MANAGERIAL ECONOMICS

SECOND EDITION

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CHAPTER 1

Foundations of Managerial Economics

OBJECTIVES

After reading this chapter, the readers will be able to

- understand the definition and scope of economics
- gain an insight into the basic concepts and analytical methods of economics
- understand the basic supply–demand analysis, the working of the market mechanism, the theory of the firm, the theory of consumer behaviour, and marginal analysis
- have clarity on the scope and definition of managerial economics
- comprehend the fundamental questions that economics, in general, and managerial economics, in particular addresses.
- appreciate the role of economics even in contexts where markets fail

Introduction

Economics is a subject that ranks high on familiarity. In a survey conducted in Japan amongst lay persons, one of the questions asked was: 'What would the respondent associate with the word "high"?' The survey results revealed that a relatively large proportion of respondents associated the word with 'inflation', an unadulterated economic term, and a much smaller portion associated the word with the volcano, Fujiyama.

The scope of economics is also very wide. It includes microeconomics, macroeconomics, welfare economics, development economics, mathematical economics, and a lot more. With 'management' having spun off as an independent discipline in academics, the applicability of tools of microeconomics to managerial decision-making was popularized. The subject which focuses on the application of microeconomic tools to the special context of managerial decision-making is called 'managerial economics'. This chapter will focus on the definition and scope of managerial economics.

After defining the subject and its scope, this chapter will elaborate on the analytical tools used in managerial economics, borrowed from microeconomics. Managerial economics borrows two important analytical techniques from microeconomics, 'optimization' and 'determination of equilibrium'. There are also

Inflation is the rate of increase in prices.

other techniques, which have been borrowed from other decision sciences. This chapter will focus on these two techniques, with which a bulk of managerial economics problems can be solved. Optimization occurs at the micro level of decision-making, wherein the decision-maker's objective is to arrive at the best combination of goods to be consumed or produced, or of inputs to be employed.

The determination of equilibrium is at a slightly higher level of aggregation at the level of markets, and is the outcome of the interaction of the different economic agents in the market.

1.1 What is Economics?

Economics is all pervading and makes its presence felt when various economic agents take decisions. In each of these contexts, economics gives us techniques, rooted in sound logic, with which the decision can be assessed in terms of the pros and cons, the advantages and disadvantages, and the benefits and costs. So much so, the head of a country once said, 'I want a "one-handed" economist to advise ...' because economists' assessment will most often say 'on the one hand ... but on the other hand ...' Listing out outcomes, both favourable and unfavourable, makes the final decision a well-informed one. Buying goods through a smuggler has its own benefits and costs. Advocating heavy tax cuts may mean less burden on individuals, but it also means less resources available to spend on public goods; curbing imports may protect domestic industry, but it also cuts off avenues for exports; a wage hike announcement by a leading steel producer may ward off potential entrants into the industry, but it may also add to overall inflation. The decision-makers using the methodology of economics will take a decision dictated by the need of the hour, well aware of both the favourable and the unfavourable consequences.

The whole gamut of issues addressed by economics is traditionally classified into the following three categories of questions:

1. What to produce?
2. How to produce?
3. How to distribute?

Three critical questions addressed by the subject matter of economics—what to produce, how to produce, and how to distribute.

These critical questions are addressed at different levels of aggregation in an economic system. The subject matter which addresses these questions at the lowest degree of aggregation, which happens to be that of the individual as a decision-maker is called microeconomics. Managerial economics borrows heavily from this. The subject matter which addresses these questions at the highest level of aggregation, which happens to

be that of the decision-maker being the 'economy' itself, is called macroeconomics.

These questions are difficult to answer because of scarcity of resources, which is a fundamental characteristic of the resource base. Therefore, decisions regarding utilization of resources that are scarce have to be taken carefully, and economics provides the methodology to answer these fundamental questions.

