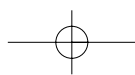
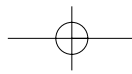


Part V: Business strategy





Part V Business strategy

This part focuses on the strategic considerations regarding organizational choices. There are several reasons why these considerations have been ignored in the previous parts. First, the emphasis hitherto has been on aspects of the internal organization of firms, the external organization being largely taken for granted. This part focuses on the strategic interactions between firms. Second, Chapter 3 in Part II formulated as a benchmark the perfectly competitive market, where one firm cannot affect the price because there are many other firms in the market, and each firm is a price taker. However, most markets have only a limited number of competitors. Markets are often oligopolistic rather than perfectly competitive, i.e. firms are price setters rather than price takers.

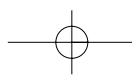
Third, transaction costs economics and incomplete contracting theory (in Part IV) assumed that the efficient governance structure is chosen. Strategic considerations therefore play no role in the choice of governance structure. This may be a good starting-point for formulating insights regarding governance structure, because very inefficient choices are not likely to survive. However, there is no guarantee that efficient outcomes will emerge. Strategic considerations may result in an equilibrium governance structure which is inefficient, i.e. the competition between a limited number of firms may drive the choice of various internal organizational decisions.

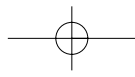
Strategic considerations will be analysed with the behavioural assumptions of Part II. Firms are assumed to possess unlimited cognitive capacities and are driven by self-interest. These assumptions are made for convenience in order to highlight the effect of strategic interactions in the choice of various aspects of organizations. Similar strategic insights can be formulated when other behavioural assumptions are used. Figure V.1 positions this part in the familiar way.

{PRIVATE}		Behavioral hypothesis		
		Opportunistic	Self-interested	Idealistic
Degree rationality	Complete rationality		Strategic interactions	
	Limited Rationality			
	Procedural Rationality			

Figure V.1: Positioning of part V

In this part the focus is on the strategic interactions between firms. This results in a rudimentary characterization of the firm as a production function, as in Part II. However, the ideas presented in this part can be extended easily towards other characterizations of the firm, like those already adopted in Parts III and IV, and those which will be adopted in Parts VI and VII. Figure V.2 presents the familiar picture regarding the concept of the firm used in this part.





Part V Business strategy

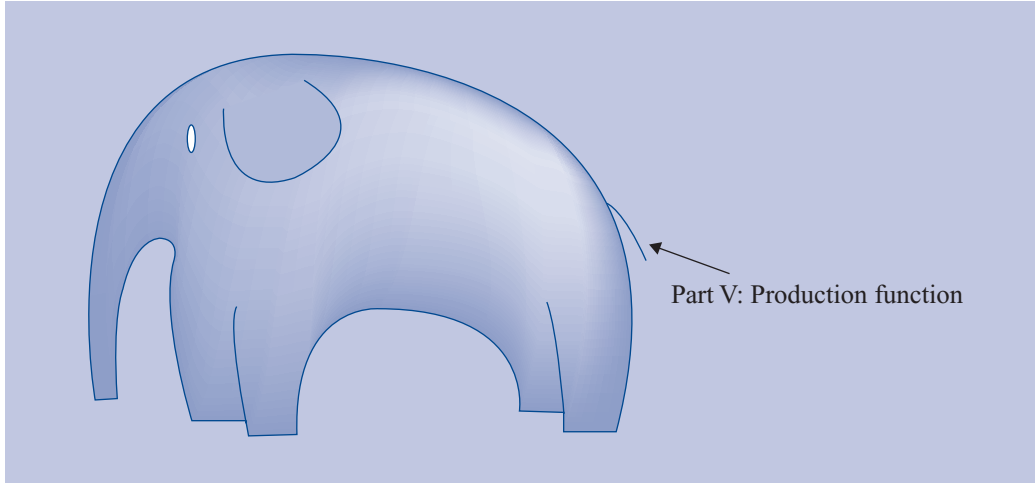
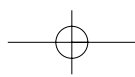
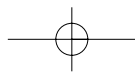
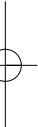
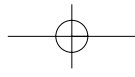


Figure V.2: View of the firm in strategy typology





11

Strategy typology

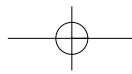
LEARNING OBJECTIVES

After completing this chapter, you should understand:

- How a reaction function depicts the nature of competition, various profit levels, the response to aggressive behaviour, increases in costs, and increases in demand.
- The distinction between hard and soft investments.
- The impact of the nature of investment, the entry condition, and the nature of competition on the profit maximizing investment strategy.

Contents

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Decision sequence in the strategy-taxonomy	11.2
Reaction functions	11.3
Properties of reaction functions	11.4
Strategy typology	11.5
Applications	11.6
Conclusion	11.7
Exercises	11.8



Chapter 11: Strategy typology

11.1 Introduction

This chapter is about the strategic behaviour of firms in markets with a limited number of competitors. Strategic interactions underlie not only market phenomena such as price wars, patent races and advertising campaigns, but also organizational phenomena like delegation, incentive schemes, financial structure and vertical integration. The interactions or interdependencies among the firms can be complicated, but the tool of game theory enables the formulation of a few simple principles regarding the optimal behaviour of a firm in a strategic setting. A strategy typology will be developed which delineates the optimal investment behaviour of the firm in various strategic settings.

Section 11.2 outlines and motivates the decision sequence used in this chapter. Reaction functions in different markets will be determined in Sec. 11.3, while Sec. 11.4 outlines various properties of reaction functions. Section 11.5 develops the strategy typology. Applications related to the topics of this book are formulated in Sec. 11.6. Finally, Sec. 11.7 concludes.

11.2 Decision sequence in the strategy taxonomy

Strategic issues will be illustrated by focusing the attention on the actions or investments of an incumbent firm influencing the entry decision of a rival firm. The incumbent firm is sometimes called the leader and the rival firm the follower. Entry entails a certain sequence of time. The incumbent takes certain investment decisions before the entrant can do something, i.e. the entrant is faced with the investments of the leader when it has to take an action. This provides the opportunity for the incumbent to structure the market in a favourable way, to a certain extent. The three-stage game of this chapter consists of the following:

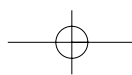
Stage 1 – Investment decision of the incumbent firm.

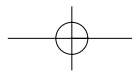
Stage 2 – Entry decision of the entrant.

Stage 3 – Competition.

Figure 11.1 depicts the strategic situation considered in this chapter. The incumbent chooses between a small (S) or a large (L) investment. Subsequently, the entrant decides regarding entry into the industry: yes (Y) or no (N). Finally, there will be either price or quantity competition between the firms in the industry.

It turns out that this simple structure can be used for the strategic analysis of many different investments in many different industries. However, various situations have to be distinguished in order to do justice to this huge variety. Eight cases will be considered. These eight cases are the possible combinations which can be formed with two types of investments, two market conditions regarding entry and two types of competitive processes. First, each investment will be classified as either a hard or a soft investment. Second, the market is such that entry is either inevitable or can be deterred by the incumbent. Finally, the market is characterized by either strategic substitutes or strategic complements. So, eight possible games will be considered. Figure 11.2 shows these $2 \times 2 \times 2 = 8$ games. The subgame perfect equilibrium in each of these eight games will be determined in the next sections. The outcome is called the *strategy typology*.





Chapter 11: Strategy typology

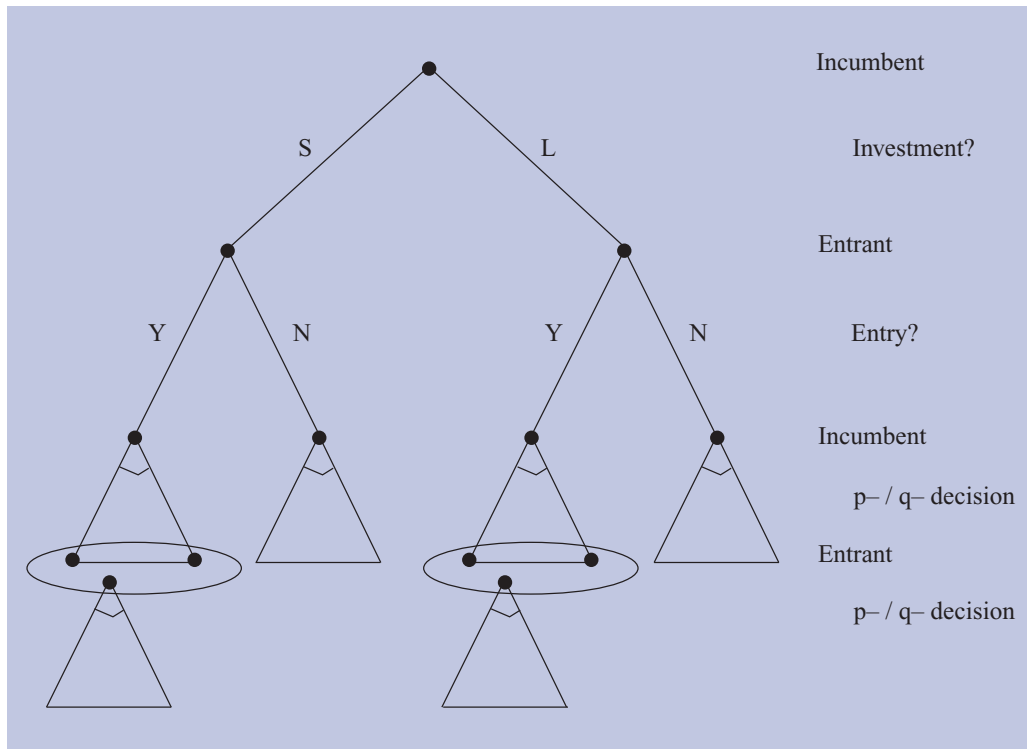
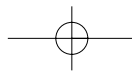


Figure 11.1: Decision sequence in the strategy-taxonomy

Type of investment	Entry?	Nature of competition	Profile	SPE investment
Hard	Yes	Strategic substitutes		
		Strategic complements		
	No	Strategic substitutes		
		Strategic complements		
Soft	Yes	Strategic substitutes		
		Strategic complements		
	No	Strategic substitutes		
		Strategic complements		

Figure 11.2: Eight games will be distinguished in the strategy typology





Chapter 11: Strategy typology

11.3 Reaction functions

Many of the ideas in the previous chapters have been illustrated with numerical, discrete examples in extensive form. This entailed a limited number of choices, represented by a limited number of branches. However, if the number of choice possibilities is large, then it is often more convenient to use a continuous choice variable than a discrete choice variable. Examples are the quantity produced and the price. The continuity of the choice variable can be represented in the extensive form by triangles, as in Fig. 11.1, but it turns out that a figure with a horizontal and vertical axis is more informative. It allows reaction functions to be depicted and the effect of investment choices to be illustrated. Such a diagram will be used in this chapter.

A *reaction function* is defined as a profit-maximizing strategy of a firm, given the strategies of the other firms. It specifies for the firm a profit-maximizing strategy corresponding to every possible strategy of its rivals, and therefore also what the response is to a change in strategy of the rivals. Reaction functions are sometimes referred to as *best response functions*.

