Pricing Strategy Under Monopoly Conditions: An Experiment for the Classroom

Robert G. Nelson and Richard O. Beil, Jr.*

Abstract

This classroom experiment allows students to explore pricing strategies available to the monopolist. Students are given full information about their costs but know nothing about demand except that it is simulated by the instructor. They submit their price-asked and quantity-offered records on one day and receive the quantity-sold response from the instructor on the next day, continuing this routine until they discover the profit-maximizing price and quantity. One of the objectives is to demonstrate that search strategies based on economic principles (MC=MR) can be more efficient than trial-and-error.

Key Words: experimental economics, games, monopolist, teaching

The monopolist holds a special place in the imagination and comprehension of the general public. Often characterized as amassing vast profits at the expense of the common people, the wicked monopolist executes this brigandage by charging prices far higher than helpless consumers can afford. The experiment described in this paper is designed to show undergraduate students what it is like to be a monopolist from an economic perspective. Using experiential learning, the student can explore the meaning of such expressions as "the monopolist charges what the market will bear" and discovers why the monopolist is a "price searcher" instead of a "price taker."

In terms of economic principles there are just three somewhat prosaic features that characterize monopoly in the elementary setting of the economics laboratory:

(1) The monopolist faces a downward-sloping demand curve. This may or may not allow him to charge an indecently high price and still sell some of his product. In fact, the strategic principles are the same for the monopolistic competitor and the perfect competitor (which can be demonstrated simply by changing the slope of the demand curve until it is horizontal).

(2) There is no need to consider the reactions of rivals in making pricing decisions since the monopolist has no rivals, by definition.

(3) In most expositions (and in this experiment) the monopolist's demand curve conveniently remains constant while he searches for the profit-maximizing point.

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How the monopolist chooses price and quantity to maximize profits using marginal analysis is often graphically illustrated in the classroom by plotting the demand and marginal revenue curves for the firm's product (usually with a linear demand curve), plotting the average and marginal cost curves, using the intersection of marginal cost with marginal revenue to establish the profit-maximizing quantity, and finally determining price from the demand curve.

However, there is another strategy that will work: trial-and-error. The monopolist can explore various combinations of total revenue and total cost until it is established that any move away from a certain price and quantity will only lower profit. In fact it is likely that this strategy will be exploited by students who have had no formal instruction in the MC=MR approach, or who do not know how to operationalize it. Moreover, in the "real world" there may be reasons to prefer this strategy.

In this experiment each student is a separate monopolist, although teams could be formed in large classes and be used to illustrate principles of cooperative oligopolies and cartels. The demand for the product is simulated by the instructor (i.e. the buyer population is just a fixed demand function). The demand schedule is not revealed to the students--finding it (or at least exploring it) is the essential task. Students are each given a schedule of costs for producing a perishable good (Appendix). Then they each submit a sheet of paper indicating the quantity of the good that they are bringing to market and the price they are asking. The next day they find out how many of their units were bought at the asking price. From this they can calculate their earnings for that period. Given a sufficient number of periods in which to search, most students can find the price and quantity combination that maximizes their earnings by trial-and-error alone. Subsequent lectures and homework problems on the graphical solution (using MC=MR principles) can be used to demonstrate that search strategies based on economic theory are more efficient.

Since records need to be submitted and retrieved over many class periods, these can double as a record of class attendance. This, together with the incentive derived from converting profits from the game into bonus grade points, has proved to be an excellent motivating influence.

Instructions for the Teacher

The presentation of this experiment is directed to lower-division undergraduate students from all disciplines who may or may not have had a Principles course in microeconomics. It is not necessary that students understand the application of MC=MR in order to play this game. In the class described here (Agricultural Marketing, with mostly sophomores and juniors), some students recalled the marginal principle and the graphical solution from previous courses and successfully applied this knowledge, although the subject was not covered in lectures until late in this class.

Record keeping is more orderly if students submit their "Price Asked and Quantity Offered" sheets and retrieve their "Quantity Sold and Profit" results on alternating days. In a class of 28 students, all facing the same demand curve and cost schedule, the first students found the profit-maximizing P and Q after about ten periods. By the sixteenth period (the last day of the experiment), 21 students had found the optimum combination.

