LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

ISEG SINCE 1911

lecture 4: natural monopoly – some (more) solutions

outline

- Natural monopoly
  - Other pricing solutions
    - peak-load pricing
    - Loeb-Magat mechanism
    - Bidding mechanisms

outline

References

- VVH, ch. 12, 13
- Joskow, P. (2007) "Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks," NBER Chapters, in: Economic Regulation and Its Reform: What Have We Learned? National Bureau of Economic Research, Inc.

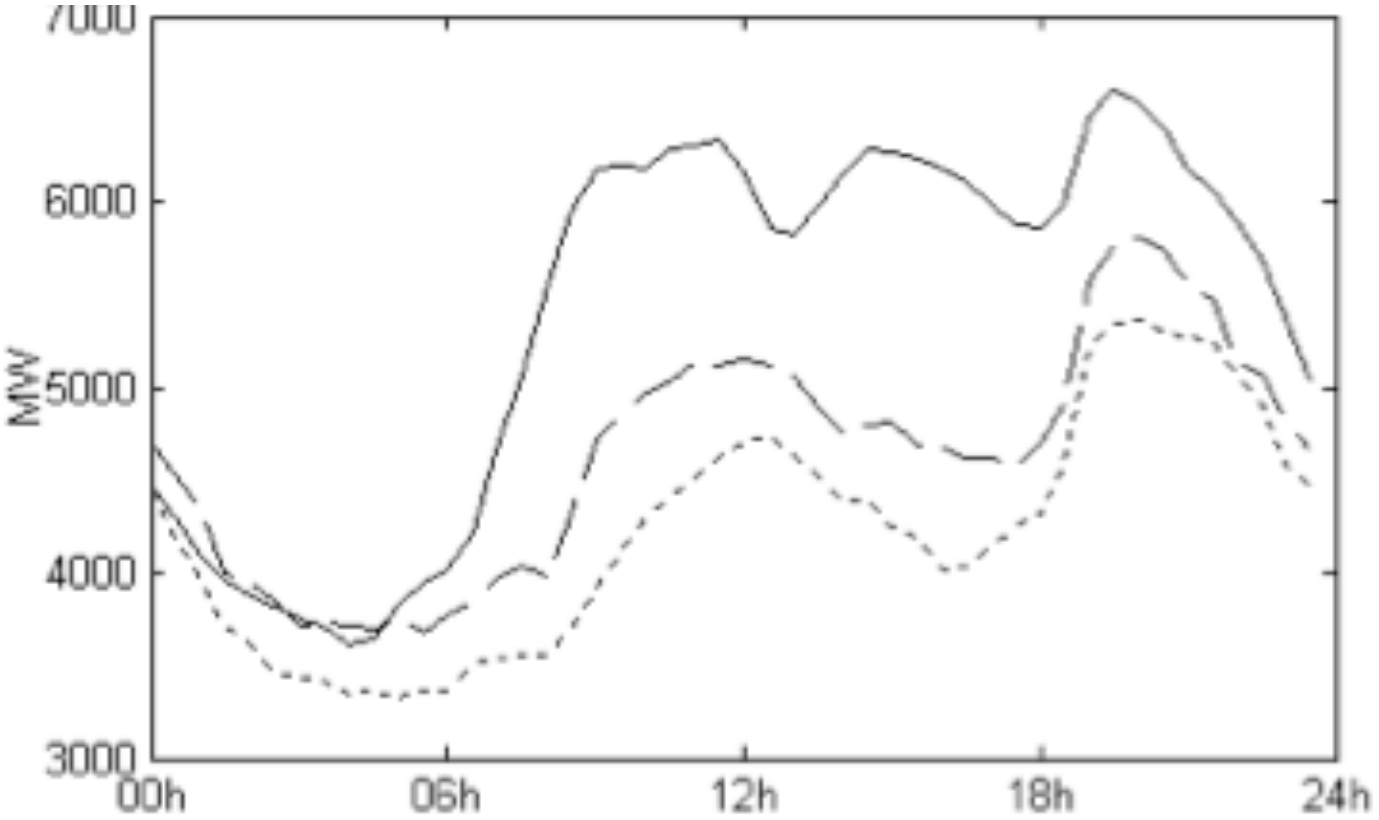
the story so far

Natural monopoly:

- Definitions
- Ideal pricing solutions
  - Linear: MC and AC pricing
  - Non-linear: two-part or multiple-part tariffs
  - Ramsey prices (for multiproduct NM)
- Regulation in practice:
  - Rate of return regulation
  - Incentive regulation:
    - Earnings sharing
    - Price caps
    - Yardstick regulation
  - Rate structure: discrimination

Peak-load pricing

- Variation in prices by time of use (eg, MC of electricity higher in the middle of the day than at night and prices vary accordingly)



