Lecture 9: Truth revelation - menus, auctions and other approaches

- Purpose
  - ► truth telling - its importance
  - ► some alternatives to standard regulations (with their strong and weak sides)
  - ► demonstrate menus/auction schemes can meet truth telling criterion

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Outline

- Truth revelation - important in regulatory design
- contracts : multiple forms (menus, auctions)
  - ► benefit of contract : may shift burden of proof (= agents prove they have met contract term, rather than regulator proving "the law" broken)
- voluntary agreements : useful under lack of information, but some problems ...
- menus : an agent's choice of menu item ⇒ agent reveals his/her type or (intended) effort
- auctions : an agent's bid ⇒ agents reveal type or (intended) effort

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Truth revelation

- Setting: asymmetric information where agents have better knowledge on their own type than regulator

- Aim: provide incentives for A to reveal his type, (cfr. adverse selection problem) - how it works:
  - A must choose between alt. 1 and alt. 2
  - A chooses 1 $\Rightarrow$ P learns that A is of type 1
  - A chooses 2 $\Rightarrow$ P learns that A is of type 2
  - example: insurance with differing deductables --
    A who perceives to be a low risk driver chooses
    insurance that costs less, but with higher deductable
    :: high risk driver chooses conversely

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Contracts (1)

- A contract is a formal agreement between two (or more) consenting entities
  - no agreement on contract terms $\Rightarrow$ no contract

- Advantages:
  - flexible prior to signing
  - burden of proof can be reversed

- Disadvantages:
  - difficult to design to cover all possible sides of an area $\Rightarrow$ need for "safety clause"
  - potentially inflexible after signing

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... contracts (2)

- <u>Justification</u> : thin markets or other conditions for applying std. instruments not in place

- Steps in the contract formulation
  - ► principal offers contract(s) to agents
    (or the converse: agents offer contract to principal - as in voluntary agreements)
  - ► negotiation phase around contract terms
    (one of the areas with the most frequent applications of game theory)
  - ► each agent chooses to accept/reject contract terms

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Voluntary agreements (1)

- VA - an agreement (contract) between agents (firms) and the principal (regulator)
  - ► Agents voluntarily implement environmental mea- sures (like investment in environmental technology)
  - ► In return the principal refrains from issuing new environ- mental regulations onto agents

- Justification: many direct regulations force agents to choose particular solutions
  - ► costs are higher than they need to be
  - ► implementation of non-voluntary regulations often time consuming (lobbying)
  - ► VA makes agents "look better" (green consumerism)

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Voluntary agreements (2)

- Advantages:
  - ► facilitates learning for agents and the firm
  - ► is consistent with how policy comes in place, which is a process (not a sudden undertaking)

 VA relevant for "new" environmental issues?

- Disadvantages
  - ► transaction costs (negotiating bilateral agree- ments is costly for all parties)
    (TC may be reduced if principal negotiates with business associations)
  - ► yield sub-optimal and cost ineffective outcomes
    $\Sigma MAC_i(z_i) \neq MD(Z_{tot})$ & $MAC_i(z_i^*) \neq MAC_j(z_j^*)$)

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Voluntary agreements (3)

- Sub-optimal and non cost effective outcomes
  - ► asymmetric information: agents know more about the technical progress in their specific area
  - ► risk that the principal gives agents "something for nothing" ($MACi = 0$)
  - ► too little abatement takes place in the future as $\Sigma MAC_i(z_i) \neq MD(Z_{tot})$

Pollution

Time trend in VA

Time trend due to technological progress

Time
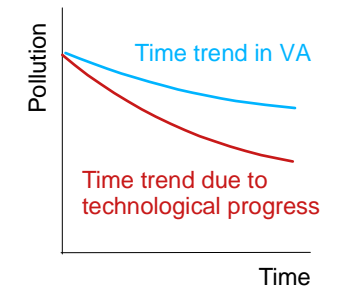
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Voluntary agreements (4)

- VA could still be justified
  - few firms in a receptor region, i.e. cost efficiency unlikely to be achieved anyhow ($MAC_i(z_i^*) \neq MAC_j(z_j^*)$ is a bit irrelevant)
  - difficult to gain political concensus on uniform or region wise regulations that bind (i.e., risk for delayed implementation)
  - in which case the principal needs to make sure that the VA is binding -- cfr. figure last slide)
  - learning is important, both for agents and the principal
    - implying that the asymmetric info. scenario is not that relevant

