

## Appendix A. General Experiment Instructions.

Notes: **Bold** typeface is used to highlight terms you will encounter during the experiment. There are concepts that are likely to be unfamiliar to you. Everything will be explained after you have read the instructions and you will be able to ask questions.

### Introduction

This is an experiment in the economics of decision making. The experiment has two parts, consisting of 10 and 20 trading periods, respectively. In this experiment, you operate one of six firms in an industry. Human participants control the five other firms. Your firm and the other five firms interact each trading period by competing to sell a product in a market. Because of this market interaction, your earnings depend on the behavior of others as well as your own behavior. The consumers in this market behave like experienced buyers and are represented by the computer. In each period, you have the opportunity to sell up to 5 units of your product. You only produce what actually gets sold. The cost of producing each of your 5 units is \$50, \$150, \$300, \$500, and \$800, respectively. In other words, your **production costs** rise as your output increases. You determine the **offer price** - the price at which you are willing to sell your product - for each of these units and type these offers in the offer submission web page (shown below). This is the only decision you have to make and your goal is to make as much money as possible. In addition to product sales, in each period you earn \$500 from your other business activities.

For every \$2,000 earned in the experiment you will receive \$1 in cash.

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Name: [Select...](#) [vosslerc] Christian A Vossler [Logout](#) Period  
Session: [Select...](#) [252] test6 cav **1**  
Representing: [Select...](#) Producer 1

[Refresh](#)

**Offer Submission for Producer 1**

Offer	Quantity (units)	Production Cost (\$/unit)	Offer Price (\$/unit)
1	1	\$50	\$ <input type="text" value="0"/>
2	1	\$150	\$ <input type="text" value="0"/>
3	1	\$300	\$ <input type="text" value="0"/>
4	1	\$500	\$ <input type="text" value="0"/>
5	1	\$800	\$ <input type="text" value="0"/>
<b>Total</b>	5		<input type="button" value="Submit Offer"/>

**Additional Information**  
Income from other sources: **\$500.00**  
Pollution = Industry Output + Random Term

Document: Done

The six firms are located near a common water resource. Some by-products of your firm enter the water, affecting water quality. The more you and your competitors produce, the higher the level of water **pollution**. Under average conditions each unit produced by you or your competitors results in one unit of **pollution**.

A variety of factors such as stream flow and the rate of surface runoff affect **pollution** levels. For example, heavy rainfall increases surface runoff, increasing **pollution** levels. High stream flow results in relatively less **pollution**, as the ability of the waterway to assimilate your by-products increases. Unfortunately, factors such as these are unpredictable due to complex physical, chemical and biological relationships. Taking into account the uncertainty surrounding realized **pollution** levels, the relationship **Pollution = Industry Output + random term** holds. **Industry Output** is the sum of all units sold by you and the other firms in your market. The **random term** is equal to zero on average and takes on values between -1.0 and +1.0. Each number in this range has an equal chance of being selected.

**Pollution** directly affects the well-being of water resource users. For example, high **pollution** levels affect the health of fish, causing losses to fisherman. Also, poor water quality affects swimming and other recreation activities. In general, each unit of **pollution** results in a \$500 loss in well-being to others. *The **pollution** level does not affect your profits in any way during the first part of the experiment but might in subsequent parts.*

## Determining Market Price

The buying and selling of your industry's product is determined in a single price auction. In this auction, the simulated consumers submit bids to buy your product. These bids are ranked from highest to lowest in price. You and your competitors submit offers to sell your product. The offers are ranked from lowest to highest in price. In the auction, the cheapest offers are accepted in rank-order as long as the bid price is greater than the **offer price**. The **market price** is the average of the bid price and **offer price** of the last unit sold.

For example, suppose the **offer prices** are \$4, \$6, and \$8, and the bid prices are \$10, \$7, and \$5. Using the auction, 2 units are sold at a **market price** of \$6.50. The consumer is willing to pay \$7 for the 2nd unit while the producer is willing to sell this unit at a price of \$6.00. A 3rd unit is not traded since the consumer is willing to pay \$5, but the producer is only willing to sell at \$8. So, this auction provides a way of making sure that only mutually beneficial trades take place. Note that you sell low cost units first. To make this happen in the market, your **offer price** for high cost units must not be less than your **offer price** for low cost units.

