A CLASSROOM EXERCISE FOR TEACHING THE THEORY OF THE SECOND BEST IN A DUOPOLY SETTING

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ABSTRACT

The Theory of the Second Best is an important proposition for students of public policy and economics. It states that, when markets are characterized by imperfections, efforts to enhance welfare by removing other imperfections can adversely reduce economic welfare. This article presents a simple classroom demonstration for teaching the Theory of the Second Best in an oligopoly setting. In the exercise, students represent firms in a duopoly choose a profit-maximizing price under specific market conditions. The results demonstrate that imperfect information and product heterogeneity, two market "imperfections," make cartel coordination challenging and, thus, can enhance market performance. A description of a typical classroom discussion follows.

The effectiveness of the exercise was tested by splitting a principles class into an experimental group and a control group. The results showed that the mean grade of students taught with the classroom demonstration was significantly higher than those taught by more traditional methods.

INTRODUCTION

The Theory of the Second Best (TSB) states that, when markets are characterized by imperfections, efforts to enhance welfare by removing other imperfections can adversely reduce economic welfare. Originally an insight emanating from general equilibrium theory (Lipsey and Lancaster, 1956), the TSB can also apply to partial equilibrium situations. A common example is of a mining monopoly where the output creates pollution -- an external cost on society. Breaking up the monopoly into many firms, an effort to remove one market imperfection could reduce overall welfare as the firms expand production and, therefore, create more pollution.

Though often overlooked, this seemingly paradoxical effect on welfare makes the TSB an important concept for students of economic policy. The narrative common in most textbooks describes how the "ideal" state of perfect competition in a market economy optimizes economic welfare. Deviations from perfect competition are described as reducing economic welfare, requiring government intervention (Ragan, pp. 281-303). However, the TSB reminds students that care must be taken when prescribing policy. Simply removing a market imperfection does not guarantee enhanced welfare and could make the outcome worse. J.M. Clarke (1940) introduced the concept of a remedial imperfection - a deviation from perfect competition that improves the functioning of the market.

This article presents a simple classroom exercise for teaching the TSB to undergraduate students of economic policy. Using a duopoly setting, the exercise acts as an effective starting point for discussions on the concepts of market imperfections and cartel behavior.

CLASSROOM EXERCISES AND DISCUSSION

This exercise is directed towards students who have completed a principles course in microeconomics (discussion questions are presented in italics). The class begins by asking students to recall the criteria of a perfectly competitive market. Collectively, students should have little difficulty remembering most of these, though (significantly for this demonstration) they may need to be reminded about the criterion of complete information. Students can also be reminded of the theoretical benefits of perfect competition towards economic welfare.

Can you name a market that meets all of the criteria for perfect competition? Clearly, this is a challenge. While some markets may be close, students begin to realize that perfect competition is an unattainable ideal.

Consider a market such as the automobile industry; what imperfections exist in this market? How about the airline industry (choose any well-known industries)? Students will recognize that these real markets are characterized by imperfections such as fewness, differentiated products, entry barriers, and incomplete information.

The instructor informs the students that they will now participate in an exercise that will help them understand the difficulties of setting economic policy for imperfect markets. The students are grouped into pairs and told they will each represent a hypothetical firm in a duopoly. They will be presented with different scenarios; their objective in each is to maximize their individual firm's profits.

Scenario 1

The first student, representing firm A, receives a cue card with the following information:

Firm A

Homogeneous Product
Market Demand: $Q = 1000 - 10p$
Your Firm's Constant Marginal and Average Cost: $MC_A = ATC_A = \$15$
Set your price to maximize your profits. No cooperation or communication.

The second student, representing firm B, receives the following information:

Firm B

Homogeneous Product
Market Demand: $Q = 1000 - 10p$
Your Firm's Constant Marginal and Average Cost: $MC_B = ATC_B = \$10$
Set your price to maximize your profits. No cooperation or communication.

