

| |
|-----------------|
| CLASS #3 |
|-----------------|

What is Game Theory?

In debriefing *Oil Pricing*, we will use terms borrowed from Game Theory. **Game theory is the study of how people behave in strategic situations.** These are situations in which each person, when deciding what action(s) to take, must first consider how others might respond to that action.

Decision-making is a constant activity of managers and business. Strategic decisions have to be made every day. Making the wrong decision can have a negative effect not only on the manager's career, but also on the company's survival. Even the most successful executives make mistakes from time to time. This is in many cases due to the way in which executives process information coming from the outside world.

Managers and business students study psychology and negotiation to avoid mind traps. Particular techniques can be used to facilitate the decision-making process (brainstorming, simulations, etc).

| |
|---|
| <p><u>Oil Pricing</u> is a so-called "social trap" exercise, in which long-term maximization requires mutual trust where significant short-term gains are possible by breaking that trust. In most rounds, communication must be implicit, and is hence highly ambiguous and subject to misinterpretation, usually by the projection of negative and adversarial intentions that don't actually exist. At certain points, the parties are given the opportunity to communicate explicitly, and may choose to reach pricing agreements or not (and subsequently, to honor those agreements or not).</p> |
|---|

| |
|--|
| <p>The exercise highlights the frequency with which we make imprecise and inadequately supported assumptions, suggesting the importance of making and keeping assumptions explicit and testing them periodically.</p> |
|--|

| |
|---|
| <p>The danger of self-fulfilling assumptions is also illustrated. Parties can turn cautious competitors into the cut-throat adversaries they fear by proceeding with pre-emptive ruthlessness.</p> |
|---|

| |
|---|
| <p>The difference between reacting to the other side's moves (or one's perception of what those moves mean or will be), and acting purposefully to influence the other side to (re)act constructively, is easily illustrated by comparing the experience of different teams. The monetary variation tends to be dramatic between cooperative and competitive games, and analysis usually suggests that to establish the former, some teams have to take a risk. Players face the tension between seeking high short-term gains and low short-term risk inherent in a competitive strategy, and lower but more stable long-term gains inherent in a cooperative strategy.</p> |
|---|

In Oil Pricing, both teams chose to follow a conservative strategy of avoiding the worse possible outcome. Pricing \$10 per barrel became the *dominant strategy* for both teams. In so doing, they were not able to reach the best possible outcome (**the cooperative outcome**), that is, to maximize their gains jointly.

CYCLE OF TRUST

The ALBA and BATIA teams in Oil Pricing go:

- from **mutual mistrust** (anxiety about the opponent's next move)
- to **breach of trust** (feelings of betrayal)
- to a future of **competitive mistrust** (resignation; search for ways to regain lost trust, usually without success).

* It is characteristic that when teams are asked about their goal when bidding 20 or 10 or 30, they give different answers like, "to maximize long-term profit", "to win", "to beat the other team", "to avoid losing", "to protect our reputation", etc. In other words, team members have different ideas of what constitutes a good outcome.

Introducing the Prisoners' Dilemma (transparency #1)

The main lesson from the Dilemma is that the prisoners are driven to an inferior, mediocre outcome, because each of them is fearful of the other's decision and each one has a strong incentive to cheat. The Anti-terrorist law that is currently in force in Greece (Law 2928/2001) clearly establishes an incentive for prisoners to confess against their fellow prisoners in exchange for their release.

[Price fixing in duopolies or cartels is the most characteristic of anti-competitive conducts.](#) The United States (Sherman Act) and the European Union (article 85(1) of the Treaty of Rome) have recognized the immense importance of prohibiting price fixing between two competitors in a duopoly (oligopoly) and impose severe penalties in cases of anticompetitive behaviour. A notable US example is the much-publicized *Christie's-Sotheby's* case of price fixing which resulted in an 18 month prison sentence, huge fines, 537 mil. dollars in compensation and a dented reputation. In the EU the treatment is equally harsh: about 132 mil. Euros in fines were cast in just three years by the Commission on price fixing cartels in the cases of *Polypropylene* (OJ [1986]L 230/1), *Belgian Roofing Felt* (OJ [1986] L 232/15), *Italian Flat Glass* (OJ [1989] L 33/44), *PVC* (OJ [1989] L 74/1) and *LdPE* (OJ [1989] L 74/21).

[Collusion \(price-fixing\) and the Prisoners' Dilemma](#)

In game theory terms, **price fixing represents a Prisoners' Dilemma**. Here the two competitors in a duopoly agree to cooperate and fix the prices instead of engaging in a price cutting war. Here is the dilemma faced by each firm: stick to high prices, if it

were guaranteed that their competitor would do the same, or otherwise cut prices in search for a larger market share.

Once again, the “players” wish to achieve cooperation in order to secure higher prices and collective and individual profits, whereas the regulators wish to prohibit such agreement and encourage defection which would result in a price war to the ultimate benefit of the consumer.

Collusion is legally prohibited by antitrust laws. If the legal obstacles to collusion are strong, oligopolists will engage in non-cooperative oligopoly behavior: Imagine McDonald’s starts advertising heavily on TV. What will Wendy’s do? Non-cooperative oligopoly behavior occurs when mutually interdependent firms do **not** coordinate their actions, but instead engage in strategic decision-making. Price fixing has led to many and large fines to companies adopting it, not to mention imprisonment of leading company officers who encouraged it in the USA, despite the inherent difficulty in proving such agreements.

