Tradable Permit Markets: Bonus Question of Midterm 2007

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2007 Midterm Bonus Question

- The Love River runs nearby Kaohsiung city
- Two polluting pig-feeding companies
  - Ace Pig & Big Fat Piggy
  - Each year dump 100 tons of glop into the river
- The cost of reducing glop emissions per ton
  - NT$1,000,000 for Ace Pig
  - NT$50,000 for Big Fat Piggy
- Goal: Reduce pollution from 200 to 100 tons

Common Resource/Public Good

(a) For the following two goods,

- Love River
- Pollution Reduction

1. Public goods or common resources?
2. Would people overuse or under-use (over-reduce or under-reduce)?

The Tragedy of Love River

1. Public goods or common resources?

- Love River is a common resource

2. Would people overuse or under-use it?

- People overuse common resources
- Love River is a common resource
- People overuse Love River

Insufficient Pollution Reduction

1. Public goods or common resources?

- Pollution reduction is a public goods

2. Would people over- or under-reduce it?

- People under-provide public goods
- Pollution reduction is a public goods
- People under-reduce pollution (under-produce "pollution reduction")

Is the Government like God?

(b) Suppose the government knew the cost of reduction for each firm

1. What reductions would it impose to reach its overall goal?
2. What would be the cost to each firm and the total cost to the firms together?

Is the Government like God?

1. What reductions would it impose to reach its overall goal?

- Knowing Big Fat Piggy has the lowest cost, it would only require Big Fat Piggy to eliminate all its pollution
- Minimizes the total cost of reducing the remaining pollution to 100 tons

Is the Government like God?

2. What would be the cost to each firm and the total cost to the firms together?

- Ace Pig:
  - Cost = 0
- Big Fat Piggy:
  - Cost = \$50,000 x 100 tons = NT\$5 million
- Total cost = NT \$5 million

We are NOT God…

(c) Suppose the government does not know each firm's cost of pollution reduction

- Impose uniform reductions on the firms
- Calculate:
  1. Reduction made by each firm,
  2. The cost to each firm, and
  3. The total cost to the firms together.

We are NOT God…

- Calculate reduction made by each firm, the cost to each firm, and the total
- Uniform reduction: Each firm reduces same amount (50 tons x 2 = 100 tons)
- Ace Pig's Cost:
  - 50 x \$1 million = NT\$50 million
- Big Fat Piggy's Cost:
  - 50 x \$50,000 = NT\$2.5 million
- Total Cost: \$52.5 million

A Tradable Permit Market

(d) Suppose the government decides to give each firm 50 tradable pollution permits.

1. Who sells permits and how many? Who buys permits and how many?
2. Where did gains from trade come from?
3. What is the total cost of pollution reduction in this situation

A Tradable Permit Market

1. Who sells/buys permits and how many?
   - Ace Pig buys all 50 permits from Big Fat Piggy so that it can pollute 100 tons
2. Where did the gains from trade come from?
   - A permit is worth NT\$1,000,000 to Ace Pig and NT\$50,000 to Big Fat Piggy, because that is their unit cost of reducing pollution.
   - There are gains from trade because Ace Pig faces higher costs of reducing pollution

A Tradable Permit Market

3. What is the total cost of pollution reduction in this situation?

- Ace Pig will not reduces pollution at all
  - Cost = [Price for 50 permits]
- Big Fat Piggy cuts pollution by 100 tons
  - Net Cost = NT$50,000 x 100 - [Price for 50 permits]
- Total Cost = NT$5 million

Comparison

(e) According to your answers above:

1. Compare the total cost of pollution reduction in parts (b), (c) and (d).
2. If the government does not know the cost of reduction for each firm, what is the best way to proceed?

Comparison

1. Compare the total cost of pollution reduction in parts (b), (c) and (d).

- In Part (b) & (d), it costs NT$5 million to reduce total pollution to 100 tons
- In Part (c) it costs NT$52.5 million
  - It is less costly to have Big Fat Piggy reduce all of its pollution

Comparison

2. If the government does not know the cost of reduction for each firm, what is the best way to proceed?

- The government could achieve the same result by auctioning off pollution permits
- This ensures Big Fat Piggy reduced its pollution to zero
  - because Ace Pig outbids it for the permits

Firms have the right to pollute

(f) Suppose the government has to compensate the cost

1. What is the minimum compensation so that both would accept a uniform pollution reduction of 50 tons each?
2. What is the total cost?

Firms have the right to pollute

1. What is the minimum compensation so that both would accept a uniform pollution reduction of 50 tons each?

- It would have to pay at least NT$50 million for a uniform reduction of 50 tons
  - = Cost for Ace Pig to reduce 50 tons

2. What is the total cost?

- Total cost = NT$100 million

Firms still have the right to pollute

(g) Suppose firms are each granted 100 tradable pollution permits

1. If the government wants to buy back 100 permits, what is the minimum price per permit it has to pay?
2. Who will sell the permit to the government at this price?
3. What is the total cost? Is this less costly than that of part (f)?

Firms still have the right to pollute

1. If the government wants to buy back 100 permits, what is the minimum price per permit it has to pay?
2. Who will sell the permit to the government at this price?

- The government only has to pay NT$50,000 each to buy 100 permits from Big Fat Piggy

3. What's the total cost? Is it less than part (f)?

- This costs NT$5 million, and is 1/20 of the cost of part (f)

Coase Theorem

(h) According to your answers above:

1. What is the difference between property rights in part (d) and (g)?
2. What is the difference in terms of outcome efficiency?
3. Explain why according to the Coase Theorem, this result is more or less expected.

Coase Theorem

1. What is the difference between property rights in part (d) and (g)?

- Part (d): Government / people have the property right to a clean Love River
- Part (g): Firms have the property right to use Love River as their dumpster and pollute at will

Coase Theorem

2. What is the difference in terms of outcome efficiency?
   - In both cases, it is always Big Fat Piggy who sells all his permits and reduces pollution to zero

- Same efficient outcome as in part (b)

Coase Theorem

3. Explain why according to the Coase Theorem, this result is more or less expected.
   - Coase Theorem: If property rights are clearly defined, and the transaction cost of bargaining are negligible, people will cut a deal and induce the socially efficient outcome on their own.

- In both cases, property rights are well defined and a permit trading market exist
- Final outcomes are both efficient (same)

Market Creation

(i) What are some other things that can benefit from such a property right and market creation process? Open question. For example,

1. Exclusive Economic Zone (經濟專屬海域)
2. Intellectual property rights (智慧財產權)
3. Class seat assignment (上課教室佔位子)
4. Tradable course right (2008 Midterm)
5. Tradable rental house (2014 Midterm B)
6. Taipei U-Bike pricing (2015 Midterm B-3)