a pedagogy or an approach that seems to make many basic microeconomic principles accessible to a wide range of students.

Economics majors are rare. High-frequency majors seem to be from the College of Education (including social work), College of Mass Communication and Media Arts (cinema and photography, journalism, radio-television), as well as various majors from Liberal Arts (e.g., art and design, history). Since many students are not from quantitative or technical disciplines, and the top students are just as likely to be education or history majors as they are to be business (or economics) or engineering majors, then this pedagogy may be a direction in which the Department might take ECONOMICS 240 in pursuit of more majors and making the economics major more attractive to students across all disciplines.

The experiments obviously take place under controlled conditions. The students operate under the barest of behavioral constraints: they are expected only to behave in a profit-maximizing way:

- suppliers have a reservation price and generally should not sell their good at a price that is less than their given reservation price;
- demanders have a reservation price and generally should not pay a price that is greater than their given reservation price.

There is an emphasis on profits because the students generally recognize or accept that that is how we behave, both individually as well as in groups that we call “firms.” Further, the primary emphasis is on **total profits**, rather than the profits of buyers alone or sellers alone. This has one significant advantage: when students negotiate the price of a single transaction, they frequently agree on the average of their reservation prices as the transaction price. When the emphasis is on the **total** profit, the allocation of profit between the traders — and the negotiated price — become irrelevant.

The focus on total profit provides a simple measure to show the **excess burden** of a tax (Experiment 3), the effect of a negative externality (Experiment 6), and the deadweight loss of monopoly (Experiment 7).

## Experiment Set-up

On a “market day” or “experiment day,” when the students come to class, they receive a personal information sheet. Here is a sample from the first experiment,

**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 ( $= P - \$30$ )			

All six of the different information sheets for the first experiment are on pages 17–22.

The information sheet assigns the student the role they will play during the various trading “sessions” and “rounds.”<sup>1</sup> Once the students understand their role and any questions have been answered, trading begins.

<sup>1</sup>A “session” is characterized by a fixed set of parameter values, such as the presence or absence of a tax. A trading “round” is an iteration of the experiment within a session. The number of trading “rounds” is usually greater than one, so that the market participants can incorporate what they learn from the first iteration and this generally helps the experimental outcome to move closer to the outcome predicted by competitive equilibrium theory.

The students then move about the room, buyers searching for sellers and sellers searching for buyers. Once a buyer and seller find each other, and if their reservation prices are such that the buyer’s reservation price, “Buyer Value,” is greater than the seller’s reservation price, “Seller Cost,” the prospective traders negotiate a mutually-profitable price.

Once the negotiations are concluded, the buyer and seller fill out a contract, an example of which is shown below.

**Sales Contract**    *Session* \_\_\_\_\_    *Round* \_\_\_\_\_

*Price:* \_\_\_\_\_

*Seller’s name:* \_\_\_\_\_    *Seller Cost* \_\_\_\_\_

*Buyer’s name:* \_\_\_\_\_    *Buyer Value* \_\_\_\_\_

Once the buyer and seller complete the contract, the contract is turned in to the “market manager.”<sup>2</sup> The transactions are then posted for all to see, either on the chalkboard, or a projected computer screen image; see figure 1. Note from figure 1 that the seller in transaction 23 had a Seller Cost of \$30 but sold for a price of only \$15; this gave the seller a profit of -\$15. Early in the semester, students sometimes ask if that transaction should be included and kept in the list of transactions. My response is generally that the market doesn’t protect us from making unwise choices.

Once all apparent transactions have been made and the contracts have been turned in, a poll is taken of the demanders and suppliers who did not participate in a transaction. The purpose of the polling is to identify any mutually-profitable transactions that were not executed because the traders did not find each other.

The trading is usually repeated under the same circumstances so that some amount of learning can be incorporated into a subsequent “market period.” Then the experiment advances to a subsequent “session.” Subsequent trading sessions incorporate new values for some of the relevant parameters. For example:

- There may be simply be a different distribution of buyers and sellers that will change the price and/or quantity outcomes.
- A tax may be introduced into the market.
- A price floor may be introduced into the market.

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<sup>2</sup>This is in which I make use of a teaching assistant, if there is one for the course. I ask the TA to screen the contracts to make sure that the Buyer Value is one of the valid Buyer Values for the experiment and that the Seller Cost is one of the valid Seller Costs for the experiment.

Transaction	Price	Seller Cost	Seller Profit	Buyer Value	Buyer Profit	SC check	BV check
1	\$13.00	\$10.00	\$3.00	\$20.00	\$7.00		
2	\$25.00	\$10.00	\$15.00	\$40.00	\$15.00		
3	\$35.00	\$30.00	\$5.00	\$40.00	\$5.00		
4	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
5	\$35.00	\$30.00	\$5.00	\$40.00	\$5.00		
6	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
7	\$20.00	\$10.00	\$10.00	\$40.00	\$20.00		
8	\$25.00	\$10.00	\$15.00	\$40.00	\$15.00		
9	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
10	\$18.00	\$10.00	\$8.00	\$20.00	\$2.00		
11	\$25.00	\$10.00	\$15.00	\$40.00	\$15.00		
12	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
13	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
14	\$19.00	\$10.00	\$9.00	\$40.00	\$21.00		
15	\$25.00	\$10.00	\$15.00	\$40.00	\$15.00		
16	\$18.00	\$10.00	\$8.00	\$20.00	\$2.00		
17	\$20.00	\$10.00	\$10.00	\$20.00	\$0.00		
18	\$35.00	\$30.00	\$5.00	\$40.00	\$5.00		
19	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
20	\$19.00	\$10.00	\$9.00	\$20.00	\$1.00		
21	\$15.00	\$10.00	\$5.00	\$20.00	\$5.00		
22	\$15.00	\$30.00	(\$15.00)	\$20.00	\$5.00		
23	\$25.00	\$10.00	\$15.00	\$40.00	\$15.00		

Figure 1: Displayed transaction information

At the conclusion of all trading rounds and sessions, the students turn in their information sheets.

