Principles of Economics

ECON F211

Dr. Rahul Arora
Assistant Professor,
Department of Economics & Finance,
BITS Pilani, Pilani Campus
rahul.arora@Pilani.bits-Pilani.ac.in
Mob: +91 – 7607481292

Oligopoly: An Introduction

- A form of industry (market) structure characterized by a few dominant firms. Products may be homogenous or differentiated
- Oligopolists compete with one another not only in price but also in developing new products, marketing and advertising those products, and developing complements to use with the products

Market Structure in an Oligopoly

Five Forces Model

- A model developed by Michael Porter that helps us understand the five competitive forces that determine the level of competition and profitability in an industry

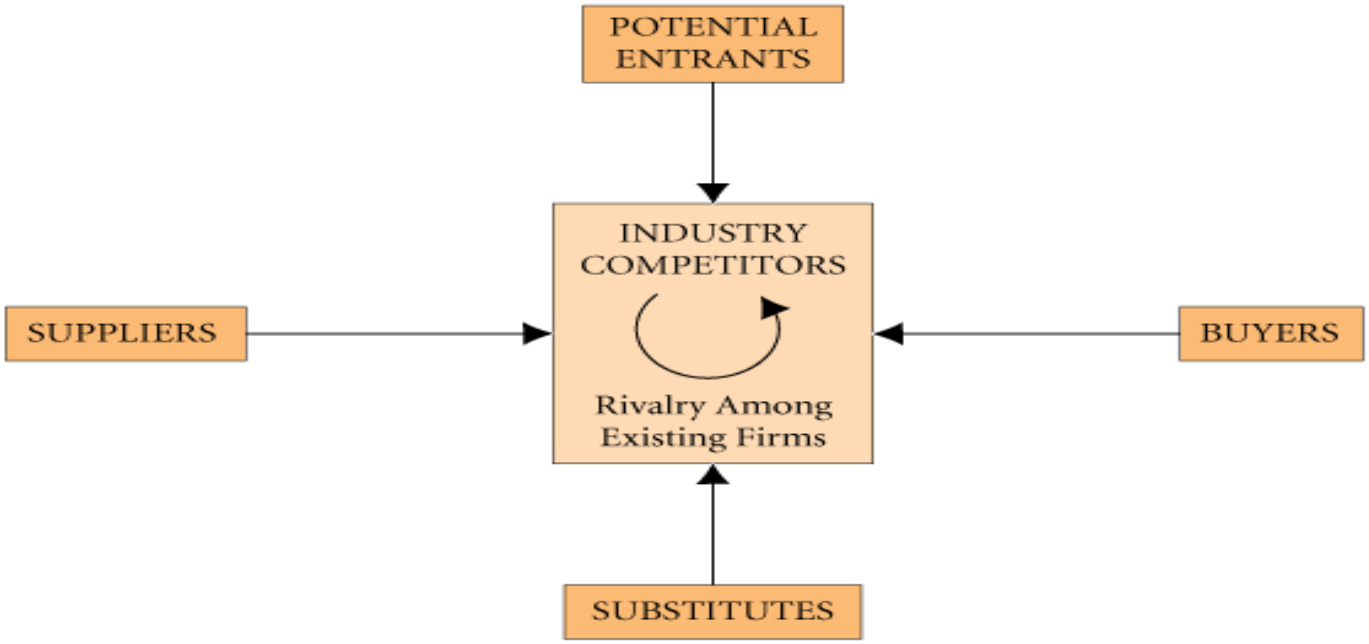


FIGURE 14.1
Forces Driving Industry Competition

Market Structure in an Oligopoly

TABLE 14.1 Percentage of Value of Shipments Accounted for by the Largest Firms in High-Concentration Industries, 2002

