Price Discrimination and Resale: A Classroom Experiment

Atin Basuchoudhary, Christopher Metcalf, Kai Pommerenke,
David H. Reiley, Christian Rojas, Marzena J. Rostek, James Stodder*

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Abstract

This paper presents a classroom experiment designed to illustrate key concepts of third-degree price discrimination. By participating as buyers and sellers, students actively learn (1) how uniform pricing differs from group pricing, (2) how resale between buyers limits a seller's ability to price discriminate, and (3) how preventing price discrimination might reduce welfare. The exercise challenges sellers to set optimal prices against unknown demand curves, using a concrete story of pharmaceutical pricing to American and Mexican consumers. By working through profit calculations for themselves, students eventually arrive at the optimal seller prices in three different settings: uniform pricing, pricing separately to two groups, and pricing to two groups who can resell to each other. The experimental design encourages students to converge reliably to the theoretical predictions, and students find the exercise to be both interesting and illuminating. Classroom discussion can focus on real-world examples of price discrimination, as well as regulatory policy questions in industrial organization and international trade.

Keywords: price discrimination, monopoly, no-dumping policy, classroom experiments

JEL Classification: A22, D21, D43, L40

1. Introduction

* Virginia Military Institute, Johns Hopkins University, UC Santa Cruz, University of Arizona, Virginia Tech, Yale University, and Rensselaer Polytechnic Institute – Hartford, respectively. **Corresponding Author**: David Reiley, Associate Professor, Department of Economics, University of Arizona, 401CC McClelland Hall, Tucson, Arizona 85721. Phone: (520) 621-6238, e-mail: reiley@eller.arizona.edu. The authors were participants in the 2004 NSF Workshop on Classroom Experiments in Economics; we gratefully acknowledge the support of NSF grant SES-0094800. We thank Ninghua Du, Subashish Dugar, Wafa Hakim, and Lucas Rosnau for allowing us to test the game in their classes. We are especially grateful to David Mack and Michael Urbancic for their research assistance and constructive comments.

Price discrimination represents a potentially exciting topic in undergraduate courses in economic principles, intermediate microeconomics, industrial organization, and international trade. Price discrimination is commonplace in diverse consumer markets familiar to undergraduate students: pharmaceuticals, airlines, restaurants, computer software, and movies. The theory of price discrimination also figures in public-policy questions, such as preventing anticompetitive price discrimination in the Robinson-Patman Act, the "no-dumping" rules in international trade, and debates over international pharmaceutical pricing. However, the topic is also relatively challenging for students.

Our interest in the pedagogy of price discrimination is motivated by both its broad applicability and the difficulty of teaching the concept. Typically, a discussion of price discrimination follows a discussion of monopoly power and its welfare-reducing effects. Under the monopoly model, price discrimination may be welfare enhancing, a result which can be both interesting and confusing to the student. Our exercise provides students with an active learning experience with this concept, as they play the roles of the buyers and sellers.[1]

Previous classroom innovations for teaching price discrimination (Zillante et al., 2005; Hudson and Lusk, 2004)[2] have mostly focused on second-degree price discrimination. By contrast, our classroom experiment illustrates the principle of third-degree price discrimination (group pricing).[3] Our experiment features the sale of pharmaceuticals by a firm to two countries with different demand schedules. The firm, a monopolist for this drug,

[1] For a general introduction to using experiments in teaching, see Holt (1999) or Bergstrom and Miller (1999).
[2] Hudson and Lusk develop a Web-based experiment. Zillante et al. present a classroom experiment of second-degree price discrimination and a variation of third-degree price discrimination in the context of parking lot permits. Our experiment, on the other hand, directly addresses the concept of third-degree price discrimination. Furthermore, their design is very context-specific, while our experiment is flexible to accommodate changes in the context.
[3] Pigou (1920) was the first to detail the three different types of price discrimination (first, second and third) and made the conjecture that if output decreases welfare may also diminish. The term 'group pricing' is due to Shapiro and Varian (1999). Varian and Shapiro also renamed first-degree price discrimination as 'personalized pricing' and second-degree as 'versioning.' We find these names to be evocative and convenient for students, especially as second-degree and third-degree discrimination cannot really be ranked in any meaningful way.

first posts a single price to sell the drug to both countries via uniform pricing (Treatment I). Next, the market is segmented and the firm announces a different price to each country (Treatment II). Finally, we repeat Treatment II but allow resale between buyers of the two countries (Treatment III).