For grading purposes, the teaching assistant or I go through all the contracts and information sheets to make sure that the information recorded on the contracts is correct. By the next class period, a data sheet is provided to the students, either as a hard-copy handout in class, or as a file posted to the course web site.<sup>3</sup>

<sup>3</sup>In recent semesters, I have used a week of class time to take the students to a computer lab and arranged for Excel training from Mr. Doug Simmons of the Academic Technology Center/Library Affairs. The material Simmons covers in the Excel training is available online at <http://mccoy.lib.siu.edu/projects/econ113/>. Because the Excel training is provided as a part of the course, this gives me license to post the data sheets for the experiments as an Excel worksheet. Platform differences between Windows and Mac should be irrelevant because the Excel files are simple spreadsheet files that contain no special formatting or content.

## The Data Sheet

The data sheet provides two different sets of important information: the distributions of the demanders and suppliers according to their reservation prices,

**Distribution of Types in Session 1**

Type of Agent	Number of Agents	Buyer Value	Seller Cost
Low-Cost Supplier	26	—	\$10
High-Cost Supplier	13	—	\$30
High-Value Demander	13	\$40	—
Low-Value Demander	26	\$20	—

and the transaction information,

**Transactions in Session 1**

Transaction	Price	Seller Cost	Buyer Value
1	\$18	\$10	\$20
2	\$19	\$10	\$20
3	\$32	\$30	\$40
⋮	⋮	⋮	⋮
28	\$18	\$10	\$20
29	\$20	\$10	\$20
30	\$12	\$10	\$20

For a sample data sheet, as a Microsoft Excel worksheet, see the most recent semester’s Experiment 1 data sheet in figure 2 (page 7).<sup>4</sup> With the data sheet, the students now have what is necessary to begin working on the homework.

## Homework

Following are the homework problems from Homework #1, the components of which are generally common to all homework assignments: the students must

- calculate the summary statistics for each Session of the in-class experiment
- derive the “competitive prediction” for each session.

The competitive prediction is the theoretical, or “theory part,” of the homework assignment.

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<sup>4</sup>For a “live” version, point a browser to <http://www.siu.edu/~econ113/data01sec2.xls>.

The screenshot shows an Excel spreadsheet with three tables. Table 1.6 and 1.7 are summary tables for agent types. The other two tables are transaction logs for Session 1 and Session 2.

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier	26		\$10
High-Cost Supplier	13		\$30
High-Value Demander	13	\$40	
Low-Value Demander	26	\$20	

Type of Agent	Number of Agents	Value	Cost
Low-Cost Supplier	13		\$10
High-Cost Supplier	26		\$30
High-Value Demander	26	\$40	
Low-Value Demander	13	\$20	

Trans-action	Price	Seller Cost	Buyer Value
1	\$18.00	\$10	\$20
2	\$19.00	\$10	\$20
3	\$32.00	\$30	\$40
4	\$30.00	\$30	\$40
5	\$16.00	\$10	\$20
6	\$15.00	\$10	\$20
7	\$16.00	\$10	\$20
8	\$17.00	\$10	\$40
9	\$20.00	\$10	\$40
10	\$35.00	\$30	\$40
11	\$25.00	\$10	\$40
12	\$15.00	\$10	\$40
13	\$15.00	\$10	\$20
14	\$18.00	\$10	\$20
15	\$20.00	\$10	\$40
16	\$15.00	\$10	\$20
17	\$25.00	\$10	\$40
18	\$20.00	\$10	\$40
19	\$15.00	\$10	\$20
20	\$20.00	\$10	\$20
21	\$25.00	\$10	\$40
22	\$20.00	\$10	\$40
23	\$19.00	\$10	\$20
24	\$17.00	\$10	\$20
25	\$32.00	\$30	\$40
26	\$20.00	\$10	\$20
27	\$18.00	\$10	\$20
28	\$18.00	\$10	\$20
29	\$20.00	\$10	\$20
30	\$12.00	\$10	\$20

Trans-action	Price	Seller Cost	Buyer Value
1	\$35.00	\$30	\$40
2	\$25.00	\$10	\$40
3	\$31.00	\$30	\$40
4	\$25.00	\$10	\$40
5	\$18.00	\$10	\$40
6	\$18.00	\$10	\$40
7	\$35.00	\$30	\$40
8	\$35.00	\$30	\$40
9	\$25.00	\$10	\$40
10	\$15.00	\$10	\$20
11	\$19.00	\$10	\$40
12	\$23.00	\$10	\$40
13	\$25.00	\$10	\$40
14	\$35.00	\$30	\$40
15	\$31.00	\$30	\$40
16	\$30.00	\$30	\$40
17	\$35.00	\$30	\$40
18	\$22.00	\$10	\$40
19	\$20.00	\$10	\$40
20	\$25.00	\$10	\$40
21	\$30.00	\$30	\$40
22	\$35.00	\$30	\$40
23	\$30.00	\$30	\$40
24	\$31.00	\$30	\$40
25	\$30.00	\$10	\$40
26	\$35.00	\$30	\$40
27	\$32.00	\$30	\$40

Figure 2: Sample data sheet

## Homework 1

1. “Use the information in Table 1.4 . . . to complete Table 1.8. Find the **mean** (average) price by adding all the prices posted during the round and dividing by the number of transactions. Find the **number of transactions** by counting the number of transactions recorded in [Table] 1.4 . . . Find total profits of sellers and of buyers by adding the corresponding columns in these tables. Find total profits of all traders by adding total profits of sellers and total profits of buyers.”

