# Procurement auctions, truthful and strategic bidding

The table below shows the costs of the management contract (first row) and is sorted by increasing management costs. 5 contracts are to be awarded to the auction participants with the 5 lowest bids.

| Costs of management contract | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Uniform price auction bid under truthful revelation (1) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Discriminatory price auction bid small strategic bid adjustment (2,3) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Discriminatory price auction bid large strategic bid adjustment (2,3) | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 10 |

(1) It is a weakly dominant strategy to bid equals the costs of the contract for the bidder → bids for the uniform price auction (2nd row) equal costs.

(2) Strategic bid adjustments involve increasing the bid to get paid more (under a discriminatory price auction, winning bidders are paid according to the size of their bid). The risk of strategic bid adjustments is loosing out on a contract that is profitable (price > costs).

(3) The size of the strategic bid adjustments increase with better knowledge on the cost distribution, and is often inversely related to own costs (a low cost provider can increase the bid more than a high cost provider at lower risks of not producing a "winning bid").

(a) What is the contract price and total payments to under a uniform procurement auction when 5 contracts are given? Explain.

**Answer:** With 5 contracts awarded, the first non-winning bid is the sixt bid (the $N$+1 ranked bid) with the size 5. All contracts are paid the same price (= 5) → total costs to the contract issuer is 25 (= 5 x 5).

(b) Compare the costs to the regulator of a uniform price procurement auction and a discriminatory price auction when 5 contracts are awarded, and with (i) small and (ii) large strategic bid adjustment.

**Answer:** (i) small discriminatory price auction bid adjustment gives total payment of the sum of the winning bids = 1 + 2 + 3 + 4 + 5 = 15 (which is smaller than 25, the total payment under a uniform price auction). (ii) large discriminatory price auction bid adjustment → total payments = 5 + 5 + 6 + 6 + 7 = 29 (which is greater than 25, the total payment under a uniform price auction).

**Remark:** for small strategic bid adjustments, discriminatory price procurement auctions often leads to lower total payments than uniform price procurement auctions). Conversely under large strategic bid adjustments.

(c) Suppose you are the head of the Ministry of the Environment and you are asked what is the size of the rents (extra profits) given under (i) a uniform price auction, and (ii) a discriminatory price auction. What is your answer, and why?

Answer: (i) Uniform price auction gives rents $\pi_i = p - b_i$ as bids ($b_i$) equal true costs ($c_i$) for bidder $i$. In this auction 5 x 5 – (0 + 1 + 2 + 3 + 4) = 15. (ii) Discriminatory price auction, you are unable to answer because you do not know the size of the strategic bid size adjustments.

**Remark:** With state auditor (Riksrevisjonen in Norway) concerns how well policies utilize public funds, ability to answer these questions may be important. If there are valid reasons that the strategic bid adjustments are small, one may still be able to justify discriminatory price procurement auctions as total payments then are smaller than for an equivalent size uniform price auctions.

(d) Suppose that the bidder with costs = 3 adjusts his/her bid upward to 6.5 in all the three auctions. What happens under the two auction formats?

Answer: We recreate the table sorted by the adjusted uniform price auction bid size for the provider with costs = 3 which implies this column is moved as shown (bids from the first table in parentheses below the adjusted bid). Green table cells now include the new contract holders, and the red cells the one potential provider who misses out on the contract. The yellow table cell indicates a mixed case (see below for an explanation):

| Costs of management contract | 0 | 1 | 2 | 4 | 5 | 6 | 3 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Uniform price auction bid under truthful revelation | 0 | 1 | 2 | 4 | 5 | 6 | 6.5 (3) | 7 | 8 |
| Discriminatory price auction bid small strategic bid adjustment | 1 | 2 | 3 | 5 | 6 | 7 | 6.5 (4) | 8 | 9 |
| Discriminatory price auction bid large strategic bid adjustment | 5 | 5 | 6 | 7 | 8 | 9 | 6.5 (6) | 10 | 10 |

Under the uniform price auction the bidder with the adjusted bid looses out on the contract and misses out of rents equal 2 (= 5 – 3) if the bid has not been adjusted (demonstrates the weakly dominance of truthful bidding under uniform price auctions). The new uniform price becomes 6 (the new first non-winning bid) and total payments increase from 25 to 30. There is also a loss in efficiency as contracts no longer are awarded to the lowest cost contract providers equal to 3.

Under the discriminatory auction with small bid adjustments this bidder looses out on the contract (6.5 > 6, the new highest bid that got a contract) and forfeits rents of 1 (= 4 – 3). Total payments increase to 17 (up from 15 in the initial case).

Under the discriminatory auction with the large bid adjustments, there is no change on who gets a contract as the adjusted bid is still among the five lowest bids (6.5 < 8, the first non-winning bid), but total payments increase by .5.

Important remarks: (1) For the uniform price auction and the discriminatory price auction with small strategic bid adjustment, one of the five lowest cost providers (c = 3) is replaced by the provider with the cost c = 5 → social costs increase by 2, which is the true loss of efficiency.

(2) Payments to contract providers (winners in the auction) are transfer payments that by themselves do not affect efficiency unless strategic bidding leads to a failure to award contracts to the (here 5) least cost providers.

(3) For the discriminatory price auction with large strategic bid adjustment, there is no loss of efficiency. This case serves as a demonstration that strategic bid adjustments may or may not lead to efficiency losses.