It turns out that the distinction between quantity competition and price competition is important for the slope of the reaction function. Suppose there are two firms in an oligopolistic market with substitute products and that there is *quantity competition*. The slope of the reaction function of a firm is determined by the profit-maximizing response to a change in output level of the rival. For example, if the firm is producing 10 units and its rival is also producing 10 units, then the question is whether the firm will respond by increasing or decreasing its output when the rival increases its output level to 15. An increase in the quantity supplied by the rival entails that a larger part of the market is taken by the rival, which implies that the residual demand left for the firm has decreased. The profit-maximizing response for the firm is to decrease its level of output. The slope of the reaction function of the firm is therefore negative when there is quantity competition. Figure 11.3 depicts this situation, where q_1 is the quantity produced by firm 1 and q_2 the quantity produced by firm 2.

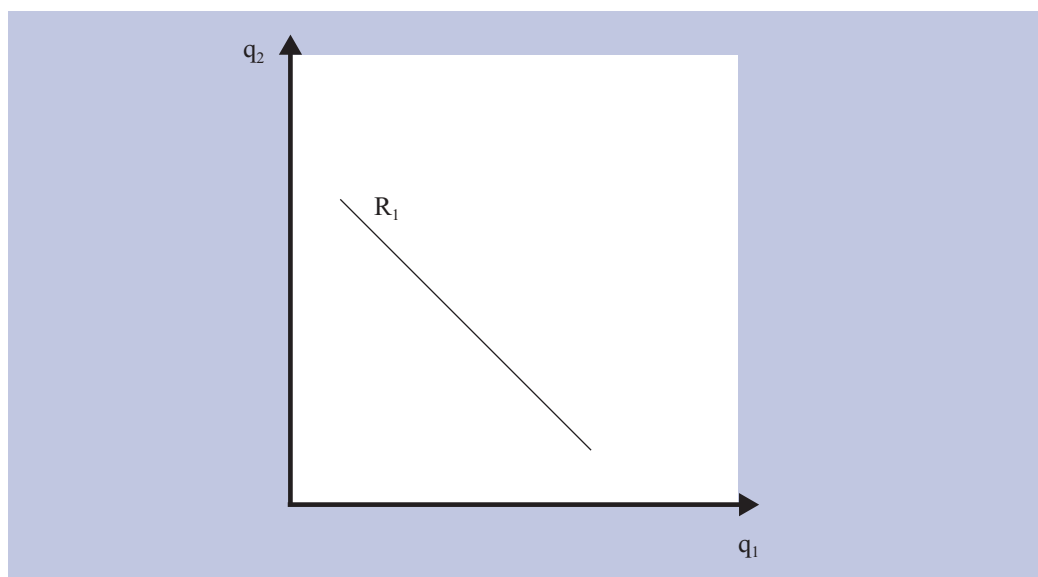
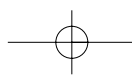


Figure 11.3: The reaction function has a negative slope when there is quantity competition



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Notice that there is a quantity level on the horizontal as well as the vertical axis. (The familiar demand function is depicted in a figure with the price on the vertical axis and the quantity on the horizontal.) A reaction function can be depicted in this figure, because a profit-maximizing output level (q_1) of firm 1 is indicated for every possible level of output (q_2) of firm 2.

Suppose now that there is an oligopolistic market with *price competition* and substitute products. The slope of the reaction function of a firm is determined in the same way. For example, if the firm is setting a price of 10 and the rival is also choosing a price of 10, then the question is whether the firm will respond by increasing or decreasing its price when the rival increases its price to 15. The increase in the price of the rival entails that a smaller part of the market is taken by the rival, which implies that the residual demand left for the firm has increased. The profit-maximizing response for the firm is to increase its price. The slope of the reaction function of the firm is therefore positive when there is price competition. Figure 11.4 depicts this situation, where p_1 is the price chosen by firm 1 and p_2 the price chosen by firm 2.

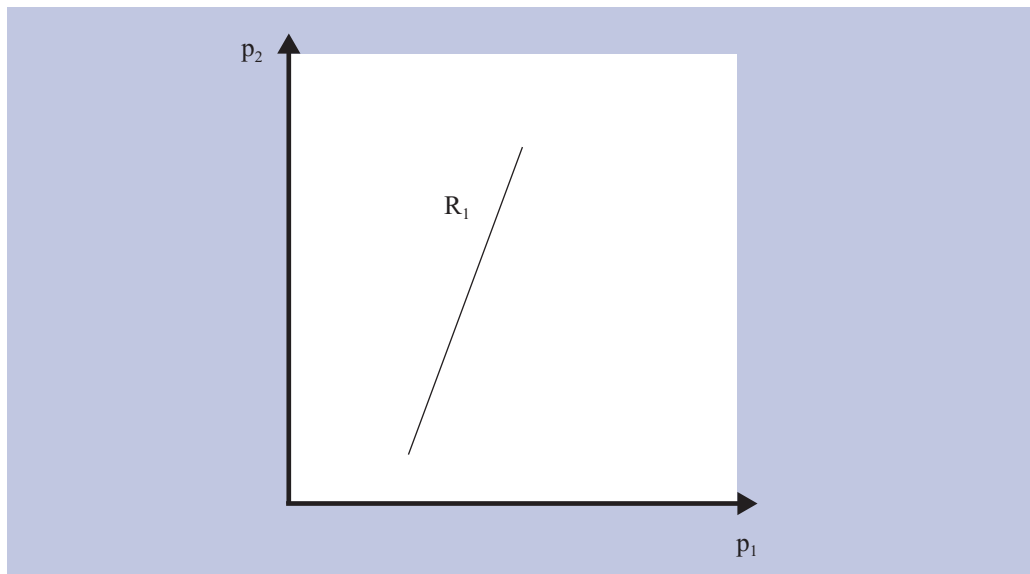
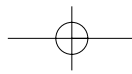


Figure 11.4: The reaction function has a positive slope when there is price competition

A Nash equilibrium is defined as a payoff-maximizing strategy for *each* firm, given the strategies of the rivals. A reaction function is defined as a profit-maximizing strategy of *one* firm, given the strategies of the other firms. These definitions imply that the intersection of the reaction functions is a Nash equilibrium. Figure 11.5 presents the Nash equilibrium in a market with quantity competition. The next section presents various properties of reaction functions.

It will turn out in Sec. 11.4 that the slope of the reaction function is one of the three crucial ingredients in determining the profit-maximizing investment strategy of the firm. This section has shown that the reaction function has a negative (positive) slope when there is



Chapter 11: Strategy typology

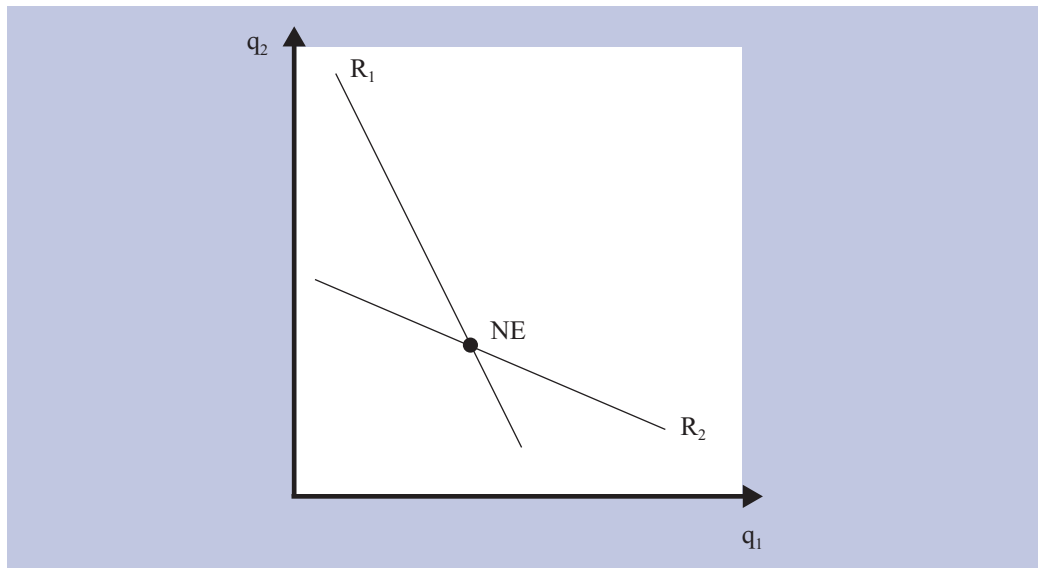


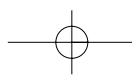
Figure 11.5: Nash equilibrium in a market with quantity competition

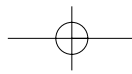
quantity (price) competition in an oligopolistic market with substitute products. There are also oligopolistic markets with complementary products. Examples are cars and tyres, computer hardware and software, and cameras and lenses. The slope of the reaction function is reversed in these markets, i.e. the reaction function has a positive (negative) slope in an oligopolistic market with complementary products and quantity (price) competition. For example, suppose there is quantity competition between a car and a tyre manufacturer. An increase in the quantity of cars sold reduces the price of a car. This increases the demand for tyres. The profit-maximizing response of the tyre manufacturer is to increase the quantity of tyres, i.e. the reaction function of the tyre manufacturer has a positive slope when there is quantity competition in an oligopolistic market with complementary products.

The notions of strategic substitutes and strategic complements are defined in order to capture the slope of the reaction function, regardless whether there is price or quantity competition. A strategic variable is called a *strategic substitute* when the reaction function has a negative slope. Quantity is therefore a strategic substitute in an oligopolistic market with substitute products. Similarly, a strategic variable is called a *strategic complement* when the reaction function has a positive slope. Price is an example of a strategic complement in an oligopolistic market with substitute products.

11.4 Properties of reaction functions

Reaction functions have various properties. Only three properties will be discussed, because they will be used in the strategy typology and the applications. The first property concerns the (profit-maximizing) *response to aggressive behaviour* by the rival firm(s). The response depends on the slope of the reaction function. Suppose that there is quantity competition. An aggressive action by a firm in a market with quantity competition entails that the quantity produced increases, i.e. that a larger share of the market is taken. The residual market





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demand of the other firm will therefore decrease, and the profit-maximizing response is to decrease the level of output. An aggressive action in a market with quantity competition is responded to in a passive way. Figure 11.6 illustrates this situation, where the reaction function of the responding firm is depicted by R_2 . An aggressive action by firm 1, i.e. an increase in the quantity q_1 , will be responded to by a decrease in q_2 by firm 2. Notice that R_2 is depicted because the *profit-maximizing* response to aggressive behaviour is determined.

