Learning Objectives

1. List the three basic elements of a game. Recognize and discuss the effects of dominant strategies and dominated strategies
2. Identify and explain the prisoner's dilemma and how it applies to real-world situations
3. Explain games in which the timing of players' choices matter
4. Discuss strategies that enable players to reap gains through cooperation
Strategies and Payoffs

- Actions have payoffs that depend on:
  - The actions
  - When they are taken
  - The actions of others
- Some markets are characterized by interdependence
  - Apply to monopolistic competition and oligopoly

Game Theory

- **Basic elements of a game:**
  - The players
  - Their available strategies, actions, or decisions
  - The payoff to each player for each possible action
- A **dominant strategy** is one that yields a higher payoff no matter what the other player does
  - A **dominated strategy** is any other strategy available to a player who has a dominant strategy
American and United – Scenario 1

- Players: United and American Airlines supplying service between Chicago and St. Louis
  - No other carriers
- Strategies: Increase advertising by $1,000 or not
- Assumption: all payoffs are known to all parties
- A payoff matrix is a table that describes the payoffs in a game for each possible combination of strategies

Payoff Matrix

<table>
<thead>
<tr>
<th></th>
<th>American Airlines Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Raise Spending</td>
</tr>
<tr>
<td>United Airlines Options</td>
<td></td>
</tr>
<tr>
<td>Raise Spending</td>
<td>United: $5,500</td>
</tr>
<tr>
<td></td>
<td>American: $5,500</td>
</tr>
<tr>
<td>No Raise</td>
<td>United: $2,000</td>
</tr>
<tr>
<td></td>
<td>American: $8,000</td>
</tr>
</tbody>
</table>

- Payoff is symmetric
- Dominant strategy is raise advertising spending
  - Both companies are worse off
Equilibrium in a Game

- A Nash equilibrium is any combination of strategies in which each player’s strategy is her or his best choice, given the other player’s strategies
  - Equilibrium occurs when each player follows his dominant strategy, if it exists
  - Equilibrium does not require a dominant strategy

American and United – Scenario 2

- Same situation
  - Different payoffs; non-symmetric
  - American raises spending
    - United anticipates American action; does not raise
The advertising example illustrates an important class of games called the prisoner's dilemma. The prisoner's dilemma is a game in which each player has a dominant strategy, and when each plays it, the resulting payoffs are smaller than if each had played a dominated strategy. Consider another example.

Prisoner's Dilemma

- Two prisoners are held in separate cells for a serious crime they did commit.
- The prosecutor lacks sufficient evidence.

<table>
<thead>
<tr>
<th>Horace's Options</th>
<th>Jasper's Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Confess</td>
</tr>
<tr>
<td>Confess</td>
<td>Horace: 5 years</td>
</tr>
<tr>
<td></td>
<td>Jasper: 20 years</td>
</tr>
<tr>
<td>Don't Confess</td>
<td>Horace: 20 years</td>
</tr>
<tr>
<td></td>
<td>Jasper: 0 years</td>
</tr>
</tbody>
</table>
Cartels

- A **cartel** is a coalition of firms that agree to restrict output to increase economic profit
  - Restrict total output
    - Allocate quotas to each player

Cartel in Action

- Two suppliers of bottled water agree to split the market equally
  - Price is set at monopoly level
    - If one party charges less, he gets all of the market
  - Marginal cost is zero
  - Agreement is not legally enforceable
Bottled Water Cartel

- Each party has an incentive to lower the price a little to increase its economic profits
- Successive reductions result in price equal to marginal cost

<table>
<thead>
<tr>
<th>Bottles/day</th>
<th>Price ($/bottles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>2.00</td>
</tr>
<tr>
<td>1,100</td>
<td>1.00</td>
</tr>
<tr>
<td>1,100</td>
<td>0.90</td>
</tr>
<tr>
<td>2,000</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Mountain Spring’s Options

- Aquapure’s Options
  - Charge $1: Aquapure: $500, Mtn Spring: $500
  - Charge $0.90: Aquapure: $990, Mtn Spring: $0

- Charge $0.90: Aquapure: $495, Mtn Spring: $495

- If one firm lowers price, they capture the entire market
- Dominant strategy for each firm is lower price to $0.90
- Cartel agreements are unstable
Repeated Prisoner's Dilemma

- In a repeated prisoner's dilemma the same players repeatedly face the same prisoner’s dilemma
- Both players benefit from collaboration
  - Tit-for-tat strategy limits defections
- A tit-for-tat strategy says my move in this round is whatever your move was in the last round
  - If you defect, I defect
- Tit-for-tat is rarely observed in the market
  - This strategy breaks down with more than two players or potential players

Ban on TV Ads for Cigarettes

- Congressional ban started 1/1/71
  - Advertising spending decreased by $60 million
- Advertising promoted brand switching
  - Legislation moved players to optimal outcome

<table>
<thead>
<tr>
<th></th>
<th>Philip Morris's Options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TV Ads</td>
</tr>
<tr>
<td>TV ads</td>
<td>RJR: $10 M</td>
</tr>
<tr>
<td></td>
<td>Philip Morris: $10 M</td>
</tr>
<tr>
<td>No TV ads</td>
<td>RJR: $5 M</td>
</tr>
<tr>
<td></td>
<td>Philip Morris: $35 M</td>
</tr>
</tbody>
</table>
Shouting at Parties

• Party begins with everyone speaking at normal volume
  – More partiers arrive
• Individual incentive to shout
  – Shouting is the dominant strategy