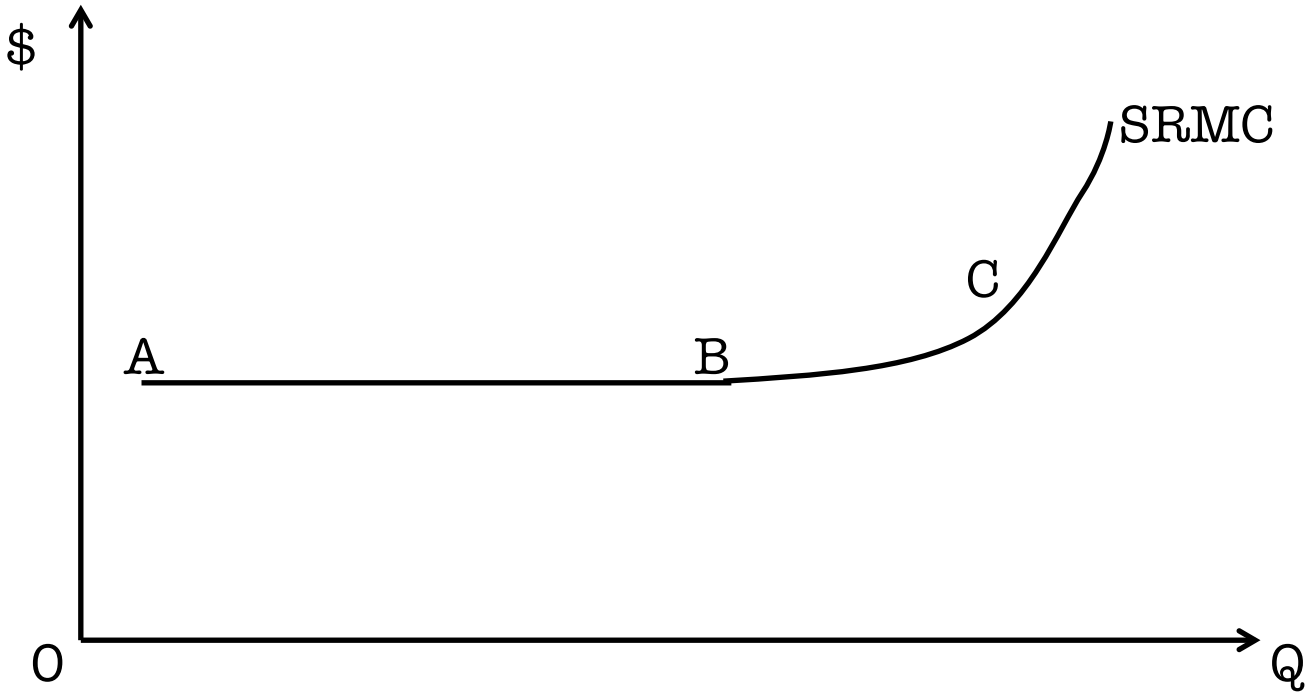
Load profiles from a working day (solid line), a Saturday (dashed), and a Sunday (dotted line) in Portugal, Oct. 2004

(Source: **Forecasting Daily Electricity Load Curves**
http://www.wseas.us/e-library/conferences/2005lisbon/papers/496-JCQ5.pdf)

Peak-load pricing

- Electricity:
  - Too costly to store; so, capacity is determined by the amount of peak demand
  - Demand has cyclical pattern (daily, weekly, monthly and seasonally): peak in the middle of the morning/end of the afternoon; weekends only 50%
  - An electric power system has different kinds of plants (nuclear plants, coal-fired plants, combustion turbines,... with decreasing FC/increasing VC); typically the short-run MC curve for the electric power system is a rising curve

