What we just concluded was that total profits were lower in oligopolies than monopolies.

This decrease stemmed from an externality.

That is, a firm maximized its own profit not taking into account the profits of its competitor.

So firms will attempt to establish agreements to increase their collective market power.

As we’ll see such agreements can result in all firms being better off.

This type of behavior will be referred to as collusion.
Collusion

- Cartel agreements are an institutional form of collusion.
- A leading example is OPEC but there are many others.
- More frequently collusion results from secret agreements, mostly because it is illegal.
- We will model such agreements with the objective of reducing supply and or increasing prices.
- Though generally, collusion can also refer to advertising expenditures, setting quality standards etc.
To start we will consider a simple duopoly with homogeneous products and constant marginal costs.

If firms set prices we know this would correspond to the Bertrand model.

We also know that in equilibrium firms would set price to marginal cost.

But if prices are allowed to change over time we would want to model this somehow.

Suppose time is $t = 1, 2, \ldots$, and in each period firms simultaneously set prices.

Firms will play a Bertrand game in each of an infinite series of periods.

We’ll refer to this as a repeated game.
So we’ll be interested in solving for the equilibrium of such games.

One possible equilibrium is for firms to play Bertrand in each period regardless of the history.

Specifically, if Firm 1 conjectures Firm 2 will set price to marginal cost in each time period, then Firm 1’s optimal response is to do the same.

But in this setting there will be other equilibria as well.

For example, consider the following “carrot and stick” strategy:
Collusion

- In the first period, both firms set monopoly prices and share monopoly profits, each denoted by \( \frac{1}{2} \pi_M \).
- In the following periods each firm observes the history of prices.
- If historical prices have always been monopoly, then each firm stays the course.
- Otherwise, “send a message”, by setting prices equal to marginal costs in all subsequent periods.
- To show that this indeed is an equilibrium, as before we will show that neither firm has the incentive to unilaterally deviate.
- In the context of repeated games we will have to compute expected discounted payoffs.
Collusion

- which is
  \[ \frac{1}{2} \pi^M + \delta \frac{1}{2} \pi^M + \delta^2 \frac{1}{2} \pi^M + ... \]

- where \( \delta \) is a discount factor, since future values are less than present values.

- The above expression is an infinite sum, which simplifies to
  \[ V = \frac{1}{2} \pi^M \frac{1}{1 - \delta} \]

- Let’s compare that to what happens if Firm 1 deviates, by say, undercutting Firm 2 by an arbitrarily small amount in a period.

- It will receive all the monopoly profits in that period but zero profits afterwards.
So be deviating Firm 1’s profits are:

\[ V = \pi^M \]

So for the proposed strategies to form an equilibrium it has to be the case that

\[ \frac{1}{2} \pi^M \frac{1}{1 - \delta} \geq \pi^M \]

which is equivalent to

\[ \delta > \frac{1}{2} \]

So the question then becomes what determines \( \delta \)?

It is directly related to the interest rate, or the rate of return on some low risk asset.

If the interest rate is \( r \), $1 today is worth $(1+r) in the next period, so

\[ \delta = \frac{1}{1 + r} \]