

Policies for Getting Rid of Pollution

Today we are playing a game that is designed to show you the welfare consequences of a quota-based system to eliminate pollution and a tradeable permits system to eliminate pollution.

1 Set Up

For purposes of class today, imagine each one of you is an individual energy producer. Some of you produce cleanly (maybe you use wind or water to generate electricity), and others of you are terrible polluters.

I have assigned each of you a polluter type on [this google sheet](#) that we'll use today. See the column "Amount of Pollution" that indicates how much you are polluting. The amount ranges from zero units of pollution to 6, where 6 is the worst. (Don't take this as a personal judgement – I assigned it randomly!) The average student in this class is emitting 3.3 units of pollution.

Each of you also has a cost of remediation (making thing clean), which is either low or high. Again, this is randomly assigned, so don't take it personally.

And finally, you each receive an initial budget of \$20. Pretend you're a firm! Don't give away your money to be nice. To incentivize profit maximization, I will donate \$20 to the charity of choice for the student(s) with the top producer surplus, defined here as cash on hand at the end of all rounds.

2 Game Playing

We will play two versions of this game. In both versions, you are not allowed to emit more than one unit of pollution.

2.1 Quota System

In the quota system, you are not allowed to emit more than one unit of pollution. If your level of pollution is one unit, you don't have to do anything, and you get to keep your \$20. If you are currently polluting more than one unit, you have the following options

1. Pay to stop the pollution
 - if you are a low cost firm, you pay \$1 for each unit of pollution you remediate
 - if you are a high cost firm, you pay \$5 for each unit of pollution you remediate

2. Exit the market

- here you go bankrupt
- your \$20 becomes a cost to society

When we play the game, you'll need to go to the google sheet and enter your choices in the columns shaded light green. The questions are

- How many units of pollution did you clean up?
 - remember that you need to end up with no more than one unit of pollution
- What is the total cost of the clean-up?
 - for those with low costs, you pay \$1 per unit to remediate
 - for those with high costs, you pay \$5 per unit to remediate
- Did you have to exit? In other words, did your cost of remediation exceed \$20? If yes, put \$20 in this column. Otherwise, leave it blank.
- What is the total cost of this policy? This is \$20 if you exit, and the cost of remediation otherwise
- How much money do you have left?
 - Remember that you started with \$20
 - So this is zero if you had to leave the market
 - And \$20 minus the cost of remediation otherwise

2.2 Tradeable Permits

Now, instead of a quota, I am going to distribute permits that allow for pollution. Since we'd like the total amount of pollution to be the same as the previous, I give each of you one tradeable permit.

Whatever your initial level of pollution, you are not allowed to emit more than one unit (just as in the previous part). If you are polluting more than one unit, here are your choices

- Exit the market
 - here you give your \$20 to the government (me)
- Buy permits from other students
- Pay to stop the pollution
 - if you are a low cost firm, you pay \$1 for each unit of pollution you remediate
 - if you are a high cost firm, you pay \$5 for each unit of pollution you remediate
- Do a combination of 2 and 3

Before we get started, which firms should want to sell their permits? Which firms may wish to purchase permits?

Now, on to trading! We'll do two or three rounds of trading. In each round, you'll trade in the breakout room for the group to which you've been assigned. We'll see how the total amount of pollution and the total cost to society compares to the quota case.

Remember that you have only \$20 to spend, and that firms do not give away things to be nice.

3 Compare Regimes

Finally, we'll fill out the blue table at the bottom of the sheet to compare across regimes.