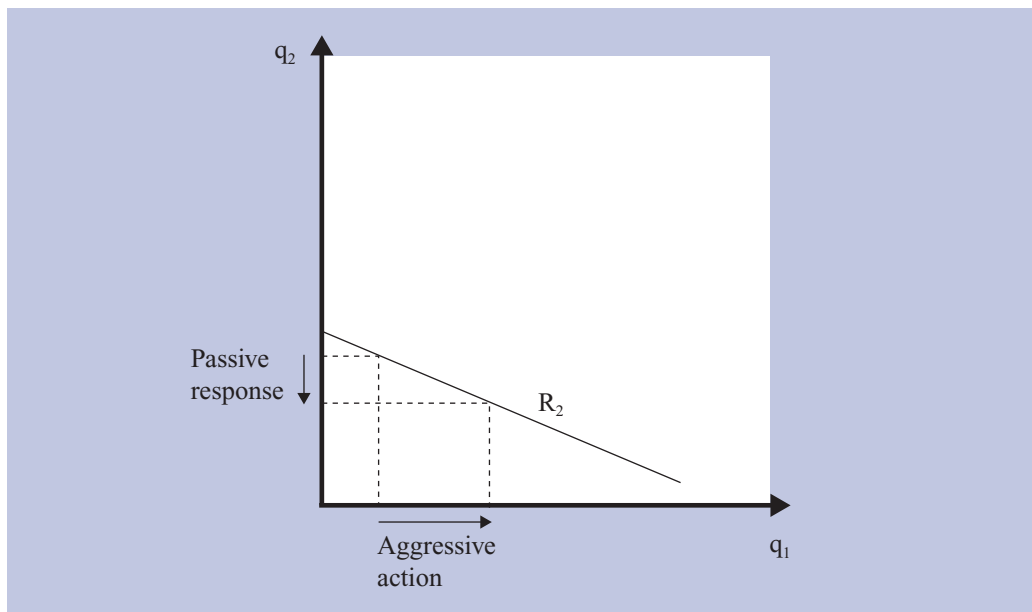
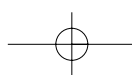
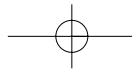


Figure 11.6: An aggressive action is met by a passive response when there is quantity competition

Suppose that there is price competition. An aggressive action by a firm in a market with price competition means that the price will be decreased, i.e. a larger share of the market is taken. The residual market demand of the other firm will decrease, and the profit-maximizing response is to decrease the price as well. An aggressive action in a market with price competition is responded to in an aggressive way. Figure 11.7 presents this situation. An aggressive action by firm 1, i.e. a decrease in the price p_1 , will be met by a decrease in p_2 by firm 2.

Each point on the reaction function is associated with a particular *profit level* of the firm. Does the profit level increase when the value of the strategic variable increases? It turns out that the answer to this question does not depend on the slope of the reaction function. Suppose that there is quantity competition. The reaction function of firm 1 is depicted in Fig. 11.8. Moving to the south-east on R_1 implies that the level of output of firm 2 decreases, while the output level of firm 1 increases. The profit level of firm 1 increases therefore to the south-east on its reaction function. (If the level of output of firm 2 has dropped to zero, i.e. $q_2 = 0$, then firm 1 is a monopolist and earns the highest possible profit level. Any increase in q_2 is sure to lower profits.)





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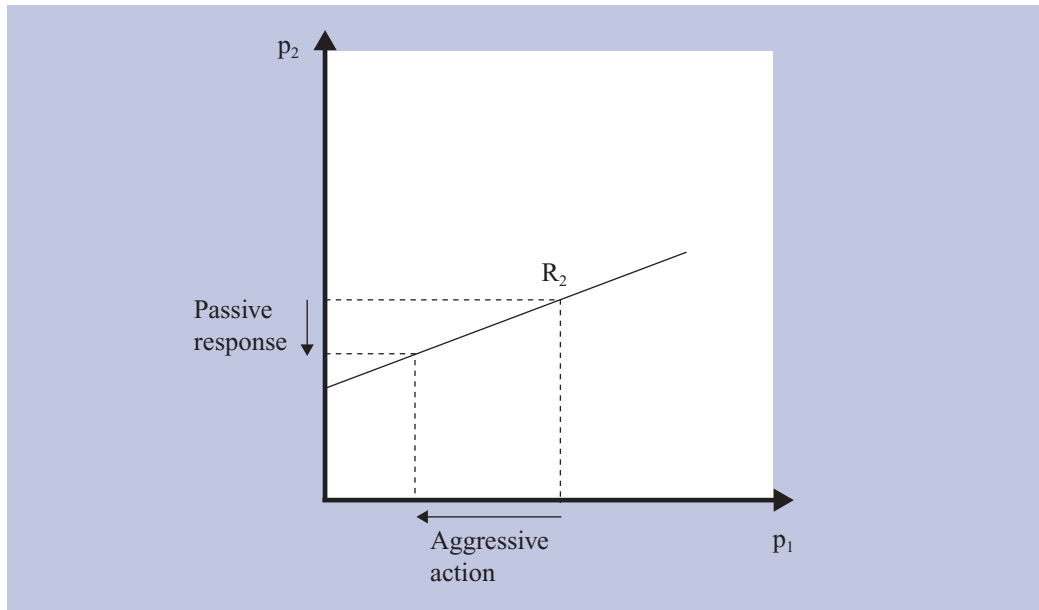


Figure 11.7: An aggressive action is met by an aggressive response when there is price competition

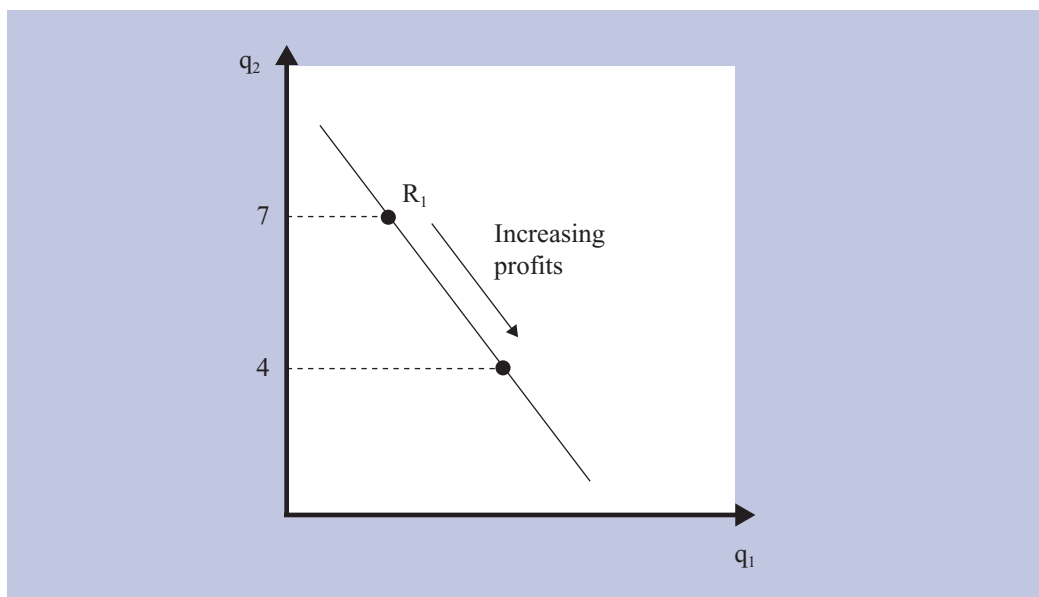
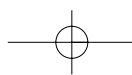
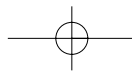


Figure 11.8: Profits of firm 1 increase on R_1 when the quantity produced increases

Suppose that there is price competition. The reaction function of firm 1 is depicted in Fig. 11.9. Moving to the north-east on R_1 implies that the price of firm 2 increases, which implies that a larger share of the market is left for firm 1. Maintaining the same price would therefore already result in a higher profit level for firm 1. However, R_1 implies that firm 1 will even raise





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its price, which must increase profits even further because R_1 depicts the profit-maximizing choice of firm 1. The profit level of firm 1 increases therefore to the north-east on its reaction function.

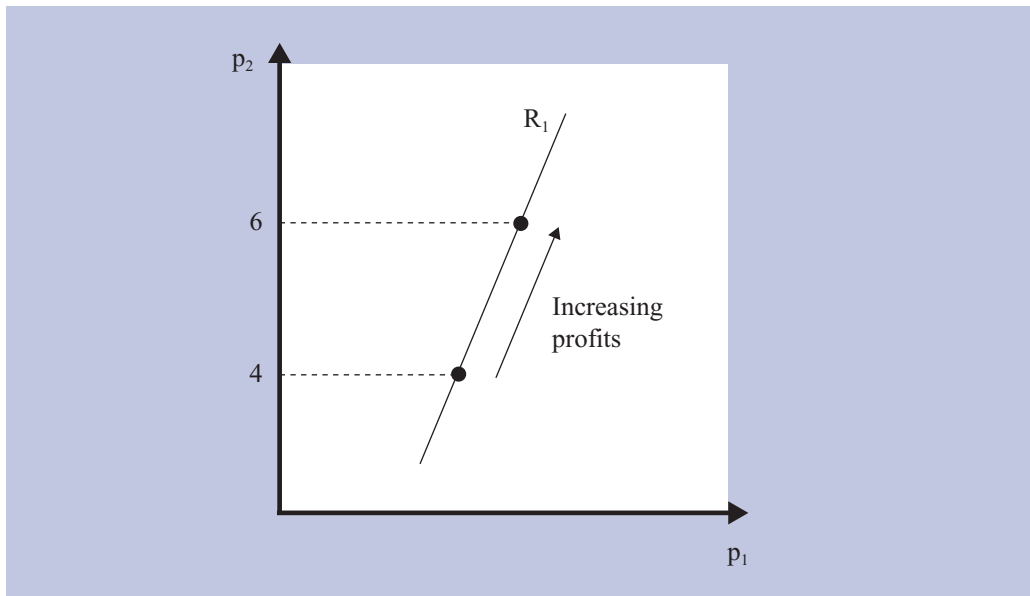
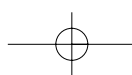


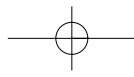
Figure 11.9: Profits of firm 1 increase on R_1 when the price increases

The *location of a reaction function* is determined by the cost structure of the firm and its market demand. A reaction function can therefore move because of a change in either the costs or demand. This will turn out to be crucial in the applications, because the incumbent determines the location of its reaction function by its (strategic) choice of investment. Suppose the market is characterized by strategic substitutes. An increase in the marginal costs, which may be due to replacing the current plant by one with a smaller production capacity, results in a lower profit-maximizing output level for every level of output of the rival. The reaction therefore function shifts to the left in a market with strategic substitutes when the costs increase. Figure 11.10 presents this situation.

The opposite occurs when the market is characterized by strategic complements. Higher marginal costs of firm 1 result in a higher profit-maximizing price of firm 1 for every price level of firm 2. The reaction function of firm 1 shifts to the right. Figure 11.11 depicts the consequences of higher marginal costs of firm 1 for its reaction function when there is price competition.

A reaction function may also shift because of a change in demand. For example, an increase in demand, i.e. an increase in average revenue (AR), results in an increase in the profit-maximizing quantity in a market with quantity competition. The reaction function therefore shifts to the right. Similarly, the profit-maximizing price increases in a market with price competition when the demand for the products of the firm increases. The reaction function shifts to the right. Figure 11.12 summarizes these comparative statics results.