Table 1.8: Summary of Results in Sessions 1 and 2

	Session 1	Session 2
Mean Price	\$20.23	\$27.78
Number of Transactions	30	27
Total Profits of All Sellers	\$227	\$200
Total Profits of All Buyers	\$253	\$310
Total Profits of All Traders	\$480	\$510

**Note:** The students must provide all of the numerical entries.

3. “Complete the Supply and Demand Tables 1.9, 1.10 for Session 1 . . . of your classroom market. These tables will be used to draw supply and demand curves for each session. The information needed to complete these tables is found in Tables 1.6 and 1.7.”

**Table 1.9**  
**Supply Table, Session 1**

Price Range	Amount Supplied
$P < \$10$	<b>0</b>
$\$10 < P < \$30$	<b>26</b>
$P > \$30$	<b>39</b>

**Table 1.10**  
**Demand Table, Session 1**

Price Range	Amount Demanded
$P > \$40$	<b>0</b>
$\$20 < P < \$40$	<b>13</b>
$P < \$20$	<b>39</b>

**Note:** The price ranges are given; the students must provide the amounts supplied and demanded.

4. “In Figure 1.6, use the information from the Supply and Demand Tables 1.9 and 1.10 to draw a (red) supply curve and a (green) demand curve for the market in Session 1. (See page 11 for detailed instructions on how to draw supply and demand curves.) Mark the intersection of the supply and demand curves with a black dot and label it *CE*.”

Because of the “scale” of the in-class experiments, the appearance of the supply and demand curves is initially surprising. For the market described by the Supply and Demand Tables above, the supply and demand curves are as shown in figure 3 (page 9).

6. “Complete Table 1.13 . . . to compare the experimental results from your classroom experiment with the predictions made by supply and demand theory.”

**Table 1.13: Predicted and Actual Outcomes, Session 1**

	Experimental Outcome	Competitive Prediction
<b>Mean Price</b>	\$20.23	\$20
<b>Number of Transactions</b>	30	26
<b>Total Profits of All Sellers</b>	\$227	\$260
<b>Total Profits of All Buyers</b>	\$253	\$260
<b>Total Profits of All Traders</b>	\$480	\$520
<b>Market Efficiency</b>	92.3%	100.0%

**Note:** The students must provide all of the numerical entries.

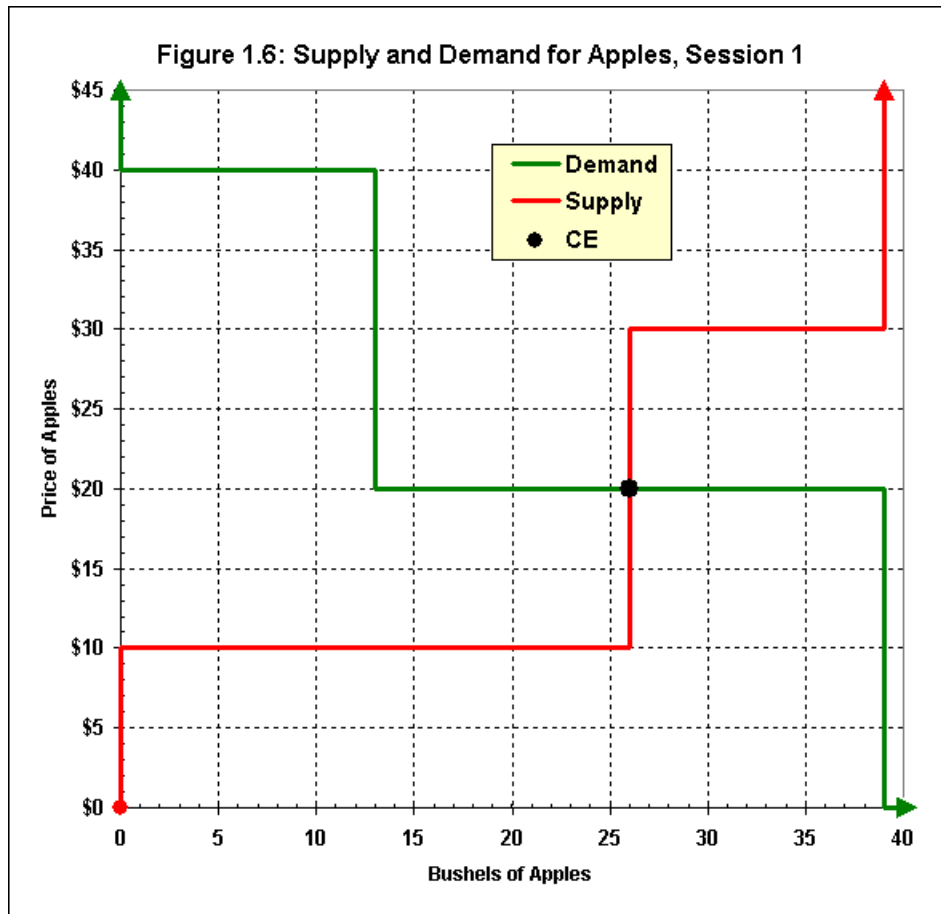


Figure 3: The supply and demand curves.

