

# Working Paper Series

## *Economic Education*



**No. 017**

### *Feeling the Pain of Deadweight Loss: A Classroom Activity*

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## Feeling the Pain of Deadweight Loss: A Classroom Activity

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February 2007

### *Abstract*

In its simplest form, deadweight loss is an unrealized potential gain, which may be undervalued because it is not seen. The public seems less concerned about deadweight losses than economists. This version of the popular Ultimatum Bargaining Game focusses attention on what is given up when people balance the fairness of a distribution with getting the most gain. The Ultimatum Bargaining Game is a classroom activity where pairs of students divide a \$10 (in the classroom paid with candy) payout over 10 rounds. One student proposes the division and the other accepts or rejects the split. If the proposal is rejected, both students get zero. If it is accepted, both students receive the proposed split. During the payout, students must put the proportion rejected into a bag to be discarded, so students see how much was lost to the class—the deadweight loss. Students analyze their own and their classmates' decisions and discuss the tradeoffs. The exercise works in small or large classes and runs about 50 minutes.

## **Introduction**

The Ultimatum Bargaining Game is accessible to a wide range of students, from middle-schoolers through adults. It does not require previous experience in economics or knowledge of economics terms. It is engaging, generates lively discussion on important topics and requires little setup and materials. These characteristics make it popular as a classroom activity in many versions, and also for researchers comparing different nations and cultures. It has been used to provide information on other economics concepts like sunk costs and marginal costs and on social concepts like cooperation and ethical behavior. This variation uses it to make visible the economics concept of deadweight loss and the equity/efficiency tradeoff. These concepts can be important for consumer decisions involving bargaining like buying a house or car and contrasting that with posted prices, and for understanding the full costs of government policies such as taxes.

**Economics Concepts:** Equity, Efficiency, Deadweight Loss

These terms have specialized meaning for economics. Equity is how evenly the distribution of gains is divided. Everybody having an equal amount is very high in equity. Efficiency is whether all possible gains are realized. If no one can get a higher gain without someone else receiving a lower gain, then efficiency is high. Deadweight losses are potential gains that are taken away from someone but not received by someone else.

**Materials Needed:** Copies of the Instruction Sheet and Bargaining Table for each pair of students (12 copies for a class of 24, may be copied on both sides of a single sheet.)

Snack-size bags of small candy pieces for each student, or other divisible small prizes. Division is easiest if there are 5 or more pieces for each student.

Clear plastic bag. The quart size is generally sufficient unless the class is very large. It can be labelled “Deadweight Loss” as long as the contents are clearly visible.

A transparency of the Discussion Questions.

**Background Information:** Economists and other researchers have used the Ultimatum Bargaining Game to highlight the difference between the results expected if players are operating purely from self-interest and behavior that takes into account the actions of others. See Vernon Smith (1998), Thaler (1998) and Kahneman (2003). Telser (1995) discusses some limitations in using the results of these experiments to predict behavior. Davis and Holt (1993) and Holt (2007) place this game in context with the field of Game Theory and Experimental Economics. I have used the version in Yandell (2002) many times with different types of groups, from high school students through adults, and always had enthusiastic participation and stimulating discussion. Yandell recommends the Ultimatum Bargaining Game for use in units on equity versus efficiency, opportunity costs, and sunk costs versus marginal costs.

The Ultimatum Bargaining Game is a classroom activity where pairs of students divide a \$10 (in the classroom paid with candy) payout repeatedly over 10 rounds. One student is proposes the division and the other accepts or rejects it. If the proposal is rejected, both students get zero. Both students receive the proposed split if it is accepted. The unique feature here is that during the payout in this version, students must put the proportion rejected into a bag to be discarded, so students see how much was lost to the class when proposed splits were rejected—the deadweight loss. Students analyze the data on their own and their classmates' decisions and discuss why the rejections occurred. The exercise works in small or large classes and runs about 50 minutes.

The Foundation for Teaching Economics uses the Ultimatum Bargaining Game in its 2004 curriculum “Is Capitalism Good for the Poor?” Their curriculum, available from their website <http://www.fte.org/capitalism/cd/>, includes a DVD of Kathy Ratté conducting their version of the Ultimatum Bargaining Game with a group of students. Their curriculum also includes a nice discussion with references on this game and its implications for countries undergoing economic development.

A purely “economic man” who is maximizing his own gain would be predicted to propose the split of \$9 for himself and \$1 for the responder in our version below. A purely “economic man” responder would accept such a division, since there would be gain (admittedly small) and that would be better than the alternative zero gain. Yet real people often reject low offers like that. Proposers offer divisions where the larger share goes to the responder (e.g., \$3 for proposer, \$7 for responder).

