

Auctions

Econ 1101

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Plan for today and Assignments

Auctions:

1. A "warm up" to supply and demand
 - What is an auctions and types of auctions
 - Experiments to illustrate different types of auctions
2. Wholesale Electricity Auctions in the United Kingdom
3. Example of electricity auction to illustrate market clearing
 - Please read UK electricity market reading (moodle or my website)
 - Take a look at the math refresher document (my website)

Announcements

- HW 1 due next Tuesday 11:45 pm CST on Aplia
- Next week auction experiment on Aplia, time TBA (moodle or email)
 - Participation mandatory
 - Make sure you set up your account before the experiment

Auctions: Introduction and types of auctions

- 1 What is an auction:
 - Definition and elements of auctions (parties, information, prices)
 - The outcome of an auction: winner (who), quantity, price
- 2 Types of auctions:
 - Classification according to parties bidding:
 - Single-sided vs double-sided
 - Classification according to information available:
 - Sealed bid vs open outcry
 - Classification according to pricing scheme:
 - Pay as you bid (like in our experiments)
 - Uniform pricing (like in the electricity exercise)
- 3 Reservation prices (for buyers and sellers) and sellers profit
- 4 Three experiments to illustrate types of auctions

Auctions: Experiments

4. Three experiments to illustrate types of auctions

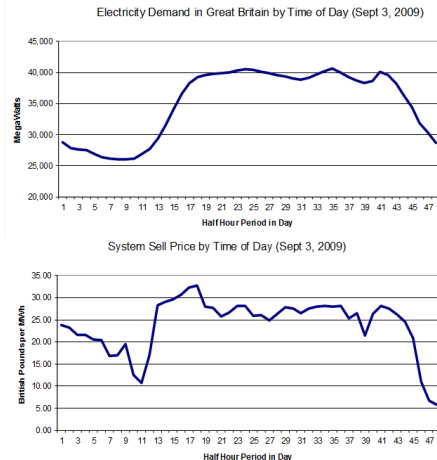
- Experiment 1: sealed bid, single sided (only sellers are bidding)
 - two variations: 1 seller, 3 sellers
 - take away: there is a tradeoff between a high bid (you might not win the auction) and a low bid (get less profit)
- Experiment 2: single sided 3 sellers, open outcry (all sellers know the cost of others so they can infer the price),
 - take away: when we add some competition (by letting others know the cost), the winning price is lower
- Experiment 3: same as experiment 2 but we let the sellers collude (3 friends agree on the price and bid the same price)
 - take away: when sellers (firms) collude we get a higher price (monopoly)

Atricle Review

- How has the electricity market in the UK changed over the last 20 years?
 - Before the 90's a monopoly (single firm) supplied electric power in the UK
 - Since 1990 the UK has used an auction system to coordinate production and to determine the wholesale price
- Suppliers (sellers) bidding prices determine how the demand is "filled" (see excercise and reading)
- Since the demand varies substantially during the day, in the UK electricity market, each half-hour period in a day is considered a separate market with its own auction.

Electricity Auction in the UK

- The first graph shows how the demand fluctuates throughout the day
- In the 2nd one we see prices are higher when the demand is the highest



Auction Setting in the UK

- The independent system operator (ISO) is the auctioneer”
- The ISO has various quantities of electricity to sell for each half hour period
- He forecasts the demand in advance and so decides 1) quantity, 2) price, and 3) who gets to sell
- This will be a uniform price auction (recall one price for all sellers)

Auction Setting: uniform price

Uniform price auction:

- The price is determined according to the following **rule**:
 - 1 Sort bids by price (from low to high) -ranking-
 - 2 Set price equal to last need to meet demand
 - determine who is in the auction (winning sellers)
 - determine the quantity
 - determine the price
- Contrast with “pay as bid auction” Simplifying assumption: Each supplier only can sell one unit of energy.

Example

- Suppose the buyer submits a quantity of electricity demanded, 6 megawatt per hour (MWh)
- There are 10 sellers offering the following prices for each megawatt hour:

| Seller Name | Sell Price for 1 MWh (£ per MWh) |
|-------------|----------------------------------|
| S1 | 30 |
| S2 | 5 |
| S3 | 50 |
| S4 | 10 |
| S5 | 20 |
| S6 | 25 |
| S7 | 5 |
| S8 | 10 |
| S9 | 50 |
| S10 | 15 |

Example

- First task of ISO (Independent System Operator): Sort Bids (lowest to highest)

Example: Ranking

- ISO will rank the sellers by price (from the lowest to the highest, recall as buyers we prefer to pay as little as possible)

| Rank | Seller Name | Sell Price for 1 MWh (£ per MWh) |
|------|-------------|----------------------------------|
| 1 | S2 | 5 |
| 2 | S7 | 5 |
| 3 | S4 | 10 |
| 4 | S8 | 10 |
| 5 | S10 | 15 |
| 6 | S5 | 20 |
| 7 | S6 | 25 |
| 8 | S1 | 30 |
| 9 | S3 | 50 |
| 10 | S9 | 50 |

Example: who will be chosen in the auction?