Industry Designation	Four Largest Firms	Eight Largest Firms	Number of Firms
Primary copper	99	100	10
Cigarettes	95	99	15
Household laundry equipment	93	100	13
Cellulosic man-made fiber	93	100	8
Breweries	90	94	344
Electric lamp bulbs	89	94	57
Household refrigerators and freezers	85	95	18
Small arms ammunition	83	89	109
Cereal breakfast foods	82	93	45
Motor vehicles	81	91	308

- Concentration ratio – The share of industry output in sales or employment accounted for by the top firms
- Contestable markets – Markets in which entry and exit are easy

Oligopoly Models

The Collusion Model

- **Cartel**

  A group of firms that gets together and makes joint price and output decisions to maximize joint profits

- Tacit Collusion

  Collusion occurs when price- and quantity-fixing agreements among producers are explicit. *Tacit collusion* occurs when such agreements are implicit

The Price-Leadership Model

- A form of oligopoly in which one dominant firm sets prices and all the smaller firms in the industry follow its pricing policy

The Cournot Model: Assumptions

- Two sellers in the industry
- Selling Homogeneous/identical Products
- The total market demand for the product (identical) is represented by: $P(q_1, q_2) = a - b(q_1 + q_2)$

Where q_1 is the output of first firm; q_2 is the output of the second firm and a & $b > 0$

- The instrument used to compete is the output (not price)
- Symmetric cost function given as follows:

$$\mathrm{TC}_1(q_1) = cq_1; c > 0$$

$$\mathrm{TC}_2(q_2) = cq_2; c > 0$$

- Each seller chooses its output independently, taking the output of the other seller (rival) as given

The Cournot Model: Profit Maximization

- For Firm 1: $\max_{q_1} \Pi_1 = Total\ Revenue_1 - Total\ Cost_1$

  $= P(q_1, q_2)q_1 - cq_1$

  $= [a - b(q_1 + q_2)]q_1 - cq_1$

- For Firm 2: $\max_{q_2} \Pi_2 = P(q_1, q_2)q_2 - cq_2$

  $= [a - b(q_1 + q_2)]q_2 - cq_2$

- For Profit Maximization:

First order condition: $\frac{\partial \Pi_1}{\partial q_1} = 0$ and $\frac{\partial \Pi_2}{\partial q_2} = 0$

The Cournot Model: Profit Maximisation

$$\frac{\partial \Pi_1}{\partial q_1} = a - 2bq_1 - bq_2 - c = 0 \qquad \dots(1) \quad MR_1 - MC_1 = 0$$

$$\frac{\partial \Pi_2}{\partial q_2} = a - bq_1 - 2bq_2 - c = 0 \qquad \dots(2) \quad MR_2 - MC_2 = 0$$

- Solving (1) for q_1:

$$a - c - bq_2 = 2bq_1$$

$$\boldsymbol{q_1 = \frac{a-c}{2b} - \frac{q_2}{2}}$$ [Best response/reaction function of firm 1]

- Solving (2) for q_2:

$$a - c - bq_1 = 2bq_2$$

$$\boldsymbol{q_2 = \frac{a-c}{2b} - \frac{q_1}{2}}$$ [Best response/reaction function of firm 2]

The Cournot Model: Profit Maximization

- For Firm 1: Substituting q_2 in q_1:

$$q_1 = \frac{a-c}{2b} - \frac{1}{2}\left(\frac{a-c}{2b} - \frac{q_1}{2}\right)$$

$$q_1 = \frac{a-c}{3b}$$

q_1 is the Cournot output of an individual firm

- Similarly for Firm 2:

