CHAPTER 9

Market-as-a-Game

"They came to the fields of joy,
The fresh turf of the Fortunate Woods …
Here was the company of those who had suffered
Wounds fighting for the Fatherland."
Aeneid, vi., 638, 660

The misreading of signals is one of the reasons for uncertainty in the business world. The market is introduced in terms of the market-as-a-game, focusing on the interaction of competitors as players in a product market wherein there is a recognised interdependence amongst the players. We do make some assumptions: **Assumption I**, player assumption, is that the company or firm is referred to as a **player** and this carries with it an understanding that the company or firm is in a game with other players. We are starting from the premise that firms are aware of their interdependence and management as players are mistake-proofing. Move and countermove ensue until both firms arrive at an equilibrating solution.

Market-as-a-Game

Some firms do not necessarily carry this understanding of a player as provided in this book, but they do compete, and compete aggressively, with each other. As long as management never perceive their interdependence, the outcome achieved is the outcome expected and not the outcome attainable. However, in different geographic markets, whether local, national or global, where the number of players is less than five there is a greater probability that the firms are players and that the management team do realise that they are in a game. This is the market known as oligopoly. **Assumption II**, the definition of game assumption, is that a group of companies realise that they are in a game whenever the fate of one company depends not only on its own actions but also on the actions of the rest of the companies in the market (Binmore and Dasgupta, 1986).

From a third-party perspective, a fact finder may observe play in a market by observing management behaviour and player actions, say, from signals on price, quantity or dividends policy. It is quite a different thing to infer the player types in a market by observing the behaviour of the management alone. So, for example, by ascribing types to the management of company X, the fact finder becomes bounded rational about the player type. The fact finder, by employing the principle known as Occam's razor, ignores the features of the economic theory that cannot be observed. He has limited ability to distinguish one type from another. So, instead, the fact finder uses experience and easy-to-process signals to sort the problem into a small number of categories. Once management realise that they are in a game, camouflage may take place – deliberate attempts to confuse the opponent — and then the type of management is subsumed within the type of player. Consequently, player type is more difficult to predict and thus to observe ex-ante in the blending of types.

In the late 1920s, the French mathematician Emil Borel wrote a series of articles to show how games, war and economic behaviour were similar activities in that they all involved the necessity of making strategic decisions. Borel's work gained the attention of economists, and the most significant achievement was the publication by Von Neumann and Morgenstern (1944). There was now a belief amongst economists and mathematicians that a full-fledged theory of games could be developed, providing a much better understanding of oligopoly behaviour than that offered by traditional economic theory.

In their seminal work, Von Neumann and Morgenstern introduced the fundamental classification of games into those of complete information and those of incomplete information. Competition may manifest itself in different ways, for example, in terms of price competition or advertising expenditures, but in a game we are focusing on patterns of observed behaviour. In this enriched view of a market, management embedded in a firm as a player will continue to look at prices but will also look at patterns of prices over a period of time; they may need to also look at entropy in the market shares (and in Chapter 10, we will discuss scramble, combat and contest competition).

Unlike formal games such as chess, bridge or poker, which have a well-defined beginning and ending, most models of strategic business situations cannot be easily assigned a clear end-point or rest point. In essence it becomes the responsibility of the fact finder to establish the context in which the game is played. The behaviour of management as described must be assessed in the context of the situation at hand. **Assumption III**, an assumption of symmetry, is deployed to capture the point that any differences in abilities of individual management must be specified within the model, otherwise all non-specified attributes are regarded as the same. The value of this assumption is significant as a device for simplification. For example, if we wish to apply the two-person zero-sum game to a price-revenue evaluation problem involving a task on elasticity, the assumption that the opposing players are equal in all respects appears to be reasonable. For example, as management they each understand the economics of the total revenue test: price increases on an inelastic demand will tend to increase net total revenues.

Minimax Strategy

Now suppose we have two companies and both are players in a zero-sum game. The **bold** Player is Apple Inc. with its iPhone and iPad platforms and resources sufficient to defend only one of them. The ***italicised*** Player is Samsung with resources to attack either the iPhone or the iPad platform, but not both. Suppose the iPhone is more valuable to both players. Our starting point is to assume that an attack of a dfended position results in neither a gain nor a loss for either player (see Table 9.1).

Table 9.1
Zero-Sum Pay-off

	iPhone5	iPad3
Galaxy S3	*0*,**0**	*3*,**–3**
Galaxy Tab	*1*,**–1**	*0*,**0**

The game is zero-sum; if we focus on one player and we give the pay-offs to Samsung, the ***italicised*** Player, we can obtain the pay-offs accruing to Apple. Hence, the standard presentation of the game is as shown in Table 9.2.

The positive entries represent a gain for Samsung, the ***italicised*** Player, and a loss for Apple, the **bold** Player. A negative pay-off number — there are none in this game — represents a loss for Samsung and a

Table 9.2
Player Gain

	iPhone5	**iPad3**
Galaxy S3	*0*	*3*
Galaxy Tab	*1*	*0*

gain for Apple. Hence, this game favours Samsung, the ***italicised*** Player. The question is: What is Apple's — the **bold** Player — best strategy?

Apple Inc. thinks that Samsung expects it to defend the iPhone, so Samsung will attack the iPad. But Samsung knows that Apple will reason this way, and so assuming that Apple will defend the iPad, Samsung will attack the iPhone. However, Samsung also knows that Apple will reason this way. This line of reasoning suggests that some kind of game-tree analysis will reveal a strategy to be Apple's best choice. But it is more complex than that — Apple has to choose to play a minimax strategy, a strategy that minimises the maximum amount Samsung can expect to get in the evolving game whilst maximising the gain Apple can expect to derive from it.

Homo Ludens

However, individual management, **homo sapiens**, is limited in both the ability and capability to see, comprehend, process and act upon all the information available. His strategic cousin, **homo ludens**, is to be regarded as a simplification of management with bounded rationality. In the study of threats, bargaining and negotiating as applied to management and business it may be worth considering, therefore, a blending of type of management with type of player into a decision quantum (DQ), the game-playing type analogue of a management team. The behaviour of the DQ is said to be rational only insofar as it coincides with an equilibrating behaviour. It is reasonable so far as the player has sound judgement. Consider the pay-off matrix from the game theory literature in Table 9.1.