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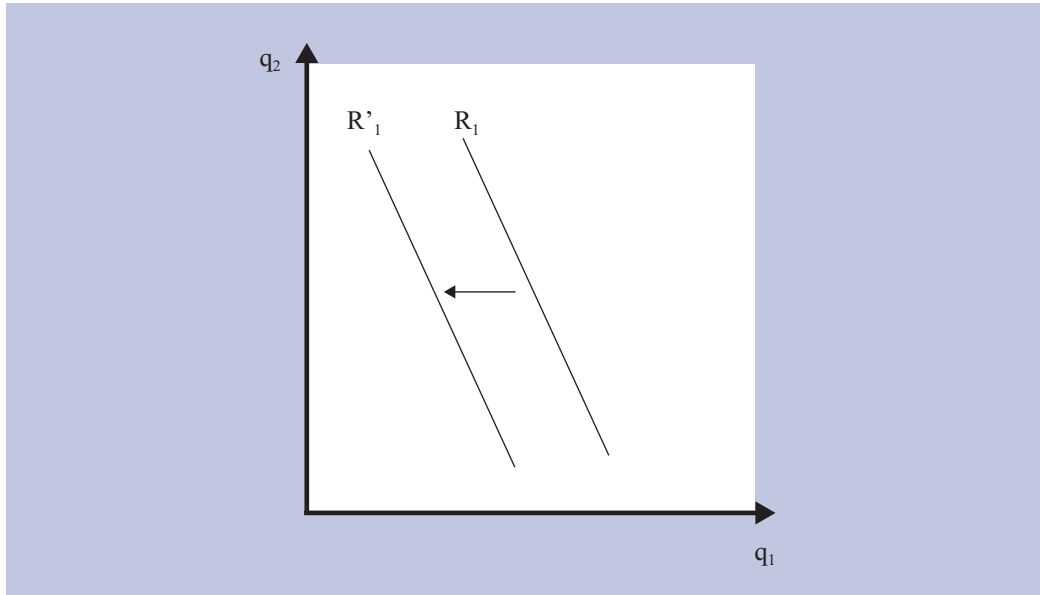


Figure 11.10: R_1 shifts to the left due to an increase in marginal costs

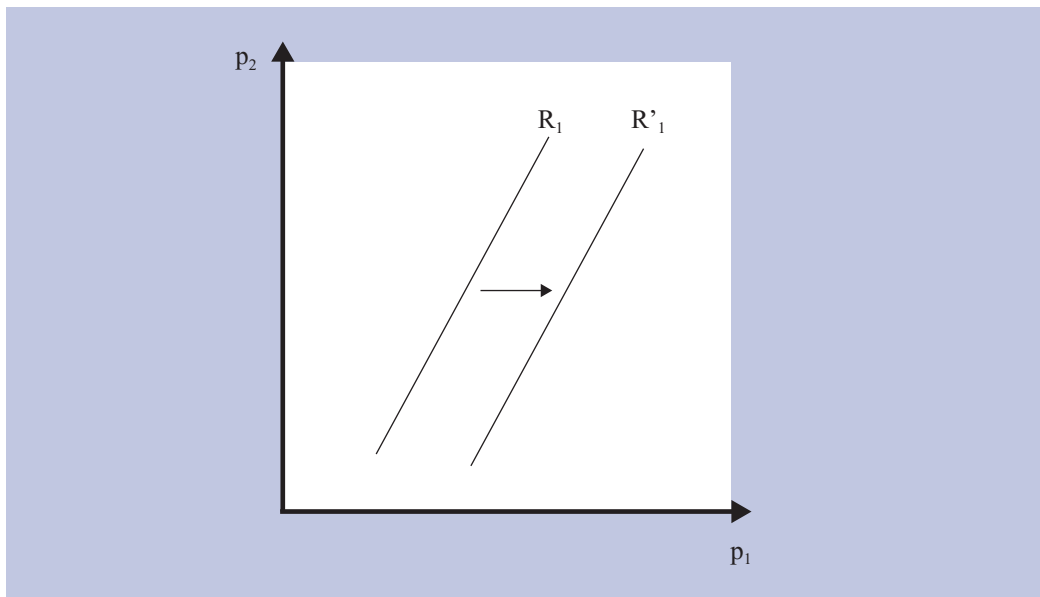
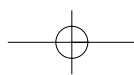
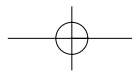


Figure 11.11: R_1 shifts to the right due to an increase in marginal costs





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		Shift in R_1 in market with	
		q-competition	p-competition
Increase in	MC	To left	To right
	AR	To right	To right

Figure 11.12: Comparative statics results

11.5 Strategy typology

The previous two sections have made every preparation to solve the game of Fig. 11.1 in general, and to determine the solution in each of the eight possible games of Fig. 11.2. The profit-maximizing investment behaviour of the incumbent in the first period is determined by three variables: the nature of the investment in the first stage of the game, the entry decision of the rival in the second stage and the nature of the competitive process in the third stage. The decisions in each stage can be phrased in terms of reaction functions, as follows:

Stage 1: Choice of location of the incumbent's reaction function R_1 by the incumbent.

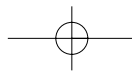
Stage 2: Will there be a reaction function R_2 of the entrant?

Stage 3: Intersection of the reaction function R_1 and R_2 of the incumbent and the entrant.

The subgame perfect equilibrium is again determined by backward induction. So, the profit-maximizing profile of the incumbent in the third stage is determined first. Four cases are distinguished, because the profit-maximizing profile depends on the nature of the competitive process in the third stage, i.e. strategic substitutes or strategic complements, and the profitability of entry for the entrant, i.e. entry is inevitable or it can be deterred by the appropriate choice of investment by the incumbent.

The aim of the incumbent is to choose its profile in such a way that its payoffs are maximized. They are maximized when it faces a passive entrant, or no entrant at all, i.e. an extremely passive entrant. Making the entrant passive is the guiding principle regarding the profit-maximizing investment choice of the incumbent in the four cases which will be distinguished. The effect of investment is distinguished in competition-intensifying and competition-reducing investments. Competition intensifying investments result in more aggressive decisions of the incumbent for the (potential) entrant, like lowering the price or increasing the quantity. This gives the incumbent an aggressive profile. An aggressive profile of the incumbent in the final period establishes a decrease in the profit level of the entrant. The opposite holds for competition-reducing investments. These investments make it attractive for the incumbent to set a high price, or to produce a limited quantity, in the competitive process, which gives the incumbent a passive profile.





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Figure 11.13 depicts a market where entry is inevitable and the market is characterized by strategic substitutes. Strategic substitutes are captured by the negative slope of the reaction functions. Two reaction functions are specified for the incumbent: $R_1(A)$ and $R_1(P)$. $R_1(A)$ represents the reaction function corresponding to an investment level which makes the incumbent aggressive, i.e. a high level of output is produced by the incumbent. Similarly, $R_1(P)$ represents an investment level which makes the incumbent passive, i.e. a low level of output is produced. The location of the zero on R_2 indicates that entry is inevitable. The reason is that the intersection of R_2 with $R_1(A)$ as well as $R_1(P)$ determines an output level of the entrant higher than the output level belonging to a zero profit level of the entrant. Another way of formulating this feature is that profits are increasing to the north-west on R_2 for the entrant, which is a straightforward adaptation of Fig. 11.8.

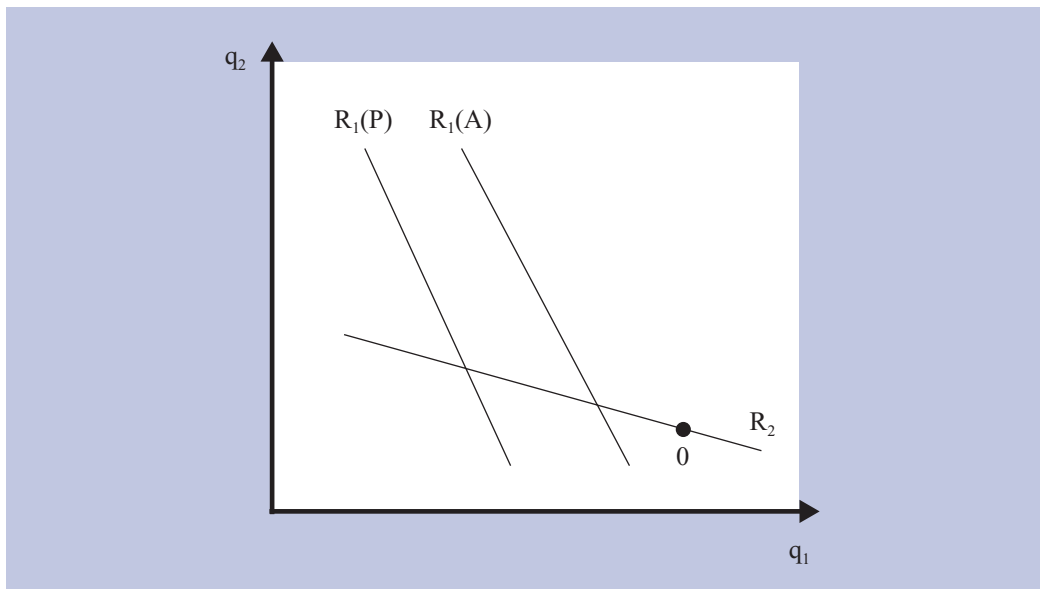
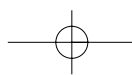
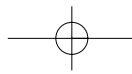


Figure 11.13: A market with strategic substitutes in which entry is inevitable

If entry is inevitable, then the incumbent faces a passive rather than an aggressive entrant. The previous section showed that an aggressive action by the incumbent is responded to in a passive way by the entrant when the competitive process is characterized by strategic substitutes. Therefore in a market with strategic substitutes where entry is inevitable the profit-maximizing profile of the incumbent is to be aggressive. Figure 11.14 summarizes this case.

Figure 11.15 depicts a market where entry is inevitable and the market is characterized by strategic complements. Strategic complements are captured by the positive slope of the reaction functions. Again two reaction functions are specified for the incumbent: $R_1(A)$ and $R_1(P)$. $R_1(A)$ represents the reaction function corresponding to an investment level which makes the incumbent aggressive, i.e. where a low price will be chosen by the incumbent. Similarly, $R_1(P)$ represents an investment level which makes the incumbent passive, i.e. where a high price will be chosen by the incumbent. The location of the zero on R_2 indicates





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that entry is inevitable, i.e. prices higher than the price belonging to the zero profit level of the entrant will result in equilibrium. The entrant will therefore decide to enter the industry, regardless of the choice of investment of the incumbent.

Entry inevitable?	Nature of competition	Profile
Yes	Strategic substitutes	Aggressive
Yes	Strategic complements	
No	Strategic substitutes	
No	Strategic complements	

Figure 11.14: Subgame perfect equilibrium profile in a market with strategic substitutes when entry is inevitable

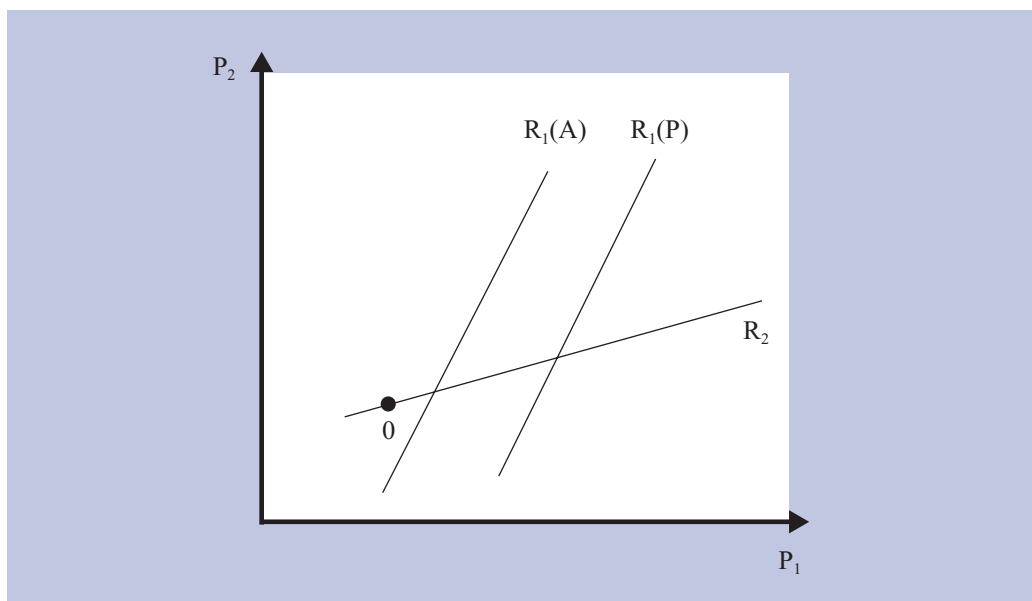
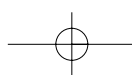
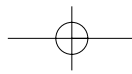


Figure 11.15: A market with strategic substitutes in which entry is inevitable

The incumbent likes to see a passive entrant. A market with strategic complements elicits a passive response of the entrant when the incumbent chooses a passive action, i.e. a high price. The payoff-maximizing profile of the incumbent in a market with strategic complements where entry is inevitable is therefore to be passive. Figure 11.16 lists this case.





