Teaching Pareto Optimality in a Supply and Demand Framework: An Active Learning Exercise

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Abstract

We provide an active learning exercise for Principles of Microeconomics students. Students are placed into small groups and subdivided into groups of consumers and producers. Both subgroups are allocated play money, representing consumer and producer surplus under a price ceiling. Students are encouraged to negotiate an agreement removing the price ceiling, with one student acting as judge. The judge enforces the rule that the ceiling will only be removed if "no group is made worse off." Most groups discover that, using a "rebate" scheme, both sides can be made better off by removing the ceiling. The results of the exercise can be quickly applied to the concepts of dead-weight loss and Pareto optimality, vital concepts that appear during the rest of the semester.

I. Introduction

In a seminal review of economics instruction, Siegfried (1991) *et al* argues, "effective learning requires active participation by students." Research on active learning "demonstrates that various forms of small-group learning are effective in promoting greater academic achievement, more favorable attitudes toward learning, and increased persistence" (Springer)[1]. In response to these findings, a number of active learning exercises have been proposed in the literature[2].

To our knowledge, however, none are designed to teach the concept of Pareto optimality in a supply and demand framework. This is a significant shortcoming. In our experience, students are able to identify consumer surplus, producer surplus and a deadweight loss graphically, but they often have an impoverished understanding of the importance of these concepts. This poses a problem throughout the typical Principles of Microeconomics course where the presence or absence of a deadweight loss is used to evaluate the outcome of various market arrangements. We present an active learning exercise intended to demonstrate the practical importance of this construct and illustrate the larger principle of Pareto optimality

II. The Exercise

During lecture, students are presented the supply and demand diagram shown in Figure 1. After explaining the concepts of producer and consumer surplus, students are

[1] See also Becker (1997), and Becker (2000).
[2] Efforts have been made for students at all levels. See, for example, Bergstrom and Miller (1997) for college-level activities, Morton and Schug (2001) for high-school-level activities, and Suiter, Dempsey, Pettit and Reiser (1996) for middle school activities.

asked to calculate consumer surplus, producer surplus, and total surplus under the following two scenarios:

1. Market equilibrium price of $5.
2. A price ceiling imposed at $3.

Following a quick reminder that the area of a triangle can be calculated as ½(Base × Height) and that the area of a rectangle is (Base × Height), the students calculate the values listed in Table 1.

As in the traditional lecture, this information is shown graphically as shaded areas in the supply and demand diagram. Students are also introduced to the concept of a deadweight loss. This can be shown by a reduction in the shaded area under the price ceiling as opposed to the market equilibrium price.

After carefully explaining the surplus that is available under the two options, students are asked to divide into groups of five. One student in each group is to serve the role of a "judge," thereby approximating a government authority. Two students will serve to collectively represent the buyers, and two students will serve to collectively represent the sellers. The buyers and sellers are distributed play money according to the surplus numbers that would be generated under a price ceiling of $3.

The students then engage in a bargaining game. The rules of the game are as follows:

1. Buyers and sellers should seek to maximize their respective surplus.

2. The student judge has the authority to remove the price ceiling of $3, but will do so if and only if the following criterion is met: **No one can be made better off without making someone else worse off.**[3]

Given these rules, students are asked to see if the $3 price ceiling is superior to the market equilibrium outcome. They are allowed to consult with each other for ten minutes to determine which outcome is preferred. The students representing the buyers are encouraged to interact with the students representing the sellers to find an outcome that would make someone better off without making someone else worse off. At the end of the ten minutes, the student-judges report and defend their decisions.

III. The Discussion

In our experience, this exercise has been quite useful in stimulating class discussion and interest. The student-judges that report on the decision are encouraged to debate their decisions, providing the added benefit of controversy, which is advocated by Frank (1998) as a way of stimulating interest.

Using the information about the surplus produced in Table 1, it can be shown that the student judge should remove the $3 price ceiling. The price ceiling results in an increase in consumer surplus at the expense of producer surplus. However, it also results in a reduction of total surplus in the amount of $4. If the price ceiling is removed, consumer surplus would fall to $12.50 and producer surplus will rise to $12.50. While this is clearly desirable for the producer, it would seem to violate Rule 2 of the game since consumers would be made worse off.