The row player can play a if she can reasonably believe that the column player could play A, since a is a best response to A. She can reasonably believe that the column player can play A if it is reasonable for the column player to believe that the row player could play a. He can believe that she will play a if it is reasonable for him to believe that she could play a, etc. This provides an infinite chain of consistent beliefs that result in the players playing to an outcome (a, A). In the business application, it is critical that each player has a belief system conjectural variation and each action should be defined in terms of a CV (see Chapter 7). In other words, a Baumol type with a CV = 0 could reduce price to increase total revenue. Unless management as a player signal this type to the market, other players might interpret this price reduction as a threat and react by reducing price, and this tit for tat as illustrated in Figure 9.4 on page 141 could continue until the signals are matched. Alternatively, a signal to the market that player X is a Baumol type will allow other players to believe that player X is a Baumol type and the observed price reduction is a one-shot price move requiring no reaction.

In Heinrich (2004), for example, social preferences are admitted to the Prisoner's Dilemma game, allowing for the possibility that some players are averse to inequality. It is argued that some players in a PD game prefer the more equal but personally less profitable outcome of mutual cooperation to the more asymmetrical pay-off produced by defecting against a cooperator. Within the PD pricing game once one player deviates by lowering price, there is a temptation for another player to follow. In other words, there is a kind of reciprocity in pricing as follows: My rival has lowered price; would it pay for me to

Table 9.3
Homo Ludens

	A	B
a	1,1	0,0
b	0,0	1,1

do the same? The reciprocal price may not be so easily forthcoming in business, as management are either increasingly subject to shareholder constraints or do not have the production capacity at a point in time to proceed with a matching price reduction.

Price Tumbles

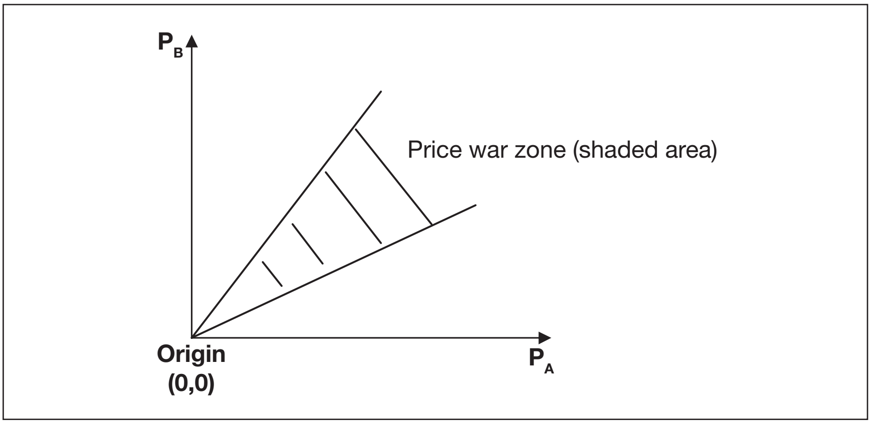
Therefore, DQ1's perception of DQ2 will influence its decision to commit resources to either avoiding or precipitating a price tumble. Consequently, the reaction system has to be interpreted in such a way that the roll-out of DQ1's price — in retrospect, the history of DQ1's prices — is relevant for DQ2's action. The price reaction functions are linear and have a positive slope to indicate that a given price reduction from DQ1 (fixed amount of resources) is triggered by a given price reaction from DQ2. But this action-reaction is only possible over a limited amount of time before each DQ begins to read the signals from the game. The essence of the competitive process is trying to understand the complex web of competitors' behaviour. Reaction function allows management to track the price reactions of competitors. Management in a game under the zero-sum constraint will soon learn to weigh competitors' price reaction more than the limitations imposed on price by the own demand elasticity. This is the essence of strategic pricing.

'Price war' is a term used in business to indicate a state of intense competitive rivalry accompanied by a multilateral series of price reductions. One competitor will lower its price, and (in sequence) others will lower their prices to match. If one of the reactors reduces their price below the original cut price, then a new round of reduction is initiated. Price war is usually costly in terms of the opportunity cost of real resources used to defend market shares. Management should avoid price wars that are costly and erode into profits.

Bertrand Model

The focus here is on strategic complements in a highly differentiated oligopoly market. It is on likely price reactions in such a market. This model examines the pricing behaviour of interdependent companies in

Figure 9.1
Bertrand Zero-price Solution



a product market with few competitors. This is more applicable to the oligopoly markets. Figure 9.1 shows non-intersection of the reaction functions of companies A and B. The price equilibrium is 0, at the origin. There is every likelihood that both players could drive the price to the (0,0) price equilibrium as the game will continue until the equilibrium price is reached.

The challenge for the Bertrand model is to explain why:

(1) in some markets, in the absence of overt collusion, competing players are able to maintain high prices: e.g., the US cigarette industry in the 1990s;
(2) in some markets where interdependence is acute, there is significant price competition: e.g., regional cement suppliers and the global video games market post-1998 and 2001–2005. The Sony-Microsoft game 2000–2004 is discussed in the following pages of this chapter.

Bertrand challenge explained by:

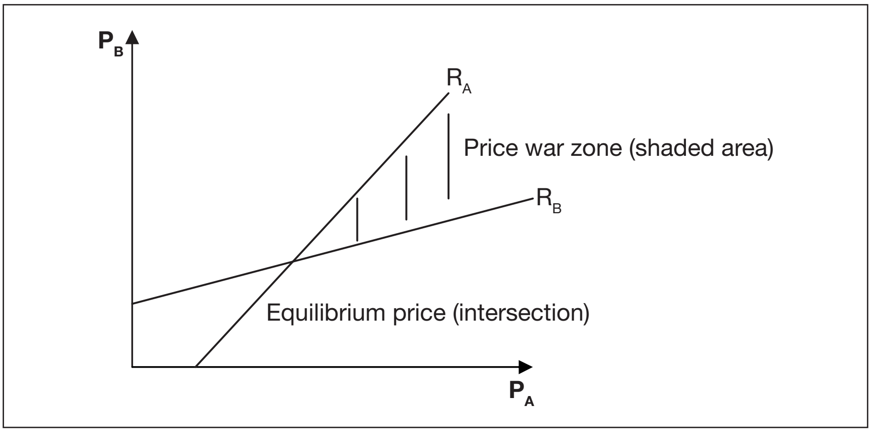
1. Realisation of the Nash equilibrium
2. Folk theorem benefit-cost condition
3. Asymmetric sameness in price condition
4. Error in the game

Realisation of the Nash Equilibrium

We explore the first challenge in Figure 9.2 with intersecting reaction functions where the point of intersection is a Nash equilibrium price for both players. It is neither an equal price nor a profit maximising price, nor does it represent equilibrium where both players have equal market shares. It is the best outcome for each player given the reaction of the other player.

