Lecture 5 - supplment: Asymmetric information, principal agent models, and RAMS

- Objectives
  - overview: principal agent models and asymmetric information
  - introduce resource allocation mechanisms (RAMs)
- Main findings
  - RAM modern version of PA
  - RAM focuses more on the message space

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Principal - Agent models (1)

In environmental economics -
the principal (P) (the regulator):
has coarser (less accurate) information than
the agents (A) (those to be regulated):
who has more accurate information about him-/herself

Two types of P/A models:

1. Adverse selection models
   (hard for P to observe A's characteristics)
2. Moral hazard models
   (hard for P to observe A's actions)

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... Principal - Agent models (2)

Environmental economics applications

- adverse selection:
  P does not know how costly it is for A to follow environmental regulations that P initiates

- moral hazard:
  P is unable to perfectly monitor A's actions
  (or perfect monitoring is so costly it does not pay to monitor at such an accurate level)

- joint adverse selection and moral hazard
  quite common (and some time hard to distinguish from each other)

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Principal - Agent models (3)

Principal: max social welfare choosing policy varibles

subject to: actions, a_i , of the various types of agents i
given the chosen policy variable(s)

Symbolically:
Principal: max SWF(a_i)
{var}
s.t.(1): agents max $V_i(\mathbf{p},M_i;z_i)$ $\forall$ i x I [agents' behavior]
$\{\mathbf{x}_i,\mathbf{z}_i\}$
s.t.(2): set of policy variable constraints [if quantity instr.]

embedded in prices and money income [if taxes]

4:10

RAMs (1)

Any economic system or mechanism is a communication process where messages are exchanged between economic agents.

Necessary features of resource allocation mechanisms (RAMs):

1. the participation constraint (individual rationality) is satisfied
2. informational viability
   info. demand not exceeded (does not require P knowledge of A's private info.)
3. incentive compatibility is satisfied
   in A's self interest to act as P prescribes

5:10

... RAMs (2)

RAMs being a communication process (between P and A), this goes to the general notion of truth telling

Desirable features of RAMs (part 1):

4. informational efficiency met
   - if a mechanism requires more costly information collection than necessary, costs can be saved by collecting information in a less costly fashion
   - by the first welfare theorem, someone can be made better off without anyone made worse off, i.e., social welfare can be increased

This is related to desirable criterion 5

6:10

... RAMs (3)

Desirable features of RAMs (part 2):

5. social welfare is maximized = Pareto optimality
   (alternatively, social costs are minimized)
   is important as it measures the RAM's performance
   - but incentive compatibility and PO may not be jointly feasible
   - alternative: Second Best Pareto Optimality
6. the budget constraint of P is not exceeded
   the RAM is not so costly to P that P spends all of his/her allocated resources on pursuing the policy
   - if the budget constraint "bites" it implies that welfare is reduced -- what is most important?

7:10

... RAMs (4)

- moral hazard in PA resolved by incentive compatibility in RAMs
- adverse selection in PA resolved (partly) by the participation constraint in RAMs
- RAM insight: in practical environmental policy both incentive compatibility and the participation constraint need to be met for the RAM to yield a predictable outcome
- incentive compatibility is more important than PO (if not incentive compatible, what allocation will actually take place?)
- budget balancing of minor relevance in theory
  - but important in practice (f.ex. developing countries)

8:10

... RAMs (5)

Same principle as for principal agent models (see P/A models (3)), but with the additional constraints

Symbolically:
Principal: max SWF(a_i)
{var}

s.t.(1): agents max $V_i(\mathbf{p},M_i;z_i)$ $\forall$ $i \in$ I [agents' behavior]
$\{\mathbf{x}_i,\mathbf{z}_i\}$

s.t.(2): set of policy constraints (or new price vector, **p**, if policy is a price constraint [incentive comp. contr]

s.t.(3): $V_i(\mathbf{p},M_i;z_i) \geq V_{io}$ [part.constraint]

Example: tradable emission permits

- Necessary criteria (= predictable outcome)
- incentive compatibility OK
  - firms with $MAC(z') < MAC(z^*) = p^* \Rightarrow$ sell permits
  - firms with $MAC(z') > MAC(z^*) = p^* \Rightarrow$ buy permits
- participation constraint OK
  - from above (it pays to engage in trades given that $MAC(z') \neq MAC(z^*)$)
- informational viability OK
  - does not require regulator access to agents' private information (= their MACs)