How does economics make such comprehensive assessments at the micro level? Economics makes a simplifying assumption—that of a rational behaviour amongst individuals—that individuals as both consumers and producers seek to maximize satisfaction and profits, respectively. With this rational behaviour, individuals interact and negotiate, and arrive at the best possible solution through a very powerful mechanism called the *market*. The solution is arrived at through the interaction of two prominent forces in the market, demand and supply. Let us take a real situation. You, along with 10 others from your class, decide to buy calculators. You have in your mind a certain value attached to it and are willing to buy so long as the price that you have to pay is less than this value. The sellers of calculators also have in their mind a certain value attached to the calculators and are willing to sell only when the price is above this value. These two forces of demand and supply meet, interact, and negotiate in a market, which enables the buyers and sellers to arrive at a situation wherein both are able to achieve their goals. An economy that encourages the free working of these forces in a 'market' and relies on solutions arrived by the market is a 'free market' economy.

Later in this chapter, the reader will be exposed to a more detailed discussion on the analytical tool of the supply–demand analysis, which is used extensively in managerial economics.

Economics examines in detail the behaviour of individual decision-making units, which constitute the forces of demand and supply. Since consumers constitute the demand side of the market, economics analyses the behaviour of the consumer (dealt with in detail in Chapters 2 and 3); and since the producer (the firm) constitutes the supply side of the market, the behaviour of the firms as producers is also analysed in economics (dealt with in Chapters 5 and 6). A thorough understanding of these market forces is important for a manager whose success or 'failure' is measured by how well he 'plays' in the marketplace to maximize the goals of the firm.

While providing solutions to the individual players in the marketplace, the analytical approach suggested by economics is the marginal approach. In this approach, problem situations are assessed by looking at the impact

Marginal approach involves using the impact of a change to take decisions.

on cost and benefits at the margin. That is the impact on cost and benefits of a unit change in the decision-making variable; for example, the impact on costs and benefits of a decision to increase or change quantity produced by an additional unit. This 'marginal approach' is one of the most significant contributions made by economics to decision-making. Managerial economics is built on the concept of marginal analysis. This is dealt with in greater detail later in this chapter.

While economics shows how the market mechanism provides solutions, there are some market solutions that are not desirable from the society's point of view. Economics' concern extends also to the society. For example, if the outcome of the working of market forces is the emergence of one large supplier, such as Microsoft in the computer software industry, economics analyses its flip side—will the supplier then exploit the market; or will the supplier become complacent about efficiency because there is no one to compete with? Therefore, economics, quite naturally, enters the area of regulation—directing the market forces to move along a desirable direction so that society's welfare is also maximized. Managers ought to be aware of these aspects of regulation so that they do not break these rules while 'playing' in the market.

There are also situations where markets fail to provide solutions. For example, let us take the case where the government decides to build a lighthouse. How much should the users be charged, and if charged, how can non-payers be prevented from using the light emanating from the lighthouse? The market will not provide solutions because users will not reveal their preferences and the value attached to the services of the lighthouse, because they can continue to use the light from the lighthouse without revealing its worth to them. This effectively means that the demand force is non-existent and so the market mechanism, which relies on the interaction between demand and supply, fails. Once again, economics comes to the rescue of the decision-makers in such situations. This is dealt with in later chapters.

1.2 Definition and Scope of Managerial Economics

The decision-making problems addressed by economics include both problems faced by individuals as consumers and producers and those faced by the economy as a whole. This wide range of issues is classified under two broad heads—those that deal with the individuals' choice (the individual as a consumer and as a producer), and those that need to be addressed at the aggregate level of the economy as a whole. The former

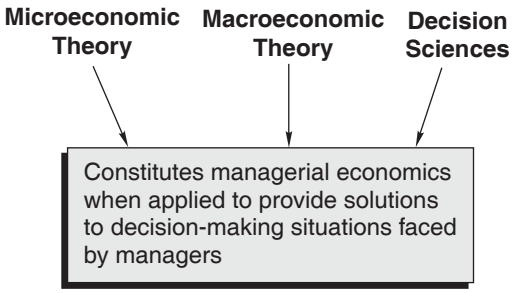

Fig. 1.1 Definition, Scope, and Functions of Managerial Economics

constitutes the subject matter of microeconomics, while the latter constitutes the subject matter of macroeconomics.

Managerial economics draws heavily from microeconomic theory to provide tools and techniques to facilitate decision-making in the managerial context. It also draws on other decision sciences, such as operations research, to enable well-informed decision-making. Managerial economics, unlike microeconomics, does not assume the 'aggregate' picture as given. The manager cannot afford to ignore the macroeconomic environment while taking rational decisions for the firm.