Figure 9.2 shows the intersection of the reaction functions of the companies. Price war occurs until the intersection point of the two reaction functions. That is the Nash equilibrium price. To see this applied to the Sony-Microsoft game dimension 2000–2004, refer to McNutt (2008).

Figure 9.2
Bertrand Modified Model



The process here is to observe the Nash equilibrium from the observed signals. It is at price point 149 and 149.99. This is the best price that both players could have achieved given the reaction of the other player. Management observe the signals ex-post and begin to reason strategically in a process called **backward induction** (see Chapter 7) by plotting the CTL and the reaction functions as illustrated in Figures 9.3 and 9.4, respectively.

Figure 9.3
Critical Timeline — Sony vs Microsoft

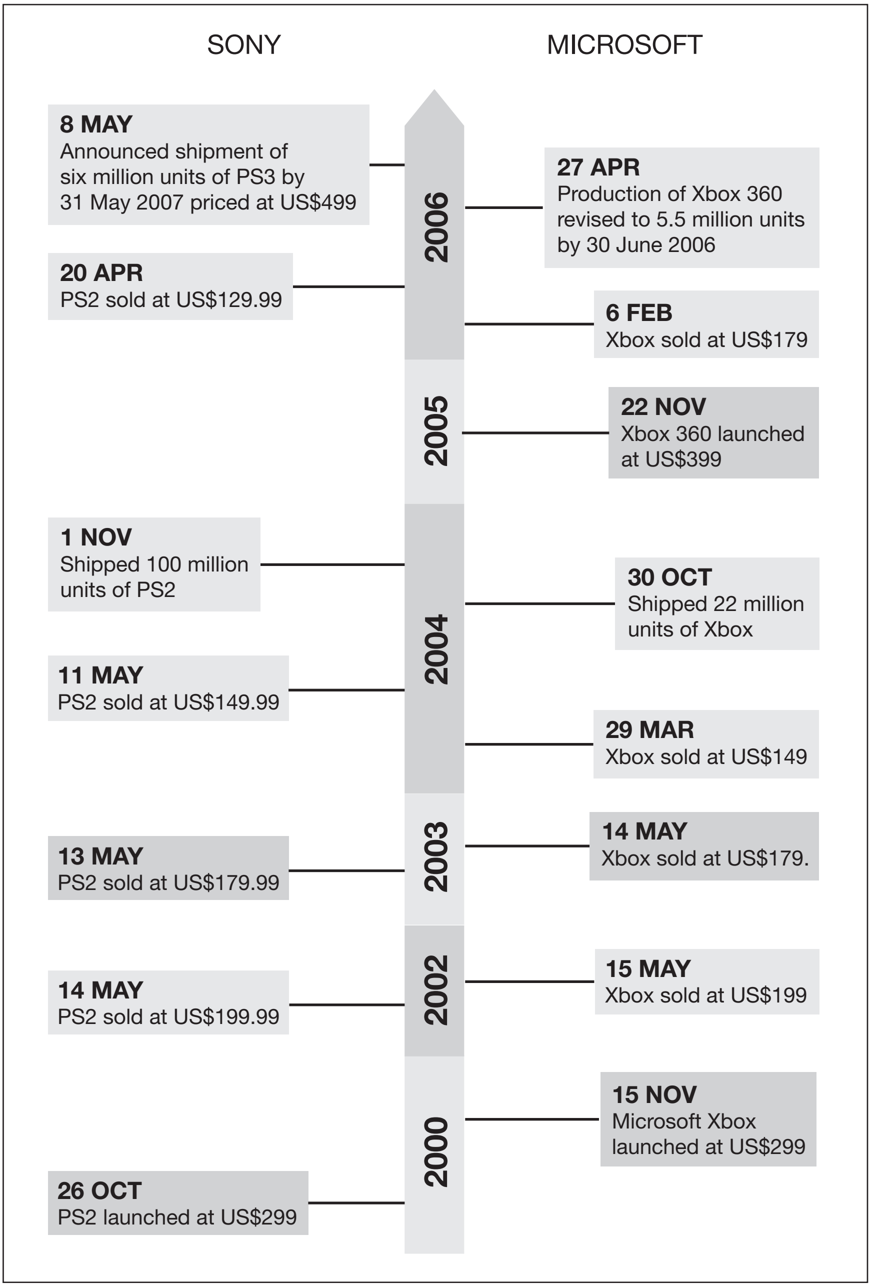
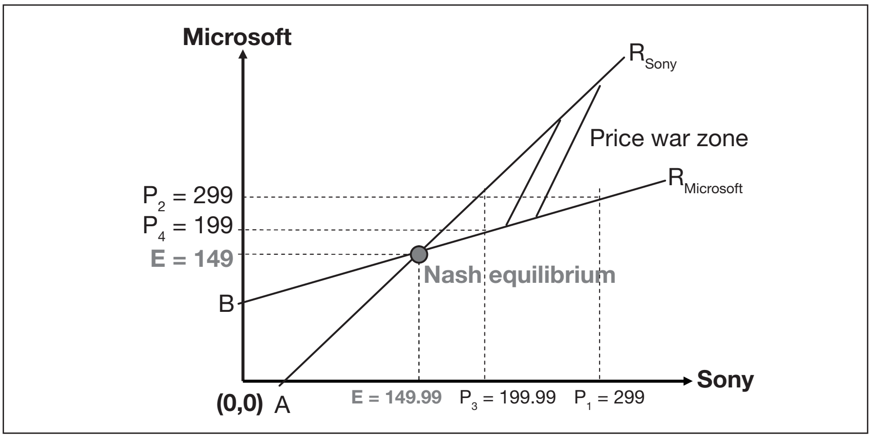


Figure 9.4
Nash Equilibrium — Sony vs Microsoft



If the fact finder were to inform both players at the price point 299, the history point, that:

(1) they were about to enter a price war and
(2) the best price for each would be in the price range 149–149.99 after four years of price competition,

neither player would believe the fact finder. This is the classic PD, as both players believe that they can do better. It is important to note that the NE price is not the best in terms of maximum profit or maximum market share; it is simply the best in the game play given the reaction of the competitor.

Folk Theorem Benefit-Cost Condition

A second explanation is to be found with reference to formally agreeing to fix prices above the Bertrand competitive level. This is illegal in most jurisdictions due to antitrust laws. The Folk theorem does not focus on formal collusion; rather, the term 'cooperative pricing' is used to refer to situations in which firms can sustain prices in excess of those that would arise in non-cooperative single-shot games. Put another way, suppose two firms are unilaterally setting prices that are near the prices they would set if they successfully colluded. Are there conditions to do with costs and profits under which neither firm would wish to undercut its rival? Under these conditions cooperative pricing is feasible.