Short-run MC cost curve for electric power system

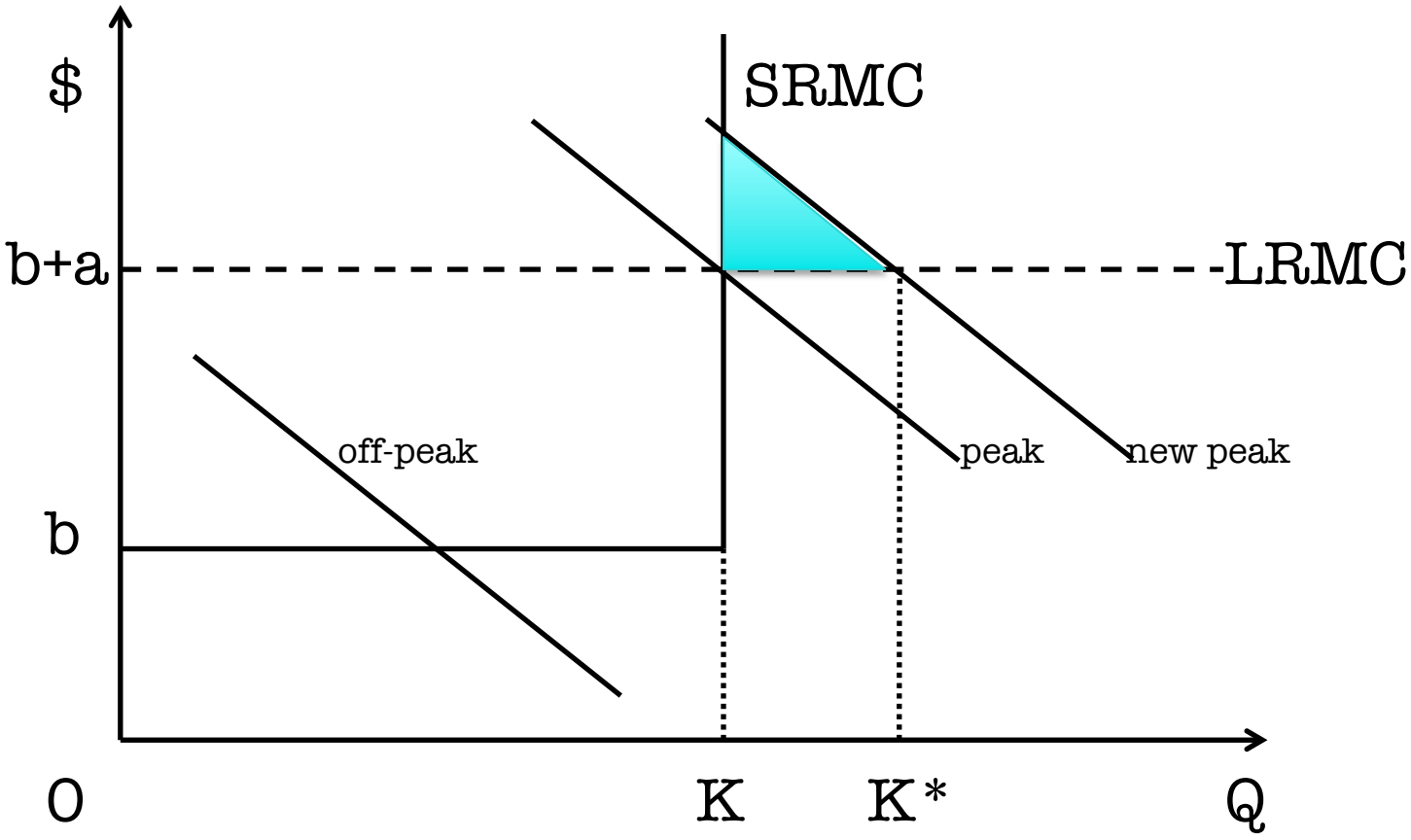


Since demand varies over time, P=SRMC would require a continuously changing price.

Peak-load pricing

- Simple model:
  - Peak demand for half the day; off-peak for the other half
  - Demands are independent (strong!)
  - VC = b until capacity K is reached; at K no more output is possible (approx. to smooth curve in slide 8)
  - *a* is the cost of 1 additional unit of capacity
  - Efficient solution P=SRMC
  - LRMC come into play to decide if K is optimal
  - Off-peak P = b; Peak P = b + a (=SRMC=LRMC, so that capacity is optimal!!)

