Classroom

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A Simple Oligopoly Classroom Experiment

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Abstract

Classroom experiments can provide a stimulating experience for students who are being introduced to the ideas presented in a microeconomic principles course. The authors propose a classroom experiment on oligopoly that highlights the difference between a collusive and a competitive equilibrium. The exercise is similar to other oligopoly classroom games proposed with the exception that the game presented here is less time consuming for instructors and provides a list of suggested modifications that instructors can use to tailor the game to their specific educational needs. Empirical observations are also provided to give instructors an idea of how the classroom experiment works in practice and the range of actions that a typical undergraduate principles of microeconomics class are likely to exhibit.

Introduction

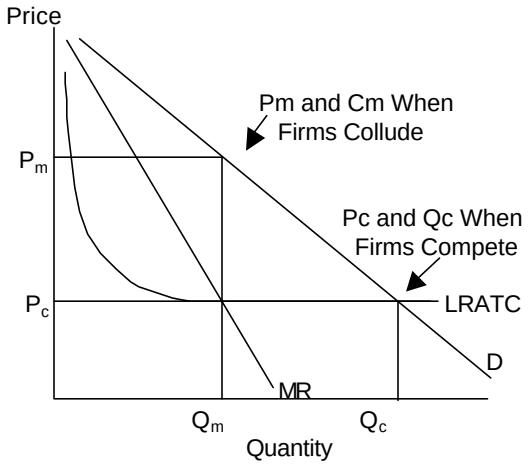
Classroom games and experiments provide instructors with an alternative teaching mechanism other than the "talk and chalk" method. Indeed, as Fels (1993, p. 365) has pointed out, "the growth of experimental economics as a field of research has led to a burgeoning interest in using games and experiments in the classroom." One potential problem, however, is that many of the classroom games and experiments are too costly, either in

terms of preparation time for the instructor or class time. Previous oligopoly classroom experiments (Nelson and Beil, 1995) required substantial preparation and execution time for their experiments.[1] We propose an oligopoly classroom experiment that is less time consuming, but also one that presents the essential ingredients of oligopoly theory that undergraduates will encounter in a micro principles course.

The distinguishing characteristics of an oligopolistic market are (1) a small number of rival firms, (2) interdependence among the sellers, (3) substantial economies of scale, and (4) high entry barriers into the market (Gwartney and Stroup, 1997).

The firms in the oligopolistic market face two differing outcomes, depending on whether they compete with other firms or collude with them. If the firms in the oligopolistic industry collude, the outcome will resemble a monopoly. As shown in Figure 1, price will be P_m and there will be substantial economic profits. Indeed, these economic profits are the incentive for firms in the oligopolistic industry to form a cartel, whereby the firms coordinate supply decisions so that the joint profits of the firms will be maximized. However, if the collusive agreement breaks down, each firm will act independently to maximize profits and the market price would be driven down to P_c, as shown in Figure 1. In this outcome, firms would be pricing so as to just cover their per-unit costs with zero economic profits. If the firm tries to raise its price, consumers would switch to other firms, and the firm that raised its price would lose customers.[2] This type of interdependence between firms is similar to a game theoretical prisoner's dilemma, particularly if the industry is essentially a duopoly. If both parties remain silent or collude, both will continue to profit from this situation and their tacit collusion. However, if one party chooses to confess or compete, this action could precipitate a downward spiral, in which all parties end up with a much less favorable result. The conclusion is the same: when comparing the options of collusion and competition, all parties will obtain a more favorable result if they do not compete with each other.

Figure 1



The Classroom Experiment

In order to provide students in our introductory economics courses with a clearer understanding of the mechanics and possible outcomes of an oligopolistic market, we have been using a very straightforward classroom experiment that functions in much the same way as firms would in an oligopolistic market. Students act as the players in the classroom experiment, placing them in a role similar to that of a decision maker for an oligopolistic firm or a prisoner faced with the prisoner's dilemma.

The classroom experiment typically begins immediately before the introductory material related to oligopolies. To quickly catch students' attention at the beginning of class, the instructor announces that he or she is about to provide an opportunity for extra credit. This may be particularly important to students at this point in the semester because the subject matter is more challenging and students are typically more

[1] A synopsis of several classroom experiments can be found in Fels (1993, p. 366).