The definition, scope, and functions of managerial economics have been depicted in Fig. 1.1.

The contribution of managerial economics as a subject to managerial decision-making has been best put by Joel Dean (1951), one of the earliest authors on the subject. In the preface to his book, *Managerial Economics*, he says, 'The purpose of this book is to show how economic analysis can be used in formulating business policies ... the big gap between the problems of logic that intrigue economic theorists and the problems of policy that plague practical management needs to be bridged in order to give executives access to the practical contributions that economic thinking can make to top-management policies ....'

1.3 Typical Decisions Handled by Managerial Economics

More often than not, young managers are asked to look into the economic validity of an expansion or diversification plan. For example, if Barista, a chain of coffee shops, decides to diversify into corner bookshops, the first task is to economically justify this diversification, that is, if it is in the interest of Barista to diversify. This requires the application of tools offered by managerial economics. All readers are aware of the rivalry between Pepsi and Coke in the soft drink market. The rationale of strategies adopted by them to become the market leader can be found in managerial economics. The movement in the price of petrol as a result of the behaviour of the crude price set primarily by OPEC is not at all baffling when the situation is analysed using the analytical frameworks provided by managerial economics.

Coming across firms that have built capacity far in excess of what is being effectively used seems apparently irrational, but the reader will

realize that it is not so after gaining familiarity with managerial economics. Firms often face problems regarding optimum resource allocation on the shop floor. Questions, such as what the size of the production run should be; which is the least cost combination of inputs the production engineer needs to employ in order to minimize costs; what should the product be priced at; should a new production process be adopted? etc., are addressed by managerial economics.

These typical managerial problems can, in one way or the other, be categorized under the three fundamental economic problems addressed by economics. These are:

1. What to produce?
2. How to produce?
3. How to distribute?

The economic decisions assume a high degree of criticality because they are to be taken in the context of scarce resources which have alternative uses, and in the context of growing wants.

These three fundamental questions arise and need to be addressed by decision-makers because of the *scarcity of resources*. Had resources been plentiful, with no perceivable limits, there would not be a decision-making problem. We could then have all that we wished for. For instance, you, a college student, would be allowed by your parents to spend any amount. You can have all you want—ice cream, movies, music, books, weekend getaways, and so on. As against this, put yourself in a position where you are given only Rs 500 per month by your parents. You will now have to decide how much to spend on ice cream, movies, etc. It is in this latter situation that economics comes to your help by providing tools and techniques with which well-informed decisions can be made. The situation is complicated by the fact that there is a *constraint* on the resources that you possess and you want to get the best out of this constrained resource. Economics helps deal with such situations where the decision-maker is seeking a solution which *maximizes* in the presence of constraints, which is called constrained maximization.

The decision-making in a situation with resource constraints could still be easy if the uses to which the resources could be put had been specified. For instance, if you had been told that out of Rs 500, Rs 200 should be spent on books, Rs 100 on movies, and the rest on food, the decision-making would be less complex. However, in reality, *resources have more than one use* to which they can be put; the Rs 500 can be used in a thousand different ways. This possibility, of putting resources to more than one use, makes decision-making difficult, and the application of economic logic eases the process.

We could still have gotten away if, as human beings, we were a contented lot with a well-defined fixed need set, which could be

methodically fully satisfied. However, human beings, by nature, have a continuously growing and constantly changing need set, which at no point is fully satisfied, thereby only adding to the complexity. Therefore, we have no choice but to resort to economics to provide us with tools and techniques to enable us take the right decisions in all economic activities, be it consumption, production, sale, or distribution.

A manager's primary responsibility is the allocation of scarce resources (financial, human, machines, etc.) amongst alternative uses in order to realize the objective of profit maximization or other objectives. The link between economic logic, tools, and techniques, and the managers' responsibilities could not be more obvious. Economists began focusing on and magnifying this link, and thus, emerged the new suffix 'managerial' to economics and the subject 'managerial economics'. Thus, the suffix 'managerial' is more than justified, and hence, the subject 'managerial economics'.