Peak-load pricing

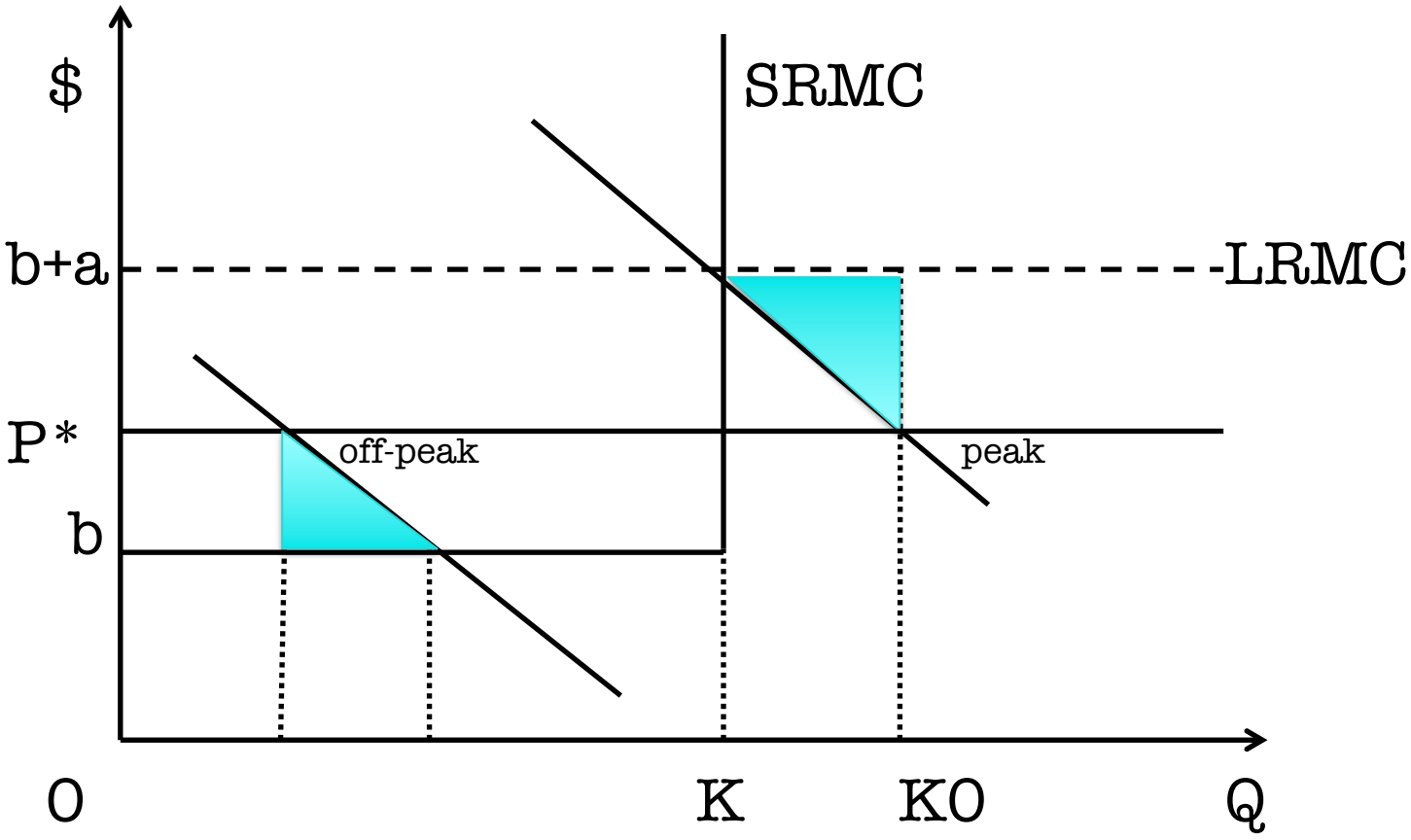


Peak-load pricing

- Solution: off-peak demanders pay b and off-peak pay b+a, i.e., peak demanders pay all capacity costs (and off-peak pay none)

- What if a single price is charged?

Peak-load pricing



Peak-load pricing

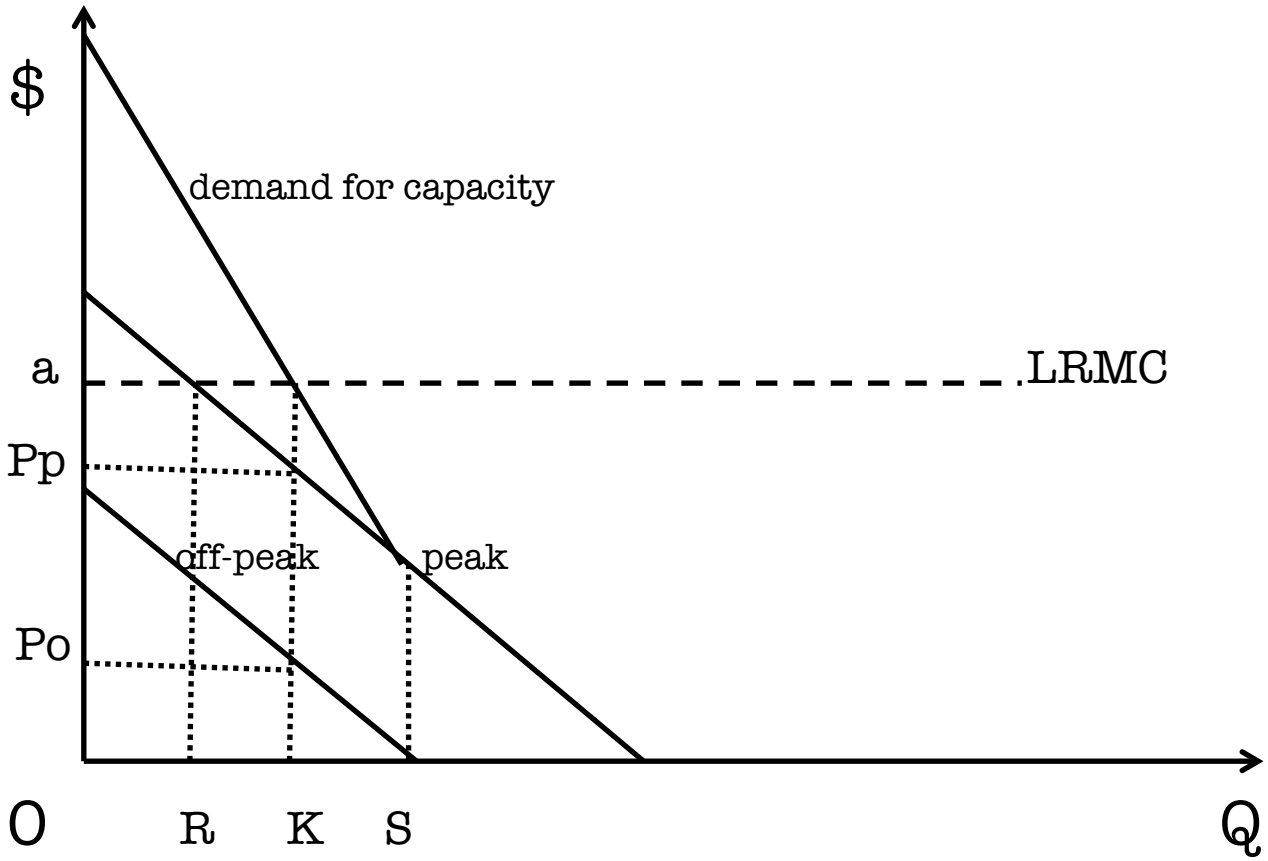
- Solution: off-peak demanders pay b and off-peak pay b+a, i.e., peak demanders pay all capacity costs (and off-peak pay none)