## Topics in *Experiments with Economic Principles*

*Topics set in italics are experiments I do not cover in my ECONOMICS 113 class: see items 9, 12 and 14.*

1. “An Apple Market”: Different outcomes from differing supplies and demands

Agent	Session 1		Session 2	
Type A	Demander	\$40	Supplier	\$30
Type B	Demander	\$20	Supplier	\$10
Type C	Demander	\$20	Demander	\$40
Type D	Supplier	\$10	Demander	\$20
Type E	Supplier	\$30	Demander	\$40
Type F	Supplier	\$10	Supplier	\$30

**Session 1** There are twice as many suppliers with the low Seller Cost of \$10 as there are suppliers with the high Seller Cost of \$30. Because the low Seller Cost is

below both types of demanders’ reservation price, this distribution of suppliers and demanders leads to a competitive equilibrium price of \$20, the lower of the reservation prices among the demanders.

**Session 2** There are twice as many demanders with the high Buyer Value of \$40 as there are demanders with the low Buyer Value of \$20. Because the high Buyer Value is above both types of suppliers’ reservation price, this distribution of suppliers and demanders leads to a competitive equilibrium price of \$30, the higher of the reservation prices among the suppliers.

2. “A Village Fish Market”: What happens when all costs are sunk? (The competitive equilibrium price is zero!)

In each of two trading sessions, the number of demanders is roughly twice the number of suppliers.

**Session 1** Each fish supplier catches only one fish to sell. Since the demanders outnumber the number of fish available for sale, there is a positive competitive equilibrium price. (There is no refrigeration or storage and the demanders are only interested in purchasing a single fish.)

**Session 2** Each fish supplier catches **three** fish. Now the number of fish that the suppliers are trying to sell is greater than the number of demanders. The only possible competitive equilibrium price is zero!

3. What happens when there is a tax? (Does it matter “who” is taxed?)

In this experiment, there are three trading sessions:

**Session 1** No tax

**Session 2** “Seller tax”

**Session 3** “Buyer tax”

The distributions of demanders and suppliers is the same for all three sessions, and the experimental outcome is suggestive that there are no significant (we would say “real”) differences between a [unit] tax collected from sellers and a tax collective from buyers. The homework answers indicate that the only difference is price, but even then, when one looks at the net price received, or total price paid, there is no difference at all.

4. “Prohibition”: What happens in a black market for drugs when sellers are punished?

In this experiment, there are three trading sessions:

**Session 1** No crime-prevention activities

**Session 2** Drugs are confiscated and destroyed

**Session 3** The police are corrupt and resell confiscated drugs

In this experiment, a distinction is made between “Buyer Value” and “willingness-and-ability-to-pay”: “Addicted demanders” suffer a \$20 loss if they are unable to successfully purchase the good. This leads to a willingness-and-ability-to-pay that is \$20 above the value assigned to consuming the good.

Given the design of the experiment, the conclusion is that it doesn’t matter if the police are corrupt or not: the competitive equilibrium price and quantity are the same in Sessions 2 and 3.

5. “Minimum wage”: What happens in a market with a price floor?

In this experiment, there are three trading sessions:

**Session 1** No minimum wage

**Session 2** A binding minimum wage is imposed

**Session 3** The minimum wage is imposed again, but it is no longer binding

6. “Externalities”: What happens in a market when there is pollution?

In this experiment, there are three trading sessions:

**Session 1** No policy intervention

**Session 2** A “green tax” is imposed. The default is to have the amount of the tax match the constant value of the [negative] externality

**Session 3** The green tax is replaced by fixed number of [tradable] pollution permits

This experiment is wonderful in showing how the total profit can be increased by either a green tax or the requirement that sellers obtain a pollution permit.

7. What happens when there is monopoly power on the selling side?

In this experiment, there are four trading sessions:

**Session 1** This is just a “thought experiment”: the students identify the profit-maximizing monopoly price, quantity and profit, given the demand they are shown.

**Session 2** Six sellers collude in the hall; they set a quantity-quota for each of themselves and the quota is enforced.

**Session 3** Six sellers collude in the hall; they set a quantity-quota for each of themselves but the quota is **not** enforced.

**Session 4** Price discrimination is permitted: sellers choose a “student price” and a non-student price.

Session 2 usually comes quite close to the standard monopoly outcome.

When the quota is not enforced in Session 3, the outcome generally comes very close to the competitive outcome! This is assured by selecting as sellers students who are likely to see that as long as they sell at, or above, marginal cost, their profit will be increased.

Session 4 (for which there is not always sufficient time) shows how sellers’ profits are increased when they can “separate” their market and charge different prices in two sub-markets.

8. “Entry and Exit”: Combining sunk costs with variable costs

In this experiment for “restaurant meals,” there are only two sessions:

**Session 1** No tax

**Session 2** Sales tax on restaurant meals

The innovation of this experiment is to illustrate the distinction between the short-run and the long-run. Each session is run with at least two trading “rounds.” In each round, the number of “firms” is different and the students can see that there are times when a new firm can profitably enter the market, and there are circumstances in which too many firms cause negative profits for all firms. This permits the introduction of the notion of a “long run equilibrium.” (The term “cost function” is introduced!)