There are three features of the game instructions that are noteworthy: there is no guarantee that all units produced can be sold, the product is perishable, and units are not divisible. The consequences of these conditions are several:

(1) unlike production-to-order, with advance production the quantity that will sell at a given price is not known beforehand, so underproduction and overproduction are possible

(2) since the product is perishable, unsold units cannot be carried over as inventory

(3) if the monopolist overproduces he can suffer net losses by incurring costs (for units left unsold) that are not exceeded by gross revenues

(4) the demand "curve" is actually a step function

In view of the potential for incurring losses, if earnings are converted to *bonus* points it may be necessary to set up a "line-of-credit" to cover such losses in order to give students a positive incentive to play the game. As an example, the instructions in the Appendix explain that one percentage point will be added to the student's final grade for every $10,000 earned in the game. In addition, a $10,000 line-of-credit is provided. The line-of-credit is not incorporated into the final earnings for the game; it serves only as a "safety net" for initial losses due to overproduction. The student can incur $10,000 in losses before being dropped from the game--a highly unlikely event. Without such a line-of-credit some students might elect to not play at all. With the line-of-credit they cannot lower their course grade by playing the game. In addition, a student who does not submit a price/quantity offer in a period (say, due to an unexcused absence) can be fined $1,000 to cover "overhead". Fines plus losses cannot exceed the line-of-credit. This fine serves two purposes: it provides a disincentive for missing class or otherwise not participating in the game and, when all students are playing with the same demand and cost structures, it discourages students from letting others search for the optimum and then stepping in at a stage where large profits are assured.

Although the demand curve is derived from a linear function, because only whole units can be sold this results in a step-shaped demand relation, with the same number of units being sold over each incremental range of prices. For example, seven units can be sold for any price greater than $232 and less than $268 (in whole dollars). The advantage of this (in comparison to infinitely-divisible production) is that it speeds up the search for the optimal quantity. On the other hand, it slows down the search for the optimal price (once Q^* is found) since it takes students several iterations to locate the optimal whole-dollar price. Smooth curves and divisible production would be more suitable in the context of the mathematical exposition of the MC=MR relation. The step function is better adapted to the process of discovery in the Principles class.

In terms of the information revealed to the class, students are neither encouraged nor discouraged regarding collaborative work on the problem. Most students eventually discover that they all face the same demand and cost conditions, but this is not likely to become apparent until later in the game. Students can be told that the demand curve is stable and linear (except for the step-function proviso). They have complete information about their cost curves. They are advised not to be too cautious about overproducing since the value of information from such actions is greater than for underproduction; overproduction brings them back to the band defining the demand frontier, whereas underproduction just defines a point in the interior space below the demand function.

Record keeping

Table 1 is a sample printout of a spreadsheet (available from the authors) used for record keeping. Spreadsheets can be used initially to explore alternative shapes of the demand and cost curves, and provide relatively fast calculation of student results to maintain every-other-day turnaround. The first two rows contain the parameters that describe the demand and marginal cost curves. The rest of the spreadsheet is linked to these parameters, so when these are changed all related cells are simultaneously adjusted. The top third of the table defines the variables of interest in the experiment: P fml (the price by formula, from the linear equation), Q, TR, TC, MC, AC, and MR.

The spreadsheet is designed to display a graph of these relations as well. When the demand and marginal revenue curves are derived from equations they do not yield the integer maxima required for the step function, but they are usually close enough to show the effects of changes in the parameters. Parameter changes in the spreadsheet are also linked to the graph for immediate viewing.

