Experimental Economics: Games Economists Play

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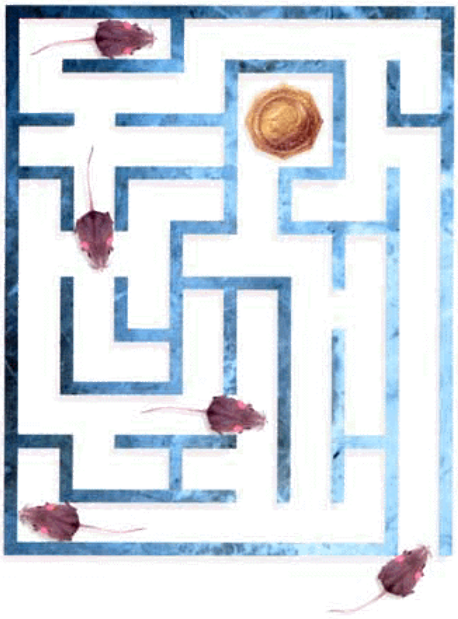

Some years back, the term "experimental economics" would have furrowed the brow of almost any economist. He might have told you, "Chemists shield their beakers from sunlight and contaminants. Animal behaviorists run their mice through the maze a thousand times. Economists, though, cannot hope for similar degrees of control and replicability. Our job is merely to observe a world that hardly notices us."

He might have told you that economists have more in common with astronomers than with chemists or behaviorists. Galileo could not fit the moons of Jupiter into his workshop to see how they would react to a bit of jostling. Likewise, Adam Smith could not rerun 1775 to see how British farmers would have reacted had corn prices been 10% higher. (Fans of *Groundhog Day* or *Back to the Future* might argue with this point.)

Nowadays, astronomy is a highly experimental science whose tools include particle accelerators as well as telescopes. Likewise, experimentation has become a small, growing, and lively corner of economics, beginning in earnest in the early 1970s. Experimentalists test the validity of economic theory under laboratory conditions. They observe the reactions of real people to real economic incentives. The laboratory is still not the centerpiece of economics, but it is at least part of the table setting.

How Economists Experiment

Economic experiments can be small or large. They can last an hour or five years. They can cost the researcher a few dollars (the rule) or a few million (the exception). They can occur in a single room or a single city, or they can span the globe. Yet almost all economic experiments share certain common elements.

The economist's catechism begins with supply-and-demand analysis. So naturally, some of the earliest economic experiments tested that end of the literature. To see a simple version of one such experiment, click here. This example illustrates the key points in experimental design, including:

Begin with an hypothesis about the real world (or several conflicting hypotheses): In the real world, different firms face differing costs, a fact mirrored in this experiment's supply curve. In the real world, some consumers value a particular good more than other consumers do, a fact mirrored here in the demand curve. From these sparse observations and a few modest assumptions we can derive conflicting hypotheses: One would be, "Competition among businesses and among consumers will result in a price of between $4 and $5." Another would be, "Incentives to collude will lead the lowest-cost businesses to

form a monopoly and bully consumers into paying nearly $6." We could also hypothesize that powerful consumers will bully businesses into selling at around $3 or that prices will be all over the chart. Perhaps the market will be so confused that no trades will occur. This simple experiment can help us decide which hypotheses are at least plausible.

Test the hypothesis by using live subjects: In this case, a group of students comprises the test group. In other experiments, the subjects might be families or randomly chosen outsiders or people responding to newspaper advertisements.

Some experimenters use rats, pigeons, dogs and other animals to test theories of animal and human response to economic incentives. Pet enthusiasts will be happy to know that animals are highly efficient economic maximizers. They act as if they are solving complicated systems of equations. (Charles Plott, a founding father of experimental economics, pointed out that dogs similarly "solve" highly complex aerodynamic equations every time they catch a Frisbee®. No wonder that Fido is as talented an economist as he is a physicist.)

Require subjects to make choices: In this experiment, some students must choose whether to buy poker chips, other students must choose whether to sell poker chips, and all must choose a price at which to deal. Students might record their choices on paper. In other games, they might register their decisions via computer. The important point is that they choose and record their choices unambiguously.

Provide real rewards: In this game, students earn real money—some will leave the experiment wealthier than when they arrived. Some experimenters pay their test subjects with goods (candy bars, gift certificates, etc.). What is important is that the participants must have a real stake in the game. They mustn't be volunteers with no real rewards for participating.

Rewards must depend on the choices made: Students' rewards in this experiment depend on the bargains they strike in the market. If Friedrich pays $3 for a chip, he leaves the experiment wealthier than if he pays $7. The more Vilfredo can charge a consumer for his chip, the more he pockets. (Note: These games are almost always structured so that participants cannot lose money—they don't leave the game poorer than when they arrive.)

The experimenter controls variables to avoid extraneous factors: The teacher uses poker chips precisely because they are intrinsically worthless to the participants. Their value depends entirely upon the monetary payoff of the game. If the teacher used Elvis Presley CDs, the students' feelings toward Elvis might influence the value they placed on the rewards. The teacher assures that participants aren't distracted by an ice cream machine. She assures that every participant knows the rules completely and, thus, makes no decisions out of ignorance.

Why Experiment?