9. “*Network Externalities*” Demand is a downward-opening parabola because demanders’ willingness-and-ability-to-pay is dependent, in part, on how many buyers are already in the market.

10. “Measuring Productivity”

In this experiment, the class is divided into firms that produce [paper] airplanes. There are several different tasks that are required:

- procure the raw material with a truck (manilla folder) and driver
- cut the raw material (tear and  $8\frac{1}{2} \times 11$ ” sheet into quarter-sheets)
- construct the plane (folding)
- mark the plane on the wings (“painting” with a single pen)
- test-fly the plane and deliver it to a shipping container

Several 3-minute production sessions are conducted with equal-sized firms of 5-students, 10-students, etc. There is a built-in bottle-neck: Regardless of firm size, each firm has only one pen with which to mark the planes. The students *always* recognize that their productivity has been restricted by having only one “paint gun.”

11. “Comparative Advantage and Trade”: Can large countries benefit from trade with small countries?
12. “*Adverse Selection: A Market for Lemons*”: What happens when there is “asymmetric information”?

This experiment involves the probabilistic concept of expected value. I have not conducted this experiment but once or twice.

13. “Auctions”

- “English auction”
- “Dutch auction”
- “Sealed-bid, first-price auction”
- “Sealed-bid, second-price auction”
- “*Escalation auction*”
- *Common values experiments*:
  - “*Unreliable accountant*”
  - “*Pennies in a jar*”

14. “Bargaining”

In this experiment, there are three “sessions”:

**One-stage (ultimatum) bargaining**

**Two-stage bargaining**

**Three-stage bargaining**

For the only time all semester, buyers and sellers do not know each other. Offers are made by use of student ID numbers that are exchanged between the buyer and seller in Sessions 2 and 3. The total profit shared between buyer and seller falls when bargaining goes from stage one to stage two to stage three. The idea of “backward induction” is introduced to work backwards from the end to the “subgame perfect initial offer” that the buyer should make in stage one.

## Advantages and Disadvantages?

### The Students Are “Engaged”

I think this is due to the fact that the data **belong to the students**. The data sets do not come from the textbook; the data sets do not come from the instructor. The data sets summarize **what the students did**. Assessment experts say that students will take homeworks and exercises seriously only to the extent that the exercises are “authentic.” The in-class experiments are somewhat contrived at times, but the students see how the experiments model real world markets and the data are unique to each class.

### Student-to-Student Teaching-and-Learning

My experience has been that the weekly homework assignments cause the students to “keep up” better than in a traditional offering of ECONOMICS 113; I was never so busy during office hours before I adopted this pedagogy. Now it is not uncommon to have four or five students in my office at once. When that happens, student-to-student teaching-and-learning occurs. Most semesters, there is at least one outside-of-class study group that forms. I sometimes attend a study group meeting to answer any questions they cannot answer among themselves, but again, there is student-to-student teaching-and-learning that occurs and education and assessment experts tell us this is the most effective kind of learning.

### Economics at its Simplest

This may be an independent advantage of the pedagogy as well as a partial explanation of why the students are engaged by the course material: Economics has been brought to the level of the individual. Further, there is an implicit emphasis on “opportunity cost.” Although the term is never used, the students repeatedly see the same pair of questions:

- What is my profit if I do?
- What is my profit if I don’t?

This pair of questions comes front and center in the experiment on prohibition because “addicted demanders” have a “Buyer Value” of \$30 for the consumption of a unit of drugs, but they suffer withdrawal symptoms and a **loss** of \$20 if they fail to obtain and consume a unit of drugs. Since an addicted demander’s profit is  $-\$20$  if consumption is zero, the addicted demander will accept a loss up to \$20 in purchasing a unit of drugs. Therefore, the addicted demander’s reservation price exceeds Buyer Value by \$20.

On the selling side, the above pair of questions is also front and center in the experiment on entry and exit of firms when we first see fixed and variable costs together. The students see that a firm may not be able to eliminate negative profits altogether, but they recognize that the loss can be reduced so long as they can sell an extra unit at a price that is greater

than marginal cost. We do not use that terminology; rather, we simply ask the pair of questions above: What is my profit if I do sell another unit? What is my profit if I do not sell another unit?

## The Pedagogy *is* the Scientific Method

The pedagogy is the scientific method: we have a theory; we conduct experiments; we compare the outcome of the experiment to that predicted by theory. See figure 4.