The formulas used to generate the variables shown in table 1 were constructed as follows:

$$\text{P fml} = 500 - 35.71428571Q$$
$$TR = PQ$$
$$TC = \Sigma MC$$
$$MC = 300 - 80Q + 7Q^2$$
$$AC = TC/Q$$
$$MR = 500 - (2)(35.71428571)Q$$

Table 1. Sample Printout of Spreadsheet File

	A	B	C	D	E	F	G	H	I
1			Price==>	Constant=	500	B1=	-35.714		
2		Marginal Cost==>		Constant=	300	B1=	-80	B2=	7
3		P fml	Q	TR	TC	MC	AC	MR	
4									
5		500	0	0	0			500	
6		464	1	464	227	227	227	429	
7		429	2	857	395	168	198	357	
8		393	3	1179	518	123	173	286	
9		357	4	1429	610	92	153	214	
10		321	5	1607	685	75	137	143	
11		286	6	1714	757	72	126	71	
12		250	7	1750	840	83	120	0	
13		214	8	1714	948	108	119	-71	
14		179	9	1607	1095	147	122	-143	
15		143	10	1429	1295	200	130	-214	
16		107	11	1179	1562	267	142	-286	
17		71	12	857	1910	348	159	-357	
18		36	13	464	2353	443	181	-429	
19		0	14	0	2905	552	208	-500	
20		-36	15	-536	3580	675	239	-571	
21									
22									
23	Date:		PERIOD·						
24		Name:		Price	Q offer	Q able	Q sold	TC	Profit
25	1	AAAAA, aaaaa		181.3	10	9	9	1295	337
26	2	BBBBB, bbbbb		190	10	9	9	1295	415
27	3	CCCCC, ccccc		194.25	9	9	9	1095	653
28	4	DDDDD, ddddd		225	7	8	7	840	735
29	5	EEEEE, eeeee		230	8	8	8	948	892
30	6	FFFFF, fffff		200	10	8	8	1295	305
31	7	GGGGG, ggggg		300	6	6	6	757	1043
32	8	HHHHH, hhhhh		275	7	6	6	840	810
33	9	IIIII, iiiii		195	7	9	7	840	525
34	10	JJJJJ, jjjjj		200	11	8	8	1562	38
35	P max must be re-estimated if price equation (cells E1 & G1) is changed								
36			P fml	P max	Q offer	Q able	Q sold	TC	Profit
37		Max	500	517	0	0	0	0	0
38		Max	464	482	1	1	1	227	255
39		Max	429	446	2	2	2	395	497
40		Max	393	410	3	3	3	518	712
41		Max	357	375	4	4	4	610	890
42		Max	321	339	5	5	5	685	1010
43		Max	286	303	6	6	6	757	1061
44		Max	250	267	7	7	7	840	1029
45		Max	214	232	8	8	8	948	908
46		Max	179	196	9	9	9	1095	669
47		Max	143	160	10	10	10	1295	305
48		Max	107	125	11	11	11	1562	-187
49		Max	71	89	12	12	12	1910	-842
50		Max	36	53	13	13	13	2353	-1664
51		Max	0	17	14	14	14	2905	-2667
52		Max	-36	-18	15	15	15	3580	-3850

The middle third of the table shows the record-keeping form for ten students. Additional students are accommodated by inserting rows into the spreadsheet and copying down the cell formulas from the tenth row. To use this part for record keeping, one simply types in the student's name, his asking price (Price) and his quantity offered (Q offer) for that day in the appropriate columns. The spreadsheet then calculates the number of units he would have been able to sell at that price (Q able), the number of units actually sold (Q sold), and his profit. Q sold and Profit are written on the student's Ask/Offer sheet and returned the next day.

The program works as follows:

Column label	Operation
Price	Type in the student's asking price.
Q offer	Type in the student's quantity offered.
Q able	A formula calculates Q_{able} from the parameters given in cells E1 and G1, currently: Q = (P - 500) / (-35.71428571)

	and rounds to the nearest integer. The LOTUS formula for cell F25 is: `@ROUND((D25-$E$1)/($G$1),0).`
Q sold	The program compares Q_{able} to Q_{offer} and writes the smaller of the two. The LOTUS formula for cell G25 is: `@IF(F25>=E25,E25,@IF(F25>0,F25,0)).`
TC	The program looks up the appropriate TC for that Q_{offer} in the table above (so as to match the values in the students' instructions). The LOTUS formula for cell H25 is: `@VLOOKUP(E25,$C$5..$E$20,2).`
Profit	If Q_{sold} is positive then the program subtracts TC from PQ_{sold}; otherwise it enters -TC. The LOTUS formula for cell I25 is: `@IF(G25>0,(D25*G25)-H25,-H25).`

The bottom third of the table shows the maximum price (P max) that can be asked for a given number of units, compared to the price derived by formula (P fml). The next whole dollar above P max forces a move to the next lower number of whole units. The profit-maximizing integer point for this example is $303 for 6 units, giving a profit of $1061 (compared to $959 by formula). Since P max must be found by trial-and-error (due to rounding effects) this column does not automatically adjust to changes made in the parameters in lines 1 and 2, but must be re-done "manually" once a new set of curves has been defined.

