



## Applying Prisoner's Dilemma to Oligopoly Markets

The Prisoner's Dilemma, a classic concept in game theory, provides valuable insights into the dynamics of oligopoly markets, particularly in the case of duopolies. In an oligopoly, a small number of firms dominate the market, and their decisions significantly impact one another. This interdependence creates a scenario similar to the Prisoner's Dilemma, where firms must choose between cooperation and competition.

In a duopoly, where only two firms control the market, the Prisoner's Dilemma becomes even more pronounced. These firms often face the temptation to engage in collusive agreements or form cartels to maximize their collective profits. A collusive agreement is an arrangement between competing firms to control prices, limit production, or divide markets. Cartels are formal organizations of producers or suppliers that agree to fix prices, limit supply, or engage in other anti-competitive practices.

To illustrate how the Prisoner's Dilemma applies to oligopolies, let's consider the example from the video. Imagine two firms in a duopoly market that have formed a collusive agreement to maintain high prices and limit production. Each firm now faces a crucial decision: to comply with the agreement or to cheat by lowering prices or increasing output.

The payoff matrix for this scenario might look like this:

- If both firms comply with the agreement, they each earn high profits (let's say \$10 million each).
- If one firm cheats while the other complies, the cheating firm earns very high profits (\$15 million) while the complying firm suffers losses (\$5 million).
- If both firms cheat, they each earn moderate profits (\$8 million each).

This payoff structure creates a dilemma for both firms. While collective compliance would yield the highest total profits, each firm has an individual incentive to cheat. If a firm believes its competitor will comply, it can increase its profits by cheating. Conversely, if a firm suspects its competitor might cheat, it's better off cheating as well to avoid significant losses.

The Prisoner's Dilemma in oligopoly markets often leads to a breakdown of collusive agreements. Even though both firms would benefit from cooperation, the fear of being exploited and the temptation to gain an advantage often result in both firms choosing to compete. This outcome, where both firms cheat on the agreement, is known as the Nash equilibrium a state where neither firm can unilaterally improve its position.

However, unlike the classic Prisoner's Dilemma, which is typically a one-time game, oligopoly markets involve repeated interactions. This repetition can sometimes lead to more stable collusive agreements. Firms may develop strategies like tit-for-tat, where they start by cooperating and then mirror their competitor's previous move. Over time, this can foster a more cooperative environment, although it remains inherently unstable.

The application of the Prisoner's Dilemma to oligopoly markets highlights several key aspects of these market structures:



1. Interdependence: Firms in oligopolies must constantly consider their competitors' actions when making decisions.
2. Tension between cooperation and competition: While cooperation can lead to higher profits, the temptation to compete is always present.
3. Instability of collusive agreements: The individual incentive to cheat often undermines attempts at cooperation.
4. Potential for price wars: If trust breaks down, firms may engage in aggressive price cutting, leading to lower profits for all.

Understanding these dynamics is crucial for both firms operating in oligopoly markets and regulators tasked with maintaining fair competition. For firms, it underscores the importance of strategic decision-making and the potential consequences of their actions. For regulators, it highlights the need for vigilance against anti-competitive practices while recognizing the complex motivations that drive firm behavior in these markets.

In conclusion, the Prisoner's Dilemma provides a powerful framework for analyzing oligopoly markets, especially duopolies. It illuminates the challenges of maintaining collusive agreements and the constant tension

### **Oligopoly Games & Strategies: Prisoner's Dilemma**

- Rules
- Strategies
- Payoffs
- Outcome
- We will see these in Prisoner's Dilemma

### **Step 1: Introduction to Oligopoly and Game Theory**

Welcome to this section where we delve into the fascinating world of oligopoly and game theory. Oligopoly is a market structure characterized by a small number of firms whose decisions are interdependent. This interdependence often leads firms to engage in strategic behavior, akin to playing games. These games are not for entertainment but are strategic interactions aimed at achieving economic profit. Understanding how these games are played and the types of games involved is crucial for comprehending the dynamics of oligopolistic markets.

### **Step 2: Definition of a Game**

Before diving into specific games like the Prisoner's Dilemma, it is essential to understand the basic components that define a game. A game in economic terms has four common features:

- **Rules:** These are the laws or guidelines that all players must follow. In the context of oligopoly, rules could include market regulations, legal constraints, and the basic principles governing the interactions between firms.



- **Strategies:** These are the possible actions that a player can take. In an oligopoly, strategies could involve pricing decisions, product launches, marketing campaigns, and other competitive actions.
- **Payoffs:** This refers to the gains or losses resulting from a player's actions. Payoffs are crucial as they determine the incentives for each player. In an oligopoly, payoffs could be measured in terms of profits, market share, or other economic benefits.
- **Outcome:** The outcome is the result of the actions taken by all players. It is the collective result of the strategies employed by each firm in the market. The outcome could be a stable market equilibrium, a price war, or any other market condition resulting from the strategic interactions.

### Step 3: Applying the Game Definition to Prisoner's Dilemma

Now that we have a clear understanding of what constitutes a game, we can apply these concepts to the Prisoner's Dilemma, a classic example in game theory. The Prisoner's Dilemma illustrates the challenges of cooperation and competition in an oligopoly. Here's how the four features of a game apply to the Prisoner's Dilemma:

- **Rules:** In the Prisoner's Dilemma, the rules are simple. Two players (or firms) must decide independently whether to cooperate or defect. The decision must be made without knowing the other player's choice.
- **Strategies:** Each player has two strategies: to cooperate (remain silent) or to defect (betray the other). In an oligopoly, this could translate to strategies like maintaining current prices (cooperate) or cutting prices to gain market share (defect).
- **Payoffs:** The payoffs in the Prisoner's Dilemma are structured such that mutual cooperation leads to moderate benefits for both, mutual defection leads to moderate losses, and one-sided defection leads to a significant gain for the defector and a significant loss for the cooperator. In an oligopoly, this could mean stable profits for mutual cooperation, reduced profits for mutual defection, and a competitive advantage for the defector if the other firm cooperates.
- **Outcome:** The outcome of the Prisoner's Dilemma depends on the choices made by both players. If both cooperate, they achieve a collectively better outcome. If both defect, they end up worse off. If one defects while the other cooperates, the defector gains significantly at the expense of the cooperator. In an oligopoly, this dynamic can lead to various market outcomes, including stable collusion, price wars, or competitive imbalances.

### Step 4: Conclusion and Implications for Oligopoly

Understanding the Prisoner's Dilemma and its application to oligopoly provides valuable insights into the strategic behavior of firms. It highlights the tension between cooperation and competition and the potential for suboptimal outcomes when firms act in their self-interest. By analyzing these dynamics, firms can better navigate the complexities of oligopolistic markets and make more informed strategic decisions.



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