- Recall our simplifying assumption, each seller provides one unit of energy
- Which firms will be chosen in the auction?

| Rank | Seller Name | Sell Price for 1 MWh (£ per MWh) | In the auction? |
|------|-------------|----------------------------------|-----------------|
| 1 | S2 | 5 | Yes |
| 2 | S7 | 5 | Yes |
| 3 | S4 | 10 | Yes |
| 4 | S8 | 10 | Yes |
| 5 | S10 | 15 | Yes |
| 6 | S5 | 20 | Yes |
| 7 | S6 | 25 | No |
| 8 | S1 | 30 | .. |
| 9 | S3 | 50 | .. |
| 10 | S9 | 50 | .. |

Auction Outcome

- Recall the auction outcome is : quantity, price and who gets to sell
- According to our previous table we have:
 - Sellers S2, S7, S4, S8, S10, and S5

What is the price?

- The price will be £20, we know this because:
 - if price is less than £20 seller 5 “S5” wont sell (his price is 20) and the demand wont be fulfilled
 - Price should not be higher than £20 because buyers prefer to pay less and they can get 6 units for £20
- The ISO wants to choose the lowest price that will still satisfy all demand

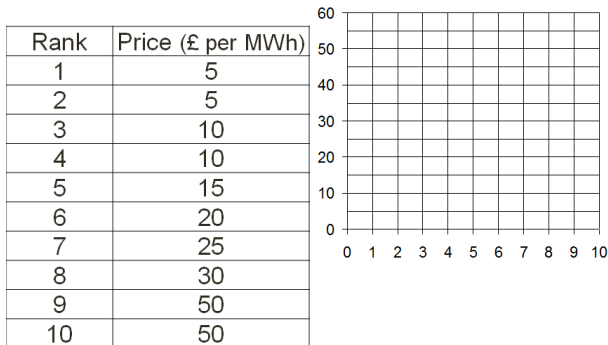
The ISO has determined the who (S2, S7, S4, S8, S10, and S5), the quantity (6), and the price (£20)

Graphical Representation

- The previous chart is also known as a supply schedule
 - it will tell us total megawatt hours supplied for each price
- We can graph this relationship to visual our auction more easily
- We will plot the price in the vertical axis and the quantity in the horizontal axis
- Please take a look at the math refresher

Graphical Representation

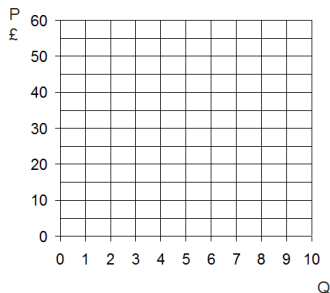
- Use the ordered bids to make the graph: first the supply curve



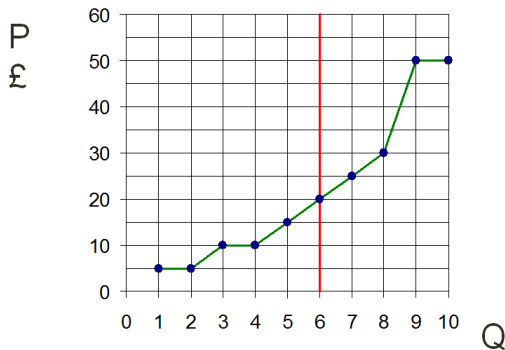
Graphical Representation

- Next the demand

| Rank | Seller Name | Sell Price | In? |
|------|-------------|------------|-----|
| 1 | S2 | 5 | X |
| 2 | S7 | 5 | X |
| 3 | S4 | 10 | X |
| 4 | S8 | 10 | X |
| 5 | S10 | 15 | X |
| 6 | S5 | 20 | X |
| 7 | S6 | 25 | |
| 8 | S1 | 30 | |
| 9 | S3 | 50 | |
| 10 | S9 | 50 | |



Electricity Auction in the UK



The Market

- This type of auction gives a nice introduction to traditional treatments of supply and demand
- Notice as demand increases, price increases to clear the electricity market
- **Market Clearing**- quantity supplied is equal to quantity demanded
- These terms will be used when we talk about equilibrium