



Cartels and Collusive Behaviour

by

Kevin Hinde

Aims

- ❖ In this session we will explore the incentive to collude between firms. We will examine the prisoner's dilemma game (again) but extend the analysis to consider dynamic implications.



Learning Outcomes

- ❖ By the end of this session you will be able to
- ❖ explain ‘Tit for Tat’ and alternative game theoretic strategies that lead to collusion.
- ❖ describe industry factors that facilitate collusion.
- ❖ Note that collusion can occur where there are vertical agreements as well as among those in the same sector (horizontal agreements).



What is meant by collusion?

- ❖ Was Adam Smith right?
 - “People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in conspiracy against the public, or in some contrivance to raise prices.”
- ❖ Today we see
- ❖ Cartels.
- ❖ Tacit Collusion
- ❖ Both materialise themselves in horizontal and vertical agreements.
- ❖ How can we explain such behaviour?



The Prisoner's Dilemma Game



RED

C

D

C

(3, 3)

(1, 4)

YELLOW

D

(4, 1)

(2, 2)



The Prisoner's Dilemma

| | | Prisoner 2 | |
|------------|---------------|---------------|---------------|
| | | Confession | No Confession |
| Prisoner 1 | Confession | $(-5, -5)$ | $(-0.5, -10)$ |
| | No Confession | $(-10, -0.5)$ | $(-1, -1)$ |



Bertrand Duopoly Game

| | | Firm 2 | |
|--------|------------|------------|------------|
| | | High Price | Low Price |
| Firm 1 | High Price | (100, 100) | (-10, 140) |
| | Low Price | (140, -10) | (0, 0) |



Resolving the Prisoner's Dilemma Game



Tit for Tat Strategies

- ❖ Discovered in Robert Axelrod's tournament to be the most successful strategy.
- ❖ It entails
 - cooperation in the first round.
 - Every subsequent round adopt your opponents strategy (e.g. in round t adopt $t-1$)
- ❖ In the tournament each program competed
 - head to head against another
 - against another, but selected randomly by a computer
 - against itself.



Playing the Game

| | Firm 1 Tit for Tat | Firm 2 Dominant Strategy |
|------------------|--------------------------|--------------------------------|
| Round 1 | C -10 | D 140 |
| Round 2 | D 0 | D 0 |
| ↓ | ↓ | ↓ |
| Round 9 | D 0 | D 0 |
| Round 10 | D 0 | D 0 |
| Total Profits | - 10 | 140 |



Playing the Game (2)

| | Firm 1 Tit for Tat | Firm 3 Tit for Tat |
|---------------|-----------------------|-----------------------|
| Round 1 | C 100 | C 100 |
| Round 2 | C 100 | C 100 |
| ↓ | ↓ | ↓ |
| Round 9 | C 100 | C 100 |
| Round 10 | C 100 | C 100 |
| Total Profits | 1000 | 1000 |



Playing the Game (3)

| | Firm 2 Dominant Strategy | Firm 3 Dominant Strategy |
|---------------|--------------------------------|--------------------------------|
| Round 1 | D 0 | D 0 |
| Round 2 | D 0 | D 0 |
| ↓ | ↓ | ↓ |
| Round 9 | D 0 | D 0 |
| Round 10 | D 0 | D 0 |
| Total Profits | 0 | 0 |



Problems for Tit for Tat

- ❖ Generally tit for tat works because it is
- ❖ nice
 - it starts out co-operatively and is not the first to defect.
- ❖ Provocable
 - it will punish defection quickly
- ❖ forgiving
 - it will act co-operatively again if the other player co-operated in $t-1$
- ❖ However it is suboptimal in
 - head to head contests with a dominant strategy player.
 - Situations where information is uncertain an incomplete



Tit for Tat and random effects

| | Firm 1 Tit for Tat | | Firm 2 Tit for Tat | |
|---------------|-----------------------|------|-----------------------|------|
| Round 1 | C | 100 | C | 100 |
| Round 2 | C | 100 | C | 100 |
| Round 3 | Nature D | 140 | C | - 10 |
| Round 4 | C | - 10 | D | 140 |
| Round 5 | D | 140 | C | - 10 |
| Round 6 | C | - 10 | D | 140 |
| Round 7 | D | 0 | Nature D | 0 |
| Round 8 | D | 0 | D | 0 |
| Round 9 | D | 0 | D | 0 |
| Round 10 | D | 0 | D | 0 |
| | | | | |
| Total Profits | | 460 | | 460 |



Tit for 2 Tats and random effects

| | Firm 1 Tit for 2 Tats | Firm 2 Tit for 2 Tats |
|---------------|--------------------------|--------------------------|
| Round 1 | C 100 | C 100 |
| Round 2 | C 100 | C 100 |
| Round 3 | Nature D 140 | C - 10 |
| Round 4 | C 100 | C 100 |
| Round 5 | C 100 | C 100 |
| Round 6 | C 100 | C 100 |
| Round 7 | C - 10 | Nature D 140 |
| Round 8 | C 100 | C 100 |
| Round 9 | C 100 | C 100 |
| Round 10 | C 100 | C 100 |
| | | |
| Total Profits | 930 | 930 |



Tolerating Cheating: An example

- ❖ OPEC Problems
- ❖ small countries have an incentive to cheat as long as Saudi Arabia maintains the cartel's Price. Indeed, Saudi will not play TFT or even TF2T.
- ❖ Non-OPEC countries should accept the OPEC price as a parametric price (fixed by economic conditions). This means there are limits to the control over prices that OPEC has.
 - Iran problem
 - Present Problem



Tolerating Cheating in a Prisoner's Dilemma Game

| | | Kuwait Production | |
|--------------------------------|---------------------|---------------------|--------------------|
| | | 1 m barrels per day | 2m barrels per day |
| Saudi Arabia Oil Production | 4 m barrels per day | (64,16) | (48,24) |
| | 5 m barrels per day | (60,12) | (40, 16) |

Source: Dixit and Nalebuff (1991)



What factors facilitate (and thus limit the extent of) collusion?

- ❖ Clearly, it is possible to resolve the Prisoner's Dilemma Game, although there are immense forces operating against it.
- ❖ Are there any clues as to when collusion may or may not occur?
- ❖ Concentration and a small number of industry participants.
- ❖ Costs
- ❖ Demand
- ❖ Rapid advances in Technology
- ❖ Non-price competition



Horizontal Agreements

- ❖ Most collusive activity takes place between firms in the same sector.
- ❖ Recent UK example: buses, car body parts.
- ❖ But not all horizontal agreements are bad. Strategic Alliances to share R and D, for example, if registered, can be exempted from competition law.
- ❖ Both UK and EC law allows for this.



Collusion and Vertical Agreements

- ❖ Vertical restraints refer to the methods used by manufacturers to restrict the ways in which retailers can market their product.
- ❖ Examples include Franchising and Distribution channels.
- ❖ These usually provide for Resale Price Maintenance Agreements.
- ❖ There are benefits but also some costs.
- ❖ Notably minimum RPM and collusive activity.
- ❖ Two examples in the UK recently: Volvo and Football Kit Manufacturers.



And Finally

- ❖ Summary
- ❖ Have you covered the learning outcomes?
- ❖ Any questions?