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Entry inevitable?	Nature of competition	Profile
Yes	Strategic substitutes	
Yes	Strategic complements	Passive
No	Strategic substitutes	
No	Strategic complements	

Figure 11.16: Subgame perfect equilibrium profile in a market with strategic complements when entry is inevitable

The markets where entry can be deterred by the appropriate choice of investment of the incumbent remain to be analysed. The profit-maximizing choice of the incumbent is to invest in such a way that the entrant forgoes entry. This applies to the market with strategic substitutes as well as the market with strategic complements.

Figure 11.17 depicts this market with strategic substitutes. The location of the zero on R_2 between $R_1(P)$ and $R_1(A)$ means that entry is not inevitable. If the investment of the incumbent results in a passive profile, then the incumbent will produce a low quantity. A substantial part of the market will be left for the entrant, which makes entry profitable. Investment behaviour which creates an aggressive profile therefore makes entry unattractive.

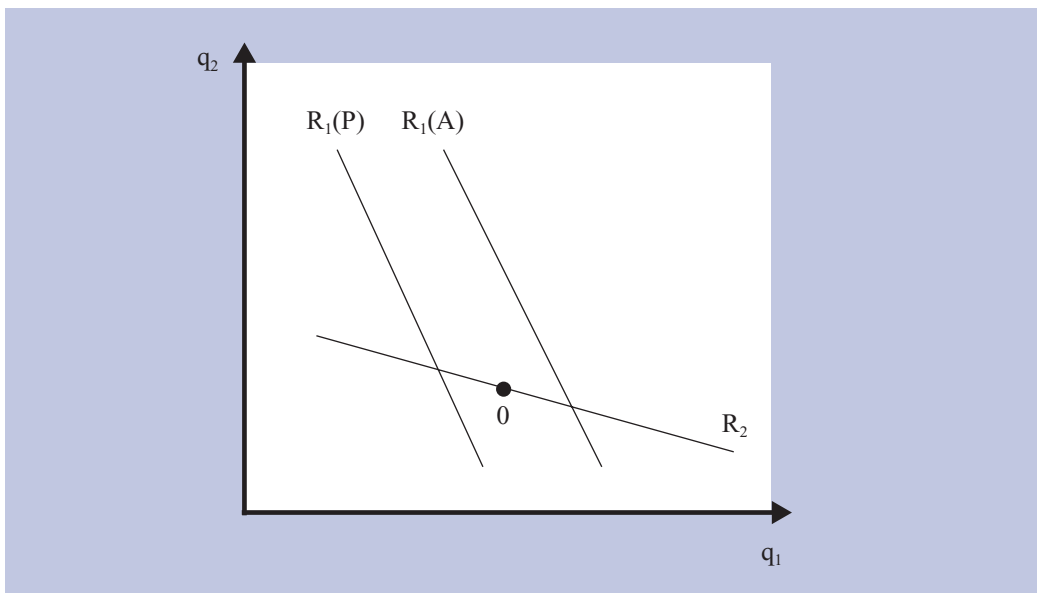
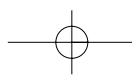
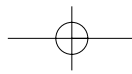


Figure 11.17: A market with strategic substitutes in which entry can be deterred





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The profit-maximizing profile of the incumbent in a market with strategic substitutes and the possibility to deter entry is to be aggressive. This deters the entrant, which establishes that the incumbent continues to be a monopolist. Figure 11.18 summarizes this situation.

Entry inevitable?	Nature of competition	Profile
Yes	Strategic substitutes	
Yes	Strategic complements	
No	Strategic substitutes	Aggressive
No	Strategic complements	

Figure 11.18: Subgame perfect equilibrium profile in a market with strategic substitutes when entry can be deterred

Figure 11.19 depicts the market with strategic complements and the possibility that entry does not occur. The location of the zero on R_2 between $R_1(P)$ and $R_1(A)$ shows again that entry is not inevitable.

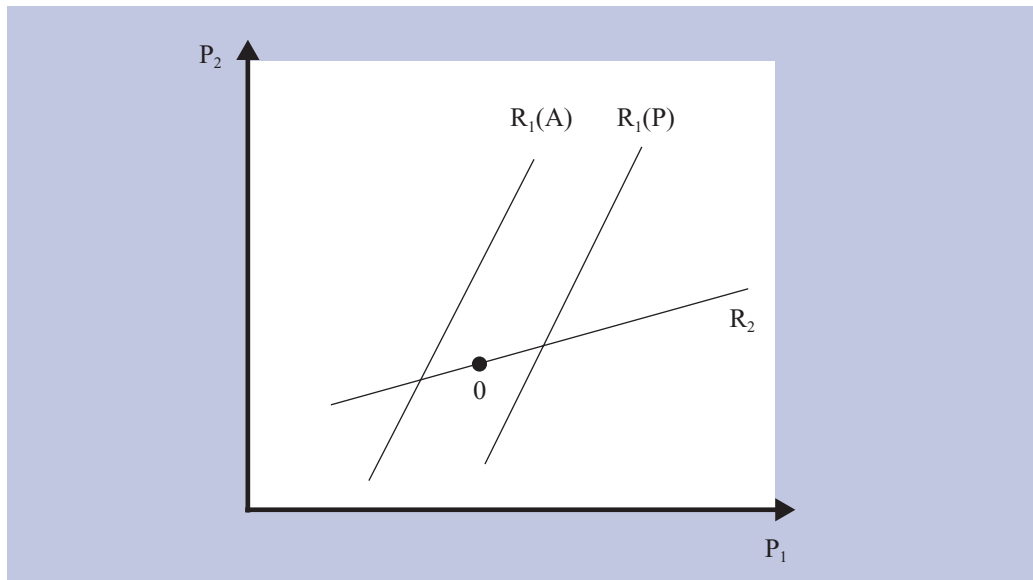
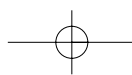
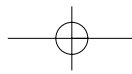


Figure 11.19: A market with strategic complements in which entry can be deterred

Figure 11.20 summarizes how the profit-maximizing profile of the incumbent is to be aggressive in a market with strategic complements in which entry can be deterred.





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Entry inevitable?	Nature of competition	Profile
Yes	Strategic substitutes	
Yes	Strategic complements	
No	Strategic substitutes	
No	Strategic complements	Aggressive

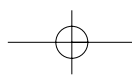
Figure 11.20: Subgame perfect equilibrium profile in a market with strategic complements when entry can be deterred

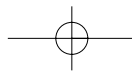
The profit-maximizing profile of the incumbent in the third stage of the game has to be made credible. This is done by the incumbent in the first stage by its choice of investment. An investment makes a certain profile credible because the costs of the investment are often to a certain extent sunk, i.e. the investment generates revenues for a substantial period of time in a specific relationship, but is less valuable when it is used for something else. This provides a commitment to a certain course of action, and therefore establishes the credibility of the profile.

Two types of investment are distinguished. An investment is *hard* when there is a negative relationship between the investment level of the incumbent and the profit level of the entrant. For example, if the investment is defined as the level of capacity, then it is hard. The reason is that a larger capacity reduces the marginal costs of the incumbent. Figure 11.12 shows that this shifts the reaction function of the incumbent to the right in a market with strategic substitutes. The intersection of this new reaction function of the incumbent with the reaction function of the entrant will be more to the south-east, which entails a lower profit level for the entrant. Similarly, an investment is *soft* when there is a positive relationship between the investment level of the incumbent and the profit level of the entrant. An example is non-informative advertising, or brand advertising. A higher level of investment in brand advertising results in higher prices for the incumbent because of the lower elasticity of demand, but it leaves a larger part of the market for the entrant or rival firm. This is attractive for the entrant, i.e. the profits of the entrant increase.

The investment choice which will make credible the profit-maximizing profile (in the four markets presented in Figs 11.14, 11.16, 11.18 and 11.20) will be considered for hard as well as soft investments. To deal first with hard investments, the question is how an aggressive or passive profile can be made credible. An aggressive profile entails that the profits of the entrant will be low. This implies that the level of the hard investment has to be high (H), because the definition of a hard investment specifies a negative relationship between the level of the investment of the incumbent and the profit level of the entrant. Similarly, a passive profile is made credible by a low (L) level of the hard investment. Figure 11.21 summarizes the subgame perfect equilibrium investment level in the four possible types of markets when the investment is hard.

In the case of soft investments, an aggressive profile means again that the profits of the entrant will be low. This implies that the level of the soft investment has to be low (L), because the





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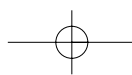
Type of investment	Entry?	Nature of competition	Profile	SPE investment
Hard	Yes	Strategic substitutes	Aggressive	H
		Strategic complements	Passive	L
	No	Strategic substitutes	Aggressive	H
		Strategic complements	Aggressive	H
Soft	Yes	Strategic substitutes	Aggressive	
		Strategic complements	Passive	
	No	Strategic substitutes	Aggressive	
		Strategic complements	Aggressive	

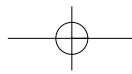
Figure 11.21: Subgame perfect equilibrium investment strategies when the investment is hard

definition of a soft investment specifies a positive relationship between the level of the investment of the incumbent and the profit level of the entrant. Similarly, a passive profile is made credible by a high (H) level of the soft investment. Figure 11.21 summarizes the subgame perfect equilibrium investment level in the four possible types of markets when the investment is soft.

Type of investment	Entry?	Nature of competition	Profile	SPE investment
Hard	Yes	Strategic substitutes	Aggressive	H
		Strategic complements	Passive	L
	No	Strategic substitutes	Aggressive	H
		Strategic complements	Aggressive	H
Soft	Yes	Strategic substitutes	Aggressive	L
		Strategic complements	Passive	H
	No	Strategic substitutes	Aggressive	L
		Strategic complements	Aggressive	L

Figure 11.22: Subgame perfect equilibrium investment strategies for both types of investment





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The various combinations of aggressive or passive profile and low or high investment have been given fancy labels by Fudenberg and Tirole (1984), where a high level of investment is associated with overinvestment and a low level of investment with underinvestment, as follows:

- Top Dog: overinvestment in order to create an aggressive profile.
- Lean and Hungry: underinvestment in order to create an aggressive profile.
- Fat Cat: overinvestment in order to create a passive profile.
- Puppy Dog: underinvestment in order to create a passive profile.

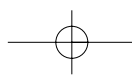
Figure 11.23 adds these labels to Fig. 11.22, and is called the strategy typology.