1.4 Opportunity Costs

Scarcity of resources, besides imposing a constraint on the choice set, also makes us realize that there are 'trade offs'. Putting a resource to one use means that you are *foregoing* the other uses to which you could have put it to had you not used it in the present use. Amongst the other uses that you could have put it to, the concern is only on the *next best* use. So what you are foregoing is what you would have got had you put the resource to its next best use. The benefits foregone by not putting it to the next best use is therefore the cost of putting the resource to the present use. This cost of putting the resource to the present use is nothing but what is foregone and so, what is foregone is called the 'opportunity cost' of this resource being put to the present use.

In the context of consumption, this concept is used to evaluate choices. Suppose a consumer decides to take a loan to buy a car and so has to pay up his EMIs. He has to evaluate this decision after considering the opportunity cost of taking the loan in terms of what he will have to forego if he took a loan to buy a car. In the context of production, a resource is valued at its opportunity cost, that is, at what one could have got by putting it to the next best use or, what one is foregoing by putting it to the present use. In the context of exchange too, this concept is used. When a country has to decide on what it should produce and what it should trade in, the rule is to concentrate on the production of those goods for which it has a lower opportunity cost. The theory of comparative advantage in the context of international trade is based on this concept. This concept of opportunity cost is dealt with in detail in the chapter on costs.

Definition: Opportunity cost is defined as what the resource would have yielded in the next best alternative, which has to be foregone if the resource is put to its current use.

1.5 Positioning Managerial Economics in the Big Picture

In the previous section, we saw that the answers to the three fundamental questions are made difficult because all economies face the problem of scarcity of resources. Economics seeks to answer these questions for individuals at the micro level and for the nation at the macro level through the mechanism of the market. In a market system, consumers and producers make their own decisions and macroeconomics and managerial economics address these issues. However, in a market system, all these players take decisions simultaneously. In order to understand this complexity, it is inevitable for the economists to resort to model building, 'abstracting' from the detailed reality to understand and conceptualize the complex reality.

Decisions addressed by managerial economics are all taken in two markets—factor market and product market. Factor market is the market where factors (resources used for production but owned by the households) are exchanged. Product markets are those where the products produced are exchanged.

One model which fits together all these players and their activities, and helps us understand the concept of markets is the circular flow model. This model visualizes the economy as consisting of two sectors or institutions—the household and the firm. The household sector owns productive resources, such as labour, capital, and land, which can be used for production by the firms. Therefore, the household indulges in selling these resources to the firms through a market called the factor market (Fig. 1.2). The resources owned by the households are the inputs, also referred to as factors of production, and hence, also termed 'the factor market'. With the income earned from the sale of factors of production, the households lay a demand on goods and services, which are produced by the firms and sold to the households in a market called the product market. The two institutions of households and firms get together in both the markets and the markets throw up the following solutions; the quantity produced (and sold), the cost at which it is produced (depends on the price at which households sell their productive resources), and the price at which the products are sold. Microeconomics examines these outcomes in detail and provides the economic logic behind these

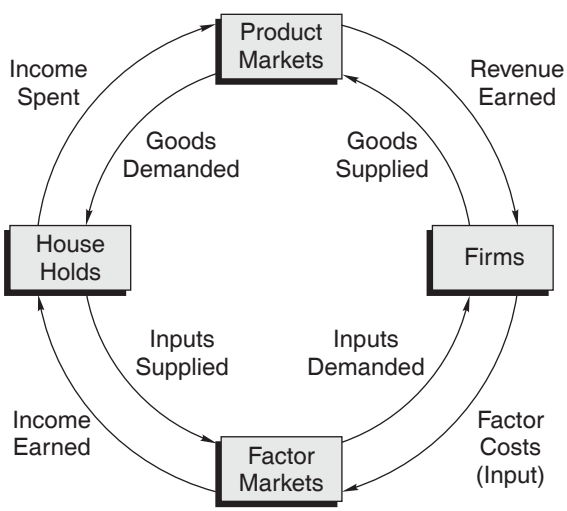

Fig. 1.2 Circular Flow Model

outcomes. This logic is used by managerial economics to provide the decision-makers with the techniques to arrive at the desirable outcomes. In microeconomics and managerial economics the focus is on the aspects within these two markets of factors and products—the players, the decision-making processes of these players, the markets, and their dynamics.

