

Experimental Economics in the Agribusiness Classroom

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In a discussion of experiential learning in economics, Herz and Merz (1998) argue that learning is a holistic process of mastering complex theories and understanding human interaction. They state “the process of learning can be enriched by providing students with an environment in which they cannot only rethink economic ideas but in which they can also experience the whole decision-making process” (pp, 248-249). While Herz and Merz were mostly concerned with simulations, their assessment of learning, influenced by David Kolb (1984), is applicable to all forms of experiential learning: simulations, case studies, and experiments.

Kolb (1981) observed that learning, as viewed through the experimental learning theory, is a four-stage process. The learner has concrete experiences on which she makes observations and reflections. Next, the learner takes her observations and reflections and forms abstract concepts and generalizations upon which she tests the implications of the concepts and generalizations in new situations. New concrete experiences begin the cycle again. Simulations, case studies, and experiments allow students to move through all four stages of the learning process; however, each teaching technique has strengths and weakness at the different stages of learning. Simulations and cases studies are common features in many agribusiness curricula. The goal of this article is to suggest that agribusiness instructors consider the use of experiments as well.

Experiential Learning in the Agribusiness Curriculum

In the Experiential Learning Model

Using experiments in the agribusiness classroom can be an innovative way of getting students to experience a number of market environments. Experiments are part of a continuum of agribusiness

teaching techniques, with case studies on one end and theory on the other. After surveying the literature on different experiential pedagogies, we discovered that many instructors have widely different definitions for simulations, experiments, and case studies. We define a simulation as a computer-based market, designed to mimic the complex decisions faced by a manager in the context of a supermarket, marketing division, etc. Simulations often pit participants against one another, all of whom have the same initial endowments and decision opportunities.

Relative to a simulation, experiments are simple markets where the participants function in narrowly defined institutions: auctions, monopoly markets, games of trust, etc. The participants may or may not compete against one another, and the participants may compete face-to-face, via a computer or against the computer. The case study method uses cases—narratives of the actual facts of a particular firm or manager facing a set of decisions—to get students to critically evaluate and discuss a series of business decisions.

In terms of the experiential learning model, simulations and case studies place students in concrete experiences, either in computerized markets or in discussions. In simulations, students receive regular reports of their performance, allowing the opportunity for observations and reflections. Because of complexity and the inability to hold other things constant, simulations are not particularly good at helping students reach the stage of the formation of abstract concepts and generalizations. Because of the multiple periods in many simulations, students try to improve their position through a trial-and-error process, which mimics the stage of testing as observed in the experiential learning model. Despite these shortcomings, simulations have the strong point of giving students concrete experiences.

The case study method is dependent on students making observations and reflections. Because of complexity and limits to the facts of the case, case studies, like simulations, are not very helpful in

getting students to the stage of the formation of abstract concepts and generalizations. While students under the case study method often learn new ways of approaching the case, testing the new approach may not be possible in the next case because of the uniqueness of each new case. The strength of case studies is that they are great at getting students to observe a set of facts and to reflect on those facts.

Experimental economics began in the classes of Edward Chamberlin at Harvard University as a teaching technique to help students understand markets (Chamberlin 1948). While experiments place students in concrete experiences, the true strength of experiments is that they permit students to form abstract concepts and generalizations. Experiments do a great job at helping students make abstractions because experiments are simple and based on theory. In many ways, an experiment is a stripped-down simulation that is oriented to test a hypothesis. The lack of complexity allows for transparency. The actions of students are traceable through the experiment because all other things are held constant. Since the experiment is based on theory, the student can compare the experimental results with the theory. From the generalizations of the theory, the student is better able to test implications of the concepts in different treatments of the same experiment.

Comparisons and Contrasts between Simulations, Case Studies, and Experiments

In simulations and many experiments, the students interact to generate a market. Depending on the institution (auctions in particular) experiments can reveal the real-time behavior of participants. Case studies are static models of a business environment. In case studies, students are required to propose plausible actions for the firm or manager under study. Simulations and case studies both try to reflect the complexities of the real world. Experiments typically strip down reality to model the essence of real markets.