- (This is true for this extreme case, in which the two demands are too far apart)

- The next graph illustrates another example (with b=0)

Peak-load pricing

Shifting peak case



If P peak =a (and off-peak P=0), peak demanders consume less than off-peak!

Peak-load pricing

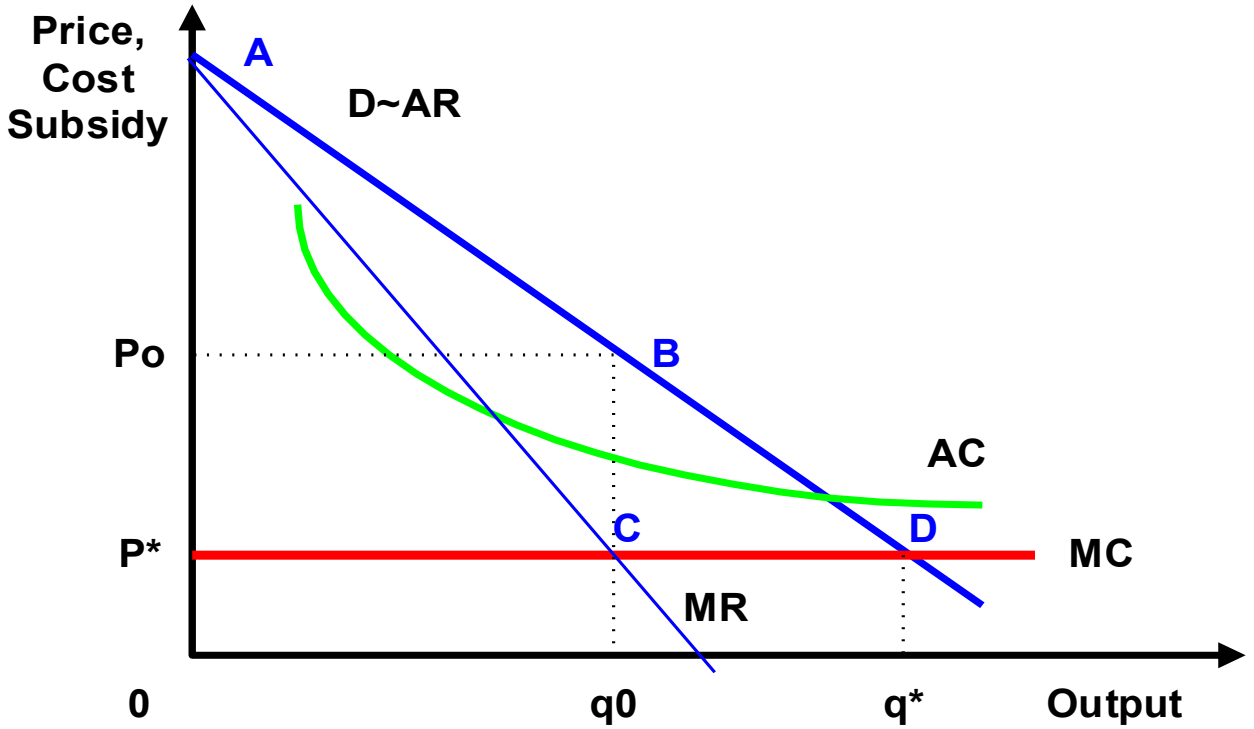
- Solution:
  - To obtain the optimal capacity, construct the demand for capacity (reflecting total willingness to pay for the plant)
  - In the graph, given optimal capacity K (at which Pcap=LRMC), the efficient prices are Pp and Po
  - So, the two groups of consumers share capacity costs