Typically, the outcomes converge to their theoretical predictions in each treatment within several rounds. Increased welfare under price discrimination becomes evident when low-income purchasers who could not afford the product in Treatment I begin purchasing in Treatment II.[4] In Treatment III, the firms learn quickly—and usually through costly experience—that the possibility of resale destroys their ability to price discriminate profitably. When they stop price discriminating, the welfare of low-income consumers decreases. In our experience, the experiment gives students new intuition about third-degree price discrimination and stimulates very interesting classroom discussion about the theory and policy aspects of price discrimination.

The remainder of our paper proceeds as follows. Section 2 describes the design and procedures. The typical classroom results are shown in section 3. Section 4 provides suggestions for post-experimental class discussion and section 5 outlines possible extensions. The Appendix provides suggested instructions for students as well as notes on implementation for the instructor.

2. Experimental Design

For the experiment, we organize the class into one or more isolated (non-interacting) identical markets, which we call 'worlds'. Each 'world' consists of one firm and eight consumers for a homogeneous pharmaceutical product. Each student takes the role of either a consumer or a firm. A single firm consists of a number of students who cooperatively make

[4] We chose our demand parameters to provide the interesting result of increased total welfare under price discrimination. See Section 5 for a variation where total welfare is reduced.

decisions. Flexibility in the number of students per firm guarantees a role to every student in the class. Three treatments correspond to different market institutions, each of which is played for several rounds until behavior converges. The instructor publicly announces the new trading institutions at the beginning of each treatment.

2.1. Demand and cost structure

The pharmaceutical firm in each 'world' produces with a constant marginal cost of 1 (and no fixed cost). Consumers have demand induced by a set of eight playing cards. Each world gets four cards with values 3, 4, 5, and 6 from a red-backed deck, plus four cards with values 7, 8, 9, and 10 from a blue-backed deck. We randomly deal one card to each buyer. The numeric value of the card represents the player's private valuation for a single unit of the pharmaceutical. For the purposes of price discrimination, the back of the card will identify the country of the buyer. Blue-card consumers live in the United States, while red-card consumers live in Mexico.[5] The instructor does not mention the significance of the colors until the second treatment.

Buyers may buy at most one unit per round of the game. A student who buys a unit earns a surplus equal to the difference between the face value of their card and the posted price. A student who decides not to purchase records zero earnings. The seller's profit equals the markup (price minus $1) times the number of units sold. The seller does not have capacity constraints and can hence sell all units demanded. We encourage students to maximize their earnings (surplus for buyers, profits for sellers), and to write them on a record sheet at the end of each round.

[5] The USA-Mexico framing works particularly well in places like Tucson, Arizona, where students are familiar with the idea of trips to Mexico to purchase drugs at lower prices. Instructors are encouraged to change the identities of the countries to suit their locations; for example, instructors in Minnesota may prefer to use USA-Canada.

To make the game more interesting and realistic, we do not reveal the demand schedules to sellers; they must guess prices and determine their optimal profits by trial and error. We also allow sellers to use non-integer prices, but the instructor may choose to speed up the game by restricting prices to whole dollar amounts. To make the task easier for sellers, we publicly announce that the economies are identical (i.e., that for each world the supply and demand conditions are the same), and we keep a complete history of results (prices, quantities, profits) for each world tabulated at the front of the room.[6] By comparing results for different prices across worlds, sellers learn their optimal prices more quickly. We find that sellers converge to near the optimum within about four rounds even when they are choosing a pair of prices against two unknown demand curves.

2.2. Treatments

Treatment I (Uniform Pricing): The seller announces a single price for the good. Any buyers wishing to purchase at this price do so by raising their hands. We do not require buyers to purchase when they can obtain positive surplus by doing so, and indeed sometimes we find a buyer or two will withhold demand for a couple of periods, in hopes of getting the seller to lower the future price. This can make it harder to achieve the exact theoretical prediction for the market, but it makes the game more interesting for the buyers.[7] Buyers then record their earnings privately, and the instructor computes and records the sellers' earnings at the front of the room. This trading process is repeated over several periods until the firm converges to (or near) its optimal price.