Sample Results

In each period profits made by class members (as calculated by the spreadsheet illustrated in table 1) were saved in a separate file. At the end of the experiment the profits from each of these files were combined into a single file and summed to give the total earnings for each student.

By sorting profits in each period in ascending order the graph in figure 1 was produced to show how a class of 28 students approached the single-period profit maximum of $1061 over time. To avoid clutter only six out of 16 periods are shown: the figure starts with the first period and then shows every third period up to the last period (P16). Some of the lines cross when the lowest profits in a later period were less than those in an earlier period. The graph is one way to illustrate the overall dynamics of class performance. For example, by period 4 three students were already within a few dollars of the maximum (it turned out that at least one of these was just a lucky guesser), and by period 10 thirteen students were at or near the maximum. The lines get shorter after period 10 because some of the students who reached the profit maximum elected to move to another monopoly game where a "successful advertising campaign" had shifted demand for their product.

Table 2 shows the Price-asked, Quantity-offered and Profit data for five selected students. The Quantity-sold feedback from the instructor is not shown here. Three of these students (S1, S2, and S3) reached the profit maximum by period 11. The other two (S4 and S5) were still searching when the game ended after period 16.

Figures 2a-e are graphs of the data in table 2, with lines connecting the points in the order that the offers were submitted. Again, the horizontal axis represents the original quantity offered, and not the subsequent quantity sold. The difference in the effectiveness of search strategies between the fastest and slowest profit maximizers is conspicuous. Figures 2a and 2c represent students using an MC=MR strategy (they confessed to this). Figure 2b is a student who admitted to stumbling on the optimal combination with his first few guesses. Figure 2d is characteristic of a trial-and-error search of the right side of the profit surface. Figure 2e appears to be some less systematic trial-and-error search.

Figure 1. Profit Rankings at Various Periods

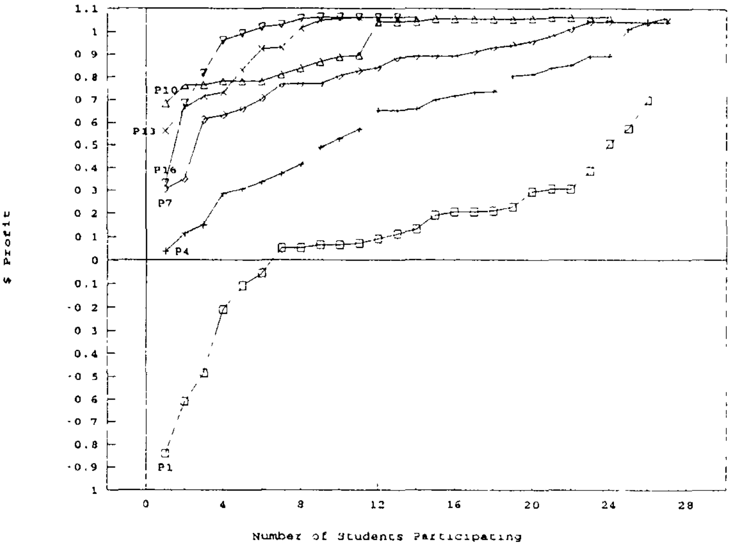


Table 2. Results of Monopoly Experiment for Selected Students

Period	S1 P	S1 Q	S1 Π	S2 P	S2 Q	S2 Π	S3 P	S3 Q	S3 Π
1	200	10	305				700	7	-840
2				164	9	380	300	9	705
3				250	9	655	250	8	802
4	190	10	415	300	6	1043	275	7	810
5	190	9	615	350	8	643	340	5	675
6	400	4	590	305	6	768	300	6	1043
7	303	6	1061	300	6	1043	300	6	1043
8	304	6	763	301	6	1049	300	6	1043
9	303	6	1061	302	6	1055	303	6	1061
10	303	6	1061	303	6	1061	303	6	1061
11				304	6	763			