Experiments require students to develop strategies under certain market conditions, a characteristic shared with simulation games. But experiments differ from simulations in that experiments often have clearly defined equilibrium solutions or global optima. The existence of these singular solutions gives experiments a benchmark from which to compare the “efficiency” of actual results, allowing the professor to discuss why certain strategies were more profitable than others. In accommodating the demand for realism, simulations often introduce too many components to allow detailed discussions of optimal strategies. While there could be an optimal solution under certain assumptions in simulations, cases typically do not have a single right answer.

Case studies in agribusiness curricula provide students with examples to assess a “real world” scenario and to discuss that scenario critically. The strength of case studies is that the learning process occurs from student interactions. In many cases, there are no right answers. Rather there are some answers that are better than others. If the case study method is used, the instructor is challenged not to lecture on principles in hope that the students will come across those principles in their analysis and discussion.

Students in case studies do not generate data. Conversely, experiments and simulations generate immediate feed back of choices and make appropriate adjustments (Salvacruz and Bobst 1998). Students are limited to the facts that are provided in the case so, the case lacks the dynamics of simulations and experiments. Cases may also present such a wealth of data that students are overwhelmed and can miss key points of the case.

In the field of agribusiness management, instructors and extension specialists have used several simulations, such as the supermarket, farm supply center, and grain elevator simulations by Babb (1985). In each simulation, student teams take the role as the manager of the enterprise. For example,

in the supermarket simulator, each team makes 26 operating decisions each week for several weeks. With so many operating decisions, instructors and students are not able to isolate the impact of individual decisions.

Herz and Merz (1998) stated that the main problem with simulations in economic courses is to find simulations that have good economic foundations and maintain flexibility and manageability. While simulations used in agribusiness courses may have sound management or finance foundations, they are usually are fairly large programs that allow limited room for manipulation for specific pedagogical purposes. If an instructor is trying to emphasize a particular theory or concept, simulations pose a challenge because it is difficult to hold other factors constant. Simulations typically try to provide a large set of decision possibilities for the manager. Conversely, experiments strip away all the complexity to focus on one theory or concept. Experiments have the added benefit that with often minor changes they can be converted to demonstrate different theories or concepts. In order to expose the student to different theories or concepts, an entirely new simulation is needed because of the limited capacity to make changes in simulations.

Another challenge with simulations is that they require considerable time to run before the student is able to get the feel of the simulation, whereas many experiments can take only one class period to run and discuss.

Experiments for the Agribusiness Curriculum

A variety of experiments can be used in the agribusiness curriculum. We highlight only three experiments: a double-auction, a monopoly experiment, and an oligopoly experiment. In this brief survey of experiments, our intention is provide a sampling of experiments that can fit into the agribusiness curriculum.

Adding experiments to the agribusiness curriculum can help our students understand that markets are not theoretical constructions of economists. One of the most important lessons that we can teach in the agribusiness classroom is that markets are dynamic entities that adjust to information, institutions, and policies. Leading students through different market settings is one way to help students learn how real markets work.

A Double-Auction

A particularly beneficial experiment to use in the agribusiness classroom is a double-auction, which is a market where buyers and sellers make offers simultaneously. A double-auction gets students involved in a market as buyers and sellers. Over the course of the experiment, the students can see the market converge on the equilibrium. The double-oral auction is an especially exciting double-auction because students make trades by shouting out prices and making deals. The double-oral auction is useful for the instructor because it will consistently generate the competitive equilibrium even when conducted under fairly diverse conditions.

In the experiment, the instructor divides the class into buyers and sellers. Buyers have decreasing unit valuations, and suppliers have increasing unit costs for the traded, standardized commodity. Each trader has one or more units that she wants to exchange. The instructor serves as the auctioneer: opening the market and posting ascending bids from buyers and descending offers from sellers until a deal is made. The auctioneer closes the market after a specified amount of time or until the students do not announce additional bids or offers (Smith 1962, Smith 1964, Davis and Holt 1993).