However, much remains unclear in the substitution of accounting profit for economic profit, particularly if, as noted by Demsetz, monopoly profits of the incumbent are capitalised in the accounting value of the firm's assets, notably, patents and trademarks. In most cases the only hard number is the market share, and the concepts of dominance and significant market power are defined with respect to a market share threshold. Landes and Posner argued for not defining market power in terms of specific market shares at all, but instead 'to interpret the market share statistics in each case by reference to qualitative indicia of the market elasticity of demand and the supply elasticity of the fringe firms'. They continued to argue that if either the market elasticity of demand or the elasticity of supply were high, different inferences would be drawn from the defendant's market share than if either or both of the elasticity values were low.

Asymmetric Sameness in Price Condition

An asymmetric sameness in price standard is asymptotically close to a bargained competitive price, and therefore it follows that not all instances of parallel behaviour can give rise to the same strength of inference that the parallelism results from anything other than the independent commercial judgement of the firms. Parties that engage in tacit collusion are behaving quite differently from firms that enter into explicit cartels. Management of firms that engage in tacit collusion may not even know what they are doing; they may not recognise that the pricing practice helps to support an anti-competitive equilibrium. In many markets, price can take on its own momentum: for example, demand for a limited supply will increase price under the basic law of supply and demand. Conversely, in a competitive price environment, price will fall to a low price on its own momentum.

Consider two outcomes: incumbents having excess capacity that signals a threat to new entrants; and a market with excess capacity that is not attractive to enter. A combination of the two outcomes could mean that we are dealing with a mixed duopoly where both firms simultaneously decide whether to enter the market or not and to communicate this, and eventually they play a Cournot-Nash duopoly game choosing the output. Barros (1984) has shown that a mixed duopoly may indeed lead to an improvement in allocative efficiency. For a fact finder trying to understand the proper context of type of competition in a market, the actions and reactions of the firms should be regarded as an evolving process in which each participant carries out its duty in the market, the job in which each is more efficient. The basis of any 'understanding' is an increase in market power with a concomitant increase in allocative efficiency.

Competition or antitrust law and policy is about maximising consumer welfare, and that can be achieved only by lower competitive prices at the retail level. The perfectly competitive price that competition promises continues to elude the consumer across many product and service markets. If we begin with the premise that a market is a classic case of signalling wherein the ability to 'do a deal' and negotiate or conduct transactions at prices through signalling mechanisms may be the modus operandi, then the fact that a bargaining mechanism — cartel arrangements or signals — exists at all reflects the nature of the business, and the fact that a bargaining mechanism cannot easily be monitored by others would make it difficult to detect instances of alleged price fixing.

The Regret Matrix

A price signal, Δp, from one player may not always lead to a matching price reduction. Furthermore, it does not require an immediate Δp if the player has a commitment to altruistic behaviour. Once the first player observes that the second player is not following with a Δp, the first player may stop and reconsider the Δp. If so, the second player has influenced the first player not to initiate Δp, in effect changing the behaviour of the first player. In these circumstances, fact finder would observe cooperation and proceed to dismiss the possibility that it could have emerged from nothing more than the cold calculation of self-interest. It need not necessarily rely on a credible mechanism.

One important signal for DQ2 is the intention of DQ1 in initially reducing the price: Was the intention to make a price war unavoidable, using it as a catalyst for greater competition? DQ1 with a CV = 0, for example, could be interpreted as a naïve strategy, especially once DQ2 reacts with a price reduction. Both DQs find themselves in a price war, but DQ2 would have to ask: Did DQ1 intend to initiate a price war? This is the error in the game — the incomplete information that can trigger a price war. And it also raises the time constraint — whether any DQ has a binding time constraint within which to complete the action.

With error, DQ1 may have a lower bound on price — thus facilitating intersecting reaction functions — otherwise DQ2 might believe that DQ1 is moving to the zero-price equilibrium. If DQ2 is going to follow with a price reduction (as perceived by DQ1, that is, CV ≠ 0), there is no reason why DQ1 should initiate a price war; and conversely if DQ2 has CV ≠ 0 then DQ2 will not initiate a price war. The price tumble that triggers a price war scenario is more likely to manifest itself with asymmetric information, where one DQ is informed of all the parameters but a second DQ is not informed as to a competitor DQ's aversion to a price war or willingness to engage.

It depends on how the DQ views the pay-offs in the game. There is an element of regret in not taking an action. The costs of regret would have to factor in the costs of playing the game. This is discussed in McNutt (2008). In Table 9.4, assume you are player A with two strategies, S1 and S2. Player B has two strategies, S3 and S4. You play S1 only if the pay-off of 3 is the maximin. If you are player B, and if player A has played S1, you play S3 only if the pay-off of 4 is your minimax.

Table 9.4
Regret Matrix

	S1	S2
S3	3	4
S4	5	1

Maximin Strategy

Within Framework Tn=3, we are advocating that it is more rational for business management as players to think in terms of the opportunity costs rather than the gains in a pay-off matrix. Consider a player faced with three options, S1, S2 and S3. The player has a conjectural variation. For illustration purposes, the pay-offs are defined in Table 9.5.

Faced with a decision, management assuming the minimum pay-off may take a pessimistic view of the market-as-a-game. Therefore, they should act to ensure that they get as large a pay-off as possible in the market-as-a-game. This is called the **maximin**, because it maximises the minimum pay-off. So management are faced with two choices, S2 and S3, and they are indifferent between them. This is sometimes called the criterion of pessimism, in that the worst is always assumed. Alternatively, management may be an optimist and thus choose the maximax strategy, which maximises the maximum pay-off, leading to the selection of S1. Note that different criteria lead to different choices. If this were not true, then, as argued by Moore and Thomas (1976), "all criteria would lead to the same action suggesting that we might as well use a pin to pick out criterion" (p. 44).

But there is a third criterion that looks at the opportunity cost of choosing a strategy. It is referred to as the regret criterion, illustrated by pay-offs in a regret matrix. To understand this better, we convert the original pay-off from Table 9.5 into Table 9.6.