$$q_2 = \frac{a-c}{2b} - \frac{1}{2}\left(\frac{a-c}{3b}\right)$$

$$q_2 = \frac{a-c}{3b}$$

The Cournot Model: Profit Maximization

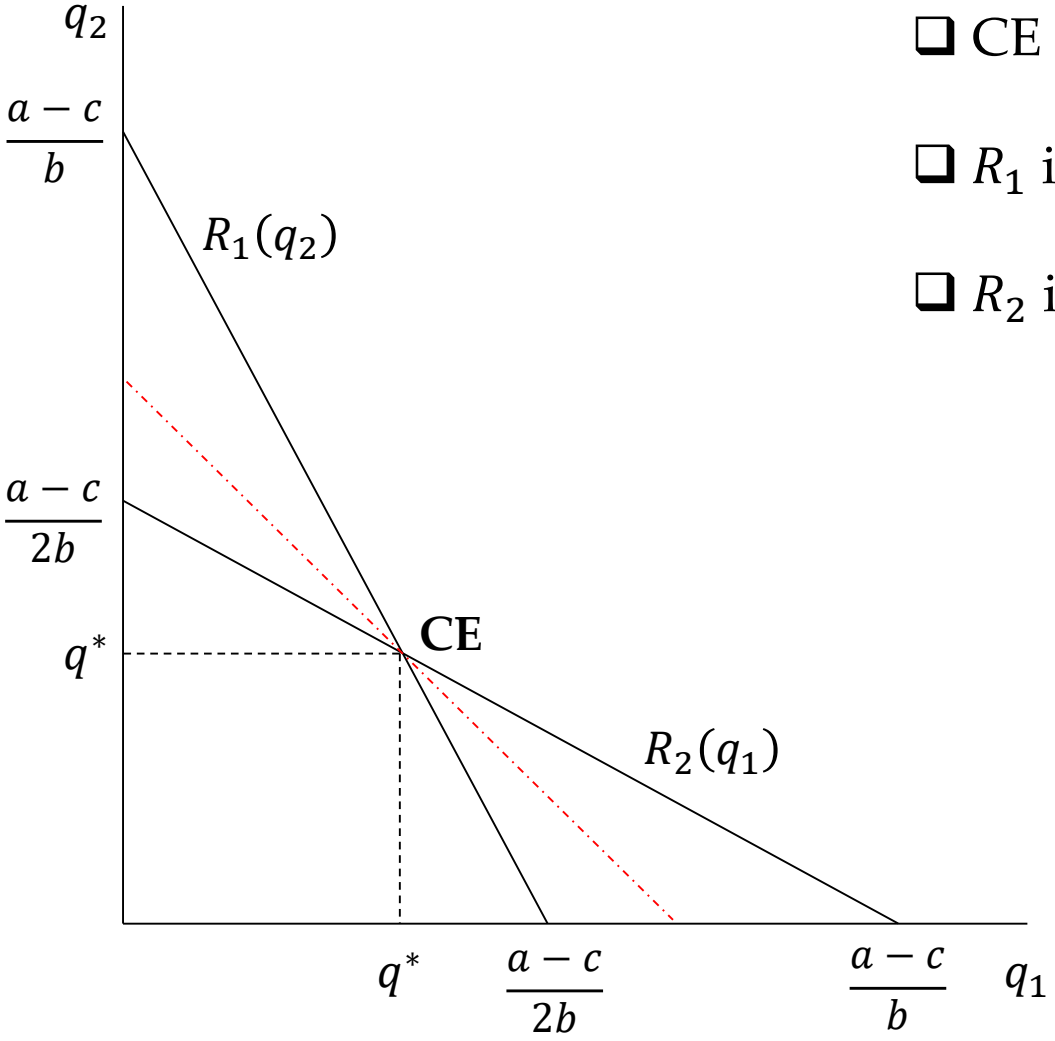
- As both the firms are identical, therefore each one of them will produce half of the output, hence $q_1 = q_2 = q^*$.