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Menus (1)

- Basic version: menu of two contracts is offered
  - both contracts leads to f.ex. reduced pollution
- Two types of agents, L and H
  - L-type agents choose the contract (menu item) that maximizes their utility/profits
  - H-type agents choose the contract (menu item) that maximizes their utility/profits
- Problem: if large share of agents choose the least performance, risk that overall policy objectives not met
  - difficult to design contracts that are cost effective and meet policy goals

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... menus (2)

- Separating equilibria :: key in menu systems
  - ► a form of "price discrimination" ⇒ principal learns more learns more about the agents
  - ► condition for separating equilibria : only one principal
  - ► classic case: insurance policies with varying degrees of deductibles (agent pays a different own share if an accident, depending policy chosen)

- Separating equilibria are often welfare enhancing (as they reduce arbitrage in the economy)

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... menus (3)

- Menu systems can contain more than two alternatives, for example if agents are very heterogenous
  - ► disadvantage: chances ↑ that agents choose wrong category (more likely w/ many items)

- Menu systems need not be designed as discrete alternatives ⇒ continuous payoff
  - ► agents signal their type or effort, and is paid/fined as a function of their effort and type
  - ► advantage: more info. about agents is extracted
  - ► disadvantage: complex for agents to relate to (but less impacts of "choosing incorrectly")

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Auctions (1)

- For auctions to yield gains over other mechanisms, only some agents can expect to have bids accepted
  - ► example: a certain share of land is to be managed in a <u>special way</u>, but it is not perceived optimal that all land is managed that way
  - ► require that contract that is auctioned off is well specified

- Principle: the winner(s) of the auction are the "fortunate" providers of some public good
  - ► rationale: agents would only hand in bids that would make them better off than w/o contract

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... auctions (2)

- Auction formats
  - ► English auction (open cry, iterative increasing bids, ex. Sotheby art auctions):
  - ► Dutch auction - clock auction (open cry, price starts high and declines, first to accept price wins)
  - ► 1.st price sealed bid: highest bidder wins
  - ► 2.nd price sealed bid (Vickrey auction): highest bid wins, but pays the price of the 2nd highest bid
- All auctions pick same winner, English auction does not extract all WTP (other formats do)
- Procurement auctions = identify the least cost provider = winners are those with lowest bids

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... auctions (3)

- "Winner's curse"
  - ► first price auctions - the one who "wins" a common value good auction usually encounter a loss (over-estimate value of the good, or underestimate cost of provision)
  - ► leads to strategic behavior in the bidding process ⇒ limited learning for the reglator

- Solution - remove linkage between own bid and price paid/received (Vickrey principles)
  - ► with just one contract awarded, 2nd price auctions
  - ► with multiple contracts awarded, N (or N+1) price auctions

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Uniform price auctions (1)

- Multiple (*N*) units/contracts auctioned ⇒ only sealed bid formats of interest
  - ► first price auctions (**discriminatory price auctions**) :: all winners pay equal to their bid
  - ► N+1 price auctions (**uniform price auctions**): all *N* winners pay the same price (= size of first non-winning bid, the N+1 bid)

- Differences discriminatory - uniform price auct:
  - ► revenue equivalence not expected to hold
  - ► Strategic bidding may occur under discriminatory price auctions, but not under uniform price auctions ⇐ weakly dominant strategy to pay true WTP

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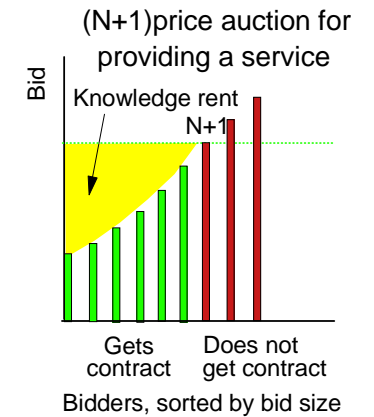
... uniform price auctions (2)