[6] We have designed an Excel workbook that facilitates recording the data and presenting results to students. Using a projector at the front of the classroom, one can enter the prices chosen by the students at each firm, and automatically generate a public record of prices and profits. The software is flexible (for example, one can easily change the number of worlds) and easy to use. It can be downloaded at <http://www.u.arizona.edu/~dreiley/papers/PriceDiscriminationGame.html>.

[7] Instructors who would prefer faster convergence to the exact theoretical prediction can choose to tell buyers that they must purchase the good if they would earn positive surplus from doing so.

Treatment II (Price Discrimination): The instructor announces the meaning of the colors on the backs of the cards. The seller is now allowed to charge a different price for each market. The seller begins each round by announcing two prices, one for red card holders (Mexicans) and one for blue card holders (Americans). First the Mexicans decide whether to purchase, and then the Americans decide whether to purchase. Earnings are recorded as before, and the game proceeds for several rounds until prices converge.

Treatment III (Resale): In this treatment, consumers may resell the good between markets. The game proceeds as in Treatment II except that after the purchases in both countries, students can attempt to make trades among themselves. This resale opportunity is announced in advance of the first round of Treatment III. We specifically recommend that the Mexicans purchase before the Americans so that the Americans will have some idea what their post-market purchase opportunities will be; this helps drive home the point that price discrimination becomes unprofitable with resale. Each buyer continues to be limited to purchasing at most one unit from the firm, and may choose either to consume or to resell a purchased unit.

One caveat with this experiment is that the buyers may lose interest because their task is so trivial, and thus miss out on the great potential for active learning in this game. We emphasize to all of our students that they should be thinking about what they would do if they were the seller. To facilitate this, we ask them to write down on their own sheet of paper what prices they would choose each period, even though these prices don't "count" for the classroom game. In this active-learning experience, we find that all students benefit from the table of previous results displayed at the front of the room.[8]

[8] If students become bored anyway, we suggest several remedies to try. One can reshuffle the cards and randomly redistribute them to buyers after each treatment, which makes things more interesting for a student who happened to get a card value too low to participate in the market. One can use tokens or poker chips to represent the pharmaceutical product: give the tokens to the sellers at the beginning of each round, and have

2.3. Predictions

Table 1 presents information regarding the demand schedule, the sellers' outcomes and welfare measures for the first treatment.[9] Given our parameters, the profit-maximizing price in the first treatment is a monopoly price of 6.[10] Assuming that indifferent buyers always purchase, the price results in sales of 5 units, for a profit of 25 each round. In the second treatment—as illustrated by Table 2—the profit-maximizing prices are 7 for the U.S. market and 4 for the Mexico market, giving a total profit of 33 and total quantity of 7 units. In the third treatment, the resale option drives the monopolist to set prices in both markets equal to the uniform monopoly price from the first treatment.[11]

Our demand specification demonstrates how price discrimination can increase total surplus, and how allowing resale may actually decrease total surplus (relative to price discrimination without resale).[12] Classroom discussion may—and should—explain why

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them actually give the tokens to the buyers in exchange for the purchase price. Buyers then can exchange actual tokens with each other in Treatment III. After each round, the instructor should remove tokens from the buyers, to simulate consumption, and give them back to the sellers. Finally, one can give the students material incentives to maximize surplus, such as candy or bonus points. The main difficulty with material rewards is the unfairness of the distribution of cards, which could be alleviated somewhat by reshuffling between rounds or treatments.

[9] Theoretical predictions for Treatment III (price discrimination with resale) are identical to those of Treatment I, since the seller will be motivated to set a uniform price to both American and Mexican consumers.

[10] Note that the profit-maximizing quantity in our setting produces a marginal revenue slightly higher than marginal cost. Some instructors might prefer to have them be exactly equal, for more direct agreement with standard textbook treatments. One could do this by changing the MC from 1 to 2, for example. However, to get exact equality of MC and MR in a discrete-demand setting, one must give up uniqueness: two different prices produce the same maximum profit. We find that having unique predictions improves the experiment.

