In the previous chapter we considered 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.
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.
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.
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.
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.
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.
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 output 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.
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.