1.6 The Theory of the Firm and the Role of Profits

Any decision is taken and evaluated in the perspective of the objective. So is a managerial decision; it is taken and can be evaluated in the context of its objective. The objective of the decision has to be clearly stated. For an individual who is a consumer, the objective is to maximize satisfaction, or what is called utility in economics. For a producer the objective is to maximize profits or other objectives. The decision-maker as a producer operates in an entity called the 'firm'. The firm is an entity that brings together resources required to produce a product. It is therefore appropriate at this juncture to look into the theories that would explain the existence and working of the firm.

The theory of the firm should explain the behaviour of a firm in the light of its objectives. Given the complexity of the working of firms, economic and behavioural theorists have resorted to model building.

One of the earliest basic models says that the firm's behaviour is dictated only by its desire to maximize profits. This theory seems commonsensical because the first objective that would come to the reader's mind is also profits. However, a closer look at the reality makes one realize that the firm's behaviour is dictated by various other considerations, such as minimizing risk, maximizing sales, etc.

A richer version of the fundamental theory of profits is a theory that says that the firm wishes to maximize its wealth or value. This is also the version adopted by managerial economists and, therefore, we will examine it in detail.

A firm's value is defined as the present value of its expected future cash flow. The reader will be exposed to the concept of cash flow in courses relating to accounting/finance, but for now, we will treat cash flow as synonymous to profits.

Present value of expected future profits

$$= \frac{P\tau_1}{1+i} + \frac{P\tau_2}{(1+i)^2} + \frac{P\tau_3}{(1+i)^3} + \ldots + \frac{P\tau_n}{(1+i)^n} = \sum_{t=1}^{n} \frac{P\tau_t}{(1+i)^t}$$

Economic profit is defined as the difference between total revenue and total economic costs.

where $P\tau_t$ is the profit in time period t, and i is the discount rate used to bring the future value to the present. This method of discounting (as against compounding, which the reader may be familiar with) will be dealt with in detail in Chapter 13.

What is profit? The reader would be able to say quite easily that profit is the difference between total revenue and total cost. In order to maximize profit, it is important to maximize total revenue and minimize total cost. Therefore, every employee working for a firm has a role to play in maximizing profits, and the behaviour of every entity in the firm can be dictated by this objective. The shop floor producers can take measures to increase efficiency, thereby reducing costs; the marketing managers can take measures to increase revenue through increased sales; the research division can develop substitutes and complements, which could further contribute to the minimization of costs and to the maximization of the total revenue.

Reality, again, dictates that this profit maximization cannot be an unconstrained maximum. Many a time, managers and decision-makers are faced with situations wherein they are stuck with some inputs, such as a specific piece of machinery, or a contractual employment, which they cannot tamper with even if that would lead to minimization of costs. The decision-makers may have little flexibility in the production process also—inputs availability may be limited. Even if economies of scale dictate installation of large plants, limited availability of inputs may restrict the size of the plants to be installed.

Given this fact, the techniques used to maximize profits are, therefore, constrained optimization techniques which the reader will be exposed to in later chapters.

Economic cost is the value of what is given up or foregone because of putting the resource to its present use.

Economists advocate a concept of profit called economic profit, wherein profit is defined as the difference between total revenue and total economic cost. Economic costs are what economists consider as relevant costs estimated using the principle of *opportunity costs*. These concepts are explained in detail in the chapter on costs, suffice for now to say that when economists speak of profit, they define total cost as inclusive of the cost of capital and labour provided by the owner of the entity called firm. Let us take a simple situation where Mr Chris runs a grocery store from one room in his house (the grocery store is the firm here). He could have taken up employment for Rs 60,000 per year, and the capital that he has invested in the shop, if put in the bank, would fetch him a return of Rs 12,000 per annum. So if Mr Chris's venture, the grocery store, has to be profitable, it has to earn at least Rs 72,000 per annum. Any earning greater than Rs 72,000 is what the economists would call economic profit.

Firm is an entity which brings together resources/factors for production of finished goods.

Definition: Economic profit is defined as the difference between the total revenue and the total economic costs. Economic cost is defined as 'relevant' cost. The 'relevance' is defined in the context of 'run'—short run or long run.

1.7 Why do Economic Profits Exist?

Economic profits, as defined in the previous section, arise under many circumstances, and each of these circumstances emerges as a theory of profit. The first situation conducive to economic profit is one where an innovation has been made by a courageous innovator. The innovation of the microprocessor by Intel is a classic example of the role played by innovation in profit generation.

