Classroom

EXPERNOMICS

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INSTRUCTOR'S INTRODUCTION

David J. Hoaas *

Two uses for experimental economics immediately come to mind. The first has to do with testing theoretical economic propositions using experimental markets. The second use involves placing introductory economics students in a simulated market to teach them first-hand economic principles. An often forgotten teaching use of experimental economics is to have students design and conduct their own economic experiments. An analysis of the results generated by one's own experiment can be an economically enlightening experience.

To this end, the Department of Economics at Centenary College offered an undergraduate workshop in experimental economics during the fall term of 1993. The students enrolled in this course implemented and evaluated their own economic experiments. The subjects taking part in the experiments were introductory economics students and other student volunteers. What follows is a shortened version of a paper that was prepared by three members of the class. To some extent, the paper represents original research by undergraduate students.

A REAL LIFE EXPERIENCE WITH SUPPLY AND DEMAND

Ashwin Damodaran
Heather Farish
Suzanne Stewman

INTRODUCTION

Supply and demand are the basic tools of economic analysis. Supply represents the amount of goods and services that firms are actually willing and able to produce and offer for sale at various prices at a specific time. Demand is the desire and ability to consume certain quantities at various prices at a specific time. The price and quantity at which quantity supplied equals quantity demanded is called equilibrium. What follows are three variations of an experiment that use different trading methods to demonstrate society's supply and demand for a product in the real world.

DOUBLE-ORAL AUCTION

EXPERIMENT DESIGN

The first variation of the market experiment was conducted by Chamberlain (1948). He promoted supply and demand transactions in a market by first dealing a deck of cards to a group of buyers and sellers. Each card was marked with either a value or a cost that was used to negotiate trades. The buyers and sellers involved in a trade received the difference between the market price and the trading price (Davis and Holt, 1993: 6).

Vernon Smith, a participant in one of Chamberlain's experiments, created the double auction, a revision of the initial experiment. In a double auction, the bids, offers, and trading prices are public knowledge. Smith showed that even with inexperienced traders, these markets would eventually converge close to an equilibrium (Davis and Holt, 1993: 7). This paper reports the results of an auction that was a replication and extension of Smith's earlier experiment. In this experiment, students entered the room, received a set of instructions, and were alternately seated as buyers or sellers. There were fifteen participants in the experiment consisting of eight buyers and seven sellers. After the participants read the instructions, a brief summary of the experiment was explained. The buyers were given a trading card that was marked with a reservation price. The sellers were given a trading card that was marked with a cost of production. The buyer cards were distributed in order with an initial reservation price of $5.00 decreasing by $.25 for each buyer. The seller cards were distributed in order with an initial cost of production of $2.25 increasing by $.25 for each seller. The experiment consisted of five trading rounds. At the beginning of each round, the buyers and sellers interacted in the designated trading area. Each buyer and seller negotiated until a trading price was finalized. After the negotiated trading price was recorded on the board and on their cards, these buyers and sellers were excluded from trading in the remainder of that round. Trading continued until time expired or until all possible trading was completed. The allotted time for the first round was five minutes, while successive rounds were three minutes each. Following the completion of the fifth round, the amount each participant earned was paid as follows: buyers were paid the sum of the differences between their reservation price and the trading price for each round while the sellers were paid the sum of the differences between their costs of production and the trading prices for each round. The expectation was that a progressive trend towards equilibrium throughout the five rounds would be seen in each of the experiments. In this simple supply and demand experiment, the values which were assigned for costs of production and reservation prices determined an equilibrium price range between

$3.50 and $3.75 with a theoretical average of $3.625 in all variations of this experiment.

EXPERIMENT OUTCOME

The trading prices that were agreed upon in each round are shown in Table 1 (the *'s indicate prices that fall within the equilibrium range).

BUYER POSTED-OFFER MARKET

As a variation, the method of trading was altered so that the buyers had to post their prices.