Market Output

$$Q = q_1 + q_2 = q^* + q^* = 2q^*$$

$$\boldsymbol{Q = \frac{2}{3}\left(\frac{a - c}{b}\right)}$$

The Cournot Model: Diagrammatically



- CE is the Cournot Equilibrium
- R_1 is the reaction curve of firm 1
- R_2 is the reaction curve of firm 2

Duopoly – The Cournot Model

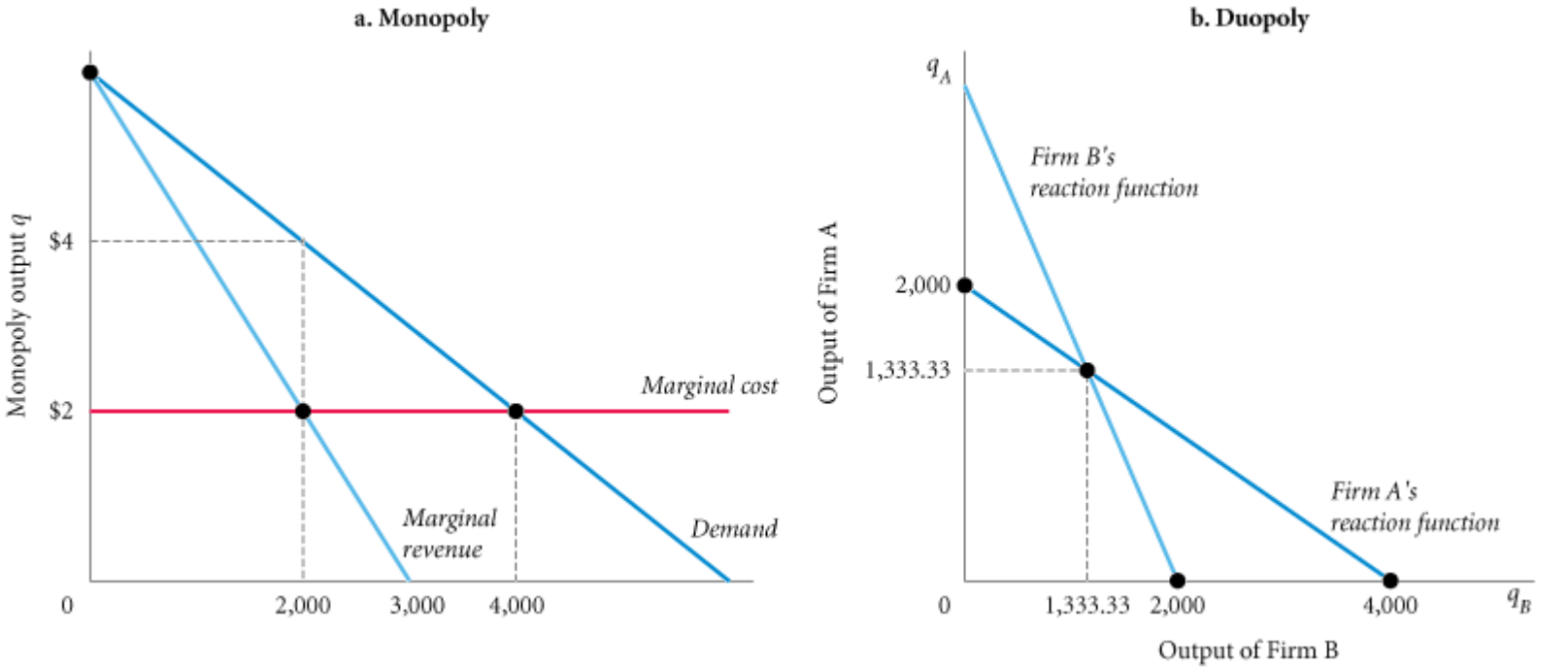


FIGURE 14.2 Graphical Depiction of the Cournot Model

- ✓ The left graph shows a profit-maximizing output of 2,000 units for a monopolist with marginal cost of $2.
- ✓ The right graph shows output of 1,333.33 units *each* for two duopolists with the same marginal cost of $2, facing the same demand curve.
- ✓ Total industry output increases as we go from the monopolist to the Cournot duopolists, but it does not rise as high as the competitive output (here 4,000 units).