[2] At this point in the discussion, the differences between the demand elasticity of the industry as a whole and the demand elasticity of individual firms can be pointed out.

anxious about their grades. Thus, when they hear that they have an opportunity to help themselves, they are typically quite receptive.

At this point, we indicate to students that we wish for them to provide us with input for a future examination. As such, each student is permitted to submit one multiple choice question. The sole requirement is that the question covers an economic principle. Questions may be submitted in person, through the department office, or via e-mail. We will also indicate a specific time period during which students may submit their questions; this time period is usually around two weeks.

However, their compensation for their efforts is dependent upon the total number of questions submitted by the class. For example, if only one student submits a question prior to the deadline, that student will have 20 points added to the score on his or her next quiz. If two students submit questions before the deadline, each of them will have 18 points added to the scores on their next quiz. If three students submit questions, each will have 16 points added and so forth. This proceeds in such a manner that if eleven or more students submit questions, then all students in the class will receive no extra credit whatsoever. Lastly, if no students submit a question prior to the deadline, every student in the class will have 5 points added to the score on his or her next quiz.[3]

Furthermore, we advise students that we will notify them at the beginning of each class meeting how many questions, if any, have been submitted. We will not reveal the names of those who submit questions, but simply the number of questions we have received. Lastly, we inform the students that the deadline for an initial submission is the beginning of class on a certain date. However, if any student submits a question immediately prior to class, other students will have the right to submit their questions at any time before that class meeting ends.

At this point, the instructor may ask if there are any questions as to how the classroom experiment will work. It is important to warn the students not to ask any questions that might divulge their own feelings regarding a strategy. Then the instructor may leave the room for a short period of time.[4] Once on their own, without fail, each class will break into spontaneous discussion of the classroom experiment, the rules, and the most appropriate strategy. Quite frequently the class decides that a collusive strategy would be the most beneficial. In some instances there is a significant amount of debate among the class members and a few spokespersons square off against each other.

If the classroom experiment is structured in this manner, in every case except one our classes have always agreed to collude.[5] They realize that if no one turns in a question they will all receive five bonus points. More importantly, they also realize that if one person does turn in a question, this will begin a somewhat vicious cycle in which other students attempt to undercut the first student in an effort to both collect some reward for themselves and punish the first student for breaking their collusive agreement. In many instances, after the class meeting students have reported that one or more class members threatened to turn in additional questions if anyone attempted to break the agreement. In this manner, they provide an effective means of enforcing collusion.

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[3] These numbers are illustrative only, and instructors are free to make up their own. For commentary on the fairness of providing extra credit within the framework of a classroom game, see Fels (1993, p. 368).

[4] The instructor may wish to remain in the room so as to 1) answer questions and 2) observe the classroom dynamics during the discussion.

[5] The section entitled "Anecdotal Evidence" provides a description of the outcome when the structure of the game changes.

Modifying the Classroom Experiment Obstacles to Collusion

The classroom experiment is quite simple and can, of course, be easily modified. In different classes, we have chosen to conduct the classroom experiment in a slightly different manner. One idea that has been suggested is that we modify the classroom experiment to make collusion more difficult. As a result, students hopefully will be able to observe for themselves some of the obstacles to collusion. Listed below are various obstacles to collusion and some simple modifications to this classroom experiment.

Large Number of Firms/Low Barriers to Entry

With a greater number of firms, it becomes more difficult for the industry to enforce a collusive agreement. This is true based on the simple reason that it is increasingly difficult to police a larger number of firms since it is more difficult to determine which firm has broken the collusive agreement. While it is not possible to alter the size of the class in question, it is possible to add another class to the classroom experiment. If the instructor were to announce that another section of his or her class were included and that the results would be determined based on the actions of both classes, many students might doubt the commitment of the other class. If a member of the second class were to break the agreement, each student would lose his or her five points. As a result of this additional uncertainty, students in both classes would be increasingly tempted to compete by submitting questions.