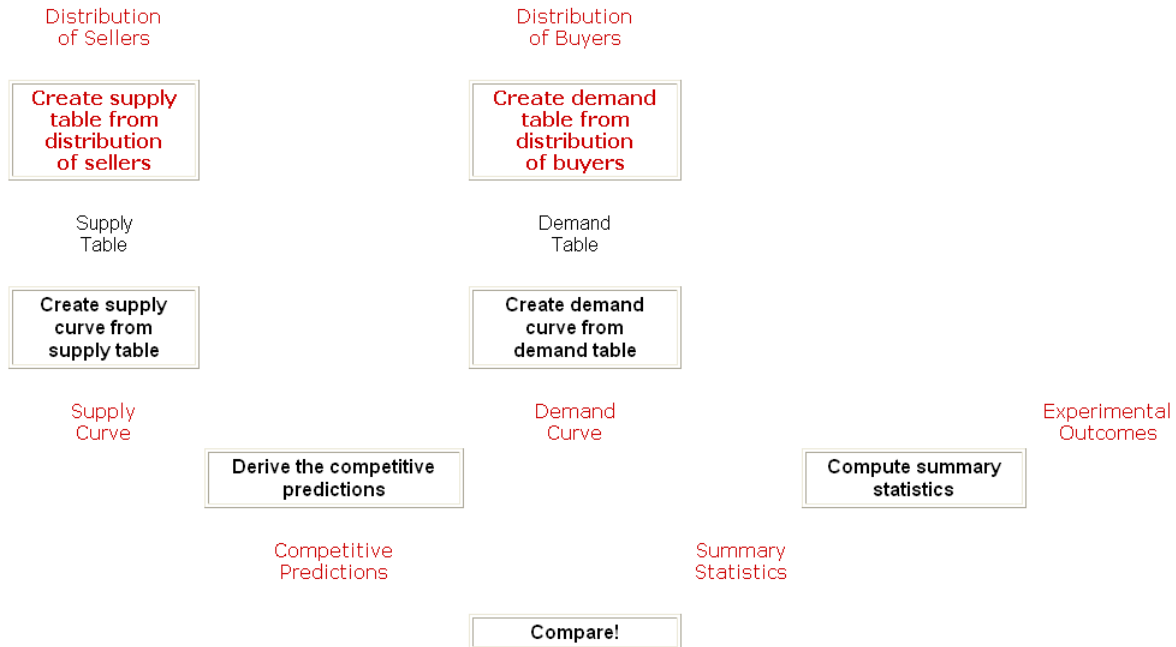


Figure 4: Schematic overview of a homework assignment.

## Attendance

Participation in the experiments is mandatory. I make it count for 15 percent of the course grade.

**Tardiness can be costly.** Some of the experiments require that the personal information sheets be distributed in a certain way that may make it impossible to accommodate late-comers. Part of the power of the experiments is that the distribution of suppliers and demanders is the same through every round of every trading session. This means that new participants cannot be added between Session 1 and Session 2, or between Session 2 and Session 3, . . . This is a problem occasionally, but this semester I have structured the points so that a student can completely miss two of the twelve experiments without reducing their semester total.

## Examinations

The pedagogy emphasizes problem-solving. **Examinations are not multiple-guess.** Exams are not terribly time-consuming to grade. It is a simple matter to model examination problems after homework problems. This almost eliminates complaints about exams. A sample first-midterm begins on page 24.

## Homework Answers Are Unique to Each Section

Because the summary statistics depend on the particular transactions from the in-class experiments, these numbers are different for every section.

Because the competitive predictions depend on the distributions of suppliers and demanders, which are dependent on the number of students who are in class on the day of the experiment, these are generally different for every section, too.

Is this an advantage or a disadvantage for the instructor? It is probably a disadvantage if the instructor works out the homework answer key “by hand” each time. However, one of the co-authors of the textbook, John H. Miller, provided me with his [password-protected] Excel file answer keys. While they were incomplete and had some minor bugs, it provided a glimpse into the power of Excel as a programming environment. I have enhanced his files on my own, with my own preferences for formatting, so my answer keys are now “fully automated”: I enter numbers related to the personal information sheets I distributed and that alone generates the competitive predictions for that homework. In class I enter the transactions into the Excel file as the contracts come in and this generates all of the summary statistics automatically.

# Appendix

## Sample Information Sheets

The sample information sheet below and on the five following pages are the actual Personal Information Sheets for Experiment 1.

**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 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 Received			
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 Paid		
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 Received			
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 Paid		
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 Received			
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 Paid		
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 ( $= P - \$30$ )			

## Sample Contract

The sample contract below is applicable to many different experiments (e.g., Experiment 1, Session 1 of Experiment 3, Session 1 of Experiment 6).

**Sales Contract** *Session* \_\_\_\_\_ *Round* \_\_\_\_\_

*Price:* \_\_\_\_\_

*Seller's name:* \_\_\_\_\_

*Seller Cost* \_\_\_\_\_

*Buyer's name:* \_\_\_\_\_

*Buyer Value* \_\_\_\_\_

## Sample Examination

ECON 113, Spring 2004  
 March 3, 2004  
 Exam 1A, 100 points

Neatly print your name .....  
 Neatly print your ID number .....

**You have 50 minutes to complete the exam;  
 there are 9 problems. Manage your time wisely.**

**Points for each problem are given in parentheses with the problem number.**

**Write or print neatly and legibly: If I can't read it, it can't be correct.**

**Make straight lines straight; points will be deducted  
 for free-hand drawn lines that are not straight.**

1. (10 points) Suppose that the following data for the Competitive Predictions and Experimental Outcome apply for a particular market.

	Competitive Prediction	Experimental Outcome
Average Price	\$10.00	\$8.50
Number of Transactions	25	20
Total Profits of All Buyers	\$ 50	\$ 25
Total Profits of All Sellers	\$150	\$125

Determine the “market efficiency” for the Experimental Outcome and enter the result in the box below.

the market efficiency of the Experimental Outcome is % .

2. (10 points)

(a) Microsoft Excel is what kind of computer program or application?

.....

(b) In contrast to a database file, an Excel file is what kind of file?

.....

(c) Every “cell” of a Microsoft Excel worksheet or workbook possesses “attributes” or characteristics. What are the attributes or characteristics of a cell?

.....

.....