Game Theory & Some Basics

- Game theory analyses the choices made by rival firms, people, and even governments when they are trying to maximize their own well-being while anticipating and reacting to the actions of others in their environment

- Dominant strategy - In game theory, a strategy that is best no matter what the opposition does

- Prisoners' dilemma - A game in which the players are prevented from cooperating and in which each has a dominant strategy that leaves them both worse off than if they could cooperate

- Nash equilibrium - In game theory, the result of all players' playing their best strategy given what their competitors are doing

- Maximin strategy - In game theory, a strategy chosen to maximize the minimum gain that can be earned

Game Theory: Advertising Game

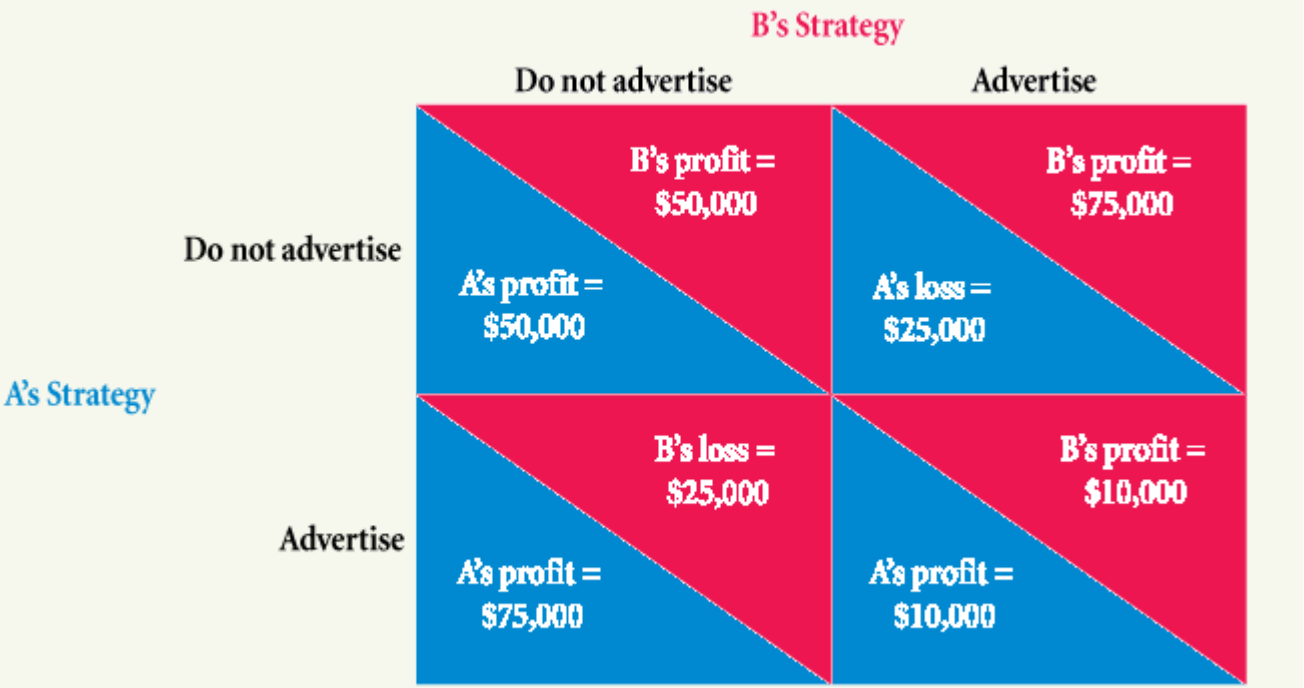


FIGURE 14.3 **Payoff Matrix for Advertising Game**

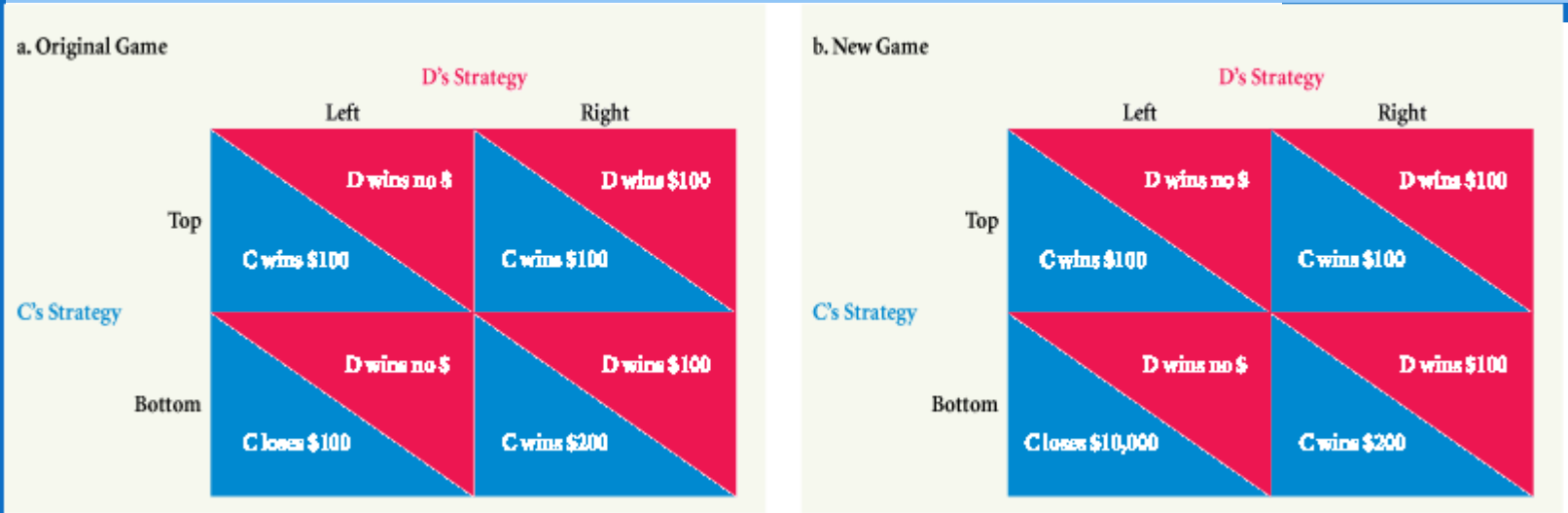
- Both players have a dominant strategy. If B does not advertise, A will because $75,000 beats $50,000.
- If B does advertise, A will also advertise because a profit of $10,000 beats a loss of $25,000.
- A will advertise regardless of what B does. Similarly, B will advertise regardless of what A does.
- If A does not advertise, B will because $75,000 beats $50,000.
- If A does advertise, B will too because a $10,000 profit beats a loss of $25,000.

Game Theory: Prisoner's Dilemma

FIGURE 14.4 The Prisoners' Dilemma

- Both players have a dominant strategy and will confess. If Rocky does *not* confess, Ginger will because going free beats a year in jail. Similarly, if Rocky *does* confess, Ginger will confess because 5 years in the slammer is better than 7.
- Rocky has the same set of choices. If Ginger does *not* confess, Rocky will because going free beats a year in jail. Similarly, if Ginger *does* confess, Rocky also will confess because 5 years in the slammer is better than 7.
- Both will confess *regardless* of what the other does.

