Chapter 10
Strategic Thinking

CHAPTER SUMMARY

In strategic situations, when the parties move simultaneously, there are several useful principles to follow: Avoid using dominated strategies, focus on Nash equilibrium strategies, and consider randomizing. When the parties move sequentially, a strategy should be worked out by looking forward to the final nodes and reasoning back to the initial node.

Through conditional or unconditional strategic moves, it may be possible to influence the beliefs or actions of other parties. In some settings, the first mover has the advantage; in others, the first mover is at a disadvantage. Finally, it is important to consider whether the situation will be played just once or repeated. The range of possible strategies is wider in a repeated situation.

In a zero-sum game, one party can become better off only if another is made worse off. In a positive-sum game, one party can become better off without another being made worse off.

KEY CONCEPTS

strategy
game theory
game in strategic form
dominated strategy
Nash equilibrium
randomized strategy
zero-sum game
network effect
positive-sum game
coopetition
game in extension form
backward induction
equilibrium strategy in a game in extension form
strategic move
first-mover advantage
conditional strategic move
threat
promise

GENERAL CHAPTER OBJECTIVES

1. Appreciate how game theory can guide strategic thinking in a wide range of situations.

2. Explain how the concept of Nash equilibrium predicts the outcome of strategic situations where parties act simultaneously.
3. Apply the concept of Nash equilibrium to a cartel.
4. Appreciate the use of randomized strategies, and calculate the Nash equilibrium in randomized strategies.
5. Distinguish strategic situations of competition and coordination.
6. Analyze strategic situations where parties act sequentially by backward induction.
7. Appreciate the use of strategic moves to influence the beliefs or actions of other parties.
8. Explain why conditional strategic moves are more cost-effective than unconditional strategic moves.
9. Understand how repetition expands the space of strategies and set of equilibria.

NOTES

1. **Strategic thinking**.
   (a) **Strategy** is a plan for action in a situation where parties actively consider the interactions with one another in making decisions.
   (b) **Game theory** is a set of ideas and principles that guides strategic thinking.
   (c) The ideas and principles of game theory provide an effective guide to strategic decision making in many situations.

2. **Nash equilibrium –** for strategic situations where various parties move simultaneously.
   (a) **A game in strategic form**: represents a strategic situation where parties act *simultaneously*, showing one party's strategies along the rows, the other party's strategies along the columns, and the consequences for the parties in the corresponding cells. This is a useful way to organize thinking about strategic decisions.
      i. A *dominated strategy* as one that generates worse consequences than another strategy, regardless of the choices of the other parties. It makes no sense to adopt a dominated strategy.
      ii. Problem of *infinite regress*: A party's best decision depends on how it expects the other party to act, which in turn depends on how the first party expects the second party to act, and so on.
   (b) **Nash equilibrium in a game in strategic form**: a set of strategies such that, given that the other players choose their Nash equilibrium strategies, each party prefers its own Nash equilibrium strategy.

i. A stable situation. Generally, when one party adopts Nash equilibrium strategy, the other parties cannot benefit from knowing the strategy.
ii. Provides a logical consistent solution to the problem of infinite regress.
iii. The Nash equilibrium strategies provide a focal point for strategic decision making.
iv. *Solving for* the Nash equilibrium/equilibria.
    (1). The formal way (rule out dominated strategies first and then check every remaining strategy, one at a time); or
    (2). The informal "arrow" technique.
        a. A strategy is dominated if the row or column corresponding to the strategy has all arrows pointing out.
        b. If there is a cell with all arrows leading in, then the strategies making that cell are a Nash equilibrium.

(c) **Nonequilibrium strategies**.
i. If one party does not adopt its Nash equilibrium strategy, then the best strategy for another party may differ or may not differ (e.g., where all the other strategies are dominated) from the Nash equilibrium.
ii. In some games in strategic form, there may be no Nash equilibrium in pure strategies.

3. **Randomized strategies**.
(a) A **pure** strategy: one that does not involve randomization.
(b) A **randomized** strategy: a strategy for choosing among the alternative pure strategies in accordance with specified probabilities. The various probabilities add up to 1.
    i. In some situations, there may be no Nash equilibrium in pure strategies.
    ii. The advantage of randomization is to be unpredictable. If a party chooses in a conscious way, the other party may be able to guess or learn the first party's decision and act accordingly.
(c) Nash equilibrium in randomized strategies.
    i. A stable situation. Generally, when one party adopts Nash equilibrium strategy, the other parties cannot benefit from learning the strategy.
    ii. Solving for Nash equilibrium in randomized strategies.
        (1). Crossing point of lines representing the outcomes of alternative strategies as a function of the probability that the other party's strategies; or
        (2). Algebra.