Sometimes Timing Matters

• One party moves first
  – The second can adjust his strategy accordingly
• Viper and Corvette hybrid models
  – When timing does not matter, the payoff matrix shows no dominant strategy
• When timing matters a decision tree is a more useful way of representing payoffs
  – A decision tree describes the possible moves in a game in sequence
  – A decision tree is sometimes called a game tree
Simultaneous Decisions

<table>
<thead>
<tr>
<th>Chevy Corvette's Options</th>
<th>Hybrid</th>
<th>No Hybrid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid</td>
<td>Chevy: $60M</td>
<td>Chevy: $80M</td>
</tr>
<tr>
<td></td>
<td>Dodge: $60M</td>
<td>Dodge: $70M</td>
</tr>
<tr>
<td>No hybrid</td>
<td>Chevy: $70M</td>
<td>Chevy: $50M</td>
</tr>
<tr>
<td></td>
<td>Dodge: $80M</td>
<td>Dodge: $50M</td>
</tr>
</tbody>
</table>

- Profits are higher when each company offers a different type of car

Suppose Dodge Moves First

\[\begin{array}{c}
A \quad \text{Dodge decides} \\
B \quad \text{Offer hybrid} \\
C \quad \text{Don't offer hybrid} \\
D \quad \text{Chevrolet decides} \\
E \quad \text{Offer hybrid} \\
F \quad \text{Don't offer hybrid} \\
G \quad \text{Final Outcome} \\
\end{array}\]

- $60 million for Chevy
- $60 million for Dodge
- $70 million for Chevy
- $80 million for Dodge
- $50 million for Chevy
- $50 million for Dodge
Threats and Promises

• A **credible threat** is a threat to take an action that is in the threatener's best interest to carry out
  – *Analyze This* and Tony Bennett's compensation
• A **credible promise** is a promise to take an action that is in the promiser's best interest to carry out

The Remote Office

• Players: Business owner and remote office manager
• Options:
  – Business owner can open the office or not
  – Manager can be honest or not
Remote Office Pay-Off

Managerial candidate promises honesty

A

B

Open remote office

C

No remote office

Honest manager
Owner: $1,000
Manager: $1,000

Dishonest Manager
Owner: -$500
Manager: $1,500

Owner: $0
Manager: $500 working elsewhere

Monopolistic Competition and Location

• First mover advantage
  – With Viper and Corvette, firms did better if products were different
  – Tic-tac-toe

• If the differentiator is time or location, the last mover may have the advantage
  – Suppose that customers go to the nearest convenience store
    • Store A locates 1 mile from Freeway
    • Where will Store B locate?
Store B's Location

- A chooses its location
- New business plans to enter the market
  - Location C minimizes customer's travel distance
  - Location B maximizes customers

Other Examples

- There are a number of cases where the last mover gains an advantage
  - Times for flights
  - Movie schedules
  - Cola drink flavors
Commitment

- A commitment problem arises from an inability to make credible threats or promises
  - A commitment device changes incentives to make threats or promises credible
    - Underworld code, Omerta
    - Military-arms-control agreements
    - Tips for waiters
- Various business problems are commitment issues

Restaurant Service

- Restaurant wants to provide superior service
  - Increases pay of wait-staff; monitoring problem
    - If wait-staff are not diligent, restaurant wasted money
  - Restaurant cannot insure good service by paying higher wages
- Repeat customers can ensure good service by tipping
  - A one-time, self-interested diner will not tip
    - Tip is marginal cost
    - Service is completed so marginal benefits are zero
To Tip or Not To Tip?

- **Waiter:**
  - Provide good service:
    - Tip: Waiter: $10, Diner: $5
  - Provide adequate service:
    - Don't Tip: Waiter: $20, Diner: $30

- **Diner:**
  - Tip: Waiter: $0, Diner: $20
  - Don't Tip: Waiter: $-5, Diner: $30

The Strategic Role of Preferences

- Game theory assumes that the goal of the players is to maximize their outcome
  - In most games, players do not attain the best outcomes
- Altering psychological incentives may also improve the outcome of a game
Honest Manager for Remote Office

An honest manager earns more than a dishonest manager

A ——— B
Managerial candidate promises honesty

Open remote office

C

Honest Manager
Owner: $1,000
Manager: $1,000

Dishonest Manager
Owner: $500
Manager: $8,500

No remote office

Owner: $0
Manager: works elsewhere for $500

Self-Interest Evaluated

- There are exceptions to outcomes based on self-interest
  - Tips at out-of-town restaurants
  - Revenge
  - Passing on "unfair" opportunities
The Role of Preferences

- Preferences are given
  - Affect choices through
    - Sympathy for an adversary
    - Generosity
    - Honesty
- If preferences can be known to the other party, the commitment problem is reduced
  - Trustworthy employee

Character Judgments

- If character were known perfectly, businesses could avoid the costs of dishonesty, shirking, etc.
  - Since people are victimized, make hiring mistakes, and so on, either
    - Character cannot be judged perfectly OR
    - Character information is expensive.
Caveat Emptor

- The payoff of deceit
  - Advantage to seeming honest while being dishonest
    - Greater opportunities
    - Greater exploitation of opportunities

Games and Strategic Behavior

- Prisoner's Dilemma
- Sequential Decisions
- Commitment Problems
- Game Theory
  - Elements
  - Equilibrium
  - Dominant Strategy