Period	S4 P	S4 Q	S4 Π	S5 P	S5 Q	S5 Π
1	265	12	-55	220	7	700
2	245	10	420	220	8	812
3	210	11	118	225	7	735
4	195	9	660	225	8	852
5	195	10	460	225	9	705
6	220	8	812	230	7	770
7	225	9	705	230	8	892
8	225	8	852	230	9	745
9	234	8	690	240	8	732
10	248	7	896	240	7	840
11	259	7	973	235	8	697
12	295	6	1013	300	6	1043
13	280	6	923	350	5	715
14	288	7	888	303	6	1061
15	290	6	983	304	6	763
16	296	6	1019	276	7	816

Figure 2a. Results for Student S1

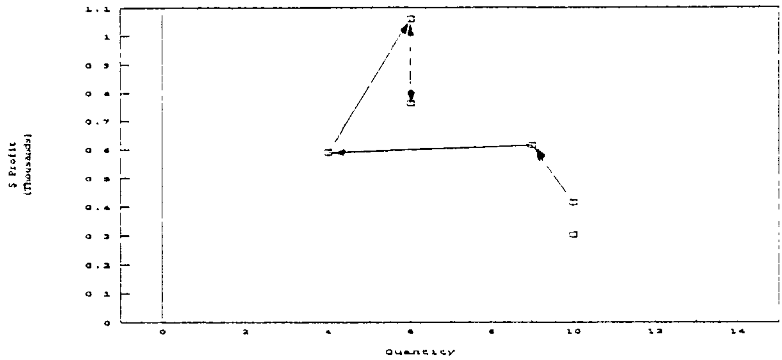


Figure 2b. Results for Student S2

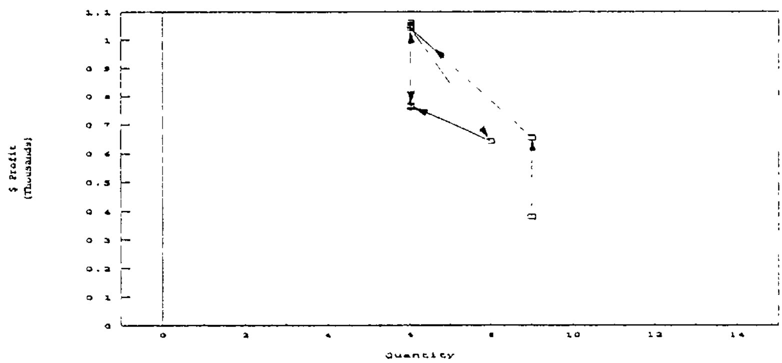


Figure 2c. Results for Student S3

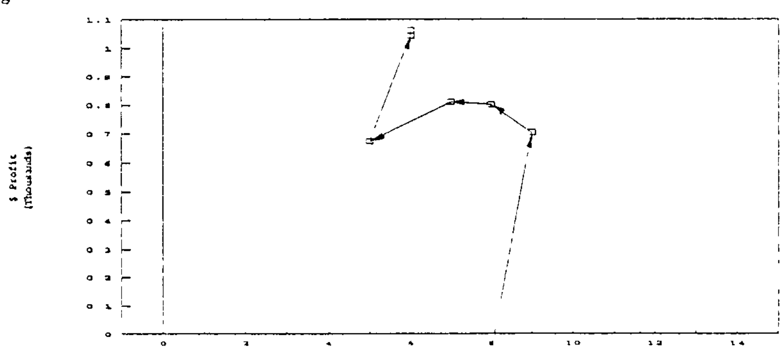


Figure 2d. Results for Student S4

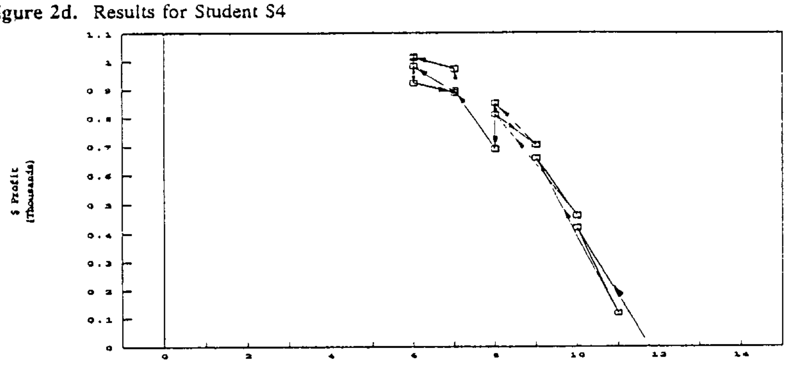
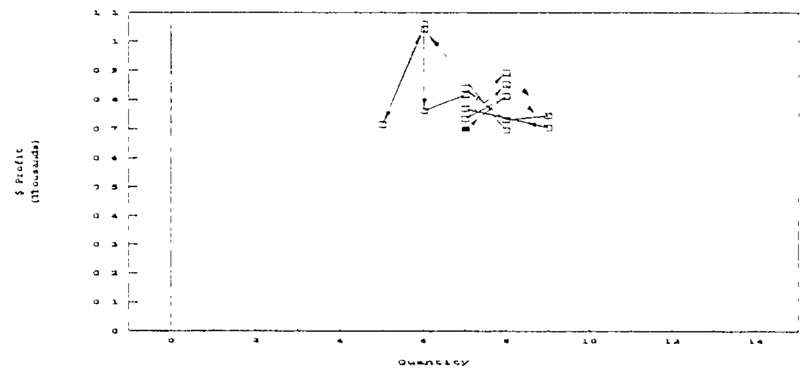


Figure 2e. Results for Student S5



How the Experiment Illustrates the Theory

Subsequent class discussions indicated that after playing the game students better understood the concept that a monopolist cannot sell all the units he wants to produce at any price he chooses, that his profit-making possibilities are not limitless, and that Demand is a force to be reckoned with. Some students were tangibly impressed by the Doctrine of Consumer Sovereignty after asking outrageously high prices (for example, on table 2 see student S3's profits in Period 1). The lectures on elasticity near the end of the quarter were facilitated since students had experienced the profit consequences of the assertion that "the demand curve for the monopolist is not everywhere inelastic." Although we ran out of time in this class, a homework assignment could have been used to demonstrate why the monopolist *wants* to operate in a range where his consumers are sensitive to price increases.