[11] To see this, note that charging the Mexicans less than the Americans leads to an incentive for all the Mexicans to buy and resell to Americans, all of whom have higher values. In practice, we find that different resale trades take place at different prices, but at any resale price between the lowest American value (7) and the highest Mexican value (6) all eight buyers will have an incentive to trade with each other. In the first round or two of Treatment III we usually observe behavior very much like this. This resale behavior costs the seller profits, because the seller ends up selling only four units at the lower of his two prices. Since each buyer is limited to one unit, any purchase for reselling purposes does not increase total quantity, but rather shifts quantity to the lower price. As a result, the monopolist would make at least as much profit by charging the highest uniform price that sells the same number of units. Therefore, a profit-maximizing monopolist should set the unique (or uniform) price of Treatment I (no price discrimination).
For completeness, we should also consider whether the seller could do better by charging a higher price to the Mexicans than to the Americans. Clearly the optimal American price is $7, and charging a price of more than $7 would result in zero demand by Mexicans, so the outcome is the same as if the seller had charged a uniform price of $7, which means the seller can do no better than to charge a uniform price.

[12] As discussed in Section 5, the effects of price discrimination on both *total* surplus and *consumer* surplus are

without effective price discrimination it is possible that only one market will be served in equilibrium. Indeed, in Treatments I and III of our experiment, when the monopolist sets the price at the predicted profit-maximizing level of 6, only one Mexican buyer will be served, and that buyer will earn no consumer surplus even if she does make a purchase.

3. Classroom Experiences

In general, we have observed consistent results and little variability across classes with the typical outcomes as follows. In Treatment I, the price converges to the monopoly level after about four rounds. Table 3 shows an example of the convergence of seller prices in four different worlds to monopoly pricing during the first treatment.[13]

In Treatment II, the sellers recognize quickly that they should charge different prices to the two markets. After the sellers have learned about the differences in demands between the two markets, the prices eventually converge toward the optimal levels (typically in three to four rounds; see Table 4 for an example). In Treatment III, it is now both the buyers and sellers who have to learn. After some rounds in which the buyers learn to make deals and change their initial demand, the seller eventually realizes that it is optimal to charge the same (non-discriminatory) price to both markets. (See Table 5.)

4. Post-Experiment Class Discussion

The discussion following this experiment can focus on the theory of price discrimination as well as applications to policy debates. In the theory discussion, one might discuss the definition of price discrimination as well as its necessary conditions. The experiment provides very concrete examples of two of the necessary conditions: (1) the firm must be able to observe the type (card color) of the consumers in setting separate prices, and (2)

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in general ambiguous; however, the demand structure can be easily modified to produce opposite effects from those demonstrated by the original game.

[13] Tables 3, 4, and 5 report results from a 36-student intermediate microeconomics course taught at the University of Arizona.

resale must not be possible (as illustrated by Treatment III). In observing the increased profit between Treatments I and II, one might ask the students whether even more profit could be possible. This leads naturally to a discussion of perfect price discrimination (personalized pricing), illustrated by the hypothetical situation where the firm observes not just the card color, but the number on each card. An intermediate situation would involve setting separate prices for more than two groups, such as having multiple groups within each country. For example, within the United States, senior citizens and poorer patients typically receive cheaper drugs than other consumer groups, either through government-run programs (e.g. Medicare and Medicaid)[14], or through new initiatives administered directly by large drug companies.[15] This relates to the discussion of personalized pricing suggested above.

Perhaps the most interesting theoretical point to discuss is the welfare effects of price discrimination. One might start by asking the class whether it was "right" for the firm to price differently to poor and rich. At first, the connotations of the word "discrimination" may cause some students to think of welfare-diminishing effects. However, a discussion of what actually happened to Mexican consumers after each treatment will clarify the welfare-improving aspects. That is, some Mexicans go from no purchase and zero consumer surplus, to actual purchase and positive consumer surplus. To further illustrate, one can directly compute the welfare effects for each of the nine players in the game. If the experimental behavior conforms exactly to the theoretical predictions, we should see an increase in Mexican consumer welfare from 0 to 3, and a decrease in American consumer welfare from

[14] National governments sometimes use "external referencing" to negotiate lower prices for themselves when international prices are well-known. For example, Canada, Italy, Greece, and the Netherlands all use external referencing in their formal drug-purchase agreements. This, of course, limits firms' ability to price discriminate between countries.