3. (20 points) Let the demand and supply for an apple market be given by the demand and supply curves in figure 5.

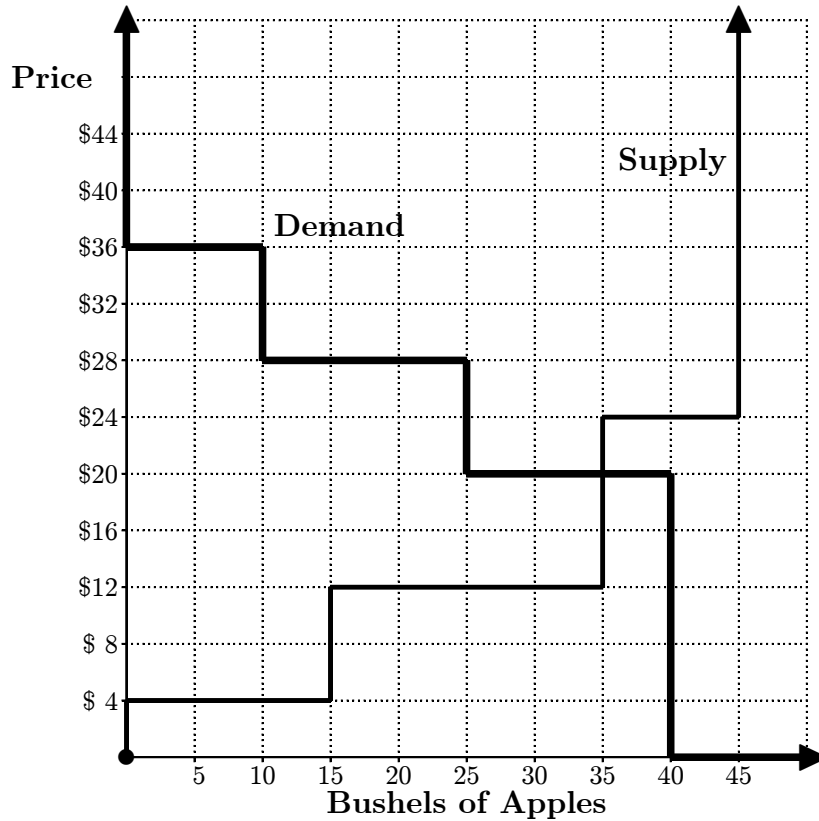


Figure 5: Supply and Demand Before a Tax on Apples

Use figure 5 for problem 3, continuing to the next page ...

(a) Using figure 5, complete the “No Tax” column of the following table.

	No Tax	Buyer Tax
Average (Mean) Price		
Number of Transactions		
Total Profits of Buyers		
Total Profits of Sellers		
Total Taxes Collected		
Total of Profits Plus Taxes Collected		
“Excess Burden” of the Tax		

- (b) If a **\$12 buyer tax** is placed on apples, draw the new demand curve in figure 5.
- (c) If a **\$12 buyer tax** is placed on apples, complete the “Buyer Tax” column of the table above.

4. (14 points) Suppose that the following table gives the experimental outcome for a particular market.

Price	Seller Cost	Buyer Value
\$ 7	\$ 5	\$ 8
\$ 9	\$ 8	\$10
\$11	\$ 7	\$11
\$ 6	\$ 8	\$10
\$ 9	\$ 7	\$ 9
\$ 7	\$ 6	\$ 8
\$10	\$ 8	\$ 7
\$ 7	\$ 6	\$10

- (a) From the above data, complete the following table.  
**Note: Don't forget to use the "\$" when appropriate.**

Average (Mean) Price	
Number of Transactions	
Total Profits of Buyers	
Total Profits of Sellers	
Total Profits of All Buyers and Sellers	

- (b) Which buyer(s), if any, behaved contrary to our usual trading rules?  
 Be certain you explain **why** the behavior violated our usual trading rules.

.....  
 .....

- (c) Which seller(s), if any, behaved contrary to our usual trading rules?  
 Be certain you explain **why** the behavior violated our usual trading rules.

.....  
 .....

5. (6 points)

What is the economically-relevant characteristic or attribute of any **buyer** in a market?

.....

What is the economically-relevant characteristic or attribute of any **seller** in a market?

.....

6. (7 points) Suppose that the following Supply Table applies for a given market.

**Supply Table**

Price Range	Amount Supplied
$P < \$5$	0
$\$5 < P < \$15$	10
$P > \$15$	25

Use Figure 6 below to graph the supply curve.