[3] While this is initially introduced as a "rule" of the game, students are later told that it is a concept called Pareto optimality.

However, if producers are willing to compensate consumers for the $4.00 reduction in consumer surplus that occurs at the market equilibrium, it would not violate Rule 2 of the game. Would producers be willing to allow such compensation? Indeed they would, because being able to earn $12.50 in producer surplus and giving up $4.00 to consumers would still leave the producer with $8.50, which is superior to the $4.50 producer surplus earned under the price ceiling of $3.00. To our surprise, students were able to quickly discover this possibility. In fact, in two different Principles sections, students independently described the process as a "rebate" from producers to consumers that would allow the price ceiling to be removed.

IV. Conclusion

Through the process of negotiating, students learn that the equilibrium price provides the opportunity to make buyers and sellers better off because it creates additional surplus that can be distributed, if necessary, according to Rule 2 of the game. Once this is established, it becomes easy to describe Rule 2 as a concept called Pareto optimality. Moreover, the redistribution of the surplus that was achieved by bargaining can be achieved through the appropriate taxation scheme. Since students have learned this principle through their own involvement, they are intuitively aware of the benefits available by allowing the market to reach a competitive equilibrium. Thus, maximizing the total surplus and avoiding a deadweight loss emerges as a new analytical tool to be used throughout the semester in evaluating price ceilings, market power and trade barriers. In the final analysis, we believe this exercise allows students an intuitive grip on

microeconomic theory that is difficult to attain with traditional "chalk and talk" techniques.

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Figure 1: Market Diagram

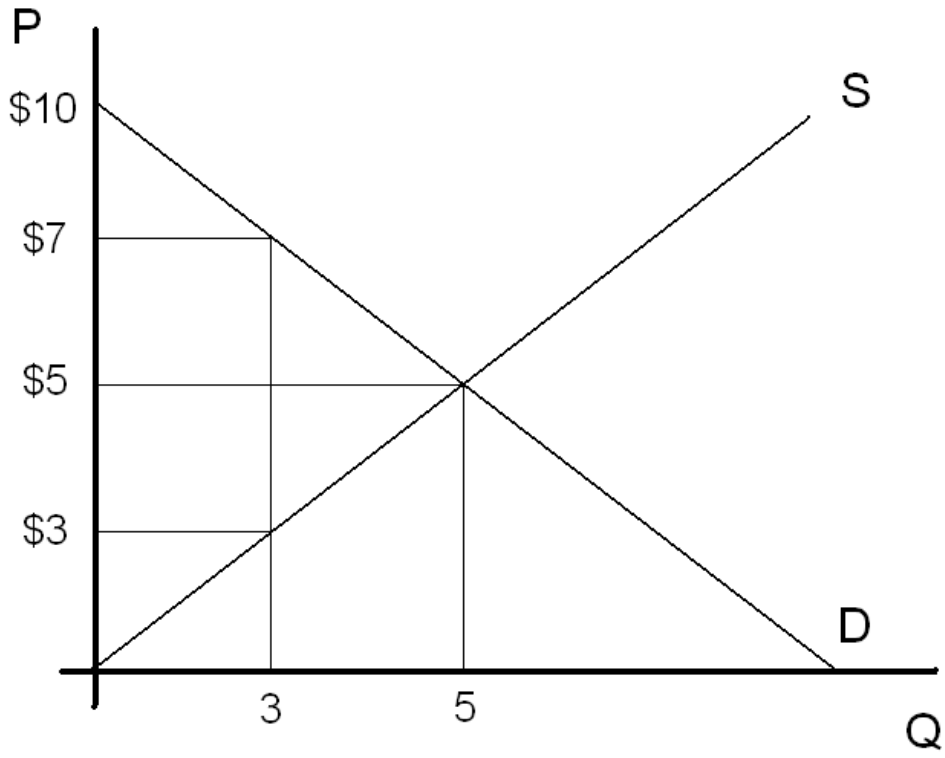

Table 1: Welfare Calculations

	Equilibrium Price of $5	Price Ceiling of $3
Consumer Surplus	$12.5	$16.5
Producer Surplus	$12.5	$4.5
Total Surplus	$25	$21