EXPERIMENT DESIGN

In the posted bid auction, students received a set of instructions and were alternately seated as buyers and sellers. There were eighteen participants in this experiment with an equal number of buyers and sellers. After a brief summary of the instructions, the same buyer and seller cards were handed out. The buyers were also provided with five sheets of paper and a marker to record their bids. The experiment consisted of five trading rounds. In each round, buyers recorded one bid on a sheet of paper, then simultaneously posted their bids. Sellers drew a playing card from a deck of cards, ace through nine, to determine their order of trading. In order, each seller was asked if they wanted to accept any bid, but they had the option to decline all bids. If a bid was accepted by a seller, it was recorded on the board as well as on the trading card and was no longer available for trade in that round. Trading continued until all sellers were given the opportunity to trade. In each of the following rounds, the buyers were given the option to post different bids. The playing cards were collected, shuffled, and redistributed to the sellers. Following the completion of the fifth round, the amount each participant earned was summed and paid.

Table 1. Outcomes for the Double Oral Auction.

Round 1	Round 2	Round 3	Round 4	Round 5
$4.25	$3.00	$3.75*	$3.00	$3.00
$2.95	$3.50*	$3.50*	$3.75*	$3.80
$3.50*	$3.75*	$3.25	$3.75*	$4.00
$4.00	$3.25	$4.10	$3.60*	$3.70*
$4.00	$4.00	$3.60*	$3.35	$3.80
	$3.10	$3.60*	$3.40	$3.60*
		$3.50*	$3.80	$3.50*
$3.74 avg.	$3.44 avg.	$3.61 avg.	$3.61 avg.	$3.63 avg.

EXPERIMENT OUTCOME

The trading prices that were agreed upon in each round are shown in Table 2.

SELLER POSTED-OFFER MARKET

As yet another variation of the initial experiment, the sellers rather than buyers posted offers.

EXPERIMENT DESIGN

In the posted offer auction, the students received a set of instructions and were seated as buyers and sellers. There were eighteen participants in this experiment with an equal number of buyers and sellers. After a brief summary of the instructions, the same buyer and seller cards were handed out. The sellers were also provided with five sheets of paper and a marker to record their offers. The experiment consisted of five trading rounds. In each round, the sellers recorded one offer on a sheet of paper, then simultaneously posted their offers. Buyers drew a card from a deck of cards, ace through nine, to determine their order of trading. In order, each buyer was asked if they wanted to accept any bid, but they had the option to decline all bids. Each time a trade was made, the posted price was recorded on the board as well as on the trading card and the bid was no longer available for trade in that round. Trading continued until all buyers were given the opportunity to trade. In each of the following rounds, the sellers were given the option to post different offers. The playing cards were collected, shuffled, and redistributed to the sellers. Following the completion of the fifth round, the amount each participant earned was summed and paid.

EXPERIMENT OUTCOME

The trading prices that were agreed upon in each round are shown in Table 3.

CONCLUSION

This supply and demand experiment was conducted to demonstrate three different ways buyers and sellers interact in the marketplace. In these experiments, the equilibrium price range between $3.50 and $3.75 was derived from the assigned reservation prices and costs of production. In the double-oral auction, equilibrium trades were made at least once in each round with progressively more trades in each round. Fewer trades were made in the buyer posted-offer market than in the

Table 2. Outcomes for the Buyer Posted-Offer Market.

Round 1	Round 2	Round 3	Round 4	Round 5
$3.26	$3.75*	$3.25	$3.75*	$3.51*
$3.00	$3.51*	$3.19	$3.32	$3.75*
$2.75	$3.15	$3.15	$3.37	$3.55*
	$3.01	$3.13	$3.16	$3.50*
	$2.99		$3.27	$3.29
$3.00 avg.	$3.28 avg.	$3.18 avg.	$3.37 avg.	$3.52 avg.

Table 3. Outcomes for the Seller Posted-Offer Market.

Round 1	Round 2	Round 3	Round 4	Round 5

$4.50	$3.00	$3.25	$3.00	$3.00
	$3.50*	$3.25	$3.50*	$3.50*
	$3.75*	$2.50	$3.50*	$3.75*
	$4.00	$3.75*	$3.75*	$3.50*
		$4.00	$3.75*	$3.75*
		$4.00	$3.75*	
$4.50 avg.	$3.56 avg.	$3.46 avg.	$3.54 avg.	$3.50 avg.

double-oral auction. The offers posted were initially low due to the fact that the buyers were trying to go as far below their reservation prices as possible. Equilibrium was not reached in every round, but there was a progressive trend towards it in later rounds. More trades were made in the seller posted-offer market than in the buyer posted-offer market. Because of the assigned sellers' costs of production, offers were initially very high; therefore, only one trade was made in the first round. Equilibrium was reached in every round except round one. The number of equilibrium trades increased as the experiment continued.