*Note: The **market price** may be higher than an unaccepted **offer price**, as a result of how the auction works. In the example above, suppose you submitted an **offer price** of \$6.25. This price would be lower than the market price of \$6.50, but you would not sell anything.*

## Determining Your Earnings

The goal of this experiment is to choose your **offer prices** in order to make as much money as possible. After you submit offers, the computer determines the **market price** based on all offers submitted by consumers and the six firms in your market. You will then see a results page, similar to the one shown below.

The top table presents your **revenue**, **costs**, and **earnings** for each unit sold and displays your **total earnings** for the current period. Your **total earnings** are calculated as the difference between **revenue** and **costs**, plus the \$500 in **income from other sources**. **Revenue** is the number of units sold multiplied by the **market price**. **Costs** are the total production costs for all units sold.

The bottom table presents the results from each trading period you have been through. It also displays information on the **industry output** and **pollution** for each period. The last two rows present your overall experimental earnings and actual earnings (your take home pay).

**GreenWeb: Auction Results - Netscape**

Name: [Select...](#) [vosslerc] Christian A Vossler [Logout](#) Period **1**  
 Session: [Select...](#) [251] test5 cav  
 Representing: [Select...](#) Producer 1

**Auction Results for Producer 1** [[history](#)]

[Refresh](#)  
[Continue](#)

Producer 1: Results for Period 1								
Offer	Quantity (units)	Production Cost (\$/unit)	Offer Price (\$/unit)	Quantity Sold (units)	Market Price (\$/unit)	Revenue (\$)	Costs (\$)	Earnings (\$)
1	1	\$50.00						
2	1	\$150.00						
3	1	\$300.00						
4	1	\$500.00						
5	1	\$800.00						
<b>Total</b>	5							
<b>+ Income from other sources</b>								\$500.00
<b>= Total Earnings</b>								

**Auction History (Periods 1 - 1)** [[results](#)]

Producer 1: History											
Period	Offer Price (\$/unit)					Qty Sold (units)	Market Price (\$/unit)	Industry Output (units)	Pollution (units)	Damages to Others (\$)	Earnings (\$)
	Offer 1	Offer 2	Offer 3	Offer 4	Offer 5						
1											
1 - 1	<b>Cumulative Earnings:</b>										
<b>Cumulative Earnings * Exchange Rate (0.000286):</b>											

## Appendix B. Supplemental Instructions for Tax/Subsidy Treatment with Cheap Talk.

Part 2 of this experiment is identical to Part 1, with one important exception. In order to protect the water resource, the regulatory authority believes that the **pollution** level should be at or below 18 units for every trading period. In order to achieve this, the authority implements the following policy: If **pollution** is less than 18 units, you receive a **subsidy** of \$500 for *each* unit of **pollution** less than 18 units. If **pollution** is greater than 18 units you pay a **tax** of \$500 for *each* unit of **pollution** above 18 units.

**Pollution** is determined by the production from ALL SIX FIRMS in your market. Recall that pollution is equal to the total **industry output** plus a **random term** that takes on values between -1.0 and +1.0. On average, **pollution** is equal to **industry output**. NOTE THAT WHETHER YOU RECEIVE A **SUBSIDY** OR PAY A **TAX** WILL DEPEND NOT ONLY ON YOUR OWN OUTPUT (AND HENCE **POLLUTION**) BUT ON THE OUTPUT (**POLLUTION**) OF ALL THE OTHER FIRMS AS WELL.

In the results table you will see a new row corresponding to the **tax** or **subsidy** amount – whichever is applicable. As before, information on the **pollution** and **industry output** is found in the history table.

### Examples

Suppose that **industry output** is 20 units and the **random term** is 0.0. Therefore, **pollution** is 20 units. Since **pollution** is two units greater than 18, everyone pays a **tax** of  $2 * \$500 = \$1,000$ .

Suppose that **industry output** is 17 units and the **random term** is -1.0. Therefore, **pollution** is 16 units. Since **pollution** is two units less than 18, everyone receives a **subsidy** of  $2 * \$500 = \$1,000$ .

### Group Discussion

Before period 11 begins, the firms in your market will have 5 minutes to informally discuss the new policy. The only guidelines for the discussion are that you cannot make any threats to the other participants and there are to be no side payments of any kind.

There will be another group discussion later on in the experiment.