Loeb-Magat mechanism

- Assumptions:
  - The firm knows its own cost structure, but regulator cannot observe the costs
  - Both the firm and the regulator can observe the demand curve
  - The firm wants to maximize profits

- Loeb-Magat's proposal to induce efficient pricing:
  - The firm choses price; the regulator offers to give the firm a subsidy equal to consumer surplus at the price choosen by the firm

Loeb-Magat mechanism



- At Po, profits are ABCP*-K
- The monopolist will set P = MC because L-M's proposal changes his objective function: the monopolist now wants to maximize total surplus
- In doing so, he absorbs all the rents

Loeb-Magat mechanism

- The solution is economically efficient, but may be objectionable on distributional grounds.
- To rectify this problem L-M suggest that a franchise bidding scheme (or a tax scheme) could recover some of the subsidy for the general treasury.
- If the monopoly franchise is auctioned off, the equilibrium price bid is total surplus at the efficient price minus fixed cost (P*AD-K)

Franchise auction (Demsetz, 1968)

- Introduces competition even though only one firm can actually produce the good or service
- The solution is to have a modified **English auction** where the monopoly franchise is awarded to the least cost bidder
- The bid takes the form of a proposed price for the service
- If there is enough competition, the price should go down to the AC (and the regulator does not have to know costs or demand!)
- In place of a regulatory commission, the government acts as an auctioneer

D-tour: auctions

- An auction is a method – or a mechanism- for allocating goods, tasks, and resources

- Types
  - English
  - First-price sealed-bid
  - Dutch
  - Second-price sealed-bid

English auction

- Open-cry, ascending bid auction
- For selling a painting or an oil lease, it works as follows
- The auctioneer announces a bid to which the bidders respond by signaling whether they are willing to buy at that price.
- If there are at least two active bidders (a bidder is active if he signals he is willing to buy at the going bid), the auctioneer raises the bid.
- He keeps raising it until there is only one active bidder.
- The last remaining bidder wins the item and pays a price equal to the final bid.

English auction

- In general, each bidder is free to raise his bid; when no bidder is willing to raise the bid, the auction ends, and the highest bidder wins the item at the price of his bid

English auction

- The bids are functions of an agent's private value, of his prior estimates of others' valuations, and past bids

- The best strategy (dominant) is to always bid a small amount more than current highest bid and stop when one's private value is reached

First-price sealed-bid auction

- Sealed-bid, single round auction
- Each bidder submits one bid without knowing others' bids, highest bidder wins the item at a price of his bid
- Bid as a function of an agent's private value and his prior estimates of others' valuations
- There is no dominant strategy in general (strategic underbidding and counterspeculation)

Second-price sealed-bid (Vickrey) auction

- Sealed-bid, single round auction
- Each bidder submits one bid without knowing (!) others' bids; highest bidder wins the item at a second highest price
- Bid as a function of agent's private value and his prior estimates of others' valuations
- There is a dominant strategy: truthful bidding (strategically equivalent to English auction , no counterspeculation, independent of others' bidding plans, operating environments.,...)

