Oligopoly Competition

- In the previous chapter we considered the the extremes of market structures.
- Here we will consider more empirically relevant structures,
- where there are a few firms but not a very large number.
- This structure will be referred to as an oligopoly.
- One feature that the two extremes we considered previously is that each firm did not have to worry about its rivals' reaction.
- In contrast a characteristic of oligopolies is the strategic interdependence between competitors.

Oligopoly Competition

- By that I mean an action by Firm 1 is likely to influence the other's profits and vice versa.
- Consequently it's decision process should take into account what it expects it's rival to do.
- In the Bertrand model, price will be the strategy that firms decide on.
- The demand received by each firm will depend on the price it sets.
- Moreover, demand will also depend on prices set by rival firms.
- Therefore it has to make some conjecture on what price its rival sets.

Bertrand Competition

- In the Bertrand model of duopolies, there are two firms which set their prices of a homogeneous product.
- It is assumed that firms simultaneously their prices.
- And to further simplify things we assume they have the same constant marginal cost, and demand is linear.
- Note that because the duopolists' products are perfect substitutes, whichever firm sets the lowest price gets all the demand.
- So if $p_i < p_j$, firm i then firm i's demand is given by $D(p_i)$ which is the market demand, whereas firm j's demand is 0.
- If both firms set the same price $p_i = p_j = p$ each firm receives half of the market demand, $\frac{1}{2}D(p)$.

Bertrand Competition

- What is the optimal price to set?
- Firm 1's optimal price depends on what it conjectures Firm 2 will choose.
- If Firm 1 expects Firm 2 to price above the monopoly price then Firm 1 will set the monopoly price since it is the optimal strategy
- It gets all the demand and receives monopoly profits, which is maximum possible.
- If on the other hand, Firm 1 expects Firm 2 to price below monopoly price but above MC, then the optimal strategy for Firm 1 is to set a price just below that of price 2.

Bertrand Competition

- Pricing just above would lead to 0 demand and 0 profits.
- Pricing below gives all the market demand but with lower profits the lower price is.
- If Firm 1 expects Firm 2 to price below MC, then Firm 1's optimal price is set higher than Firm 2, but greater or equal to its own MC.
- The preceding scenario defined Firm 1's best response with respect to Firm 2's choice.
- Firm 1's best response is a function that gives, for each price set by firm 2, firm 1's optimal price.
- We'll denote this by $p_1^*(p_2)$.
- Because Firm 2 had the same constant marginal cost as Firm 1, its best response function is identical.

bertrand Competition

- A Nash equilibrium is a pair of prices such that no firm can increase profits by unilaterally changing price.
- Graphically, this is represented by the intersection of the two best response functions.
- At the intersection, $p_1 = p_1^*(p_2)$, $p_2 = p_2^*(p_1)$.
- Therefore the only equilibrium is where $p = MC$.
- This suggests that two competitors are sufficient for perfect competition.

Bertrand Competition

- This is not realistic, since it implies that an increase in the number of firms does not reduce the equilibrium price.
- Also, there's never zero profits in industries with two firms.
- What are some of the assumptions (that we can relax) that led to this drastic result?
- Product Differentiation (chapter 12)
- Dynamic Competition (chapter 8)
- Capacity constraints.

Capacity Constraints

- To model capacity constraints, we'll keep the same assumptions, but assume each firm has a capacity constraint of k_i.
- Now it's no longer the case that if Firm 2 prices higher than firm 1 that its demand would be 0.
- We'll express this as $p_2 > p_1$, $D(p_1) > k_1$.
- Firm 2's demand will be $D(p_2) - k_1$.
- Assume $k_2 > k_1$ and note $k_1 + k_2$ is total capacity.
- Let $P(k_1 + k_2)$ be the price at which total demand equals total capacity.

Capacity Constraints

- Will now argue that both firms setting this price is an equilibrium.
- What is Firm 2 optimal price given Firm 1 chooses $P(k_1 + k_2)$?
- If Firm 2 undercuts, it will receive all market demand.
- But this won't help, it gets lower profits, because output is the same but prices are lower.
- What if it sets prices higher than $P(k_1 + k_2)$?

Capacity Constraints

- It might want to because it can get positive demand because of the capacity constraint.
- But that's not the case.
- That's because marginal revenue is greater than marginal cost for every value of out put less than k_2.
- So setting a higher price than $P(k_1 + k_2)$ would lead to a lower output than $q_2 = k_2$, and the revenue lost exceeds the cost saving.

Capacity Constraints

- A similar argument can be made for Firm 1.
- Note that the arguments used were based on relatively small capacity levels.
- So we can conclude that if industry capacity is low relative to market demand equilibrium prices will be greater than marginal cost, overturning the previous result.