Table 9.5
Maximin

Action	CV = 0	CV ≠ 0	Minimum	Maximin	Maximum	Maximax
S1	10	1	1		10	10
S2	9	3	3	3	9	
S3	5	3	3	3	5	

Table 9.6
Regret Criterion

Action	CV = 0	CV ≠ 0	Maximum Regret	Minimum of Max. Regrets
S1	0	2	2	
S2	1	0	1	1
S3	5	0	5	

If CV = 0 is correct in retrospect, then choosing S1 would have been the correct choice and management would incur no opportunity loss or regret as measured by the difference between the pay-off for the chosen strategy and the pay-off for the optimal strategy S1 with CV = 0. If the game is unprofitable to player A, player A should always use a maximin strategy. In other words, if player A cannot hope to obtain **more** than his maximin pay-off anyhow, then player A should adopt a strategy that will absolutely assure the player at least that much (Harsanyi, 1966).

In the mid-1990s, Motorola was emerging as a significant player in the mobile phone market — a nascent market that has grown exponentially over the past ten years. In many countries, there are more mobile subscriptions than people. But in retrospect, Motorola had CV = 0 with respect to a small obscure Canadian start-up called Research in Motion (RIM), who were targeting a new mobile email market. Had RIM, *aka* BlackBerry, not succeeded, Motorola would have had no regret in their choice of strategy that underestimated the mobile email market potential.

Saddle Point Market Shares

If the game considered is a zero-sum game, strictly adversarial between the players, then maximin-minimax provides a unique stable equilibrium solution to the game. In many markets, the market shares are consolidated in the sense that should one firm gain 2 per cent it translates into a 2 per cent loss for one or more competitors in the market. The game is about market shares, and this is not an unreasonable assumption to make across many product markets for two-player games.

Consider two players, A and B, in Table 9.5. Assuming that player A has the strategy set (S1, S2, S3) represented across the rows and that player B can react with strategies (S4, S5, S6, S7) represented in the columns, then what should player A do if faced with the market share pay-offs? If player A could be sure that player B would respond with S4, S1 would be an optimal strategy for player 1 since it would get 95 per cent of the market. Strategy S1, given player B's response of S4, yields the largest pay-off for player A but the worst pay-off for player B, so player A can be certain that player B will not respond with S4.

Player A must assume that player B will respond with S5, which will give player B 95 per cent leaving player A with only 5 per cent. By assuming the worst possible response, player A predicts the outcome for his use of strategy S1 will be the minimum pay-off, that is, 5 per cent of the market. We illustrate this in **bold** print in Table 9.7. It would appear reasonable for player A to reject S1 as too risky. As viewed by player A, the strategy offers an almost all-or-nothing gamble. It depends on how player B responds. So player A chooses another strategy. S2 offers the possibility of 90 per cent if player B can be counted on to

Table 9.7
Saddle Point Matrix

	S4	S5	S6	S7	Row Minimum
S1	*95*	**5**	50	40	5
S2	60	*70*	***55***	*90*	55
S3	30	35	30	**10**	10
Column maximum	95	70	55	90	

respond with S7. However, there is also the possibility that player B will respond with S6, allowing player A 55 per cent market share. This is the least market share for player A if he uses S2, so again we print it in **bold**.

If player A considers S3, the least market share is 10 per cent, obtained if player B responds with S7. Player A notes the least attractive outcome for each strategy. Player A in a zero-sum games assumes that the rival player B will deploy a strategy that reduces player A's market share to a minimum. So player A uses a **maximim** strategy, that is, the maximum of all the minima, and that is S2. Conversely, player B will select the highest possible outcomes in terms of player A's payoffs providing column maxima of 95, 70, 55 and 90, as illustrated in **italics**. So in order to obtain the highest market share, player B will choose a strategy that will hold player A to the lowest of the greatest possible outcomes.

Accordingly, player B will choose S6, which allows player A 55 per cent market share. Confining player A to the least of the greatest shares, player B is said to be employing a **minimax** strategy, that is, choosing the minima of the column maxima. We conclude that the game does have a unique equilibrium. The market share **55** per cent is both the maximum of the row minima and the minimum of the column maxima. If player A chooses S3, player B will respond with S6; and if player B decides on S6, player A will reply with S2. The market share **55** per cent is referred to as the saddle point of the game.

Games in strategic or extensive form are obvious candidates for management games where player 2 is committed to not exciting a price war and player 1 either considers exciting a price war or not. Player 2 then faces the option of a counter-strike if a price war ensues. In this case, the non-cooperative solution is the dominant solution used to analyse games in strategic or extensive form. The main property of the non-cooperative equilibrium is optimal response. If A knows B's action, then at the non-cooperative equilibrium, A will have no desire to change his strategy as he cannot improve. The same holds for B. This gives rise to the Nash equilibrium, the best outcome a player can obtain given the moves or actions of other players.

Minimax: Is There Always an Equilibrium?

Consider two players, A and B, in the game of manufacturing cigarettes. If Player A produces a king-sized (KS) cigarette and Player B selects a filter, the former will end up with 20 market share while under zero-sum the latter has 80. Player A's best decision or strategy choice is not completely obvious. If Player A opts for KS, the reward could be 60 or 20 whereas the strategy of regular size yields 80 or 10. Management at Player A might decide on a 50:50 probability of Player B adopting either of its strategies. Thus, they evaluate the strategy of KS at 50 of 20 and 50 of 60 = 40. The alternative could be 50 of 10 plus 50 of 80 = 45. On the balance of probabilities, Player A's best choice would be regular-length cigarette.

Let us examine this in greater detail. Player B is known to Player A and both players are deemed rational. If Player A produces a KS cigarette, Player B would cut the latter's market share to 20; if Player A selects regular length, it will secure only 10 market share. Hence, Player A should pay attention to the worst outcome (minimum) of each strategy and be content with the **maximin** pay-off of ***20***, and chooses KS (see Table 9.8). Similarly, Player B plays **minimax** as it considers the best Player A could do in response to each of its strategies, and chooses the strategy that minimises the maximum pay-off to Player A. Thus, if Player B goes for filter at best, Player A gets 20; whereas if Player B goes for unfiltered, Player A can get 80. The minimax is ***20*** from the pair (20,80).

Table 9.8
A's Maximin = B's Minimax

	B (Filter)	B (Unfiltered)
A (King Size)	***20***	60
A (Regular)	10	80

If Player B chooses filters, Player A can do no better than to choose KS (regulars will only give 10). Player A's best response to Player B's minimax filter strategy is its own **maximin** of KS, and Player B's best countermove to Player A's maximin is its minimax. But do we always have an equilibrium outcome? Consider the market shares in Table 9.9.