Why would we want to use experiments when we already have a whole world full of economic data? Our supply-and-demand experiment also sheds some light on this issue:

An alternative to second-hand data: Suppose a nonexperimental researcher wishes to study the market for potato chips. To construct a supply curve, she might collect data from individual manufacturers and industry associations. To construct a demand curve, she might use data from consumer surveys or from

government data. The problem is, none of these data were designed specifically for her economic research. She might have to use some heavy-duty mathematical tricks and make some iffy assumptions to force the data to work in her model. An experimental laboratory allows the economist to create custom-designed data freer of such problems.

Control over extraneous factors: When a chemist writes that a liquid boiled because its temperature reached 285F, she makes sure that it did not boil because the air pressure changed or because she spilled some water into the beaker at that moment. She tightly controls laboratory conditions. Similarly, our experimenter makes sure that the price of poker chips isn't influenced by extraneous factors—say, a sudden offer by one participant to trade his poker chips for some potato chips.

Small mistakes rather than big ones: Experiments allow economists to make small, cheap errors, rather than big, expensive ones. Before lobbying Congress or selling economic consulting services, an economist might use the lab to test competing hypotheses, like those imbedded in our supply-and-demand experiment. He might think twice about advocating some market structure that always fails in the lab.

In recent years, the Federal Communications Commission has auctioned off portions of the broadcast spectrum. There are many different types of auction, each with its own set of rules. One type might favor large existing broadcasters; another might favor small, upstart companies. One type of auction might bring in revenues of $10 billion, another $6 billion. And some auction rules just plain don't work.

Economic experiments allowed the FCC to weed out unworkable auction rules without having to hold a public auction, watch it flop, blow $5 billion, and ruin the broadcast spectrum. Melanie Marks points out that she is careful to test fundraising strategies in the laboratory before she would ever try to convince a large company to spend a lot of money employing her methods.

Testing in practice what we don't know in principle: Economic theory can be quite adamant about where the equilibrium lies in some market (where the supply and demand curves intersect is frequently a good guess). But economic theory often says little about how the markets move toward equilibrium when they start out somewhere else. In our experiment, suppose the first trade occurs between Friedrich and Jeremy. Jeremy is a shrewd bargainer and gets Friedrich to pay him $7.50 for the poker chip. At that moment, the market price is, by definition, $7.50. Once this occurs, will other players find their way toward the $4-$5 equilibrium, or will the market remain "stuck" at $7.50 for some reason?

The competitive model suggests that competition among buyers and among sellers will tease their true preferences out into the open. As this occurs, the market will edge its way toward the competitive price. On the other hand, the evening newspapers are filled with anecdotes about stock prices, retail prices and wages remaining "too high" or "too low." Often, these anecdotes can be debunked through careful analysis; but at other times, economists must recognize that their science has not fully explained those phenomena that go under the heading "market psychology." One way to resolve such puzzles is simply to put some people into the lab and see how they behave—and this is one of the great strengths of experimental economics.

Range of Applications

Experimental economists often remind others of their specialty's limitations. Charles Plott, the experimentalist mentioned earlier, once compared the field to a wind tunnel. Wind tunnels, he said,

help aerospace engineers to tell which aircraft designs *will not* fly. They will not, in general, tell you which ones *will* fly. (But it's good to eliminate the sure-to-fail designs before trying to build an aircraft.)

While many areas of economic research are appropriate for experimental techniques, others are not. One problem is that games with payoffs in the tens of dollars will never give us an exact view of how people behave in markets where the real payoffs are in the billions of dollars.

Another problem is that experimental subjects are prone to so-called "Hawthorne effects." Many years ago, a factory in Hawthorne, New Jersey, wanted to test the hypothesis that, "Up to some point, brighter light will make more workers more productive." They increased the wattage and found that productivity increased. They made the lights brighter still, and productivity increased again. Eventually the light was made blindingly bright, but productivity still increased. Then they dimmed the lights, but productivity didn't decrease as expected—it increased once again. Every time a change was made in any direction, productivity went up. Why? The workers knew that whenever the lights were changed, they were being watched, so they worked harder. In other words, humans are aware of their surroundings—they act differently when they are observed.

The only sure way to avoid Hawthorne effects is to hide the experiment from the subjects—to observe them in secret. Ethical considerations, though, preclude a great number of scientifically interesting but morally suspect experiments. In the United States, universities are forbidden to violate subjects' privacy in the name of experimentation.

Where then, can experimental economics take us? In recent years, lab techniques have spread into a number of corners of economic research. From its beginnings in supply-and-demand analysis, experiments have moved on to include auctions, lotteries, other decisions under uncertainty, voting patterns, and strategic interaction between small numbers of players (such as business negotiators or warring nations).

In short, experimental economics has squeezed its way into a variety of areas where other methods of economic research cannot fully illuminate the room.

Suggestions for teachers

Try the experiment described above in your own classroom. Before beginning the game, write down the price and quantity expected in a competitive market ($4 to $5 and 3 chips, in this case). Seal the paper in an envelope. When this outcome actually occurs, open the envelope to demonstrate how smart you are. When this outcome doesn't occur, quickly eat the envelope. [One word of warning: experimenters must assure that all the participants fully understand the rules of the game. Often, experiments fail precisely because this step is not taken adequately.]

Those interested in learning more may wish to look at *Experimental Economics*, by Douglas D. Davis and Charles A. Holt (Princeton University Press). Those electronically inclined may wish to look over Charles Plott's Website where one can see a range of experiments. At least one creates an economy with a Federal Reserve Bank and in which, in Plott's words, "Money works!" (As the article on pages 8-10 notes, the fact that money works is a greater mystery than laymen might assume.)