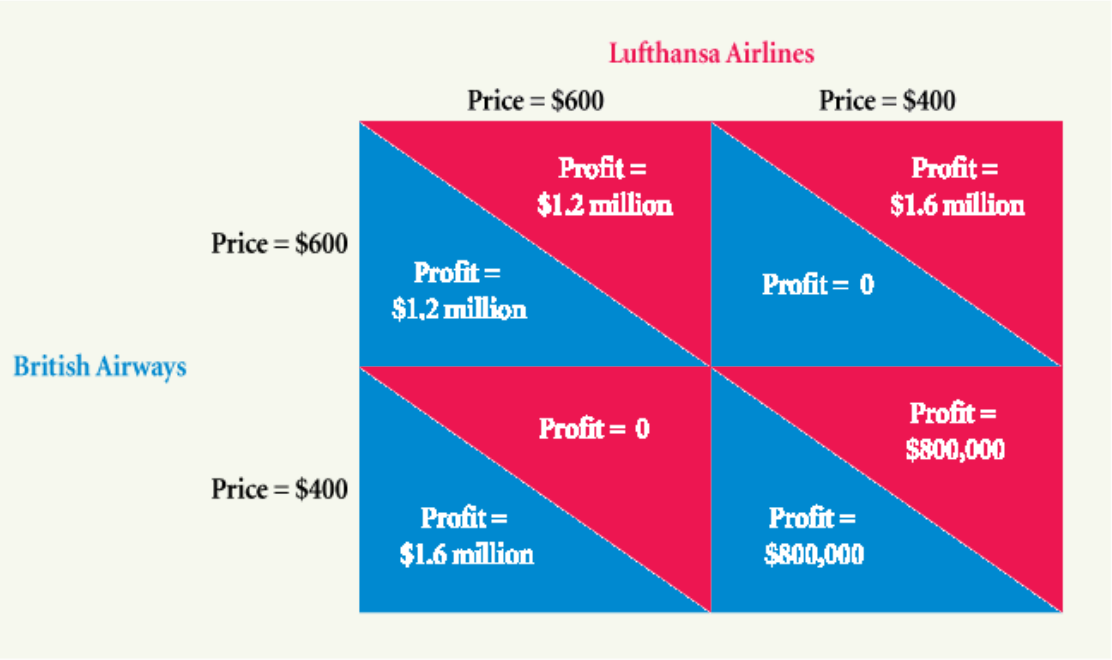
Game Theory: Left/Right – Top/Bottom



▲ **FIGURE 14.5 Payoff Matrixes for Left/Right–Top/Bottom Strategies**

- In the original game (a), C does not have a dominant strategy. If D plays left, C plays top; if D plays right, C plays bottom. D, on the other hand, *does* have a dominant strategy: D will play right regardless of what C does. If C believes that D is rational, C will predict that D will play right. If C concludes that D will play right, C will play bottom. The result is a Nash equilibrium because each player is doing the best that it can *given* what the other is doing.
- In the new game (b), C had better be very sure that D will play right because if D plays left and C plays bottom, C is in big trouble, losing $10,000. C will probably play top to minimize the potential loss if the probability of D's choosing left is at all significant.

Game Theory: Repeated Games



tit-for-tat strategy - A repeated game strategy in which a player responds in kind to an opponent's play

FIGURE 14.6 Payoff Matrix for Airline Game

- In a single play, both British Airways (BA) and Lufthansa Airlines (LA) have dominant strategies.
- If LA prices at $600, BA will price at $400 because $1.6 million beats $1.2 million.
- If, on the other hand, LA prices at $400, BA will again choose to price at $400 because $800,000 beats zero.
- Similarly, LA will choose to price at $400 regardless of which strategy BA chooses.

A Game with Many Players: Collective Action Can Be Blocked by a Prisoner's Dilemma

- Coordinated collective action in everybody's interest can be blocked under some circumstances.
- A multiple-player game can result in a classic prisoners' dilemma, where collusion if it could be enforced would result in an optimal outcome but where dominant strategies result in a suboptimal outcome.
- The only necessary condition of oligopoly is that firms are large enough to have some control over price.

Reference

Case, K.E., Fair, R.C., & Oster, S.E. (2018). *Principles of Economics*. 12th Edition, Pearson India Education Services Pvt. Ltd.