[15] Two very recent examples are Pfizer's "Pfriends" program and Merck's "Prescription Discount Program." See the relevant corporate websites for details.

10 to 6, so total consumer welfare decreases from 10 to 9. Meanwhile, profits increase from 25 to 33, so total welfare increases from 35 to 42.

There are additional welfare issues not brought out by the game. One is the ability of the government to regulate or disallow monopolies. When price discrimination is not feasible, particularly because of resale, the loss of consumer welfare may be so great that the government may attempt to destroy the monopoly altogether. For example, although few countries have explicitly rejected patent laws, some large countries like India, Brazil and South Africa, in negotiating for lower prices, have worked out deals to allow for local production of their own generic versions of anti-retroviral AIDS drugs. In more advanced classes, one may raise the issue of incentives for technological innovation: the ability to price discriminate may lead to increased research incentives because it increases the returns to innovation. Contrasting the positive effects of breaking the monopoly with the negative dynamic effects on research is a helpful example of the importance and difficulty of economic analysis.

The resale element of the game also provides some interesting applications. For example, the EU specifically authorizes the resale or "parallel trade" of pharmaceuticals. If firms tried to price discriminate between EU countries, one might expect merchants in the poorer nations to resell to their richer neighbors, limiting the pharmaceutical firms' ability to price discriminate. Danzon, Wang, and Wang (2003) show evidence of narrow international gaps in prices in the EU, and document the fact that firms react to this by delaying the launch of new drugs in the poorer EU nations.

One possible solution to the resale problem is setting quantity limits for the low-price group. In fact, quantity limits to Canada have started to take place in the pharmaceutical

market (MacDonald, 2004).[16] Another possible strategy is for the firm to put forward a single (high) international price, and then negotiate confidential discounts in the countries where it would like to charge lower prices. If the discounts take place in the form of lump-sum rebates, then the unit prices remain the same in each country, which should discourage parallel trade.

5. Extensions

The design we present is flexible enough to accommodate all classroom sizes (see Appendix) as well as other variations the instructor may be interested in (e.g. alternate welfare effects, using different pricing schemes, allowing for multiple-unit resale, changing the context). For clarity, in this section we refer to the game structure that appears in section 2 as the original or baseline game; the extensions are merely modifications of that basic structure.

As noted earlier, the baseline game parameters predict that price discrimination will increase total (producer plus consumer) welfare relative to uniform pricing. However, the work of Robinson (1933), generalized by Schmalensee (1981), notes that third-degree price discrimination has ambiguous welfare effects in general. If one wishes to emphasize that welfare may be either increased or decreased by price discrimination, an instructor could modify the demand structure of the two markets. One possibility is to decrease the willingness to pay of the poorest American (the blue 7) from 7 to 5, which results in a lower

[16] Incidentally, we have tried a version of the classroom game in which individual consumers are permitted to purchase more than one unit for resale. The rules are a bit harder to explain to the students, but in the end we get the same basic result: the introduction of resale causes an eventual return to uniform pricing.

predicted total welfare in Treatment II than in Treatment I. In this case, the total welfare at the profit-maximizing prices is 37 in Treatment I and only 36 in Treatment II. [17]

Just as with total welfare, the effects of price discrimination on consumer welfare are also ambiguous. In the baseline game, consumer welfare decreases from 10 under uniform pricing to 9 under price discrimination (Tables 1 and 2), with a substantial transfer of surplus from American consumers to Mexican consumers. By contrast, one can find an alternative distribution of values for which consumer welfare unambiguously increases under price discrimination. For instance, replacing the red 6 with a red 8 in the baseline deck has the effect of increasing consumer welfare from 7 in Treatment I to 11 in Treatment II for the respective profit-maximizing prices.[18]

For smaller class sizes, an instructor may find it easier to break a class up into worlds of seven students as opposed to nine students. One possibility is to take out the blue 7 and the red 3. This simpler version of the game will likely converge more quickly, and the positive effects of price discrimination are more striking. Then the predicted profit-maximizing price in the first treatment shuts out the Mexican consumers completely, but price discrimination in the second treatment gives them all an opportunity to purchase the good. The American consumers should be unaffected by price discrimination in this scenario. Thus, price discrimination makes no one worse off, but makes both the seller and the Mexican consumers better off. This example may be useful if an instructor is looking for a quick demonstration where price discrimination is unambiguously "good" for everyone.