4. **Competition or coordination**.
   (a) **Competitive** situation.
      i. A **zero-sum game** is a strategic situation where one party can be better off only if another is made worse off (extreme of competition). There is no way for all parties to become better off.
      ii. Situation is zero-sum when the consequences for the various parties add up to 0 or the same number in every cell of the game in strategic form.
   (b) **Coordination** situation.
      i. A **positive-sum game** is a strategic situation where one party can become better off without another being made worse off.
      ii. A **network effect** arises when a benefit or cost depends on the total number of other users. Various situations of network effects represent positive-sum games.
      iii. Nash equilibria are *focal points* for strategic thinking. In situations of coordination, since the essential issue is coordination among the parties and Nash equilibrium strategies are self reinforcing, it is reasonable that they meet and use Nash equilibrium as a basis for discussion.
   (c) **Co-opetition**.
      i. A strategic situation that involves elements of both competition and coordination.
      ii. **A cartel's dilemma**. In a seller cartel, the Nash equilibrium is for all to produce more than their quota: if cartel participants cooperate, they can increase their profit. However, following the quota is a dominated strategy. When each acts independently, it will decide to exceed its quota – resulting in production at the competitive rather than a monopoly level.
         (1). The seller's cartel is an example of the **prisoners' dilemma.** In a prisoner's dilemma, the Nash equilibrium is for both suspects to confess: even though they would both be better off if they did not confess.
         (2). Cooperation may arise when co-opetition is **repeated**. By conditioning their actions on either external events or the previous actions of the other party, the parties may be able to avoid the undesirable outcomes of one shot situations.

5. **Sequencing** – situations where various parties move sequentially, rather than simultaneously.
   (a) **Game in extensive form**: Represents a strategic situation where parties act in sequence, showing the sequence of moves and the

corresponding outcomes. It consists of nodes and branches: the nodes are where a party must choose an action, and the branches leading from a node represent the possible choices.

(b) **Equilibrium strategy in a game in extensive form**: a sequence of best actions, where each action is decided at the corresponding node.
   i. *Backward induction* is the procedure of looking forward to the final nodes and then reasoning backward toward the initial node.
   ii. It is different from that of the Nash equilibrium strategy in a game in strategic form where parties move simultaneously.

6. **Strategic Moves**.
   (a) An **unconditional** strategic move is an action that influences the beliefs or actions of other parties in a favorable way.
      i. Typically involves self imposed restrictions and real costs; e.g., destroying the lithograph plates.
      ii. Importance of credibility, e.g., sunk costs commitments.
      iii. Apply an extensive form to analyze the impact of a strategic move.
   (b) **First mover advantage** gives the party that moves first an advantage over other parties that move later.
      i. Not all situations involve first mover advantage; in some situations, the party that moves later gains an advantage.
      ii. Apply an extensive form to identify situations involving first mover advantage.
   (c) A **conditional** strategic move is an action under specified conditions to influence the actions or beliefs of other parties in a favorable way.
      i. Conditional strategic moves are more cost-effective than unconditional strategic moves.
      ii. A *threat* imposes costs under specified conditions; e.g., poison pill.
      iii. A *promise* conveys benefits under specified conditions, e.g., deposit insurance.
      iv. Apply an extensive form to analyze threats and promises.

7. **Repetition**.
   (a) With repeated interaction, a party may condition actions on external events or the actions of other parties.
   (b) The expanded set of strategies may give rise better Nash equilibrium outcomes than in once-only situations.
   (c) **Tit-for-tat is an equilibrium strategy** in a **repeated cartel**.
      i. When competing sellers interact over an extended period of time, it is possible to maintain a cartel and achieve profit above competitive level.

ii. A seller conditions its production on the actions of another party at an earlier time. The seller begins by following its quota and will continue until the others exceed their quotas.
iii. Combines a promise (to abide by the quota if the others do) with a threat (to produce more than the quota if the others exceed their quotas).
iv. In a cartel that extends to several markets, tit for tat promises greater benefit (increased profit in all the markets where production is restricted) and threatens greater punishment (reduced profit in all the markets covered).

ANSWERS TO PROGRESS CHECKS

10A. A Presidential election candidate must consider how competing candidates will react to her or his decisions. Accordingly, these decisions are strategic.