Type of investment	Entry?	Nature of competition	Profile	SPE investment
Hard	Yes	Strategic substitutes	Aggressive	Top Dog
		Strategic complements	Passive	Puppy Dog
	No	Strategic substitutes	Aggressive	Top Dog
		Strategic complements	Aggressive	Top Dog
Soft	Yes	Strategic substitutes	Aggressive	Lean & Hungry
		Strategic complements	Passive	Fat Cat
	No	Strategic substitutes	Aggressive	Lean & Hungry
		Strategic complements	Aggressive	Lean & Hungry

Figure 11.23: Strategy typology

11.6 Applications

The above typology implies that only three variables have to be specified in order to determine the profit-maximizing organizational choice or investment in a strategic setting. First, the *investment has to be defined*. This determines whether the investment is hard or soft. The definition of the investment usually starts with ‘The extent of . . .’. A specific word, like delegation, vertical integration, or limited liability, has to be added in order to complete it. Determining whether it is a hard or soft investment is the most difficult part of applications, because it requires one’s general knowledge regarding economics and management to be brought to the forefront. Second, the *condition regarding entry* has to be specified, i.e. the inevitability of entry. Finally, the *nature of the competitive process* has to be determined, i.e. the slope of the reaction function. The strategy typology has been applied to many situations. This section limits itself to applications which relate to the topics of the previous chapters, like delegation, limited liability, vertical integration, licences and royalties, organizational structure and equity participation and joint ventures.



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Application: Strategic delegation

Suppose an incumbent firm is confronted with the possibility of entry. It threatens to start a price war when entry actually occurs, which renders entry unprofitable. However, entry will occur anyway because this threat is not credible; the incumbent will make more money by co-operating (C) with the entrant and the entrant is aware of this. The incumbent can make the threat of a price war credible by appointing a manager whose salary is based on market share (M). Such a manager will (credibly) fight an entrant because entry will reduce his salary. The strategic delegation of decision power deters entry (Vickers, 1985).

The situation is depicted in Fig. 11.24. The incentive scheme of the manager can be based on profits (P) or market share (M) by the firm. The entrant decides to enter (Y) or not to enter (N). Finally, the manager either starts a price war (W) or co-operates (C) with the entrant. The payoffs reflect the various market scenarios. If there is no entry, then the incumbent firm is a monopolist. If there is entry and a price war is started, then the entrant loses money. Both firms make money when they cooperate once entry has taken place. Finally, the manager is rewarded for fighting a price war when incentive scheme M is used. The subgame perfect equilibrium is determined in the usual way by backward induction:

- Firm: M;
- Entrant: (Y,N);
- Manager: (C,C,W,C).

Notice that the above means that a firm may establish profit-maximization by not rewarding its manager on the basis of profits. Strategic considerations dictate that market share maximization, rather than profit maximization, of the manager results in the highest profits.

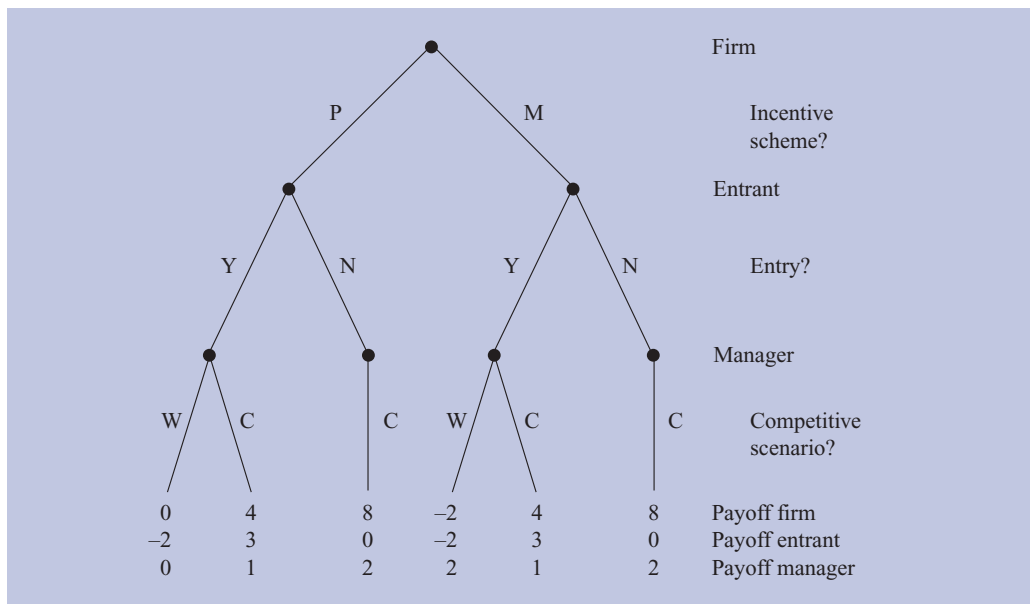
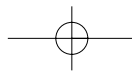


Figure 11.24 Market share maximization as profit maximizing strategy



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The above can also be presented with reaction functions (Lyons, 1987). Define the investment as the extent of market share based payments for the manager. This is a hard investment because there is a negative relationship between the level of this investment of the incumbent and the profit level of the entrant. The reason is that a higher degree of market-based payments increases the incentive for the manager to start a price war when entry occurs, which reduces the profit level of the entrant. The level of investment determines the location of the reaction function, where the aggressive investment is presented by M in this application, and the passive investment by P . Entry is not inevitable in the situation presented, so either Fig. 11.17 or Fig. 11.19 applies. The situation with strategic substitutes is considered first. The strategic situation is therefore characterized by

Investment: Extent of market-share-based payment;
Entry: Not inevitable;
Competition: Strategic substitutes.

Figure 11.25 presents the situation. $R_1(M)$ is to the right of $R_1(P)$, which entails that a manager with a market-share-based salary will produce more than a manager with a profit-based salary for every output level q_2 of the entrant. Investment M makes entry unprofitable because the intersection point of $R_1(M)$ with R_2 is to the south-east of 0 on R_2 . The investment M is a Top Dog strategy, which gives the incumbent an aggressive profile in order to deter entry. This corresponds with the third case in Fig. 11.23.

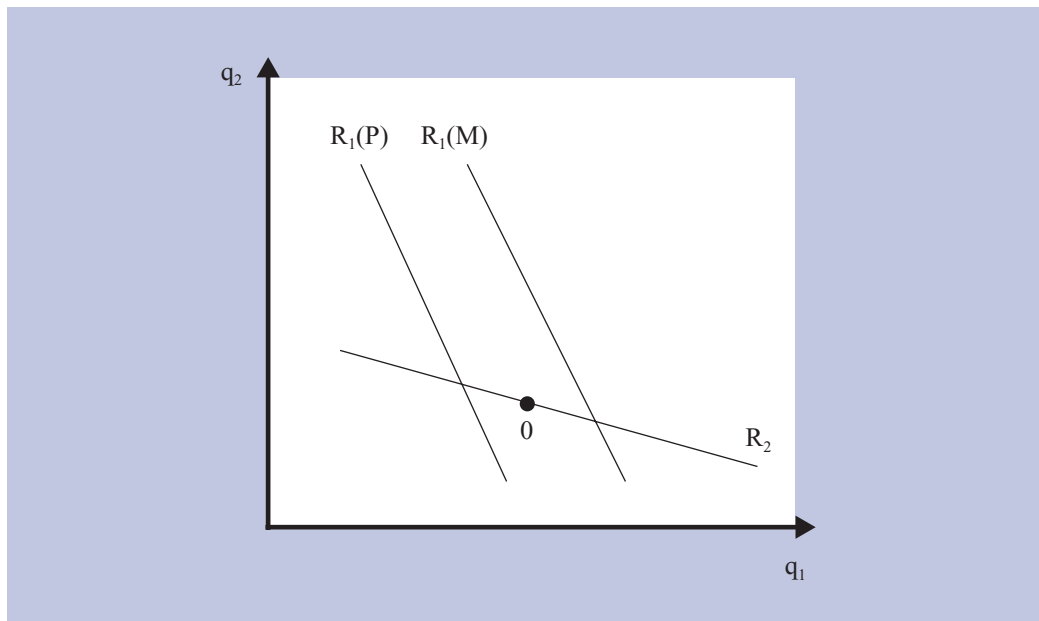
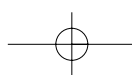
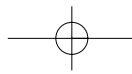


Figure 11.25: Strategic delegation in a market with strategic substitutes in which entry can be deterred





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Consider next the situation with strategic complements. The strategic situation is therefore characterized by

Investment: Extent of market-share-based payment;

Entry: Not inevitable;

Competition: Strategic complements.

Figure 11.26 presents the situation. $R_1(M)$ is to the left of $R_1(P)$, which means that a manager with a market-share-based salary will choose a lower price p_1 (on the horizontal axis) than will a manager with a profit-based salary for every price level p_2 (on the vertical axis) of the entrant. Investment M makes entry unprofitable because the intersection point of $R_1(M)$ with R_2 is to the south-west of 0 on R_2 . The investment M is therefore again a Top Dog strategy, which gives the incumbent an aggressive profile in order to deter entry. This is in line with the fourth case in Fig. 11.23.

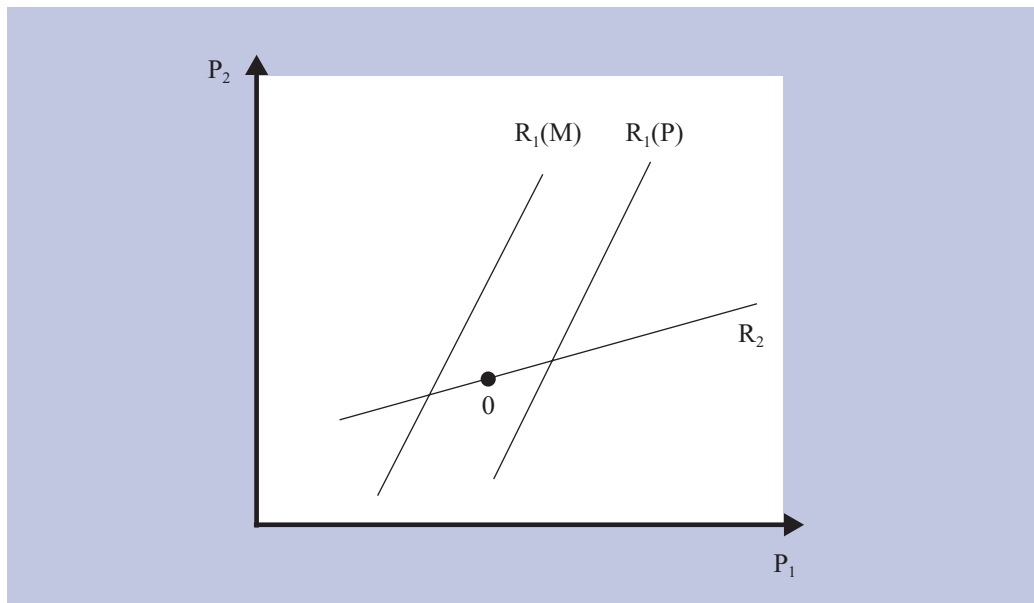
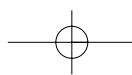
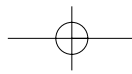


Figure 11.26: Strategic delegation in a market with strategic complements in which entry can be deterred

Application: Limited liability

The strategic consequences of the debt/equity ratio of a firm will be addressed in this application. Equity means that losses as well as gains are borne or made completely by the provider of equity. Debt is different. The provider of debt receives a fixed reward for making funds available, which is independent of the profit level as long as it is above a certain level. If the firm goes bankrupt, then the provider of debt has had bad luck and





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will not receive his money back. The implication is therefore that all the profits of the debt-financed investment go to the firm, while losses are for the debt-providers. This is the characteristic of limited liability of debt. It encourages risky and/or aggressive investment behaviour, which has already been discussed in Chapter 6.