- Weakly dominant strategy: bid true opportunity cost/value in uniform price procurement auction
  - ► bid size (b_i)
  - ► opportunity costs (c_i)
  - ► auction price (p)
- Overstating the bid :: $b_i > c_i$

  $\Rightarrow$ risk that $b_i > p > c_i$) $\Rightarrow$ does not get a contract one should have had, loss $p - c_i > 0$

- Truthful revelation: :: $b_i = c_i$

  $\Rightarrow$ $p > c_i = b_i \Rightarrow$ gets contract and gains $p - c_i > 0$ OR

  $\Rightarrow$ $c_i = b_i > p \Rightarrow$ does not get contract and gains or looses nothing

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... uniform price auctions (3)

- Truthtelling costs

  example (N+1) price auction: those getting a contract receive a compensation that exceeds their bid

- Parallell to RAM criteria
  - ► incentive compatibility costs
  - ► here: (incentives) for truth-telling costs

  $\Rightarrow$ must weight marginal costs and benefits from truthtelling

(N+1)price auction for providing a service

Bid

Knowledge rent

N+1

Gets contract · Does not get contract

Bidders, sorted by bid size

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Uniform or discriminatory price (1)
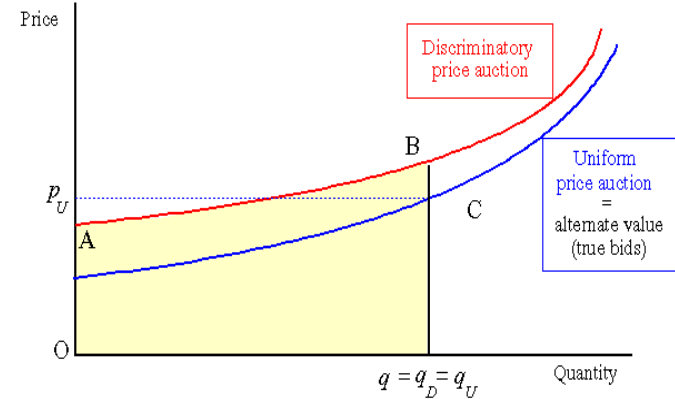
- Revenue - truthtelling tradeoff
  case 1: agency is revenue constrained
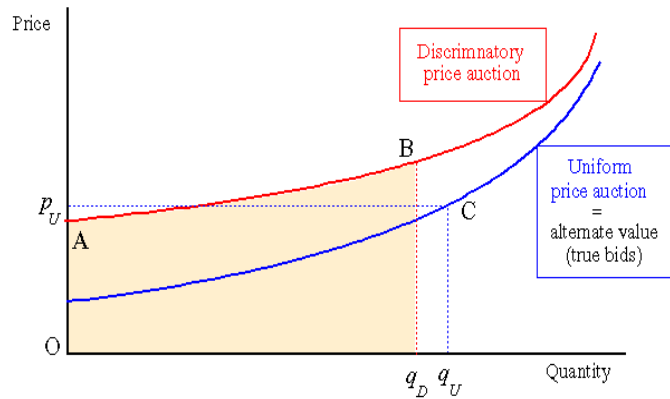
... uniform or discriminatory price (2)

- Revenue - truthtelling tradeoff
  case 2: agency has quantity target

Summary (1)

- Contracts - all parties must agree to enter
  - ▶ applicability when std. instruments not useable
  - ▶ reversal of "burden of proof"

- Voluntary agreements
  - ▶ if done properly, may reduce transaction costs
  - ▶ ... severe asymmetric info. problems
  - ▶ a regulatory instruments for "new problems"?

- Menus
  - ▶ problem: hitting optimal menu prices when principal in advance know agent types, and cannot go back on a contract once signed

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... summary (2)

- Auctions
  - ▶ provides more info on agent type/intended effort
  - ▶ only applicable if there is competion to get "contract" (some agents will "not" win contract)

- Discriminatory vs. uniform price auctions
  - ▶ "revenue equivalence"
  - ▶ topic under discussion among researchers which is "best"

- Truthtelling costs - is it worth it?
  - ▶ RAM equivalence (need to know where one is)
  - ▶ decision rule: E(benefits truth) $\geq$ E(costs truth)

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