Students who tried mark-up pricing by some standard percentage (like 10% or 15% above average cost) soon became aware that prices could be raised much higher when demand was taken into account. Students who mistakenly believed that the quantity corresponding to the minimum average cost must be the profit-maximizing quantity were soon disabused of this notion. However, after the experiment was over it was discovered that, by accident of parameter choice, the quantity giving the minimum marginal cost in this exercise also happened to be the same as the optimal quantity. The coincidence was pointed out in class, although no one mentioned that this had motivated their strategy. Future experiments can easily rectify this problem by changing the parameters in the spreadsheet price equation. For example, changing the demand equation constant in cell E1 from 500 to 583 will change the optimal quantity from six to seven units, P fml to $333, P max to $350 and maximum profit to $1610.

Except for the lucky guesser, most students conceded that search strategies based on theory can be more efficient than trial-and-error, especially after they saw how early some of their classmates discovered the optimal price and quantity. Many of them appeared to gain some appreciation for the use of marginal analysis in formulating pricing strategies. On the other hand the trial-and-error approach may have some usefulness in real-world situations where it is difficult or costly to experiment with large price changes.

It is important to point out some of the real-world conditions that were *not* operating in this experiment. For example, since demand was held constant and buyers were simulated, the information contained in the response received from a change in price asked or quantity offered could be interpreted by the monopolist unambiguously. Also, although we know from theory that a monopolist will charge a higher price and supply a smaller quantity than would be found under competitive equilibrium, this can only be demonstrated *empirically* by comparison with another experiment using a competitive market institution.