The second factor that explains differences in behaviour and differences in performance, as indicated by economic profit, is the ability to take risk, and profit is seen as a reward for risk bearing. The ability to take on the risk of innovation, such as, the Intel chip, is to be rewarded, and that is called economic profit.

Many a time, imperfections in the market give rise to economic profit. A market with a single seller or a few large sellers will have greater power and this shows up as economic profit. This is in contrast with the situation of perfection in the market where there are a large number of sellers, so large that no single seller has any power to influence the price in the market. In such situations, economic profits are non-existent.

There are other theories of firms, which are discussed in detail in Chapter 5.

1.8 The Invisible Hand

No introduction to economics in general is complete without exposing the reader to the concept of the invisible hand. This concept is to economics what Darwin's principle of natural selection is to biology or what Newton's principle of gravitation is to astronomy.

This unifying principle is the contribution made by Adam Smith (1776) in his book, *Wealth of Nations*. Adam Smith argued that even if individuals behave selfishly and pursue their own interests, they will be indirectly promoting the interest of the society. To quote Adam Smith:

> But it is only for the sake of profit that any man employs his capital in the support of industry; and he will always, therefore, endeavour to employ it in the support of that industry of which the produce is likely to be of the greatest value, or to exchange for the greatest quantity either of

> money or of other goods ... he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for the society that it was no part of it. By pursuing his own interests, he frequently promotes that of the society more effectually than when he really intends to promote it.

This was conceptualized by Adam Smith more than two centuries ago and holds good even today. Millions of transactions take place between two ends of the world, each working with a purely selfish interest, and yet, in the process, furthering the welfare of the nation.

Adam Smith's conceptualization of the economy as one big market working under some laws like the law of the invisible hand is the corner stone of micro and managerial economics. It is from this that we derive the concepts of the market and market economy.

Having gained familiarity with the definition and scope of managerial economics, let us now move on to elaborate on the analytical techniques used in managerial economics.

1.9 Microeconomic Problems in Managerial Economics

As mentioned in the introduction to this chapter, the two analytical techniques of optimization and determination of equilibrium help bring order in an otherwise gigantic and complex set of economic problems by enabling the classification of the relevant economic problem as amenable for the use of one or the other technique. When the decision-maker wants to arrive at the best choice of goods to be produced or consumed, it is an optimization problem. Mathematically, the process of optimization is equivalent to finding the maximum (of a desirable variable) or minimum (of an undesirable variable). This is what calculus deals with. This is the reason why mathematics enters the realm of managerial economics in a big way.

When we are interested in ascertaining the price of a good, say, onions, in the market, from which it has little or no tendency to change, then we are trying to arrive at an equilibrium price. This equilibrium price level is a crucial input for fixing ceiling or floor prices in regulating markets, and for decisions regarding entry and exit of firms.

To arrive at equilibrium solutions, the working tool used is the supply–demand analysis, and to solve optimization problems the reader must have an understanding of the concepts of total, average, and marginal magnitudes and the relationship amongst these.

We will examine the supply–demand analysis in the following section, and the total, average, and marginal magnitudes in the subsequent section.

1.10 Supply–demand Analysis

In economics, we often resort to graphs to facilitate comprehension of abstract phenomena, such as markets. Supply–demand analysis also can be best understood through graphical representations. We will, therefore, keep the graph represented in Fig. 1.3 as the reference.

In the figure, the horizontal axis represents quantities of a good per month, per week, or per any other unit of time. The vertical axis represents the price expressed in monetary terms, and is stated as Rs/unit of the good. That we plot price on the *Y*-axis is a matter of convention (although we will see later that price is an independent variable, and therefore, ought to be plotted on the *X*-axis). The curve *DD* is the demand curve. Every point on this curve shows the quantity that the consumer is willing to demand at that price. Let us take any price, say Rs 8. The demand curve shows the quantity Q_D, which is what the consumer is willing to buy at Rs 8. In other words, it captures the relationship between the quantity demanded and the price, that is, what the consumer is willing to buy at different prices. Normally, the demand curve slopes downward, showing an inverse relationship between price and quantity. While we will be examining the reasons for this inverse relationship in-depth later, it is sufficient at this point to offer a commonsensical explanation to this, that we, as consumers, tend to buy more at lower prices and less at higher prices. The reader can relate to the discount sales offered by sellers to attract buyers. The curve *SS* is the supply curve. Every point on this shows the quantity that the seller is willing to supply at that price. For example,