Most research has concentrated on how even the proposed divisions are, and where the boundaries lie for proposed divisions to be rejected, or the equity-versus-efficiency tradeoff. This variation highlights the amount of resources wasted because of the rejections, the deadweight loss. Deadweight loss occurs in the economy when economic transactions that

would benefit both parties could occur, but they are prevented by some obstacle. For example, some sales do not take place because a tax raises the price above what buyers are willing to pay or brings the revenues to sellers below their costs. We do not see what might have been produced, but was not. We do sometimes see these disruptions, though. For example, rent controls lower the return to renting apartments. That means potential rental apartments will not be built, resulting in shortages.

**Directions:**

1. Instruct students to wait for the signal to start the activity.
2. Divide the students into pairs and distribute a copy of the Instruction Sheet and the Bargaining Table to each pair.
3. Read the Instruction Sheet and answer any questions about how to proceed.
4. Designate the proposer in each pair. Tell students the proposer is the one on the left or the one whose birthday is closest to the current date, or some other way not related to students' choices.
5. Give students the signal to start Round 1. Instruct students to stop after Round 1.
6. Make sure students understand the procedures and rules, then tell students to start Rounds 2-10.
7. **Calculate Gains.** Tell proposers and responders to add their gains for all 10 periods, and to calculate the total gains for the pair, entering them on the Bargaining Table.
8. Check students' Bargaining Tables for errors. Tell students that if there were rounds where the proposer's division was rejected, then the total gains sum to 100 and the deadweight loss is zero. If one or more rounds were rejected, the total gains will be less than 100 and there will be a deadweight loss.
9. **Distribute Gains.** Ask the pairs if there were any whose total gains were 50:50 for the 10 periods. (40:40 is an equal split, but tell any pairs whose total gains were less

- than 100 to wait.) If there are any 50:50 pairs, these students each receive one snack-size package, and their pair(s) had no deadweight loss. No candies go into the clear plastic bag.
10. Ask the pairs if any others had zero deadweight losses (total gains sum to 100) but different splits than 50:50 for the 10 periods. The split of 60:40 is in this category. Give each student one pack of candies, and instruct the student with 40 to give  $\frac{1}{5}$  of the candies in the pack to the other. This is a gain to the receiving (60) student and a loss to the 40 student, but there is no deadweight loss. No candies go into the clear plastic bag. Distribute candies for the rest of the pairs with zero deadweight losses. .
  11. The majority of pairs usually have rejected some rounds. Ask if there were any who rejected all rounds, so the total gains were zero. If any, these students each receive zero candies and the deadweight loss was 100. Open 2 bags and empty them into the clear plastic bag. All the potential gains were deadweight loss—not earned by either proposer or responder. This is uncommon.
  12. Ask the remaining pairs about their splits. A common division is 40:30. The proposer and responder each receive a snack-size pack. The 40 student puts  $\frac{1}{5}$  of the pack into the clear plastic bag, and the 30 student puts  $\frac{2}{5}$  of the pack into the clear plastic bag. The amounts put into the instructor's clear plastic bag are the deadweight loss. Give each of the remaining pairs their candy and collect the deadweight losses in the clear plastic bag.
  13. Show students the amount of candy in the clear plastic bag. It is generally substantial. The deadweight loss candy will be thrown away—not available to anyone. It is usually not seen, but this activity is designed to make it visible to them.
  14. Display the discussion questions and discuss students' responses.

- a. Answers will vary. Students should recognize that they had to anticipate the responses of their partner and that affected their own actions. Some students offer splits or accept proposals from friends that they would not offer/accept from strangers and vice versa.
- b. Proposals are less likely to be rejected in the last few rounds than in the first ones. In the last round, sometimes students propose and respond differently because they know there won't be another round.
- c. Proposers often mention that they don't propose splits too far from equality for fear of their being rejected. Responders sometimes punish proposals that are too far from equality. These amounts show some of the costs of enforcing fair behavior among people, and if they were not paid, people might take advantage of each other.
- d. Sometimes, a proposer will signal by splitting in the responder's favor first, then trying the same split in their own favor. They are trying to negotiate, which is much harder when they are not allowed to talk.
- e. Results under different circumstances: higher-valued payoffs mean there is a higher opportunity cost to rejecting them, so they are less likely to be rejected. If the proposals are anonymous, or if there are fewer rounds, there may be lower consequences to proposers for not being fair, but also lower benefits to responders from rejecting, so the net result could go either way.
- f. Students are proposers when they buy treats to share. Students are responders when making purchases. If there are more than one store selling the same good, such as a shirt, at different prices, sometimes the higher-priced store will match the lower price, or you can purchase it from the lower-priced store. There are many other possibilities.

# Instruction Sheet

**NO TALKING OR OTHER COMMUNICATION EXCEPT BY THE RULES BELOW.**

**Description:** Each pair will have 10 rounds to divide \$10 between them, silently. One person will always be the proposer—the one who suggests how to split the \$10. The responder either accepts or rejects the proposed split. If the responder accepts the split, the responder enters the split as gains. If the responder rejects the split, the earnings for both proposer and responder are zero for that round. After the 10 rounds are completed, proposer and responder total their gains over all 10 rounds. If no divisions were rejected, the total gains for proposer plus responder will sum to 100. If some rounds were rejected, they will sum to less than 100.