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[17] In this case, total welfare at the predicted profit-maximizing price in Treatment I is 37, while it is only 36 in Treatment II. Naturally, there are many other distributions of buyer values that have the effect of decreasing total welfare under price discrimination, some of which imply much starker welfare effects. This example was chosen for its similarity to the baseline demand distribution.

[18] We have prepared an additional Excel spreadsheet that quickly evaluates the predicted results of Treatments I and II given user-determined variables for the seller's marginal cost, the valuations of four American consumers, and the valuations of four Mexican consumers. It may be helpful to instructors who wish to tailor specific outcomes by tinkering with the game. See <http://www.u.arizona.edu/~dreiley/papers/PriceDiscriminationGame.html>.

In summary, our game gives instructors a powerful tool for helping students understand the effects of price discrimination and resale on consumers and producers. Though simple and easy to administer, it also provides many options for instructors wishing to explore various nuances of the theory and its public-policy applications.

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Table 1. Demand, Seller Outcomes and Consumer Welfare under Uniform Pricing (Treatments I and III)

Price	*# of Units Demanded*	*Total Revenue*	*Marginal Revenue*	*Seller Profit*	*Consumer Welfare*	*Total Welfare*
10	1	10	10	9	0	9
9	2	18	8	16	1	17
8	3	24	6	21	3	24
7	4	28	4	24	6	30
6	**5**	**30**	**2**	**25**	**10**	**35**
5	6	30	0	24	15	39
4	7	28	-2	21	21	42
3	8	24	-4	16	28	44

Note: Row in **bold** denotes predicted profit-maximizing outcome.

Table 2. Price Discrimination without Resale (Treatment II)

	Price	*# of Units Demanded*	*Total Revenue*	*Marginal Revenue*	*Seller Profit*	*Consumer Welfare*	*Total Welfare*
USA	10	1	10	10	9	0	9
	9	2	18	8	16	1	17
	8	3	24	6	21	3	24
	7	**4**	**28**	**4**	**24**	**6**	**30**
Mex	6	1	6	6	5	0	5
	5	2	10	4	8	1	9
	4	**3**	**12**	**2**	**9**	**3**	**12**
	3	4	12	0	8	6	14

Note: Rows in **bold** denote predicted profit-maximizing outcome.

Table 3: Sample Results for Treatment I (Uniform Pricing)

Round	*World*	*Price*	*Quantity*	*Profit*
1	A	7	4	24
	B	**6**	**5**	**25**
	C	8	2	14
	D	4	5	15
2	A	5	6	24
	B	5	6	24
	C	**6**	**5**	**25**
	D	6	4	20
3	A	4	7	21
	B	**6**	**5**	**25**
	C	**6**	**5**	**25**
	D	7	2	12
4	**A**	**6**	**5**	**25**
	B	**6**	**5**	**25**
	C	5	6	24
	D	6.5	4	22

Note: Rows in **bold** denote realized profit-maximizing outcomes.

Table 4: Sample Results for Treatment II (Discriminatory Pricing)

Round	*World*	*US Price*	*US Quantity*	*Mexico Price*	*Mexico Quantity*	*Profit*
1	A	7	4	3	2	28
	B	**7**	**4**	**4**	**3**	**33**
	C	6	4	5	2	28
	D	6	4	3	4	28
2	A	7	4	5	2	32
	B	8	1	4	3	16
	C	7	4	4	2	30
	D	6.5	4	4	2	28
3	**A**	**7**	**4**	**4**	**3**	**33**
	B	7	0	4	3	9
	C	7	4	5	2	32
	D	6.5	4	3	4	30
4	A	7	3	3	4	26
	B	6	4	4	3	29
	C	7	4	5	2	32
	D	7	3	3.5	3	25.5

Note: Rows in **bold** denote realized profit-maximizing outcomes.
US buyers in world B were actively engaged in collective bargaining with their seller; rounds 2, 3, and 4 demonstrate the buyers' solidarity as well as the effectiveness of their boycott.