Variations on a Theme

A production-to-order environment is an obvious alternative to this advance-production game. Here the monopolist simply posts a price and receives feedback on how many units are ordered, and subsequently are to be produced and sold, at that price. There is no concern about overproduction since units are not produced until they are ordered. Services and some industrial goods are produced in this environment.

The advance production environment can be easily modified to accommodate inventory carryover. An extra column in the spreadsheet could be set up to accumulate excess production (Q offer - Q sold) for use in later periods. Such an environment would eliminate the need for the line-of-credit if inventory carrying costs are negligible. The capacity to produce exactly to demand, or to overproduce at no cost, both serve to speed up the discovery of the optimum since more wide-ranging attempts to locate the demand curve can be made without serious effect on profits. On the other hand, losses of the magnitudes experienced by some students can be real "attention getters" and serve to stimulate genuine strategy-development by discouraging random price and quantity offers. The simple advance-production game is generally more challenging and encourages the student to focus on costs as well as demand.

The indivisibility of units and the resulting step function have been mentioned as complications. The problem could be resolved by allowing units to be infinitely divisible, but this would increase the complexity of the task since equations for the cost relation would be required in place of cost schedules. As a compromise, schedules for intervals of units such as 1000, 2000, 3000, etc. could be used to provide an approximation of the underlying equation. Students could use linear interpolation between points as a first approximation of the cost, then smooth out the curve. In either case the spreadsheet can easily be modified to return the exact cost derived from an equation so that record keeping of profits is based on exact relations.

A number of issues can be demonstrated by shifting the cost and demand curves. The demonstration that the optimal quantity for the monopolist need not be at the minimum of average cost or of marginal cost was mentioned earlier. It is also possible to demonstrate that even for the monopolist the demand curve may be below the average cost curve at every point, although this would be a frustrating game for the student since all P and Q combinations would incur losses. It might be instructive to use a steeply ascending average cost curve under severe diseconomies of scale or capacity constraints. Economies of scale and natural monopolies could be similarly illustrated. Harrison, McKee, and Rutström tested monopoly effectiveness under different experimental cost conditions and found that their research subjects achieved much higher percentages of monopoly profit when faced with a constant or decreasing cost function than with an increasing cost function.

Alternative pricing strategies can be explored. For example, students could be told that their product is of such durability that each consumer will only purchase one unit, and after purchasing a unit in some period that particular consumer would be removed from the demand curve in future periods. Thus the demand curve would be changing shape and moving leftward. A "skimming price" policy might then be suggested whereby the highest prices are charged early to the consumers with the highest demand. Conversely, students could be allowed to invest in advertising or research and development in order to move their demand curve rightward. As long as the instructor controls the structure of demand several varieties of profit-maximizing experiments with determinate solutions are possible.

Considerable research has been focused on laboratory monopolies, but much of it is beyond the scope of undergraduate instruction. Plott reviewed a number of monopoly experiments involving both fixed and variable supply under various market institutions such as double-oral auction, posted price (offer or bid), sealed bid, and English and Dutch auctions. He pointed out that the posted-offer institution (as used in the experiment described in this paper) gives the monopoly result predicted by theory much more regularly than double auctions or an institution where buyers post bids. One explanation for this phenomenon in the double-oral auction setting (where a single seller faces several real buyers) is that buyers seem to withhold their purchases and thereby force prices down by exercising some sort of tacit countervailing power (Plott, p. 1144).

Davis and Holt reviewed the literature on contested market experiments. Several of these experiments used a design where there are two potential sellers, there may be a cost to enter the market, and usually only one seller can earn profits in a given period. Total surplus was as much as 40% higher in these contested markets than that predicted under monopoly.

Several studies have examined theories of decentralized incentive regulation of monopolies. Using an experiment where subjects bid for a franchise on a regulated monopoly, Harrison and McKee found that performance was comparable to contested markets. Cox and Isaac modified a previously-used subsidy mechanism--one that frequently led to bankruptcy of the regulated monopolist in the laboratory--and showed that their modification mitigated such severe penalties while maintaining the desired convergence of prices toward competitive levels.