Inability to Detect Price Changes

If a firm attempts to compete, that firm will charge a lower price in order to capture a greater market share. At this point, if other firms have the ability to readily detect such price changes, they may also alter their pricing strategies to maintain market share. Assuming an equal reduction in prices, the cost to all firms involved is lower profits. If, however, firms are unable to detect such price changes, it will become quite difficult to determine when a collusive agreement is broken and which firm is doing so. Quite simply, if the instructor indicates that he or she will not inform students when a question is received, the class will not be able to determine if and when the agreement has been broken. As a result, any one student might conclude that he or she can successfully undercut the remainder of the class by submitting a question. Furthermore, if all students attempt to do so, the result will be that no students receive any points. This obstacle to collusion often does create significant problems for the class and lead to a breakdown in any collusive agreements.

Unstable Demand Curve

If the demand conditions are not stable, it becomes difficult to establish a consistent price that would result in the greatest amount of profit for the industry. Thus, all firms would be required to adjust their prices more frequently in attempting to do so. As a result, it becomes more difficult to determine if a firm has changed its price in response to a perceived change in demand or in an effort to undercut the prices of other firms in the industry. In order to simulate this set of circumstances in our classroom experiment, the instructor might change the level of the reward for each progressive question that is submitted or change the level of the reward if no questions are submitted. If the reward level for any one question becomes excessively high, or the reward level for the class if no questions are submitted becomes excessively low, one or more students will be tempted to break any agreement that was in place and secure whatever they can for themselves. This obstacle to collusion can lead be quite frustrating to students; instructors should be cautious in using this modification if the payouts or bonus points are relatively substantial.

Anecdotal Evidence

To this point, we have only attempted this experiment with a relatively limited number of classes at Florida State University, Ohio University, and Gainesville College. However, these efforts have produced noteworthy results in terms of student involvement and enthusiasm. As to the decisions made by the class to either

collude or compete, the results have varied with the situation.

In 25 instances that we have conducted the experiment as initially described above, the classes have elected to collude 24 times. This may primarily be attributable to the descending scale of rewards that is easily noticeable to students. If at least one student is able to recognize that if any student submits a question, it will lead to a downward spiraling of the rewards given to the ultimate point at which no students receive any compensation. If such a student communicates this concept to the majority of the class, it is very likely that the 'cartel' will hold.

In contrast, our earlier efforts to conduct this type of game or experiment featured different rules for the game in each semester. In many cases, one of us would simply inform our class that if one person submitted a question, he or she would receive ten bonus points and if no one submitted a question, then all students would receive five bonus points. Under these circumstances, we found that members of six classes competed and members of only three classes colluded. With these parameters in place, students may quickly sense an opportunity to provide themselves with an instant reward by submitting a question before their peers. Indeed, this was the typical result in these earlier attempts. For those instances in which the class effectively colluded, it may have been that the class consisted of older or more experienced individuals. It may even be possible that the class meeting time had an effect on students' responses. Students in the 8:00 am classes might tend to be less involved, or such students might exhibit limited attendance, creating a smaller group tending more towards collusion.[6]

Most recently, we have implemented two of the modifications described above. In the first case, we informed the students that they would not receive any indication if and when one of their classmates submitted a question. This caused a significant level of concern among students and they attempted to construct an agreement among themselves to prevent any one individual from 'breaking their cartel'. This modification has led to a breakdown in collusion such that students submit questions before the deadline. We also attempted to generate unstable demand conditions by changing the amount of the reward on a daily basis that both the individual student and the entire class would receive. However, in this case the instructor would inform the students of any submissions. This piece of information proved to be critical. Since each of the students had a means of enforcing their agreement, unsurprisingly the cartel held.

Conclusion

Classroom experiments can provide an instructor an alternative to the normal "chalk and talk" routine of teaching a microeconomic principles course. However, one of the disadvantages of using classroom experiments has been the substantial time investment in preparing the exercise on the part of the instructor and the time spent during class explaining the classroom experiment to the students. We believe that our classroom experiment overcomes these two obstacles by substantially reducing the time spent preparing for the exercise on the part of the instructor and the time spent explaining it to the students. Students participating in the oligopoly classroom experiment are generally enthusiastic about doing so. Our anecdotal evidence would also seem to confirm the notion that students respond to changes in the incentives of the classroom experiment. The oligopoly classroom experiment described in this paper is designed to allow instructors the maximum latitude when devising their own experiments. We believe that this latitude is a strength of this particular classroom experiment and we hope that using our classroom experiment can provide instructors an easy method with which to discuss the various intricacies of oligopoly theory.