Franchise bidding

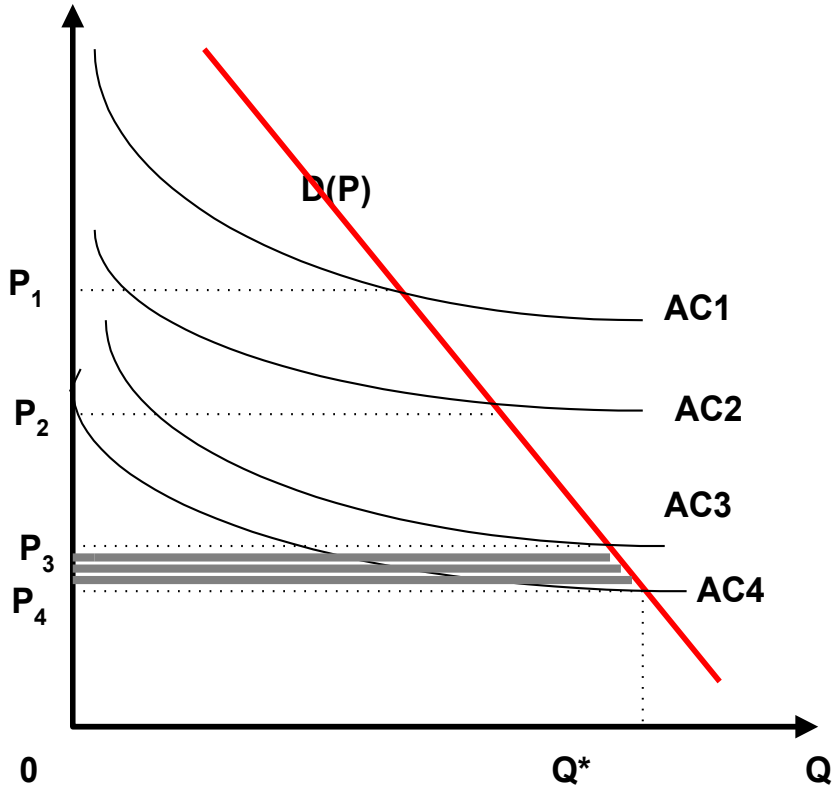
With linear pricing

- Auctioneer announces price at which the service will be offered to consumers
- Determine how many active bidders are around at that price
- If the number is >1 , announce a lower price
- Keep going until only one bidder is left and the last price is the price at which the service will be offered to the population

Franchise bidding

With linear pricing - example

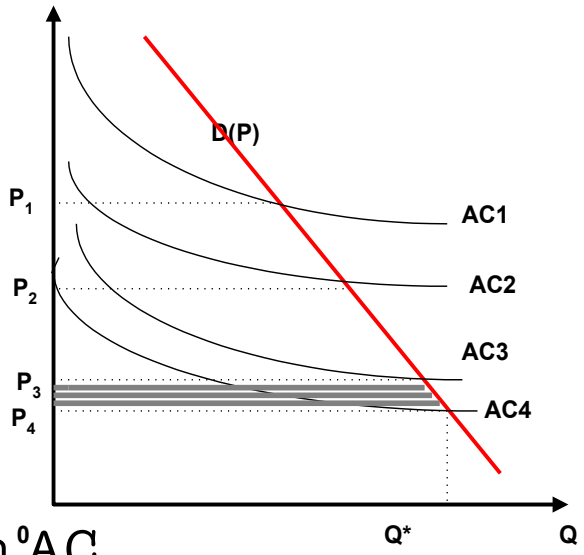
- Four firms with different average cost functions
- Constrained to linear pricing (that is, a constant per unit price), the social welfare optimum is to have firm 4 supply the good at a price of P_4



Franchise bidding

With linear pricing - example

- The optimal bidding strategy for firm I is to remain active as long as the bid is greater than P_i



- If the bidding price is lower than P_i, firm i leaves the auction because it will have to charge a price lower than ^0AC

- As soon as the bid falls just below P_3 firm 3 leaves the bidding and firm 4 is now the only active bidder; firm 4 wins the franchise and charges a price slightly less than P_3

Franchise bidding

- Positive consequences
  - Least cost firm wins
  - No problem of over-capitalisation
  - No informational requirements on regulator
  - Franchise owner has incentive to be cost efficient
- Negative consequences
  - Price is above the least cost, competition is lacking

    (fall in consumer surplus with respect to AC pricing equals the shaded area above)
  - As contract is written on price may skimp on quality
  - Two-part tariff is more efficient