The most trades were made in the double-oral auction even though the fewest number of participants were involved. In all three experiments, each progressive round found more trades within the equilibrium range, as was expected. A maximum of seven trades were possible in each round, and in the double-oral auction in three of the five rounds, the maximum was reached. This may be due to the fact that the buyers and sellers could negotiate until they agreed upon a trading price. In the posted-offer experiments, trading prices were posted and therefore were non-negotiable. Also, the prospective traders were given only one chance in each round to accept a bid.

The seller posted-offer experiment depicted what actually occurs most often in the marketplace. However, the double-oral auction produced the most trades because of increased interaction between buyers and sellers.

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SUNK COST AND MARGINAL COST: AN AUCTION EXPERIMENT

Michael J. Haupert*

The concepts of sunk and marginal costs can be difficult to get across to students. To do so, I employ an experiment that involves auctioning dollar bills in class. I tell the students that I will be auctioning dollar bills the next class period and to bring change if they are interested in participating. I impress upon them: there is no catch, I will be auctioning off genuine U.S. one dollar bills, each bill will be sold to the highest bidder, and I will auction off at least two dollar bills--more if there is sufficient interest.

On the day of the auction, I first show the students the stack of twenty crisp, new one dollar bills I will be selling. I have always had at least 20 out of 35-45 students interested in participating in the auction, so lack of bidders has never been a problem. I choose an assistant from among the non-bidders to keep track of individual bids, and I then explain the rules of the auction.

The auction is a sunk-cost or, as I explain, a poker model. Each time a player bids, his or her bid is recorded by my assistant. If a player bids more than once, the higher bid replaces the lower bid, so that a player always has only one outstanding bid. The auction is conducted as an English auction, with the highest bidder taking the dollar bill. As opposed to a standard English auction however, the winning bidder is not the only bidder who pays for the dollar. When the auction ends, all bidders who entered a bid during the auction must pay an amount equal to their highest bid. Only the highest bidder, however, gets the dollar. Once these rules are explained, I begin the auction for the first dollar.

Predictably enough, the auction generally starts with a bid of a penny or two. Bids then slowly approach $.50, $.90, and then $1.00. The person who bids $.99 only to be outbid at $1.00, hesitates a few seconds before realizing that bidding $1.01 for a dollar is not such a crazy idea. She realizes that if she stops now, she will have spent $.99 for nothing; whereas, spending only $.02 more may net her a dollar. The first bidder to go over a dollar generally brings a roar of laughter from the class, which appreciates it even more as the bidding escalates further.

My experience is that the dollars tend to sell for between $1.50 and $1.75, although I have sold some for over $2.00. After auctioning off the first dollar I ask the bidders their strategies and why they would pay more than $1.00 for a dollar. I have been delighted to find that when they are subjected to the experience of comparing marginal (versus sunk) costs and marginal benefits, they seem to catch on quickly. However, they are still anxious to buy more dollars.

After a few purchases, the bidders begin to scheme and wonder aloud about the possibility of colluding in order to depress prices. I do not discourage collusion, rather I encourage it; if they don't ask me to leave the room, I offer to do so in order to let them plot strategy. When I return to the room, it takes only a few bids before the collusion breaks down and the price escalates beyond a dollar. This leads to a very interesting discussion about collusion and cartels and the difficulty of maintaining them.

After the auction, I have in my possession a rather large sum of cash. After reclaiming my $20, I inform the class that I will return the money to them, but they must decide how to divide it up. I do not tell them before the auction begins that I will return any money. I only inform them of this when I have auctioned the last bill. Their decision on how to divide the money usually leads to

yet another discussion, this one on allocation. Should only those who participated in the auction receive the money (usually the first criteria agreed upon)? Should the money be divided equally? Should only those who lost money or did not get a dollar receive money? Should a lottery determine who receives the money?

