A pollution policy game

Summary of the situation

- There are 10 firms in an area. Historically, they have not been regulated and have been emitting pollution. The history of emissions is presented on your history sheets.
- The EPA has decided that it needs to reduce monthly emissions to 1000 pounds.

You are also a firm

- You have two choices that must be made each round:
  – what pollution technology to use, and
  – how much labor to use.
- You would like to maximize profits, but are now facing environmental regulations.
You are also a firm

• Your engineers & accountants have prepared two pieces of information for you.
• A table that presents your options

<table>
<thead>
<tr>
<th>Pollution Control Level</th>
<th>Profit: 535</th>
<th>Pollution: 56</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>Profit: 516</td>
<td>Pollution: 42</td>
</tr>
<tr>
<td>20%</td>
<td>Profit: 497</td>
<td>Pollution: 30</td>
</tr>
<tr>
<td>40%</td>
<td>Profit: 478</td>
<td>Pollution: 19</td>
</tr>
<tr>
<td>60%</td>
<td>Profit: 458</td>
<td>Pollution: 9</td>
</tr>
<tr>
<td>80%</td>
<td>Profit: 439</td>
<td>Pollution: 1</td>
</tr>
</tbody>
</table>

• And a figure that presents your profits & pollution graphically.

Practice Round
Manager

• Identify the labor and pollution control that you would use in the absence of environmental regulations.
  – What pollution technology should you use?
  – How much labor to use?
Analysis of Practice Round

• Suppose you had to reduce your pollution a little bit.

• By how much would your profits fall? (∆Π)
• By how much would your pollution fall? (∆Poll)
• What is the approximate marginal cost to you? (∆Π / ∆Poll)

C&C: Regulator

• You are a regulator using a “command & control” approach to regulation, based on the historical record, what pollution control technology are you going to require (0% - 80%)?
• How much should firms be fined if they do not comply?
• Each team makes a decision and then we vote as a class what level to choose.
C&C: Manager

• Now you are your firm. Your profits and pollution are presented on your sheet. You must make 2 choices:
  – What pollution technology should you use? You will be fined if you do not comply.
  – How much labor to use?
• When you have made a decision, send a representative to report your decisions.

Let’s talk about Command & Control regulations

• What are the advantages and disadvantages from the perspective of the policy maker?
• What are the advantages and disadvantages from the perspective of the firms?
• What are the advantages and disadvantages from the perspective of the citizens?

There are options that should be ignored?
Identify the optimal set of options

<table>
<thead>
<tr>
<th>Team #: _________________</th>
<th>Max Profit</th>
<th>Actual Pollution</th>
<th>Pollution Control Level</th>
<th>Labor</th>
<th>Marginal Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Did any firms use a dominated choice under C&C?

---

Pollution Limit
Regulator

• You are a regulator using a simple limit on pollutions. Based on the historical record, what limit should be placed on the firms’ emissions in order to reach an aggregate monthly load of 1000 pounds?
• By how much ($/pound) should firms be fined if they go over the limit?
• Each team makes a decision and then we vote as a class what level to choose.
Pollution Limit Manager

- Now you are your firm facing the pollution limit policy as decided by the class?
- You must make 2 choices.
  - What pollution technology to use?
  - How much labor to use?
- What is your marginal abatement cost at this limit?

Practice with a tax policy

- Suppose that you faced a tax of $2 per unit of pollution. What would your firm do?
- How would you make your choice?
- Make a team decision on the pollution-control technology and the labor you want to use.
- Report your decisions

Pollution Tax Regulator

- You are a regulator using a “pollution tax” approach to regulation, based on the historical record, what tax per pound of emissions do you think you should set to achieve a monthly load of 1000 pounds.
- Each team makes a decision and then we vote as a class what level to choose.
Pollution Tax
Manager

• Now you are your firm facing the tax rate on your emissions.
• You must make 2 choices.
  – What pollution technology to use?
  – How much labor to use?

Let’s talk about pollution taxes

• What are the advantages and disadvantages from the perspective of the policy maker?
• What are the advantages and disadvantages from the perspective of the firms?
• What are the advantages and disadvantages from the perspective of the citizens?
• Do we often see pollution taxes? Why or why not?

Subsidy Policy
Regulator

• You are a regulator using a “pollution subsidy” approach to regulation. Firms will be given a subsidy per pound by which they reduce their pollution below 300 pounds. What subsidy per pound of emissions do you think you should use to achieve a monthly load of 1000 pounds.
• Each team makes a decision and then we vote as a class what level to choose.
Subsidy Policy Manager

- Now you are your firm facing the subsidy for your emission reductions.
- You must make 2 choices.
  - What pollution technology to use?
  - How much labor to use?

Let’s talk about pollution subsidies

- What are the advantages and disadvantages from the perspective of the policy maker?
- What are the advantages and disadvantages from the perspective of the firms?
- What are the advantages and disadvantages from the perspective of the citizens?
- Do we often see pollution reduction subsidies? Why or why not?

Cap & Trade Manager

- You are a regulator using a “cap and trade” approach to regulation. Firms will have a cap on their emissions, but they can trade rights.
- Each firm will have initial rights, allowing 100 pounds of emissions
- What fine should a firm pay for each pound by which it exceeds its cap?
- We will vote as a class on the fine per pound.
Step 8: Prepare for Trading

- Using your Marginal Abatement Cost table:
  - **WTP**
    - On average, how much do your profits go up per pound of additional pollution if you can increase your pollution above 100 lbs?
    - That would be the starting point for your WTP.
  - **WTA (willingness to accept)**
    - On average, how much do your profits go down per pound of pollution if you decrease your pollution below 100 lbs?
    - That would be the starting point for your WTA.

Step 8: Prepare for Trading

- Based on your WTP and WTA numbers, come up with two initial bids:
  - Our team would be willing to pay $__ each to buy ___ credits so we could pollute more.
  - Our team would be willing to accept $__ each for ___ credits, requiring us to pollute less.

Submit your bids to the instructor.

Trading

- All trading should take place in the center aisle.
- Two negotiators per team go to the aisle to make deals. Hold your team number high.
- After a buyer and seller agree on a trade, both must go to the front of the room to record the trade.
- The time limit for trading is 10 minutes.
Step 10: Close the market

- Your trades have been recorded.
- You must make 2 more choices.
  - What pollution technology to use?
  - How much labor to use?

Let’s talk about cap and trade

- What are the advantages and disadvantages from the perspective of the policy maker?
- What are the advantages and disadvantages from the perspective of the firms?
- What are the advantages and disadvantages from the perspective of the citizens?
- Do we often see cap and trade approaches? Why or why not?

Overall

- Which pollution policy approach is most attractive and why?
  - From the perspective of the regulator?
  - From the perspective of the firm?
  - From the perspective of the society as a whole?