[6] These explanations are our conjectures; many possible reasons may exist for the various outcomes presented in the paper.

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Streamlining Production Possibilities Frontier Experiments

*Calvin Blackwell**

Numerous classroom experiments involve the production of fictional goods. For example, Anderson and Chasey (1999) describe an experiment in which students produce two different products, widgets and whajamas, while Neral (1993) describes an experiment in which students produce widgets. In both of these experiments the fictional good is created with student labor and a variety of office supplies, including paper, pens or pencils, and staplers. While these experiments tend to be both entertaining and enlightening for the student participants, they are time consuming to prepare[1] and make an enormous mess! Fortunately, there is a way to maintain the educational content of these experiments without creating all the waste.

A simple production sheet copied repeatedly can replace the staplers and reams of (hopefully recycled) paper called for by both Anderson and Chasey (1999) and Neral (1993). Instead of producing a widget by manipulating a piece of paper, I have my students create a widget by drawing it on a specially formatted form. An example of this form is presented in Figure 1.

The widget and the gzot are figures that must be drawn on the boxes shown on a form similar to the one in Figure 2.

When a student starts to "produce" widgets or gzots, his/her form will look something like Figure 3.

I use these forms for an experiment demonstrating comparative advantage. To "stack the deck" and build in a comparative advantage for some students, I add some of the lines to their pages, as can be seen in Figure 4. Other students are given completely blank forms as in Figure 2.

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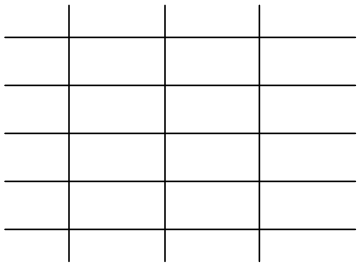
[1] Neral (1993) cuts each 8 ½ by 11" piece of paper in half, reducing waste, but increasing instructor effort.

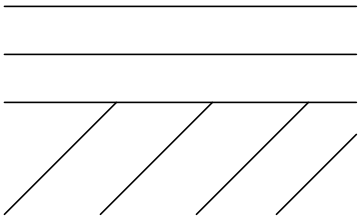
Figure 1.

Today you will have the opportunity to earn some cash. I will pay you 3 cents for each pair of widgets and gzots that you produce over a given time period, subject to some additional rules outlined below.

A widget looks like this:



A gzot looks like this:



Each widget or gzot must fit within the rectangles on the papers given you. I will not pay you for widgets or gzot whose lines reach outside the rectangle.

Figure 2.

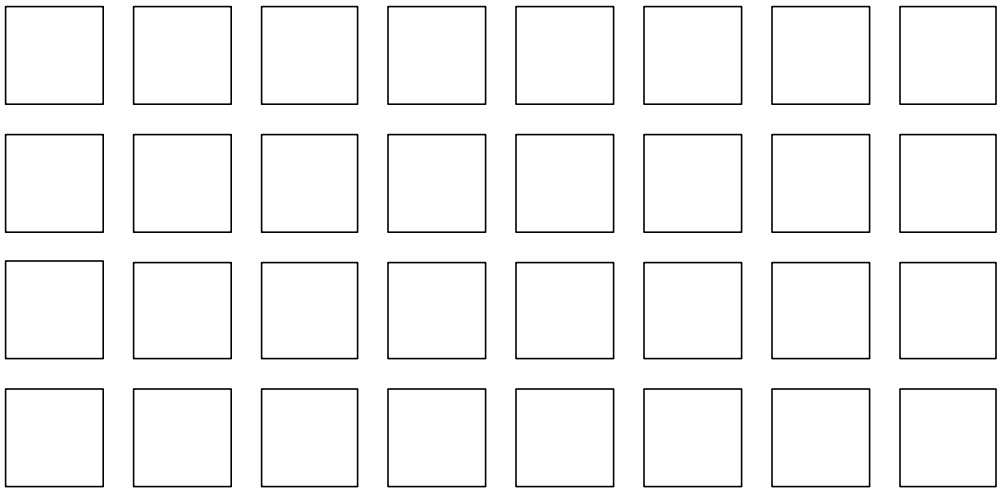


Figure 3.