After the experiment, students are typically amazed by the life cycle of the market. Initially, a few buyers and sellers enter the market with trepidation. After the first few trades, the market picks up in volume (and typically in noise); prices converge to equilibrium; finally, trading slows till the last

tradable unit is exchanged. Students learn that a competitive equilibrium can be obtained without a large number of buyers and sellers. While the traded commodity was uniform, the students, unbeknownst to them, were diverse in their valuations. Perfect information was not available because the students did not know the valuations or costs of the other students. Ultimately, students experience what is meant when we say the “invisible hand” moved them to equilibrium.

The double-auction can be adaptable to show more than convergence of equilibrium and the relaxing of assumptions of competitive markets. With simple modifications, the instructor can lead students through the effects of price interventions. With the same structure as before, the auctioneer can announce a price floor or ceiling. Isaac and Plott (1981) and Smith and Williams (1981) showed that binding price controls shift the equilibrium and produce inefficiencies in the markets. These modified experiments can help students better appreciate the effects of market interventions.

Another use of the double-auction market is in the context of asset markets. Smith, Suchanek, and Williams (1988), Peterson (1991), and King et al. (1991) showed the development of bubbles and crashes in double-auction markets. Lessons such as these are hard to teach because students can dismiss the speculation of others as foolishness and error, but allowing the student to experience and contribute to the bubble helps them to understand the vagaries of a financial market in the safe confines of a classroom.

A Monopoly Experiment

The monopoly experiment can play a unique role in the agribusiness class. Monopolies and monopsonies are fast becoming a more common market structure in agribusiness. Thus, introducing this market structure through an experiment may help students better appreciate the functioning and problems of the monopoly structure. The monopoly experiment is a nice contrast to the perfectly

competitive double-auction, and the monopoly experiment also provides a point of reference to understand better the results from experiments of imperfectly competitive markets.

The basic monopoly experiment places individual students in markets as monopolist producers with dummy consumers; that is, the professor uses a constructed demand curve so there is no interaction with actual consumers. The students are given a schedule of marginal, average, and total costs, but they do not know the demand curve. Then, each student is asked to produce a quantity of product and decide on a single price at which he or she will offer the entire quantity for sale. From these data, the professor reads off the demand curve and tells each student the quantity sold at the price asked (Nelson and Beil 1994). If the entire quantity produced is not sold, the excess product perishes and is not carried over into the next period—a condition called “advance production without inventory carryover.” This condition is particularly arduous since producers must discover the demand curve by trial-and-error while absorbing the cost of unsold product.

Students learn from the experiment that determining the demand for their product is not simple and can be costly. Some students initially price themselves out of the market and sell nothing. Other students try mark-up pricing, above average cost, but they soon discover that offering a higher price can generate higher profits. The monopoly experiment demystifies monopolies for students. An important lesson that students take from the experiment is that monopolists are price searchers, and monopolists are constrained by demand and technology just like firms in more competitive markets.

The Oligopoly Experiment

In light of the consolidation of firms in the agribusiness sector, an increasingly important topic to cover in agribusiness courses is imperfect competition. Imperfect competition is difficult to cover in many agribusiness courses because our knowledge and presentation of oligopolies is mostly theoretical.

Economic theory is an especially difficult subject to deal with in courses like agribusiness management, finance, and marketing. Experiments provide an innovative way of exploring the behavioral environment without resorting entirely to a presentation of theory.

The basic structure of the oligopoly experiment is to place a small number of firms (individual students or groups of students), typically 2 to 5, in a market and allow the firms to satisfy the market. A simple version of an oligopoly experiment is to have firms compete in terms of quantities, where the output price is a function of the total quantity placed on the market (a quantity-setting or Cournot oligopoly). Each round, the students submit a quantity, the instructor sums total output and gives this information to each group. After a few rounds, students begin to appreciate the fact that a reduction of supply can increase the profits of everyone. Students, however, are often frustrated by their inability to control the actions of their rivals even if the rival would benefit (Meister 1999). In many cases the competition in oligopoly markets result in a near competitive outcome.