Conclusions

The experiment described in this paper allows students to explore pricing strategies available to the monopolist. Using a trial-and-error search of the profit surface, the strategic objective is to make the least number of moves to find a maximum, and then to establish that it is a global maximum. Using marginal principles, the strategic objective is to locate and plot the position of the demand curve, apply the graphical MC=MR rule, and then fine-tune the maximum price to the step function. Although an understanding of marginal analysis is not necessary for students to make progressively more rewarding choices in the game, one objective is to persuade students that this approach is more efficient than trial-and-error.

Since demand is simulated, prices are posted, and costs are known, the game is essentially an investigation of individual "firm" behavior without the complications of real-world market idiosyncracies. This makes it ideal for simplifying the environment to fit monopoly theory at the undergraduate level, while still allowing for more elaborate extensions involving different market institutions (auctions, posted bid, sealed bid, etc.), the interactions of additional players (real buyers, potential competitors, cartels, etc.), and changes in design features (shifting demand and cost schedules, production-to-order, inventory carryover, advertising, R&D, etc.) suitable for more advanced classes.

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Appendix

Instructions

This is an experiment in strategic pricing for the monopolist. Your profits from this experiment will be converted to bonus points that you can add to your grade in the class. The conversion rate will be one percentage point added to your final grade for every $10,000 earned in this experiment.

This experiment is designed to simulate a real-world situation in which a monopolist makes decisions on how to price a new product that he is putting on the market. The monopolist revises his price and quantity estimates of what the market will bear after he receives feedback from the market. You will see that without some strategy he cannot just charge any price that he wants to and still sell all the units that he can produce.

Each of you will be the only seller in the market. Think of yourself as having invented a unique new product for which you have a patent. Your invention is sufficiently different from everyone else's that you do not need to worry about what anyone else in the class will do if you change your price. The behavior of the buyers in your market will be simulated by an equation.

Your production costs are as follows:

UNIT	MARGINAL COST (COST FOR THAT UNIT)	AVERAGE COST (TOTAL COST/# UNITS)	TOTAL COST (CUMULATIVE MC)
1	227	227	227
2	168	198	395
3	123	173	518
4	92	153	610
5	75	137	685
6	72	126	757
7	83	120	840
8	108	119	948
9	147	122	1095
10	200	130	1295
11	267	142	1562
12	348	159	1910
13	443	181	2353
14	552	208	2905
15	675	239	3580

You start playing the game by choosing a PRICE that you are willing to sell your product for in the first trading period, and also the QUANTITY that you will produce and offer for sale in that period. All units that you sell in a period will be sold for the same PRICE. You can only sell whole units, e.g. not 4½ units. You cannot offer more than 15 units for sale.

After you have chosen the PRICE you are asking and the QUANTITY you are offering for the period, write it down on a piece of paper with your name on it and hand it in to me. At the next class period I will tell you how many units you sold. When you know how many units you sold at your PRICE for that period you can calculate your Total Revenue (gross earnings) and then subtract how much it cost you to produce the units that you *offered* for sale, whether they were bought or not. The difference between your Total Revenue and your Total Cost is your net earnings or Profit, which you can convert into bonus points toward your course grade. Your product is perishable so you cannot carry units produced in one period over to another period. The game will continue for several trading periods.

You do not know what the demand is for your product, so you will have to start by experimenting with your PRICE and QUANTITY offers until you know more about how the market values your product.

In order to give you a positive incentive to play the game, a "line-of-credit" of $10,000 is being extended to you that will function in the following way. **The line-of-credit is *not* incorporated in your final grade**; it serves as a "safety net" for initial losses due to overproduction. You can incur $10,000 in losses before being dropped from the game. Without such a line-of-credit some of you might feel that you could be lowering your course grade by playing the game and that it would be safer if you did not play the game.

To encourage you to participate, if you do not submit a price and quantity offer in a period you will be fined $1,000 to cover "overhead". Fines plus any other losses cannot exceed the line-of-credit, so **your grade cannot be lowered by playing the game**. Note that an unexcused absence results in a $1,000 loss due to the overhead charge. We will negotiate your earnings for an excused absence.