Table 9.9
Loading the Dice

	B (Filter)	B (Unfiltered)
A (King size)	20	60
A (Regular)	80	10

The **maximin** strategy for Player A is still KS and the maximin pay-off is 20. However, Player B's **minimax** strategy and pay-off is now unfiltered and 60, respectively. In this case, Player A will choose to play KS, Player B will choose unfiltered and Player A will be surprised to receive 60. If Player B opts in advance to believe that Player A will adopt a **maximin** KS strategy, it will no longer think it wise to play the game with the unfiltered cigarettes strategy. Instead, it will switch to a non-minimax strategy and play a filter cigarette strategy. In this case, Player A's pay-off remains at 20. In this case, we have mixed strategies with Player A playing maximin and Player B playing a non-minimax strategy; it is to Player A's disadvantage (not securing an elusive 60) to have its plans guessed by Player B. Therefore, Player A could respond by 'loading the dice' and play a mixed strategy. For Player B, the key question is: What will Player A do? How will Player A reshape its strategy?

Trust: The Core of the Bertrand Dilemma

Do you trust your partner? Should you trust your competitor? Trust ultimately depends on one's belief structure about other people, whether they be competitors or not, in the business world. If Mr A trusts Mr B to do x, then Mr B, knowing that Mr A trusts him to do x, has a choice to make: Does he do x, or not? The consequences of x are of interest in the business world. One scenario, referred to as the moon-shot, is the belief without providence that x will be done. Neither Mr A nor Mr B issued the moon-shot, neither knows that about the other, and so they behave as if the moon-shot has happened. Another scenario is the extent to which trust is credible in terms of doing x, where x has significant negative consequences for both A and B. In this cartel scenario, both players must trust each other absolutely.

Combat competition is about entry at the margin and manifests itself when an increasing number of firms is not an advantage to the market system. Contest competition differs in that the market is unequally partitioned — some firms are content with their market shares, while other firms are targets of merger or takeover. Contest would occur, for example, where individual firms compete either for a given market share or for market position. Contest competition can be seen as a mechanism that will tend to maintain the market level of concentration as long as the number of firms does not change. One essential characteristic of contest and scramble is that in both cases there is no exit of firms below a threshold level of concentration when there is ample market share for all competing firms.

Above a critical threshold level of concentration, exit increases abruptly in the case of perfect scramble but gradually in the case of perfect contest. This follows necessarily from the requirement that contest leaves a constant number of firms in the market system. We contend that almost all competition under normal market conditions falls between these idealised extremes of contest and scramble. This may be a key contributor to undermining an understanding in antitrust analysis that competition and concentration are antithetical. Within antitrust folklore, concentration leads to collusion; if we accept that competition and concentration are not antithetical, the debate in antitrust circles on concentration and collective dominance would become uncomfortable and possibly untenable, if it leads to the conclusion that competition contributes to collusion in a market system. However, it may be possible, theoretically at least, to enunciate the possibility of competition with monopoly outcomes. Pure contest is rare; as individual firms compete for market share, there will often be a compromise as combat competition becomes more intense and average market share may be reduced.

Stigler's Dilemma

Players avoid price wars. They are expensive. One option is to form a cartel. Stigler argued that firms seek cartelisation — the gains from cartelisation include a less elastic demand curve and a slower rate of entry. It is rational and may be commercially sound for modern firms to collude, and therefore no amount of legislation will stifle that desire. In US antitrust, parallel pricing arises under Section 1 of the Sherman Act, where the courts focus attention on the type of evidence 'from which a conspiracy can be inferred'. In this instance the type of behaviour referred to is conscious parallel behaviour. However, as we know, the difficulty in antitrust is in deciding whether or not parallel behaviour is sufficient to establish an agreement. A not dissimilar debate took place in EU competition circles arising from the court's interpretation of collective or joint collusion in the Gencor/Lonhro case (McNutt, 2005). The argument can be traced back to Sraffa (1926), who argued that firms would avoid competition if the expected rents from cartelisation exceeded the gains from long-run competition. This requires us to focus on the type of competition in a market and not on market structure per se, on scramble, combat and contest competition. Or alternatively, if management enter a signalling game, the risk of competition could be avoided.

Across the literature, it is clear there is a need to return to an understanding of the type of competition that prevails in a market under scrutiny with a focus on firms interacting in an evolving Boolean network of interrelated firm behaviour. As the atomistic behaviour of a perfectly competitive market structure leads to a long-run equilibrium, likewise the Boolean behaviour of the market systems evolves into an ordered arrangement that manifests itself as market-sharing strategies and inevitably implicit or parallel collusion on price. In types of market systems, the firm is an integrated network of market systems. As argued elsewhere, greater emphasis should be placed on the relevant firm than on the relevant market for antitrust analysis.

With different elasticities, for example, a two-firm and a ten-firm market structure challenge the traditional economic theory underpinning antitrust policy. A ten-firm structure with an industry elasticity of 0.5 could be more monopolistic as measured by the Lerner Index than a two-firm structure with an industry elasticity greater than 1.5. In the Chamberlin model, the degree of industry elasticity determines the level of profit. Could we imagine an industry structure that exhibits an oligopoly structure with zero long-run profit? The problem is that the industry structure is defined within the traditional structure-conduct-performance model with reference to H and η and deriving the equation

$$L = H/\eta$$

But this equation does not depend on any form of explicit collusive behaviour. Rather, the monopoly power arises from the exogenous assumption of Cournot-Nash play and the restriction on entry — these conditions assure an outcome, which, according to Cubbin (1988), could be interpreted as an 'apparently collusive arrangement'. Ironically, the monopoly equilibrium arises from the best-reply responses in what is essentially a non-cooperative Cournot-Nash competition.

Trigger Price

An equally important determinant is the DQ's knowledge about elasticity for its suite of products. At its simplest, elasticity measures the responsiveness of any quantity variable Δq to changes in price, Δp. The concept can be expanded to include supply-side responses and indeed to consider other quantity-type variables on the demand side. The most interesting is the advertising elasticity of demand, which would measure, for example, how a percentage change in advertising expenditure would contribute to changes in sales. This has been referred to earlier in the book as price elasticity (of demand). For a given linear demand, an elastic region lies above the mid-point and an inelastic region below the mid-point. The real market price will be in one or the other of the two regions. Therefore, strategically, DQ should now interpret a price fall as movement towards the mid-point and a price increase as a movement upwards towards the mid-point. How do we distinguish between the two? We can do so by computing that mid-point, the trigger price, and identifying the likely responsiveness in the direction of the price signal.

