

Common-Pool Resources (Ch 34)
and
Public Goods (Ch 36)

March 3, 2010

Final Exam Details

- End-of-quarter festivities
 - Review session: F 3/12 2-4pm IV THEA1
 - Extra OH: Sun 3/14 4-6pm, TBA
 - Final Exam: T 3/16 IV THEA1 (here)
- Format: Mult choice + long answers, < 3 hours worth
- Bring: pink ParScore Scantron, pencil
- Don't bring: blue-book, calculator, visible phone, electronic devices

Final Exam Details

- Focus of coverage: Equilibrium (16), Monopoly (24,25), Oligopoly (27), Exchange/General Eq. (31), Externalities (34), Public Goods (36)
- For the most part: only cumulative to the extent that new material builds on old
- How to study: do workouts/quizzes/practice problems, come to OH with questions
- Next Thursday's class: review/synthesis. Will revisit important topics/messages
- Grading: see syllabus

Common-Pool Resources and Public Goods

What do these goods/resources have in common?

- Fisheries
- (Public) freeways
- National Security
- Broadcast radio/tv
- Clean air
- National parks

If *anyone* has access to the resource or can consume the good, then *everyone* can. E.g. you can't prevent someone from breathing air or receiving radio waves.

Public Resources and Public Goods

What do these goods/resources have in common?

- Fisheries
- (Public) freeways
- National Security
- Broadcast radio/tv
- Clean air
- National parks

We call these types of goods **non-excludable** because all consumers can consume them.

Common-Pool Resources

- Some of these goods are like 'regular' goods in that one person's consumption detracts from others' use
- E.g. fisheries can be overfished, public pastures can be overgrazed, freeways can be congested
- These types of goods are **rival** in consumption
- Goods that are non-excludable, yet rival in consumption are known as commons, or common-pool resources

Common-Pool Resources

- Problem: property rights are not well defined
- *The Tragedy of the Commons* occurs when people share the same resource without well-defined property rights
- Individuals don't take into account the fact that their use of the resource detracts from others' consumption
- This leads to overuse of the resource

Common-Pool Resources: Example

- All people in a village graze cows in a common field
- It costs $a = 10$ to buy a cow and it's only value is the milk it produces
- With c cows grazing on the field, total value of their milk is $f(c) = 100\sqrt{c}$.
- Milk per cow:

$$\frac{f(c)}{c} = \frac{100\sqrt{c}}{c} = \frac{100}{\sqrt{c}}$$

- Nobody owns the land—entry is not restricted

How many cows will and should the village raise?

Common-Pool Resources: Example

How many cows *will* the village raise? (Competitive Outcome)

- Each villager will buy and graze a cow whenever she can make a profit by doing so
- Profit from owning a cow, given c cows on the field:

$$\pi = \frac{f(c)}{c} - a = \frac{100}{\sqrt{c}} - 10$$

- As long as buying a cow is profitable, someone will go ahead and buy another cow
- I.e. stop buying cows when profit π is zero
- $\frac{100}{\sqrt{c^*}} = 10$
- Average product = average cost
- $c^* = 100$ cows in equilibrium
- Total net-value of milk is zero!

Common-Pool Resources: Example

How many cows *should* the village raise? (Optimal Outcome)

- A “social planner” would maximize the total net-value (Π) of raising cows:

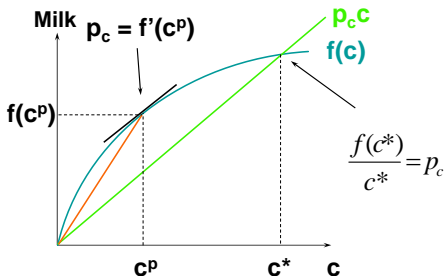
$$\max_c c \frac{f(c)}{c} - ac = \max_c f(c) - ac = \max_c 100\sqrt{c} - 10c$$

- Optimality condition: $\frac{\partial \Pi}{\partial c} = 0$
- $100\left(\frac{1}{2}\right)\frac{1}{\sqrt{c^P}} = 10$
- Marginal product = marginal cost
- $c^P = 25$
- Total net-value of milk is

$$100\sqrt{c^P} - 10c^P = 100\sqrt{25} - 10 \cdot 25 = 250$$

Common-Pool Resources: Example

- Marginal product = marginal cost: maximizes total profit
- Average product = average cost: eke out last bit of profit



The Tragedy of the Commons

- The commons are overgrazed—tragically
- A villager increases her profit by adding a cow, but lowers the profit of everyone else (and the profitability of her other cows)
- She doesn't internalize the cost her cow imposes on the rest of the village
- Examples: over-fishing, over-logging, over-use of parks, traffic congestion

Public Resources and Public Goods

Recall our list of some **non-excludable** goods.