Define the investment as the extent of limited liability (Brander and Lewis, 1986). This is a hard investment, because a high level of debt induces the firm to choose a risky investment strategy with a high level of output. Either this results in high profits or else the firm will go bankrupt. High profits are nice for the firm, while the costs associated with bankruptcy are at the expense of the providers of debt. The reaction function of the incumbent with a high level of debt, i.e. $R_1(D)$, is associated with higher output levels or lower prices than the reaction function of the incumbent with a high level of equity, i.e. $R_1(E)$. Figure 11.27 depicts a market with strategic substitutes in which entry is inevitable. The strategic situation is therefore characterized by

Investment: Extent of limited liability;
Entry: Inevitable;
Competition: Strategic substitutes.

This is the first case in Fig. 11.23. The profit-maximizing investment profile is to be aggressive in order to elicit a passive response. This is established by the Top Dog strategy of overinvesting in debt financing.

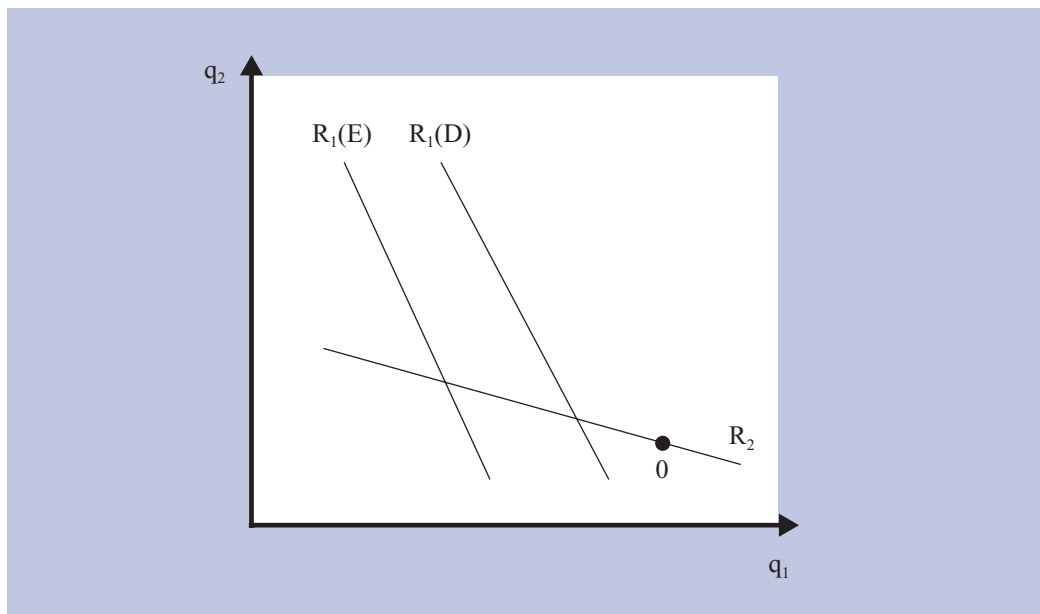
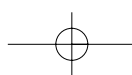


Figure 11.27: Limited liability in a market with strategic substitutes in which entry is inevitable



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Figure 11.28 depicts this market with price competition, i.e. the strategic situation is characterized by

Investment: Extent of limited liability;
Entry: Inevitable;
Competition: Strategic complements.

This is the second case in Fig. 11.23. The profit-maximizing investment profile is to be passive in order to elicit a passive response. This is established by the Puppy Dog strategy of underinvesting in debt financing.

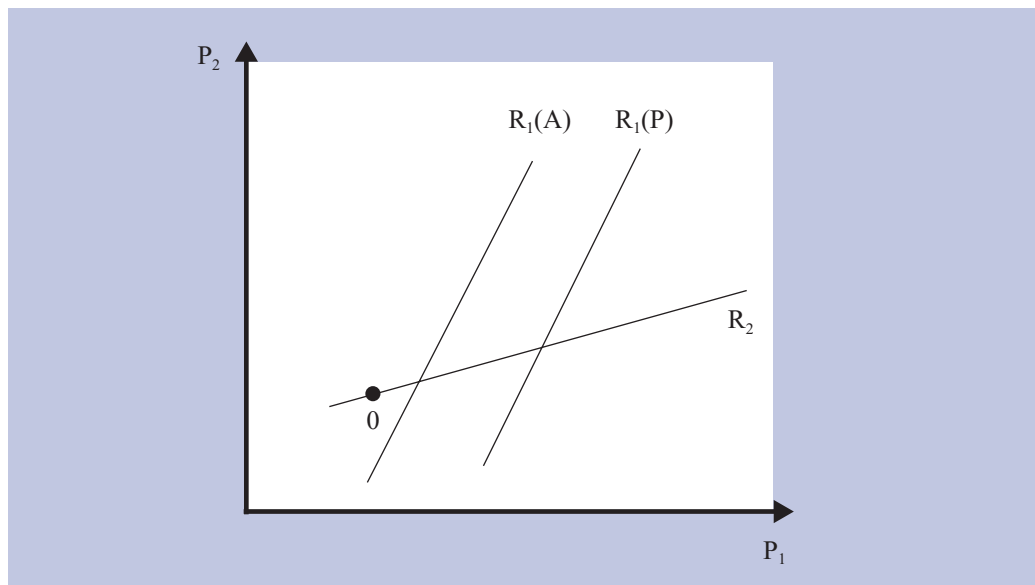
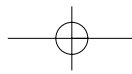


Figure 11.28: Limited liability in a market with strategic complements in which entry is inevitable

Application: Vertical integration

Suppose a processor sells its output to a wholesaler. Usually a profit is made by the wholesaler, i.e. a price is chosen higher than marginal costs. Subsequently the wholesaler makes a profit by selling its output also at a price above its marginal costs. This is called the *double marginalization problem* (Spengler, 1950). Vertical integration reduces this problem to one marginalization problem, because the wholesaler will now receive the output of the processor at marginal costs. The elimination of the double marginalization problem by vertical integration therefore reduces the final product price, i.e. vertical integration intensifies the competitive process. So, vertical integration might not be attractive for the wholesaler because it intensifies competition, i.e. it results in lower prices (Bonanno and Vickers, 1988).



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Define the investment as the extent of vertical integration. A low level of vertical integration is wholesaling (W), whereas a high level of vertical integration is vertical integration (VI). It has been argued above that this is a hard investment. Suppose that entry is inevitable and that the competitive process is characterized by price competition. The strategic situation is therefore summarized by

Investment: Extent of wholesaling;
Entry: Inevitable;
Competition: Strategic complements.

Like the previous application, the profit-maximizing investment profile is to be passive in order to elicit a passive response. This is established by the Puppy Dog strategy of underinvesting in vertical integration, i.e. wholesaling. Fig. 11.29 depicts the situation.

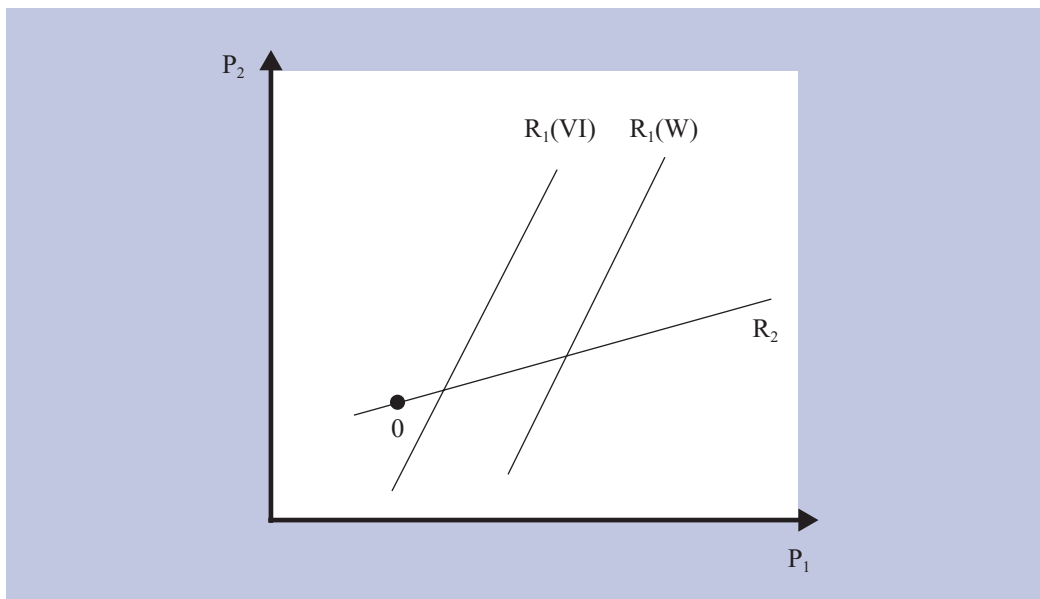
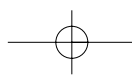


Figure 11.29: Vertical integration in a market with strategic complements in which entry is inevitable

Application: Licences and royalties

An inventor wishes to make as much money as possible with his technological breakthrough. The new technology lowers the marginal costs of production. The innovation can be sold either by asking a fixed fee, i.e. by licence, or by asking a royalty for each unit sold. The choice of sales method depends on the nature of the market (Bulow *et al.*, 1985).

Firms in a market with strategic substitutes are willing to pay more than the direct savings of the new technology when they can also gain a strategic advantage. This is possible because the lower marginal costs result in less aggressive behaviour of the



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rival firms. The sale of the new technology by licence ensures that the costs are made in the first period, i.e. the costs of the licence are sunk in the second period. This establishes an aggressive profile and a high level of profits, which implies that firms are willing to pay a substantial amount of money for a licence.

Define the investment as the extent to which royalties are used by the inventor. This investment is soft because a higher level of the investment, i.e. a royalty, is used, increasing the marginal costs in the second period. It results in a lower quantity produced, which is attractive for the rival firm. The profit-maximizing sales method is a Lean and Hungry strategy of underinvestment in royalties in order to create a credible aggressive profile. This is the licence. Figure 11.30 presents the relationship between the sales method and the location of the reaction function, where L indicates licence and R stands for royalty. The strategic situation is summarized by

Investment: Extent of royalties;
Entry: Inevitable or not inevitable;

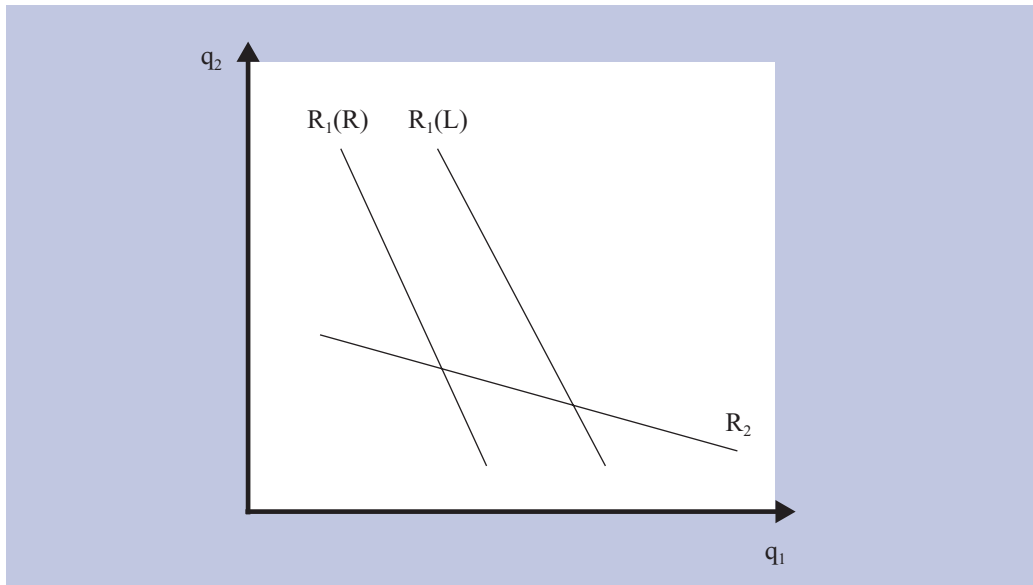
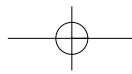


Figure 11.30: Sales method and strategic substitutes

A licence is not a profit-maximizing sales method for the inventor in a market with strategic complements. Lower marginal costs due to a licence result in aggressive actions, and therefore in an aggressive response in this market with strategic complements. The firms will therefore bid less for the licence than the direct cost savings. This disadvantageous strategic effect of the sale of the technology by a licence can be prevented by asking a royalty per unit sold. The marginal costs will stay unchanged in the second period. The Fat Cat strategy of overinvestment in royalties, i.e. the sales method royalty, is therefore advised for the inventor.