Solving/Overcoming the Dilemma

- **A pact not to confess** between the two prisoners before they got caught by the police. This agreement would make them both better off only if they both honor it, because they would only spend 1 year in jail. But would they live up to this agreement?
- Many methods of tacit collusion have been developed by companies wishing to engage in price fixing: a characteristic example is **the ‘most favoured customer clause’** which promises best prices to favoured customers. Although *prima facie* it looks like a clause promoting competition, it in fact makes price cutting less favourable to the firms and thus strengthens the power of the cartel [*Ethyl Corporation et al.*’ *FTC Docket 9128, FTC Decisions, pp. 425-686*].
- The same effect is achieved if we consider that the two prisoners are actually **members of the Mafia**. The Mafia has very strong penalties against members who talk and “rat” against each other. If you are worried about losing your life, or having family members hurt, you prefer a longer jail sentence. It’s actually quite safer for you in jail! This is why police on an international level (Interpol) are having such a tough time dealing effectively with organized crime.
- In a **repeated Prisoners’ Dilemma game** (as in tournaments that game theorists hold), the two players are able to reach the cooperative outcome. In the long run, the players always cooperate.
- **The law** can sometimes direct the parties in a particular PD game towards the more efficient outcome (as in the cigarette company example that we’ll see on the transparency today).

Oligopolies as a Prisoners' Dilemma Game

The game oligopolists play in trying to reach the monopoly outcome is very similar to the game that the two prisoners play.

OPEC → What is currently happening with OPEC, the Organization of Petroleum Exporting Countries (5 members in 1960 and 8 more members in 1973 → total of 13) [for more information on OPEC, please visit <http://en.wikipedia.org/wiki/OPEC>]

The five founding members created OPEC in 1960: Qatar, Indonesia, Socialist Peoples Libyan Arab Jamahiriya, United Arab Emirates, and Algeria. Shortly after, eight additional members joined. Membership in OPEC is open to any country whose major source of income comes from the export of petroleum. Current members of OPEC are Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela. These members currently supply forty percent of the world's oil and are currently producing about 1.5 million barrels a day above their output ceiling. [For more information on OPEC and its supply processes, click on <http://web.syr.edu/~trychel/>].

OPEC is one of the world's best known cartels (a group of firms acting in unison). Oil producing countries make up an oligopoly. The role of OPEC is to set policies that ensure the fair trade of petroleum. OPEC primarily uses price and production controls to do this. Their decisions about how much oil to pump are strategic decisions. What is their goal? To maintain a high price of oil. To do that, they must keep oil production low. But each member of the cartel is tempted to increase production in order to get a larger share of the total profit. OPEC members often agree to reduce production but then cheat on their agreements.

Remember: A monopoly is not a price-taker like a competitive firm. In other words, it cannot sell all it wants at the market price. **If a monopoly increases production by 1 unit, it must reduce the price it charges for every unit it sells.**

OPEC has been most successful at maintaining cooperation and high prices in the period from 1973 to the early 1980s. The price of crude oil rose from \$2.64 a barrel in 1972 to about \$35 a barrel in 1981. But then member countries began arguing about production levels, and as a result, the price of crude oil had fallen back to \$12.52 a barrel in 1986. During the 1990s, each member country made production decisions largely independent from other members, and the world market for oil became fairly competitive.

TRANSPARENCY ON CRUDE OIL PRODUCTION

Let's consider an oligopoly with two members, Iran and Iraq. After prolonged negotiation, **the countries agree to keep oil production low in order to keep the world price of oil high**. After they agree on the production levels, each country must decide whether to cooperate and live up to this agreement or to ignore it and produce at a higher level. The profits of each country depend on the strategies they choose.

Iraq is better off with high production regardless of what Iran chooses to do. So producing at a high level, and cheating on the agreement is a dominant strategy for Iraq. But of course Iran reasons in exactly the same way. So both countries produce at a high level. The result is an inferior, mediocre outcome for each country, with lower profits than if each of them had lived up to the agreement. So although the monopoly outcome is jointly rational for the oligopoly, each oligopolist has the incentive to cheat.

TRANSPARENCY ON THE ARMS RACE

Throughout the era of the Cold War, the US and the Soviet Union attempted to solve this problem through negotiation and agreements over arms control. But self-interest is too powerful a force that has its own relentless logic and drives the players to a non-cooperative outcome that is worse for each party.

TRANSPARENCY ON ADVERTISING

Two firms advertising to attract the same customers. Let's take two cigarette companies. If neither advertises, the two companies split the market. If both advertise, they again split the market, but profits are lower, since each company must bear the cost of advertising. But if one company advertises while the other does not, the one that advertises attracts customers from the other. **Advertising becomes a dominant strategy for each firm. They both choose to advertise.**

In 1971, U.S. Congress passed a law banning cigarette advertisements on television. To the surprise of many, cigarette companies did not apply political pressure to oppose the law. When the law went into effect, cigarette advertising fell, and the profits of cigarette companies rose. The law did for the companies what they could not do on their own: **it solved the prisoners' dilemma by enforcing the cooperative outcome --with low advertising and high profit.**