Thus, this is a Bertrand duopoly situation with a homogeneous product and constant marginal costs. The only difference between the two firms is that Firm B has a cost advantage. Before the students begin, it is useful to ask: what imperfections characterize this market? Most students will identify that, with only two firms and no cooperation, the market is characterized by fewness and incomplete information. Depending on the level of the students, it may also be helpful to remind them that, with a homogeneous product, the competitor with the lower price will capture all of the demand.

Students typically realize that they must set their price as low as it is possible to still make a profit. Thus, firm A's price is typically set just above \$15, while firm B's is set just above \$10. So, Firm B captures all of the demand. The instructor asks the students to calculate the level of output and the consumer surplus for the prices they set. Depending on the student level, the instructor can assist with a numerical example.

Scenario 2

The first student, representing firm A, receives the following information:

Firm A

Homogeneous Product
Market Demand: $Q = 1000 - 10p$
Your Firm's Constant Marginal and Average Cost: $MC_A = ATC_A = \$15$
Your Competitor's Constant Marginal and Average Cost: $MC_B = ATC_B = \$10$
Set your price to maximize your profits. No cooperation or communication.

The second student, representing firm B, receives the following information:

Firm B

Homogeneous Product
Market Demand: $Q = 1000 - 10p$
Your Firm's Constant Marginal and Average Cost: $MC_B = ATC_B = \$10$
Your Competitor's Constant Marginal and Average Cost: $MC_A = ATC_A = \$15$
Set your price to maximize your profits. No cooperation or communication.

The only difference from Scenario 1 is that the firms now know the costs facing their competitor.

Most of the students playing Firm B now recognize that they can raise their price to just below \$15 and still capture all of the demand.

Discussion

Compared to Scenario 1, what market imperfection was removed in Scenario 2? Students typically recognize that information became more complete.

How did the prices, outputs, and consumer surpluses differ between the two scenarios? The students have calculated that price is higher and both output and consumer surplus are lower in Scenario 2.

So, when we removed a market imperfection by making information more complete, consumer welfare decreased. Given that perfect competition maximizes consumer welfare, wouldn't you expect the removal of an imperfection to improve consumer welfare? At this stage, students begin to grasp the supposed paradox that is the TSB, which the instructor can formally define.

If the instructor only wants a quick demonstration of the TSB, she may wish to stop here and move on to a discussion of the TSB's implications for setting economic policy (see below). If she wants another demonstration of the TSB that provides insights into the nature of cartels, she can continue with scenarios 3 and 4.

Scenario 3

The first student, representing firm A, receives the following information:

Firm A
Differentiated Product
Your Firm's Demand: $Q_A = 500 - 7p_A + 3p_B$
Your Firm's Constant Marginal and Average Cost: $MC_A = ATC_A = 10$
Communicate with your competitor and set a price to maximize your profits.

The second student, representing firm B, receives the following information:

Firm B
Differentiated Product
Your Firm's Demand: $Q_B = 500 - 8p_B + 2p_A$
Your Firm's Constant Marginal and Average Cost: $MC_B = ATC_B = 10$
Communicate with your competitor and set a price to maximize your profits.

Note that the two firms' demands are such that if $p_A = p_B$, then the market demand could be represented by $(Q_A + Q_B) = Q = 1000 - 10p$. This makes scenario 3 roughly comparable to the others. The instructor can point this out to the students.

What are the market imperfections inherent in this scenario? The students typically recognize product differentiation as an "imperfection." Some in the class also recognize that communication sets up the possibility of a cartel. If no students raise this possibility, the instructor should do so.

The results for scenario 3 are varied. Some students cooperate and set a price through trial and error. Others set their price independently. Typically, whether they coordinate or not, students use the ATC of $10 as an anchor and add a substantial markup, so that prices are generally in the range between $15 and $25. The instructor may wish to ask students how they set their prices. This can invoke a discussion of price setting in real markets and the debate between rational price-setting and administered pricing.

As above, the instructor asks the students to calculate the joint output that results from their prices. While calculating consumer surplus is a challenge in this setting, the instructor can remind students that lower prices and greater output typically result in greater consumer welfare.