- Fisheries
- (Public) freeways
- National Security
- Broadcast radio/tv
- Clean air
- National parks

Some of these, e.g. fisheries we labeled **rival** because one person's use detracts from that of others.

Public Resources and Public Goods

Recall our list of some **non-excludable** goods.

- Fisheries
- (Public) freeways
- National Security
- Broadcast radio/tv
- Clean air
- National parks

For others, e.g. clean air, radio waves, this is not the case.

Public Resources and Public Goods

Recall our list of some **non-excludable** goods.

- Fisheries
- (Public) freeways
- National Security
- Broadcast radio/tv
- Clean air
- National parks

We call such goods **non-rival** because each consumer can consume all of the good, without reducing it's availability/quality to others.

Public Goods

- A good that is both **non-excludable** and **non-rival** is called a (pure) public good.
- Public good users care little about who else uses it
- Knowing this, individuals have an incentive to free-ride, relying on others to provide (enough of) the good
- Because of this, public goods are under-provided

Public Goods: Examples

- National Security
- Broadcast radio/tv
- Clean air
- National parks
- Road and highways (disregarding congestion)

Public Goods

Key questions:

- When should public goods be provided and how much?
- When will they actually be provided and how much?
- How can we get people to truthfully reveal their willingness to pay for a public good?

Providing Public Goods

When *should* a public good be provided?

- Suppose it costs c to provide the good
- Two consumers, A and B
- Have reservation prices r_A, r_B
- If their payments (to provide the good) are g_A and $g_B \dots$
- They need $g_A + g_B \geq c$ to provide the good

Providing Public Goods

When *should* a public good be provided?

- For the payments to be individually rational, we need $g_A \leq r_A$ and $g_B \leq r_B$.
- If $r_A + r_B > c$, then they can provide the good without anyone paying more than his or her reservation price
- In other words, $r_A + r_B > c$ means that it is Pareto-improving, or efficient, to supply the good

Providing Public Goods

When *will* a public good be provided privately?

- Suppose $r_A > c$ and $r_B < c$
- Then A would supply the good even if B contributes nothing
- Free-riding: B enjoys the good for free

Providing Public Goods

When *will* a public good be provided privately?

- Now suppose $r_A < c$ and $r_B < c$
- Then neither will supply the good alone
- Yet, if $r_A + r_B > c$, it is Pareto-improving to supply it
- A and B may try to free-ride on each other, causing no good to be supplied

Free-Riding

Let's take a closer look at free-riding, and how it may be overcome

- Suppose A and B each have just two actions: individually supply a public good, or not
- Cost of supply $c = 100$
- A values the good at 80
- B values the good at 65
- $80 + 65 > 100$, so supplying the good is Pareto-improving

Free-Riding

	Buy	Don't
Buy	-20, -35	-20, 65
Don't	100, -35	0, 0

- What are the NE?
- (Don't buy, Don't buy) is the unique NE, and it is inefficient.

Free-Riding

How can we overcome this problem?

- *Possible* solution: let A and B make partial contributions to supplying the good
- E.g. A contributes 60 and B contributes 40
- A 's payoff from the good if contributes is $20 > 0$
- B 's payoff from the good if contributes is $25 > 0$

Free-Riding

New game:

	Contribute	Don't
Contribute	20, 25	-60, 0
Don't	0, -40	0, 0

- What are the NE?
- Both (Contribute, Contribute) and (Don't, Don't) are NE.

Free-Riding

- Allowing partial contributions makes possible the supply of a public good when no individual will supply the good alone
- But what contribution scheme is best?
- Also, free-riding can persist even with contributions