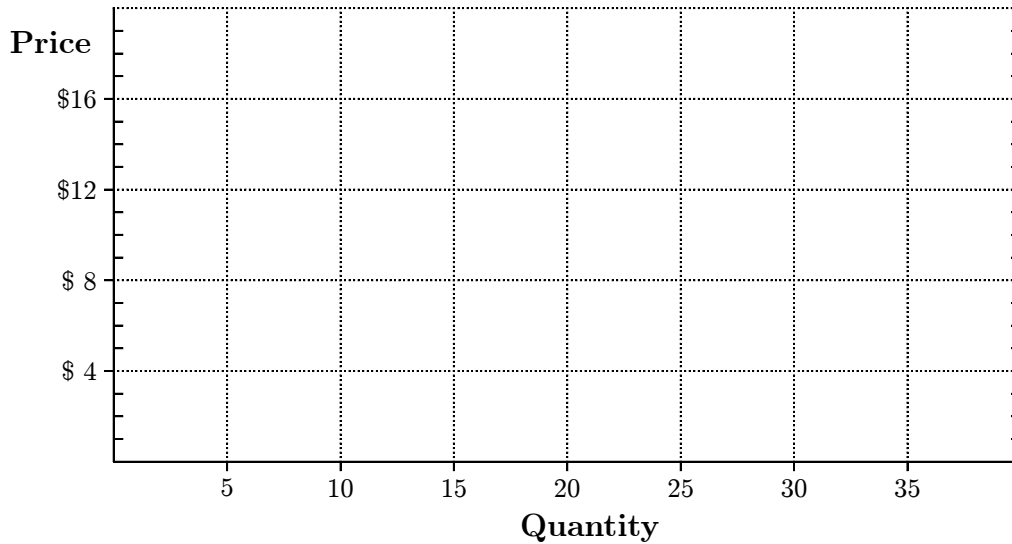


Figure 6: Competitive Supply

7. (15 points) In figure 7 are shown the demand and the supply of wheat.

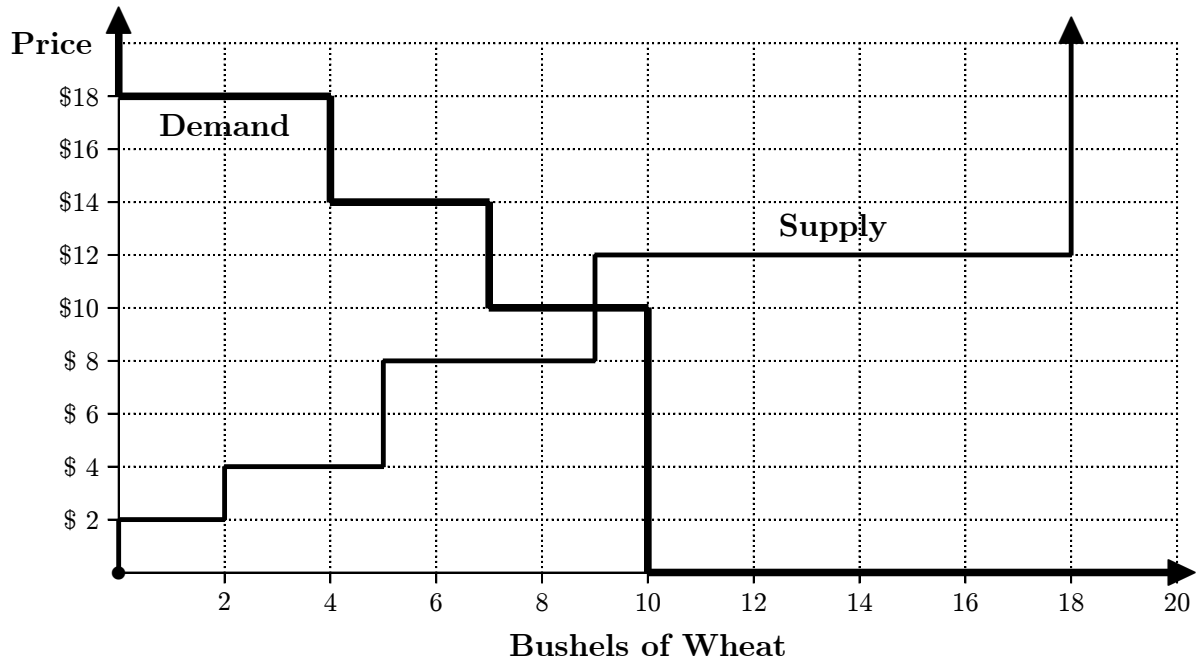


Figure 7: Competitive Market for Wheat

Complete the following table for the competitive predictions for the wheat market.

**Competitive Predictions**

Average (Mean) Price	
Number of Transactions	
Total Profits of Buyers	
Total Profits of Sellers	
Total Profits of All Buyers and Sellers	

8. (8 points) Suppose in a market there are 2 different types of buyers, as given in the following table:

**Distribution of Demanders**

Buyer Value	Number in Market
\$ 25	7
\$ 12	19

Complete the following Demand Table.

**Demand Table**

Price Range	Amount Demanded

9. (10 points) Suppose in an apple market there are two different types of sellers: one type of seller has sunk costs of \$5 and there are 10 such sellers; the other type of seller has sunk costs of \$15 and there are 20 of these sellers. **The sellers have no other costs.** Suppliers will supply only zero or one bushel of apples. In figure 8 below, draw the competitive supply curve for this market.

**Distribution of Types of Sellers**

Sunk Cost	Number in Market
\$ 5	10
\$15	20

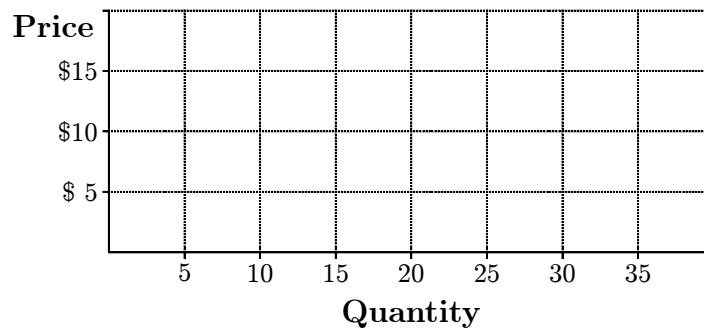


Figure 8: Competitive Supply