In Meister's classroom experiment, he did not allow his students to collude and any efforts to lower quantities through signaling failed to reduce total output. Nelson and Beil (1995) allowed collusion after ten rounds of play in their classroom experiment. In one market, a cartel formed and survived for the remaining rounds (after an initial round of adjustment). However, in another market, the cartel failed, and participants submitted quantities that on average were close to the Cournot solution, fluctuating between the competitive and collusive (monopoly) solutions. From the two treatments (allowing and not allowing collusion), students began to appreciate the difficulty of maintaining solidarity. In the market that maintained a cartel, the cartel organizer asked each firm the quantities they submitted. Cheating on the cartel was still possible in this market, but the disclosure was sufficient to foster

collusion. In both experiments, students took away a better understanding of oligopolies because they were involved in one.

Other versions of the oligopoly market are possible. For example, the student could choose prices Bertrand oligopoly or the instructor could allow one group to be the leader (Stackelberg oligopoly). An interesting twist to the straightforward oligopoly market is to have the students serve as buyers, instead of sellers, of goods demonstrating, an oligopsony market as more representative of current trends in agribusiness.

The Follow-up Exercises

Students gain a great deal of knowledge from working through the experiments, but the knowledge tends to be fragmented. In many double-auctions, the student is either a buyer or a seller, rarely both. To explore different market scenarios, the instructor may give students in the monopoly experiment vastly different cost curves. With a sufficiently large class, different oligopoly markets may have different numbers of firms. The students leave the different market settings with vastly different experiences. A great learning tool to incorporate in the use of experiments is a detailed debriefing session. The debriefing session brings together the different experiences.

Before the debriefing session, the students should document their experiences in lab reports. Students are better able to discuss their experiences after a thoughtful mapping of their strategies and their perceptions of the strategies of others. The lab reports should also include a discussion of strategies that failed, contingency plans, objectives, and monitoring approaches. By documenting the experiences, students are encouraged to think through strategies and to learn from mistakes. In many ways the writing component is similar to the preparation for case studies.

After the reports are submitted, the debriefing session can be handled in a number of different ways. A student-directed approach is to encourage the students to discuss their experiences with little emphasis on the theoretical issues of the experiment. The debriefing session is an excellent format to allow students to learn from each other. The session can have the feel and the educational opportunities of the case study. The discussion helps students bring together the fragments of the knowledge gained from their independent experiences.

Another approach is for the instructor to lay out the theory behind the experiment: contrasting the actual and predicted equilibria, discussing surplus and efficiency of the market under different treatments, and mapping out the observed strategies of different students. Unlike simulations and case studies, the compactness of experiments allows the instructor to focus on a particular theory or issue without the complexities associated with simulations and case studies.

Incentives

While the learning experiences associated with experiments can be great, encouraging students to take the contrived markets seriously can be challenging. Some instructors grant students extra credit points based on their percentage of the total earnings. Some instructors do not give extra credit points at all. Different instructors have different opinions on the topic of incentives. Holt (1999) has stated, “the use of extra credit points in classroom experiments adds stress and often conflicts with key economic ideas [such as cooperation]” (p. 605). Consequently, Holt does not award extra points for experiments. In our experiences, we have seen students respond well with and without rewards. In some settings, the competitive nature of the students was sufficient incentive to encourage thoughtful participation in the experiment. The instructor can best make the choice of incentive by knowing the students and what motivates them.

If an instructor believes that a grade incentive is necessary, one idea that may encourage thoughtful participation is to grade the lab reports. The reports can be graded on the reasoning behind the strategies and what was learned from the experience. When students know the criteria of evaluation before the experiment, students are more likely to approach participation seriously. Writing lab reports may have the added benefit of improving students' writing skills.

Conclusions

Experiments provide students with opportunities to interact and learn in simple market situations that generate appreciable pedagogical payoffs. Through the reports and debriefing session, students are challenged to explain and defend their choices of strategy and to learn from their errors and the experiences of others. The flexibility of experiments allows the instructor to modify the experiment so that different topics can be explored. Thus, experimental economics can provide the agribusiness curriculum with an adaptable teaching technique that challenges students to think critically in a stimulating environment.

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