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Application: Organizational structure

Suppose that an organization considers the choice between a functional and a divisional structure. A functional structure is chosen when the advantages of scale are more important than the co-ordination problems associated with this structure. A divisional structure is chosen when the co-ordination problems are most important. There are also strategic considerations taken into account in the choice of organizational structure (Hendrikse, 1991)

Decisions regarding product specifications are taken by the divisional unit in a divisional structure (D), whereas these decisions are taken at a more centralized level in a functional structure (F). A divisional structure is more aggressive in its pricing policy than a functional structure. The reason is that the local decision-making in a divisional structure entails negative externalities, i.e. they compete with each other in order to increase the divisional profits at the expense of the company profits. This makes the market less attractive for potential entrants. Define the investment as the extent of a functional structure. This is a soft investment, because more of a functional structure makes the incumbent less aggressive and therefore increases the profits of the entrant. Assume that entry is not inevitable and that the nature of competition is characterized by strategic complements. The strategic situation is therefore characterized by

- Investment: Extent of a functional structure;
- Entry: Not inevitable;
- Competition: Strategic complements.

Figure 11.31 presents the situation.

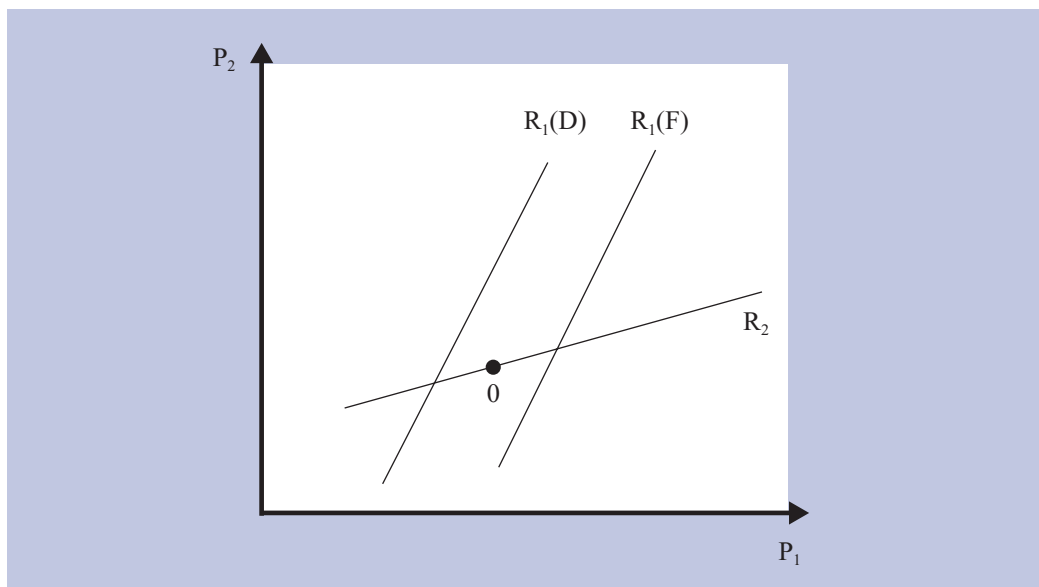
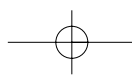


Figure 11.31: Organizational structure in a market with strategic complements in which entry can be deterred



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The profit-maximizing investment strategy of the incumbent is to choose an aggressive profile in order to deter entry. This profile is made credible by an underinvestment in a functional structure. This is the Lean and Hungry strategy in terms of the strategy typology of Fig. 11.23, i.e. the eighth case is actual. Notice that the investment of the incumbent could as well have been defined as the extent of a divisional structure. This definition of the investment makes the investment hard, and the subgame perfect equilibrium strategy of the incumbent is overinvestment in a divisional structure. This is the Top Dog strategy in terms of the strategy typology of Fig. 11.23, i.e. actually the fourth case of this typology. Notice that this opposite definition of the investment does not change the choice of organizational structure of the incumbent. The divisional structure is chosen in order to make the aggressive profile credible, which deters entry.

Application: Equity participation and joint ventures

Joint equity participations and joint ventures establish a positive relationship between the profits of the separate firms, because they have a stake in each others' well-being (Reynolds and Snapp, 1986). This reduces the intensity of competition between firms, which results in a lower quantity being produced and higher prices. Define the investment as the extent of equity participations, where H represents a high level of equity participations and L a low level of equity participations. It is obvious that this is a soft investment. Assume that entry is inevitable and that the nature of competition is characterized by strategic complements. The strategic situation is therefore characterized by

Investment: Extent of joint equity participations;

Entry: Inevitable;

Competition: Strategic complements.

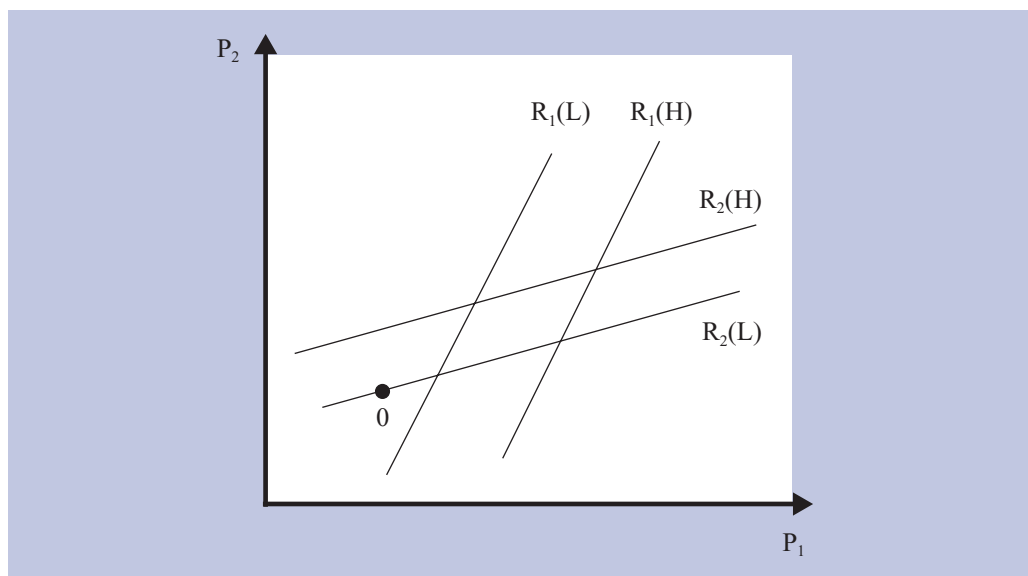
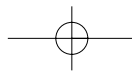


Figure 11.32: Limited liability in a market with strategic substitutes in which entry is inevitable



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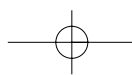
Figure 11.32 shows the effect of the investment on the location of the reaction functions. The reaction function of the incumbent as well as the reaction function of the rival firm will shift. A higher level of joint equity participations results in a shift of the reaction function R_1 of the incumbent to the east, and a shift in the reaction function R_2 of the rival firm to the north. A passive profile in order to elicit a passive response is made credible by an over-investment in joint equity participations. This is the Fat Cat strategy in terms of the strategy typology, i.e. the sixth case in the strategy typology of Fig. 11.23.

11.7 Conclusion

Organizational choices are driven by efficiency as well as strategic considerations. Strategic considerations are highlighted in this chapter. A simple framework has been developed to address a large variety of strategic situations in a systematic way. Three variables turn out to determine the choice of investment: the nature of investment, the entry condition and the nature of competition.

11.8 Exercises

- 11.1 Draw the reaction function of a firm in a market with quantity competition and
- Homogenous products.
 - Independent products.
 - Substitute products.
 - Complementary products.
- 11.2 If a potential entrant actually enters (E) the industry, then the incumbent may start to retaliate (R). This results in a payoff of -10 for each party. If the incumbent co-operates (C), then the incumbent earns 20 and the entrant 10. If the potential entrant does not enter, then the incumbent earns 50 and the entrant 0.
- Define Nash equilibrium.
 - Present the extensive form.
 - Determine the Nash equilibria
 - Which Nash equilibrium is not a subgame perfect equilibrium? Explain your answer.
- Suppose the incumbent has the possibility to invest before the potential entrant decides regarding entry. The effect of this investment is that the payoff of the incumbent decreases with an amount of 40 to -20 when entry (E) is responded to with (C). All other payoffs stay the same.
- Present the extensive form.
 - How much is the incumbent willing to pay for this investment, i.e. what is the value of this commitment?
- 11.3 A company considers entering an industry. The scale of entry, small (S) or large (L), has still to be decided. The incumbent decides after entry regarding starting a price



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war (P) or to co-operate (C). If the entrant chooses S, and the incumbent chooses P (C), then the entrant earns -1 (1) and the incumbent 2 (3). The choice L of the entrant results in a payoff of -2 (0) for the entrant and 1 (0) of the incumbent when P (C) is chosen.

- A Present the extensive form.
- B Determine the subgame perfect equilibrium.
- C Depict the above situation with reaction functions in a market with price competition.
- D Define an investment in order to investigate the strategic consequences of entry.
- E Is this investment hard or soft? Explain your answer.
- F How is the profit-maximizing investment strategy of the entrant characterized in the strategy typology? Explain your answer.

11.4 Many products consist of several components. For example, a computer consists of hardware and software, photographic equipment of a camera body and a lens. There is product differentiation not only regarding the complete product, but also regarding the separate components. Preferences of consumers differ substantially. Some consumers prefer all components of one brand above another, while there are also consumers whose ideal product consists of one brand regarding the first component and another brand regarding the second component. The availability of this latter product is not clear and is the focus of attention in this application. The company has to decide regarding the compatibility of its components with the components of the rival firm. Assume that Modak and Kinolta are active in the market for photographic equipment, where the components consist of a camera and a lens. The competitive process is characterized by price competition.

- A Does the decision regarding compatibility affect the demand or the costs of the company? Explain your answer
- B Is the slope of the reaction function positive or negative? Explain your answer.
- C Define the investment.
- D Is the investment hard or soft?
- E Determine the profit-maximizing investment strategy of Modak in the situation where Kinolta cannot be pushed out of the market. Explain your answer with a diagram.
- F Determine the profit-maximizing investment strategy of Modak in the situation where Kinolta can be pushed out of the market. Explain your answer with a figure.