Franchise bidding

vs. two-part tariffs

- With two-part tariffs

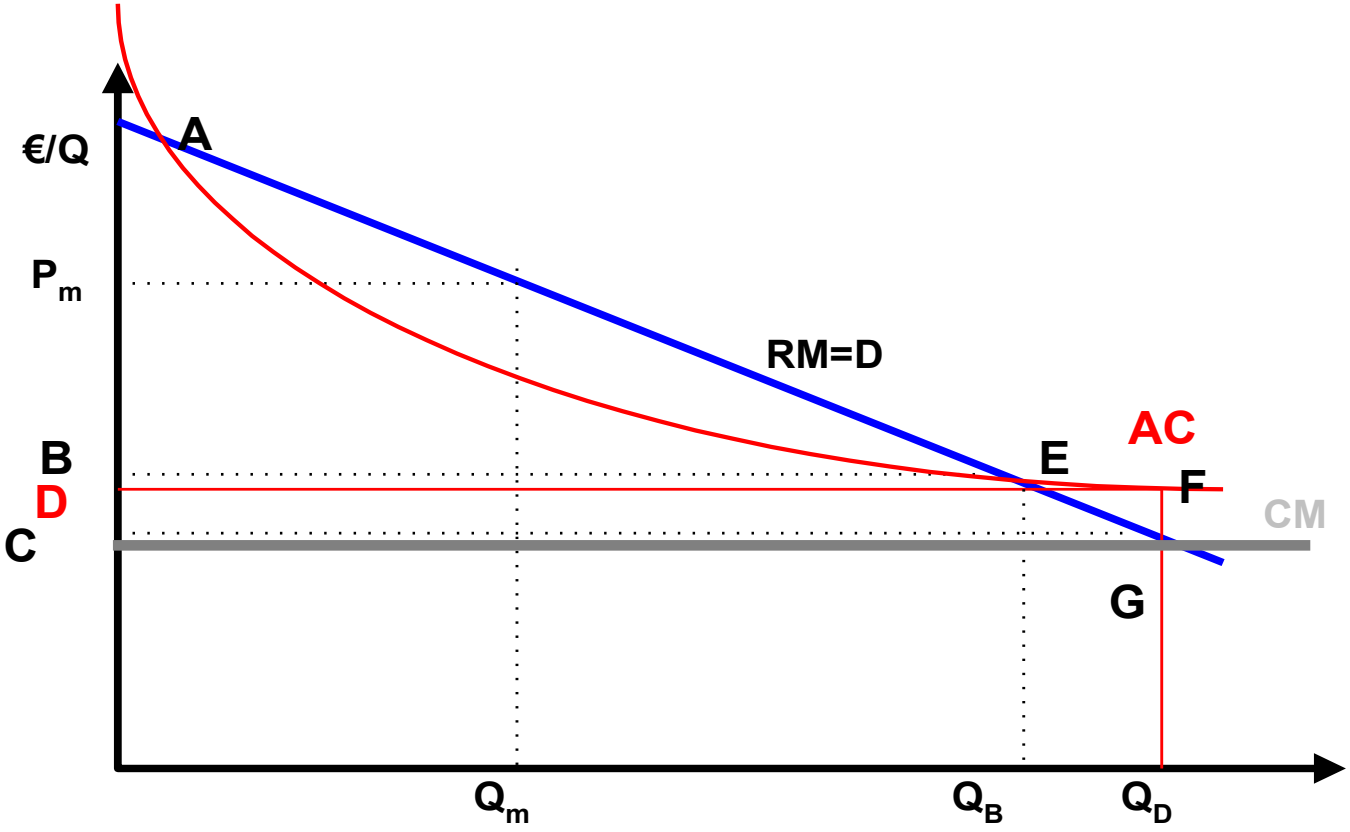
  - Regulator knows demand (measure of how much consumers value a two-part tariff), but not the cost curve

  - The bidders offer P = MC and a fixed fee “a”

  - The regulator awards the franchise to the bid with highest welfare

Franchise bidding

vs. two-part tariffs



Franchise bidding

vs. two-part tariffs

- Assume the demand is perfectly income-inelastic

- What is the gain in social welfare ?

  - With AC pricing Consumer Surplus (CS) is the area ABE; with MC pricing CS is now the area ACG

  - Thus, consumers are better off if BCGE does not excede aN ('a' is the fix fee and N is the number of consumers)

  - If there is enough competition, the bid on "a" will go down to CDFG

  - There exists a two-part tariff that yields higher welfare than the AC tariff (BCGE > CDGF)

Franchise bidding

- Instead, suppose the franchise is awarded to the firm willing to pay the highest fee to the government and it was allowed to price freely
- The firm would then charge P_m and be able to pay the government up to the monopoly level of profits
- Thus, at the monopoly price P_m the franchise owner earns normal profit. But the market price is too high...
- So, for franchise bidding to lead to a socially desirable solution, the franchise must be auctioned off to the firm offering the lowest price for service and not the highest franchise fee

Franchise bidding

quality

- Usually a firm chooses product's durability, reliability,...
- If per-unit cost is increasing in the level of quality and bidding is over price, competition will drive down quality
- The winning bidder will be the one that offers the lowest quality product at a price equal to average cost
- But society may not desire the low-quality, low-price alternative: Consumers may be willing to pay a higher price for higher-quality service

Franchise bidding

quality

- Solutions:
  - Government agency specifies the level of quality
  - Multidimensional bidding: firms bid over price and quality (harder task!)

- Difficulties:
  - Agency needs information on consumers' valuation of quality to specify the required characteristics of a service or to analyse the trade-off between quality and price in awarding the franchise
  - Enforcing the agreement made: Quality is considerably more difficult to monitor than price

Franchise bidding

contractual arrangements

- Input prices, technology and demand may change over time, so that bidding cannot be performed once and for all

- Solutions:

1. Recurrent, short-term contracts: periodically, the franchise is put up for auction
   - The current franchise owner has incentives to honour current contract
   - But, bidding parity may fail: the current owner has already made the investment and may bid down to AVC (while others bid down to AC) OR the government agency may be more inclined to maintain the status-quo

2. Incomplete, long–term contract: 15-20 years, not all contingencies are provided for
   - Franchise owner has incentives to invest in long-lived assets
   - But, difficult to write (price formula,... needed), penalties if quality standards are not met,..

Franchise bidding

conclusions

- Franchise bidding has been a qualified process in introducing some competition into the provision of "specific" monopoly services
- However, the effective pursuit of economic welfare through the competitive awarding of monopoly franchise has its difficulties:
  - The number of bidders
  - The advantages of incumbent firm
  - Anticipation of future events
  - The design of the bidding process
- As we introduce product quality and uncertainty, franchise bidding becomes close to regulation