10B. Neither is dominated.

10C. The Nash equilibrium, is for both companies to produce more. Please refer to Table 10C on page 542 of the text.

10D. (1) If Merkur switches to Lite AC, its expected share would be (40 x 2/5) + (60 x 3/5) = 260/5 = 52.
(2) If Merkur does not change, its expected share would be (60 x 2/5) + (40 x 3/5) = 240/5 = 48.

10E. It is not a zero-sum game.

10F. If the two stations take different time slots, their combined profit will be higher than if they take the same time slot. Accordingly, the situation is not a zero-sum game.

10G. Delta would choose 8:00pm and Zeta would choose 7:30pm.

10H. Agua Luna would produce 2 million bottles, and Moonlight would produce 1 million bottles. See Figure 10H on page 543 of the text.

ANSWERS TO REVIEW QUESTIONS

1. (c).

2. (a) A dominated strategy generates worse consequences than some other strategy, regardless of the other parties' choices. It makes no sense to adopt a dominated strategy. (b) Given that the other parties choose their Nash equilibrium strategies, each party prefers its own Nash equilibrium strategy. It is a logically consistent solution to the problem of infinite regress. It also provides a focal point for strategic decision making.

3. (c).

4. Venus chooses Orange with probability 0.5 and chooses Green with probability 0.5; and Sol does the same.

5. (b).

6. You and your boyfriend each have one strategy corresponding to each possible meeting point. The pair of strategies in which you go to the meeting point and your boyfriend goes to the same place are a Nash equilibrium. There is one Nash equilibrium for each possible meeting point in the store. The customer service counter is a natural focal point, as it people frequently *arrange* to meet there.

7. Yes; because the returns in each cell add up to the same number, in this case, -10.

8. Venus will choose either Orange or Green---either way, it will receive 1.5. Please refer to Figure RQ7 on page 544 of the text.

9. (a) A strategic move is an action to influence the beliefs or actions of other parties in a favorable way. Typically, the move involves a deliberate restriction of the party's freedom of action. (b) A promise conveys benefits under specified conditions to change the beliefs or actions of other parties. It is effective only if it is credible. (c) A threat imposes costs under specified conditions to change the beliefs or actions of other parties. It is effective only if it is credible.

10. Strategy (b) is more credible.

11. The strategy may not be internally consistent, in the sense that, if and when a party reaches a particular node, he/she may prefer to take some action other than that in the planned strategy.

12. If it could be easily switched, then the investment is not a sunk commitment, and hence is not credible.

13. If they work as intended, the party making the move may not need to incur the cost of the commitment.

14. Debtors will repay only if they suffer greater costs by not repaying. If loan sharks cannot use the legal system, then they need some other way to threaten debtors who do not repay. Violence is the usual solution.

15. Actions may be conditioned on external events or the actions of other parties.

WORKED ANSWER TO SAMPLE DISCUSSION

A common issue among couples is what to do on the weekend. A woman may wish to go shopping, while the man would rather attend a football match. Other things equal, both would rather be together. So, the consequences if the two persons attend separate activities are relatively poor. Game theorists call this the *battle of the sexes.*

a. Construct the following game in strategic form. Show the man's strategies along the left-hand side of the strategic form, and the woman's strategies along the top of the strategic form. Calculate the consequences for the man and the woman from each pair of strategies.
b. Identify the equilibrium or equilibria.
c. How might the equilibrium or equilibria change if the woman could move first?

Answer

(a) To construct the game in strategic form, consider the following. If both man and woman spend time together either shopping or watching football, they both benefit. The man would prefer both watching football, while the woman would prefer both shopping. On the other hand, if the man watches football alone while the woman shops alone, each will derive some benefit but less than from doing the activity together. The worst case is where the man shops alone and the woman watches football alone.

		Woman	
		Go shopping	Watch football
Man	Go shopping	M: 2, W: 3	M: -1, W: -1
	Watch football	M: 1, W: 1	M: 3, W: 2

In each cell, the first number is the man's benefit and the second number is the woman's benefit.

(b) There are two Nash equilibria: in one, both watch football, while in the other, both go shopping. (There is a third Nash equilibrium, in randomized strategies.)

(c) In a situation where the woman moves first, there is only one equilibrium. The woman has first mover advantage. If she decides to go shopping, the man must choose between football by himself, which provides a benefit of 1, or shopping with the woman, which provides a benefit of 2. He will choose shopping.