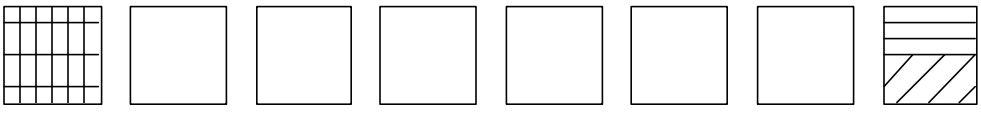


Figure 4.

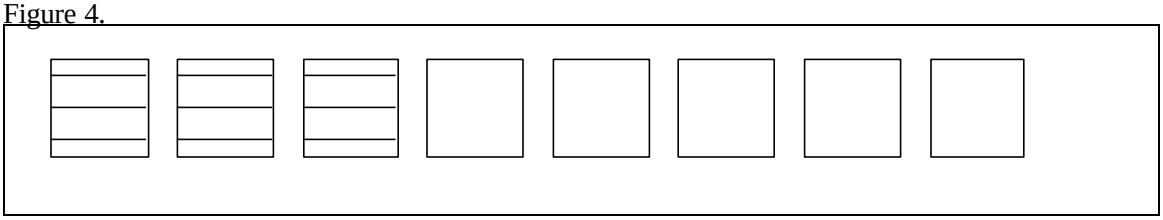
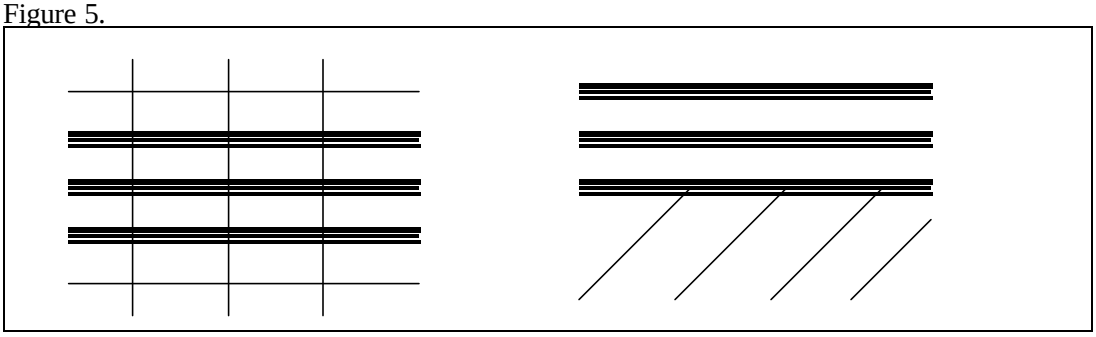


Figure 5.



To illustrate diminishing marginal returns one could add another input to the production process, e.g., a highlighter. Now a widget has to be produced by pen or pencil, but some of the lines must be highlighted, as in Figure 5. The standard diminishing marginal returns will set in if you limit the number of highlighters to one, but add labor to the production process. (I generally put students in groups of 6 and have them compete—the group that produces the most gets some sort of prize. The entire group shares one highlighter. In round 1, only one student is allowed to produce widgets, in round 2, two students, and so forth. Anderson (1986) describes a similar demonstration.)

Using these drawn widgets and gzots allows the instructor to bring only a stack of papers to class, much like the instructor might bring a stack of exams or some other handout. One sheet represents one round, so it is easy to keep track of production across rounds. Each student can be given a stack of forms such that the stack has one sheet for each round the instructor plans to run. In this way, the instructor is freed from having to carry staplers (or other bulky supplies) and from having to clean up a classroom full of widgets at the end of the demonstration.

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