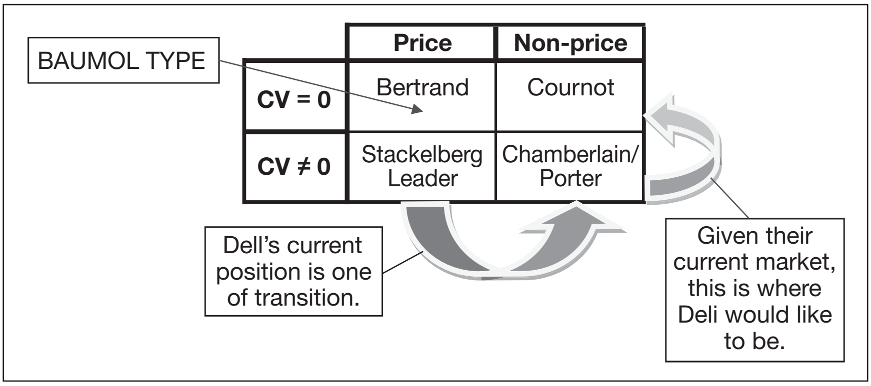
In the elastic region, as price falls sales increase, so revenue goes up; conversely, revenue falls if price rises. Therefore, in the elastic region, price and revenue are inversely related. By contrast, in the inelastic region, price and revenue are positively related. Now a management decision to change price must assume knowledge of such a price, the trigger price, because if price is to drop, it can do so only from the elastic range toward the mid-point, otherwise management fail the total revenue test. And such failure is a strategic mistake if the price change excites a price war by sending the wrong signal to rival players. If anything, the need to compute the trigger price is to act as a guide. It is not a real price that can be charged to consumers; rather, it is a measure of the amount by which a price **ought** to change in any price sequencing.

What Market to Enter?

Chandler's thesis is that structure follows strategy. In other words, it is the behaviour of management, observed as strategy by competitors, that determines the market structure. If a firm's strategy is to be carried out, or implemented, individuals working within the firm must know about the strategy and its operational requirement for tasks and actions, and their coordination. How the firm responds to problems of information, innovation, coordination and commitment in a game will determine its long-term position in an industry.

Within Framework Tn=3, there is a game embedded strategy (GEMS) that has the following important characteristics. In particular, determining the preferred market will depend on a host of factors discussed throughout the book, from sustaining competitive advantage to strategic positioning in the market and playing the non-cooperative game of competition. Management's best response will ultimately depend on the unique set of circumstances they face, although management

Figure 9.5
Dell's Movement in Strategic Focus



may differ by type and may differ on the threats facing the firm or how the firm should respond.

Dell Inc. represents an interesting case (see Figure 9.5). Competing on non-price attributes is a new approach for Dell and takes them into new strategic territories.

All players would like to significantly differentiate themselves to remove their nearest rival from the horizon. In Dell's current strategic position, this could mean moving to the non-price competitive Cournot box with CV = 0. However, Dell Inc historically has a type — a Baumol type — of using price to drive earnings, revenues and value, and whether or not they keep to type can be gleaned from signals in CEO statements and through their fiscal year performance.

Drawing on Framework Tn=3, game theory can be used to directly play out scenarios to determine which strategic options are optimal. This is important for making the step from strategic option to strategic decision. The toolbox presented in this monograph can apply to business strategy at different levels — corporate, divisional or regional — all of which have one starting point: the goals of the organisation. Once the goals are known and understood, management seek to implement strategies that will achieve those goals. Tactics determine how each of the strategies is played out on a day-to-day basis. The toolbox incorporates game theory. There are many industry analysis tools and many models for deriving business strategies, including Porter's Five Forces model and the Value Net. They can be deployed to support a view of the organisation with management as players in a dynamic non-cooperative evolutionary game.

The toolbox is a process that starts with requiring DQs to understand organisational goals. It then moves on to requiring an understanding of the industry in which the company operates and the factors affecting the industry and its future. Through this analysis, opportunities and challenges should present themselves. These in turn present strategic options, which may benefit from being played out as a game — the next stage in the process. Game scenarios will help determine which of the strategic options is optimal. Furthermore, game theory

A Game Embedded Strategy (GEMS)

Strategy Question: What Market Should We Be In?

A company should NOT be in a market where the identity of the nearest competitor is not known OR where the identity is known but not the likely reactions.

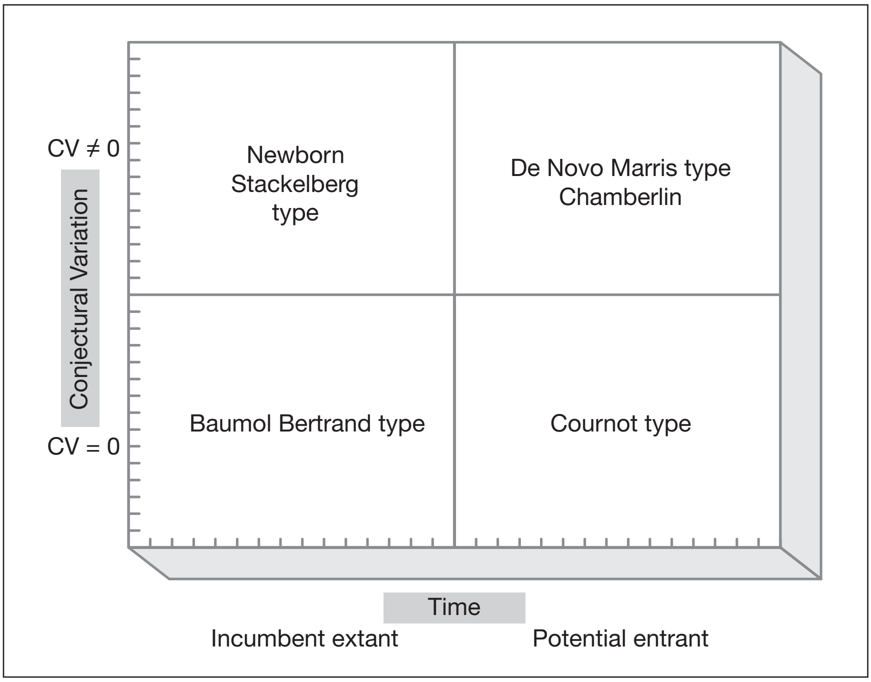
Dimensions of GEMS

1. Profits are captured by management as players. Porter's 5 Forces strategy focuses on the threat to industry profits, Framework Tn=3 identifies new opportunities for growth, and a game embedded strategy enables management to act to capture and retain profits in t+1.
2. A game embedded strategy is more likely to be ahead of the game in terms of the next strategy adopted in oligopoly markets. It facilitates a second mover advantage, and with no surprises a first mover advantage is obtained.
3. Participation in a game requires management to pay attention to signals, to camouflage their type and to be both consistent and coherent over the life cycle of the game.

can help add insight into what factors are important in undertaking the chosen strategy, such as where to compete, what the price sensitivity of the market is, and how the firms structure themselves to compete effectively. The process ends with a strategic decision being made, given the outcome of strategic game playing.