This experiment is easy to run, enjoyed immensely by students, and vividly displays the important concepts of marginal and sunk costs. In addition, it fosters many discussions and involves students more readily in the learning process. Since implementing it, I have found teaching the concepts of sunk and marginal costs much easier.

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A BUDGET BALANCING GAME

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Regular peace time budget deficits are a relatively recent phenomenon in the U.S. Crain and Muris attribute this not to an adoption of Keynesian counter-cyclical policies or any other ideological shift, but to a restructuring of the congressional budget process. They claim that the rise of the subcommittee system and limitations on the appropriations committee created a common-pool problem with the "general fund." Each subcommittee will overgraze the common fund, that is they will recommend increasing spending on projects overseen by their own committee and funded out of general revenues. At the same time they will hope that the other subcommittees will show restraint.

A classroom game can easily show students both the common-pool model of budget deficits and illustrate why small items in your budget are relatively price-inelastic. I obtained a balance-the-budget program from the National Chamber of Commerce (Flex-Freeze) which covered the budget periods for 1988-1994, but instructors may want to just look up this year's budget projections. The budget by function (education, welfare, defense, medicare, etc.) and the deficit are posted. The class as a whole must propose alternative budgets and pass one using a majority vote. The class as a whole will divide up a larger reward (extra credit) the smaller the deficit that is passed.

However, the share of the total reward received by any one student depends on how well her interest group does. Each student is assigned to an interest group (or committee if you wish but students seem to have more fun with the interest groups). The interest group receives points for every dollar spent on its favorite projects (example, construction workers like spending on roads and bridges, etc.) and may have points deducted for money spent on certain other projects (example, Hollywood might gain points for money spent on environmental protection and lose points for money spent on defense). There are enough budget functions so that all students are potentially members of a winning coalition but not at the same time.

Students will try to form coalitions with other students to cut other programs but increase spending on their own. They quickly see the incentive for deficit financing. Various

budget proposals are brought forward and debated. Typically, counter offers are made to bid a few people away from the proposing coalition. Eventually, a budget is passed. The total reward is calculated from the decrease in the size of the deficit. The total points for each interest group are added up and represent all the shares. Each student's reward is their total share of the class reward.

Usually, students ignore the smaller programs and you will hear them say that it is not worth the time to look at those for spending cuts. Enterprising students whose interest is tied to smaller programs can even get large percentage increases if they propose the budget. The rest of the class often will not even notice that program's budget was increased. After the experiment, students respond positively to a review of the determinants of elasticity focusing on the importance of being unimportant.

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A SIMPLE EXPERIMENT OF COMPARATIVE ADVANTAGE

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Paul Samuelson once said that David Ricardo's demonstration of Comparative Advantage is one piece of Economics which is perfectly simple without being perfectly obvious. This is shown, he claims, by the many business and political leaders of obvious intelligence who have utterly failed to understand it.

Unfortunately, this can also be said of the many intelligent Economics students, who, having learned to parrot the theory, still do not believe it. Am I the only instructor who, having put his Ricardian triangles through their paces, has turned from the blackboard to notice expressions that are somewhat more than skeptical? As an MBA student said to me good-naturedly after class, "Well, it's all theory, isn't it?"

The best diet for such healthy skepticism is for students to take a ride atop those trade triangles themselves--before hearing what theory says should happen. By taking this ride, the teacher himself was led to discover a simple misinterpretation reproduced in many textbooks. The pedagogical experiment is as follows.

Have your students pair up, letting them choose which will play the part of Mexico and which the U.S. Then hand out graph paper and ask them to reproduce linear Production Possibility Frontiers for two good, Trucks and Computers, in something like the following forms. (Do not draw for now the points I have picked out on the frontiers, along with the regions shown lying to the North-east of those points. That will come later.)

Having explained what Production Possibility Frontiers (PPFs) are, ask each student to pick out any point along his or her PPF that he/she "likes"--the best point of production/consumption in autarky. Sample points are represented above.

Now ask each pair of students, given these best autarkic points, if they can find a way to swap Trucks and Computers that makes each country better off. Explain that even without knowing anyone's preferences, we can still agree that a country is "better off" if it gets "no less of each of the goods and more of at least one" than under autarky. Thus the right-angled indifference curves above.