Table 5: Sample Results for Treatment III (Discriminatory Pricing with Resale)

Round	*World*	*US Price*	*US Quantity*	*Mexico Price*	*Mexico Quantity*	*Profit*
1	A	6	2	5	2	18
	B	**6**	**4**	**6**	**1**	**25**
	C	7	1	6	1	11
	D	5	2	3	4	16
2	A	4	4	4	3	21
	B	6	4	6	0	20
	C	***4.99***	***4***	***5***	***4***	***31.96***
	D	4	3	3	4	17
3	A	7	3	6	0	18
	B	4	4	4	3	21
	C	7	0	6	3	15
	D	5	4	5	0	16

Note: Row in **bold** denotes legitimate realized profit-maximizing outcome.
Row in ***bold italics*** denotes illegal results obtained in an improperly run round. Apparently the seller misunderstood the order of events during the round (though as seen above this slip was suspiciously advantageous to him). Instead of announcing both US and Mexican prices before taking Mexican orders, the seller announced only a Mexican price, took Mexican orders, after that announced a US price that undersold the potential Mexican suppliers, and finally took US orders. The resale period for this world was thus mooted. This point was immediately clarified and did not occur again in any world.

Appendix: Suggestions for the Instructor and Student Instructions

Preparation before Class

To identify the high and low demand buyers, you will need at least two decks of cards of different colors, for example red and blue. Modify instructions accordingly if you have other colors. Separate from the red deck four sets of cards, each with the numbers 3, 4, 5 and 6. Separate from the blue deck four sets of cards, each with the numbers 7, 8, 9 and 10. With these cards, create four different sets of cards containing the numbers 3 through 10. Each of these four sets will then have four red cards (with numbers 3 through 6) and four blue cards (with numbers 7 through 10). Each of these four sets will be the reservation values of the buyers in each world.

Two decks of cards should hence allow you to create four worlds, each with eight buyers (with numbers 3 through 10) and one seller. To allow more students to be sellers, you can group two or three students as a single seller and let them together come up with the price decision each round. Add more decks for bigger classes. You can assign assistants to help distribute instructions or collect information. A simple formula to figure out the set-up of a given class is class size divided by 9 then to distribute the remainder to be in the seller firms or assistants. The experiment can accommodate different class sizes. For example, if you have 66 students in a class you can have: 7 worlds, with 3 worlds having 2 students as the seller or you could have 6 worlds with each seller composed of 3 students.

We recommend that you project the results of each market in every round to the whole class. We have developed a spreadsheet that allows you to register prices, quantities and sellers' profits in each world. This spreadsheet has built-in formulas that automatically calculate the sellers' profits. In addition, the spreadsheet creates tables and graphs that can be used for later class discussion.

Running the Experiment

The experiment can be run in approximately 40 minutes. Depending on the length of the class, discussion can either be conducted after the experiment or it can be delayed for the next session. Separate the worlds (groups), and assign students the roles of buyers, sellers or assistants. Read the general instructions for buyers and sellers as well as the instructions for the first game. Make sure that everyone understands the exercise and ask if anyone has questions. Next, deal a card to each of the buyers of each world. Do not mention the fact that some cards are red and some are blue and, if asked, say that the colors do not matter at this point in the game. Begin the first round of trading according to the instructions. At the end of each round, record the outcome (prices, quantities, and profits) of each world, make sure everyone in the class notices these results, and then begin the next round. For each treatment, read aloud the instructions for sellers and buyers for that treatment. Repeat rounds of that treatment until prices converge to predicted values or until five rounds, whichever comes first. Since buyers who get cards with a number 3 or 4 have limited interaction ability, we recommend that at the beginning of each treatment you reshuffle the cards in each market. Also, make sure that sellers do not interact with buyers and display the results of all markets only after every world has finished trading.