Business strategy can be interpreted as games of complete information wherein management not only know their own type but also the type of the other competitors. Incomplete information is introduced by the concept of vertical blending, whereby the type of management blends with the type of player, and thus the preferences of management are clouded. In this context, by adapting the arguments of Harsanyi (1967, 1968), we are able to assume that each player has a particular characteristic, which determines its preferences over actions (social states) and its beliefs about the Z-preferences of the other players, the competitors.

Figure 9.6
Nomenclature on Type



In other words, with vertical blending the type of player is no longer common knowledge in the game. To have assumed that the beliefs of players are common knowledge in the real world of business strategy appears unreasonable. In reality, we have little idea how individual management actually acquires beliefs. However, vertical blending allows us to define the players in a game by their strategies. In other words, we do not ask: How does management behave? Rather, we ask: Given their strategy, how should they behave? The focus is on answering: What market should they be in? There is less focus on answering: How can they optimise in the present market? Management make a decision knowing that something has to be done in terms of improving financial performance, and then management take an action knowing how and when to improve that performance. The action depends on their understanding of type and their realisation that their company is a player in a market-as-a-game.

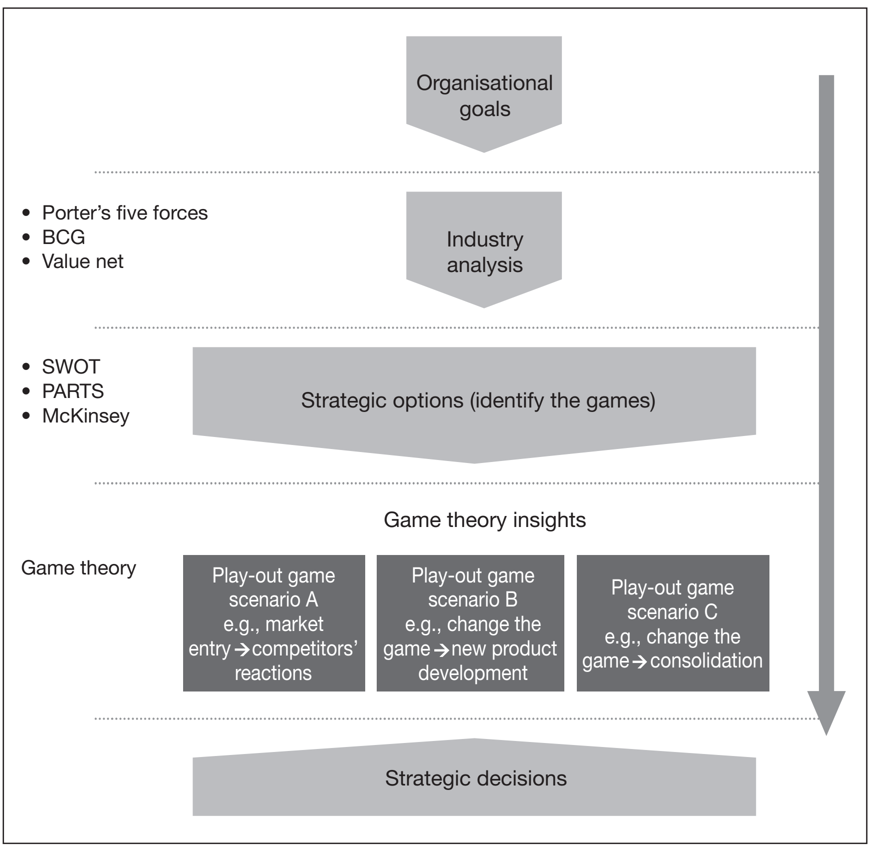
GEMS Strategy Toolbox

In all the pay-off matrices, self-interest (maximising the size of the pay-off) governs the likely response of a player and the fact that the probability of the outcome is not relevant can be diluted through the introduction of behavioural characteristics of players. In assessing the game dimension, management should pay particular attention to understanding the behavioural characteristics of players in the game, as well as their type, and assessing the likely responses of players based on a set of assumptions, beliefs and prior knowledge. The key point to note is that game pay-offs can be adjusted to reflect the nature of the response by players, given assumptions made about their behaviour. Management should derive a set of behavioural aspects about the other players in a strategic game in order to factor in the likelihood that the behaviour will affect the game pay-offs.

The majority of pay-offs in the game analogies referred to in this book can apply and be extended to include conditional probability. Through the review of the concepts of game theory, it is clear that the discipline can add a different perspective and complementary approach to examining strategic business decisions. Many of the key elements of game theory provide insights into areas such as competitor reactions, pricing, cooperation and competition, the importance of scale, the value of information, signalling and the importance of communication. The concepts of adverse selection and signalling provide valuable direction and insight on how to compete. Game theory broadens the scope of economic analysis.

Easterbrook and McNutt have constructed a strategic toolbox to incorporate game theory (see Table 9.10). Game theory can be used to directly play out scenarios to determine which strategic options are

Table 9.10
Easterbrook–McNutt Strategic Toolbox GEMS



optimal. This is important for making the step from strategic option to strategic decision.

It is critical to understand the future implications of one's action in time period t. One is reminded of Goethe, who tells us that Faust lost the liberty of his soul when he said to the passing moment, "Stay thou art so fair".

In Table 9.11, the win-win payoff (2,2) for both players is to play SA, and signal type.

Samuelson (2005) reported that in laboratory experiments on PD games some players preferred the more superior outcome (2,2). In a business context, where the market is a game, and where type is either signalled by all players or analysed by third parties, the DQ player may prefer the more equal, although firm-specific, less profitable outcome of SA to the more asymmetric pay-offs obtained under SB. If both players adopt SA we observe a penguin strategy — a credible collective response by competitors to a market event such that no one competitor acts unilaterally and all competitors are observed to behave together. It can give rise to an accidental sameness in price (ASP) observation absent tacit collusion as argued in McNutt's *Law, Economics and Antitrust* (2005). This would be a defining characteristic of a game embedded strategy.

Table 9.11
Prisoners' Dilemma

	SA	*SB*
SA (Signal your type)	**2,*2***	**–1,*3***
SB (Act differently)	3,***–1***	**0,*0***