Having done this in three different classes--two of freshmen and one of MBAs, I can say that after 30 minutes about half the pairs figure it out. There was no appreciable difference in this rate of discovery between MBA's and freshmen--again, Samuelson's point. A couple of student comments are worth noting.

Several times the student playing the role of the U.S. would say, "How can you make me better off? I can do both things better than you!" Afterwards you can compare this with Ross Perot's argument that Mexicans are "too poor" to pay for American goods. All the common anti-trade fallacies, from both sides of the border, can be answered by this venerable little Ricardian example. I tell students that the error comes from looking only at "first-order" differences--that one country is "bigger" than the other in both dimensions, instead of the "second-order" difference--that within Mexico Trucks are cheaper relative to Computers than they are within the U.S.

A couple of freshmen (females) raised their hands in perplexity. "Do we have to barter?" asked one. "Can't we just cooperate to make each other better-off?" I thought this was a nice illustration of the emotions that can obscure the workings of the invisible hand. For many people, "competition" leads to thinking that the game must be zero-sum. "Of course," I said, "if that helps you to see it better." (On this point I offer two hypotheses--something for a "real" experiment? If you gave the same numerical example as two roommates who could Cook and Tidy-up -- either for themselves individually, or cooperatively for each other, I predict that more people would "get it". A second hypothesis is that females would get it more often than males!)

Now comes the common pedagogical

mistake--one I used to make myself. The textbook I use, Peter Lindert's International Economics (9th Edition)--a superb book in most respects--claims that "With constant costs one of the two trading countries can fail to specialize completely only in the special case in which the international terms of trade settle at the same price ratio prevailing in that country with no trade." (p. 29, ff.5)

In a recent conversation, Professor Lindert has graciously acknowledged that this should read "the smaller of the two trading countries can fail to specialize...". The autarky points chosen above show why the original statement was incorrect. Let the U.S. produce and consume 1 (million) Computers and 4.5 (million) Trucks before trade, as shown. Students often settle on "1-for-1" terms of trade intermediate to their PPF slopes. Then the U.S. can get slightly more than 4.5 Trucks by specializing mostly in Computers: it produces 0.8 Trucks and 8.4 Computers, selling 3.8 of those Computers to Mexico for an equal number of Trucks, to be left with 4.6 of each good. But there is no way for the U.S. to get as many as 4.5 million Trucks if it gets them only from Mexico. And note that the U.S. would have to produce even more than 0.8 Trucks for itself if Mexico insists on consuming more than 0.2 Trucks. But Mexico still specializes in Trucks.

It might be thought this contradiction to "complete specialization" is an artifact of the Leontief indifference curves illustrating "better off". But it's easy to get differentiable examples if the elasticity of substitution is low enough (but not necessarily zero), and the larger economy wants to consume most of its production of the good in which it does not have a comparative advantage.

The U.S. could specialize completely in producing Computers if there were many countries like Mexico--Adam Smith's old point about the division of labor being limited by the size of the market. One can use this example to illustrate this stylized fact about trade among Developed Countries--the amount of their GNP derived from trade is inversely proportional to the size of their economy.

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NEW EXPERIMENTAL ECONOMICS BOOK RELEASED

Experimental Methods: A Primer for Economists, by Daniel Friedman (Professor of Economics, University of California--Santa Cruz) and Shyam Sunder (Richard M. Cyert Professor of Management and Economics, Carnegie Mellon University) has recently been published by Cambridge University Press.

This primer is the first readily accessible, self-contained summary of experimental method and technique for students and researchers in economics. The authors touch on broad conceptual issues and discuss the basic principles, but emphasize concrete procedures for successful experimentation: picking an interesting and important problem, creating a laboratory environment, choosing and motivating subjects, designing and conducting experiments, collecting and analyzing the data, and reporting the results. This book will help beginners to avoid making mistakes in organizing an experiment and increase the experiment's scientific returns.

John D. Hey writes: "The authors succeed triumphantly in their chosen aim: providing helpful advice on all aspects of setting up, designing, implementing and analyzing experiments. What is particularly satisfying is that the advice is not merely theoretical and abstract, but is based upon, and illustrated by,

much experimental evidence. The book will prove to be of practical value to economists carrying out experiments, whether they are novices or semi-experts."

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