## **Instructions:**

- 1.** The instructor will designate the proposer in each pair. Wait silently for the signal to start.
- 2. Round 1.** The proposer divides the \$10 for the first round by writing the shares in the first two open columns in the Bargaining Table. Shares are in dollars, such as 1 and 9, 9 and 1, 8 and 2, 2 and 8, 6 and 4, 5 and 5, and so on.
- 3.** The proposer silently passes the sheet to the responder, who marks an X in either the Accept or Reject column.
- 4.** If the proposer's division is accepted, the responder enters the proposed division in the Gains columns for proposer and responder.
- 5.** If the proposer's division is rejected, the responder enters zeroes in the Gains for both proposer and responder.
- 6. Rounds 2-10.** The responder returns the Bargaining Table to the proposer, and the pair repeat steps 2 – 5. Each round divides a new \$10.
- 7. Calculate Gains.** Proposer and responder add their gains for all 10 periods, and calculate the total gains for the pair, entering them on the Bargaining Table.
- 8. Payoff.** Submit the Bargaining Table to the instructor. The proposer and responder will each get their shares of the gain, paid in candies.

## Bargaining Table

Proposer's Name: \_\_\_\_\_ Responder's Name: \_\_\_\_\_

**NO TALKING OR OTHER COMMUNICATION EXCEPT BY THE RULES BELOW.**

1. The proposer divides \$10 each round into two shares, one for the proposer and the other for the responder. The responder decides whether to accept the proposed division or to reject it. No negotiation is allowed. All communication is by writing the division by the proposer and by the responder's accepting or rejecting that division.
2. If the responder accepts the proposal, the proposer and responder each get the split as the proposer divided it for that round.
3. If the responder rejects the proposal, both proposer and responder get zero for that round.
4. Conduct one round at a time, passing the sheet silently between proposer and responder.
5. After Round 10, calculate the total gains over all 10 rounds for both proposer and responder, the total gains over all 10 rounds for both, and any deadweight loss.

Round	Proposer Columns: Divide \$10 in 2 Parts		Responder Columns: Choose One		Gains	
	Proposer Share	Responder Share	Accept	Reject	Proposer Gains	Responder Gains
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
Add the Gains from Each Round for <b>INDIVIDUAL GAINS</b>						
Add Totals for Proposer and Responder for <b>TOTAL GAINS</b>						
Subtract Total Gains from 100 for <b>DEADWEIGHT LOSS</b>						

## Discussion Questions

1. Proposers, how did you decide what split of the \$10 to suggest? Responders, how did you decide whether to accept or to reject the proposed division? What tradeoffs did you consider in making proposals or rejecting them?
2. Did you change your proposals or the way you responded over the 10 periods? Why?
3. Should responders consider how much will be lost to both parties in their decision to accept or reject?
4. If equity is how fair the division was, and efficiency is whether the proposed division was accepted or not, what tradeoffs did you experience between equity and efficiency in a single round?
5. Do you think the results would have been different, and why or why not, if
  - a. The payoffs were money instead of candy?
  - b. The amounts were much bigger such as splitting \$100 or \$1,000 or 1,000,000?
  - c. You did not know who your partner was?
  - d. There was only one round?
6. When have you had a consumer decision that involved a “take it or leave it” proposition? Were you the proposer, or the responder? Did you have any options besides accept/reject?

## References

Davis, Douglas D. and Charles A. Holt (1993), *Experimental Economics*, Princeton University Press, Princeton, NJ.

Holt, Charles A. (2007), *Markets, Games and Strategic Behavior*, Pearson: Boston, MA.

Kahneman, Daniel (2003), "A Psychological Perspective on Economics," *The American Economic Review*, Vol. 93 no. 2 , pp.162-168.

Smith, Vernon L. (1998), "The Two Faces of Adam Smith," *Southern Economic Journal* 65(1), pp. 1-19.

Telser, L.G. (1995), "The Ultimatum Game and the Law of Demand," *The Economic Journal*, Vol. 105, no. 433, pp. 1519-1523.

Thaler, Richard (1998), "Anomalies: The Ultimatum Game," *The Journal of Economic Perspectives*, Vol. 2, no. 4, pp. 195-206.

Walton, Gary, Kathy Ratté, et al. (2004), *Is Capitalism Good for the Poor?* CD and DVD, Foundation for Teaching Economics, <http://www.fte.org/capitalism/> .

Yandell, Dirk (2002) "Ultimatum Bargaining, The Division Experiment," *Using Experiments, Cases, and Activities in the Classroom*, Second Edition, Prentice Hall: Upper Saddle River, NJ, pp. 1-7.