Scenario 4

Firm A

Homogeneous Product
Market Demand: Q = 1000 - 10p
If you and your competitor set the same price, you will share the market equally.
Your Firm's Constant Marginal and Average Cost: $MC_A = ATC_A = 10$
Communicate with your competitor and set a price to maximize your profits.

Firm B

Homogeneous Product
Market Demand: Q = 1000 - 10p
If you and your competitor set the same price, you will share the market equally.
Your Firm's Constant Marginal and Average Cost: $MC_B = ATC_B = 10$
Communicate with your competitor and set a price to maximize your profits.

This scenario returns to a homogeneous product. Communication between the firms increases the likelihood of collusion.

The great majority of students decide to collude with their competitors and set prices considerably higher than any of the previous scenarios. Depending on the level of the students, some are able to calculate the price and quantity that maximizes joint profits (p = $55, Q = 90).

Discussion

How do scenarios 3 and 4 contrast with respect to your ability to coordinate and set prices? Most students find that the complexity added by product differentiation in scenario 3 makes setting prices much more difficult.

How do price and quantity for scenario 4 compare with scenario 3? For almost all students, price is higher and quantity lower for scenario 4. The homogeneous product has made it much easier for them to coordinate prices. The instructor points out that this is another example of the TSB -- when the market imperfection of a differentiated product is removed, collusion becomes easier and the resulting higher prices and lower output decreases consumer welfare.

So, we have seen two examples of the TSB in an oligopoly setting (the instructor may wish to provide other examples such as the mining monopoly described above). *What are the implications for economic policy?* The principal insight is that policy-makers must proceed with caution; they cannot simply assume that removing market imperfections will improve economic welfare (although often it may). Such policy measures may have unexpected negative consequences. The implications of any policy intervention should be examined on a individual basis.

Cartel Formation

The instructor may wish to continue with a discussion on the factors conducive to forming cartels. *Contrasting scenario 4 with the others, what are the characteristics that make price collusion relatively difficult?* By now, the students recognize that collusion is more difficult when products are differentiated and when information is secret or incomplete. Other factors

complicating collusion include (Church and Ware, pp. 318-325; Waldman and Jensen, pp. 285-291; Lipczynski et al., pp. 169-185):

cost asymmetries
the level of vertical integration
entry barriers
the pace of demand growth
the frequency of sales
elasticity of demand
the pace of innovation
market uncertainty
the social structure of the industry (i.e., the willingness of one firm to act as an organizer)
the strength of antitrust enforcement
the cost of monitoring and detection of cheating.
market concentration (number and size distribution of the firms).

This last factor can be examined quickly by rerunning scenario 4, but with larger groups of competitors (say, ten firms in the market instead of a duopoly). The greater the number of firms, the greater is the likelihood that on will cheat on the cartel to capture the entire market (particularly if the instructor reminds the students that cheating is possible).

TEST OF EFFECTIVENESS

To test the effectiveness of this exercise in teaching the TSB, a Principles of Economics class was split into two groups. The experiment was run near the end of the course, so that the students had the background knowledge required to understand the implications the TSB. The experimental group was taught using the exercise described above, while the control group was taught using traditional teaching methods consisting of a lecture, examples, and Socratic questioning. The time devoted to teaching each group was held constant (40 minutes), and both groups were taught by the same instructor. The next class, five days later, the students understanding of the concepts surrounding the TSB was evaluated by a test consisting of seven multiple choice questions. The results were as follows:

Table 1
TEST OF EFFECTIVENESS RESULTS

	Experimental Group	Control Group
Mean (%)	73.81	66.36
Standard Deviation	19.37	19.89
Observations	42	44

H1 The mean grade of the experimental group is greater than the mean grade of the control group.

The results yield a p-value of 0.041; The null hypothesis is rejected at the 5% significance level. Thus, there is evidence at the 5% level of significance that the mean grade of the experimental group is greater than the mean grade of the control group.

CONCLUSION

The exercise described in this article is an effective method of teaching the Theory of the Second Best and cartel behavior to undergraduate students of economic policy. The participatory nature of the exercise enhances students' understanding of the concepts and provides an association that helps them remember their significance.

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