Instructions

We are going to set up a market in which some people will be buyers of pharmaceuticals, and others will be sellers. One seller and a group of 8 buyers represent an independent 'world'.

Buyers: Each buyer will be given a numbered playing card. Please hold your card so that others do not see the number. The number on each card represents the dollar value of the utility (in dollars) that you receive if you purchase a unit of the product. You are only allowed to buy one unit. The dollar amount that you earn from each unit purchased is the face value of your card minus the price at which you purchase. You have the option of not purchasing, but then you will have earnings of zero. The game will be played for several rounds, please record your earnings for each round.

Sellers: To each group of buyers, there should be assigned one group of sellers, referred to hereafter as "The Seller," consisting of 1 to 3 people. The seller acts as a single unit selling to a group of buyers, so that the exact number of people in the seller group is not important. Individuals in the seller group should come to a consensus on their pricing decisions each round.

The seller may sell as many units as are requested by consumers. The seller will be required to sell at a price that is no lower than Marginal Cost, which is $1. Earnings on the sale of each unit are calculated as the difference between the price negotiated and $1. The seller should record earnings for each round.

First Game

First, the seller announces one price at which the buyers in that world may purchase. The seller may choose a price in dollars and cents (whole-dollar increments are fine but not required). Then, each buyer wishing to purchase at the announced price should raise her hand and record the purchase price and her earnings, which will be her card value minus the seller's stated price for that round.

The seller should count and record the number of buyers purchasing at the quoted price, and then calculate the resulting profits. This is done for a number of rounds.

Second Game

Now we are going to set up a market in which some people will be Mexican buyers of pharmaceuticals, and others will be US buyers. Buyers with red cards are residents of Mexico, and buyers with blue cards are residents of the US. The game proceeds as before, except that now the seller announces two prices (one for each nation) and Mexican buyers will be given the opportunity to purchase first. After Mexican buyers have made their purchases US buyers are given the opportunity to raise their hands and purchase. Buyers and sellers will then record their earnings. Again, this is played for a few rounds.

Third Game

Proceed as in the second game, with the difference that now buyers have the option of reselling their unit to other buyers after the seller has concluded transactions with both the Mexicans and the Americans (remember Mexicans buy first, then Americans). If a buyer buys a unit from the seller and resells his/her unit to another buyer, earnings are calculated as the difference between the two prices (price sold to another buyer minus the original seller price). Otherwise, earnings are calculated as before: the difference between the price at which unit was purchased (whether it was from seller or another buyer) and the card number. To summarize this game:

a. Seller quotes two prices
b. Mexicans buy, Americans buy
c. Americans and Mexicans trade units (if desired)
d. Buyers and seller record earnings.

NOTE: You may purchase a unit even if the quoted price is higher than your card number; however, if you do so and cannot resell the unit at a higher price (or at least as high) you will incur a loss.

Buyer's Record Sheet

Game 1

Round	**Price Paid**	**Earnings:** •(Card # – Price) if purchased •0 if no purchase	*Price you would charge next period if you were the seller*
1			
2			
3			
4			
5			

Game 2

Round	**Price Paid**	**Earnings:** •(Card # – Price) if purchased •0 if no purchase	*Prices you would charge next period if you were the seller*	
			USA	*Mexico*
6				
7				
8				
9				
10				

Game 3

Round	**Price Paid**	**Earnings:** •(Card # – Price) if consumed •(Price sold – Price paid) if resold •0 if no purchase	*Prices you would charge next period if you were the seller*	
			USA	*Mexico*
11				
12				
13				
14				
15				

TOTAL EARNINGS	

Seller's Record Sheet

Game 1

Round	Price	Quantity Sold	Revenue	Unit Cost	Total Cost	Profit
1				1		
2				1		
3				1		
4				1		
5				1		

Game 2

Round	USA Price	USA Quantity	Mexico Price	Mexico Quantity	Total Revenue	Unit Cost	Total Cost	Profit
6						1		
7						1		
8						1		
9						1		
10						1		

Game 3

Round	USA Price	USA Quantity	Mexico Price	Mexico Quantity	Total Revenue	Unit Cost	Total Cost	Profit
11						1		
12						1		
13						1		
14						1		
15						1		

TOTAL EARNINGS	