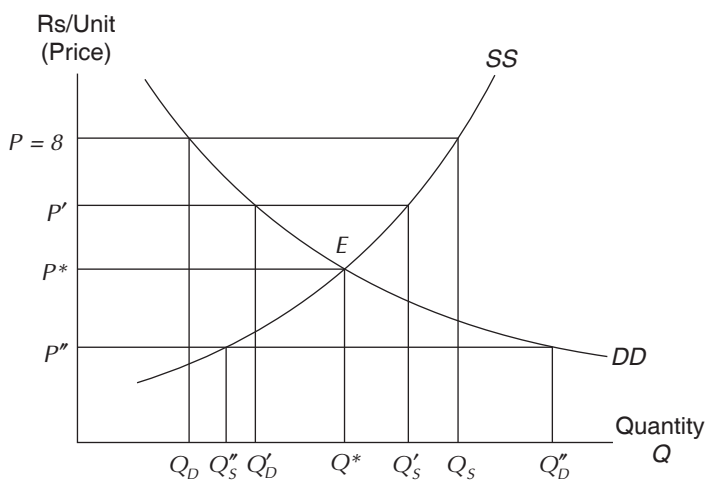

Fig. 1.3 Basic Demand–Supply Model

if the price is equal to Rs 8, the *SS* curve will show the quantity Q_S that the seller is willing to supply at the price, Rs 8.

In other words, the supply curve captures the relationship between the quantity supplied and the price, that is, what the supplier is willing to sell at different prices. Normally, the supply curve slopes upwards, showing a positive relationship between the price and the quantity supplied. While we will be examining the derivation of the supply curve in detail later, suffice it to say that it reflects the normal tendency of the seller to be willing to supply more only at higher prices.

It can be seen in Fig. 1.3 that the two curves, *DD* and *SS*, intersect at point *E*, and the corresponding price and quantity are P^* and Q^*, respectively. This point of intersection is called the equilibrium. The equilibrium state is a state of balance (state of balance between demand and supply), from which there is no tendency to change. Even if the price or the quantity deviate from this equilibrium price or equilibrium quantity, the forces of *DD* and *SS* will make it unsustainable, and eventually, it tends to get back to the equilibrium level. In the figure, if P were to drift upwards from P^* to P', the situation would be one of imbalance, with the imbalance showing up as an excess of $SS(Q'_S)$ over $DD(Q'_D)$. What happens to price if there is an excess supply of a good in the marketplace? The price has to come down; it will tend back to P^*. Let us take a situation where the price falls below the equilibrium level to *P*. At this price, the situation is one of imbalance, with the imbalance showing up as an excess $D(Q''_D)$ over supply (Q''_S). The reader must be able to see that if the demand for a good exceeds its supply, the price will go up, and tend back to P^*. It is not difficult for the reader to visualize a situation where the consumer, caught up in a shortage, bids up the price and triggers off an upward pressure on price.

Thus, the point of intersection is the point of equilibrium, since it is a state of balance from which, if either P or Q deviates, it will sooner or later tend back to the equilibrium level. This inherent characteristic of tending back to equilibrium automatically from any point of disequilibrium is called *stable equilibrium*. The supply–demand model described above with the demand and supply curves sloped the way they are is a model which gives a stable equilibrium solution.

Such a solution is possible and acceptable only if the market is a level play field with no one individual or group capable of distorting either of the two forces. Such a solution is acceptable if the 'market' includes the entire relevant population. If the market excludes the low income group simply because they cannot afford to pay the high price which may be arrived at by the market mechanism, then the solution may not be

acceptable. A solution can be arrived at only if the buyers reveal their preferences and reveal the value that they are willing to attach to the consumption of a commodity. If they choose not to reveal, then the market mechanism fails.

There are many situations in which the solution offered by the market are not accepted and the regulator chooses to tinker with them. Such situations are described in Chapter 9 in the sub-section titled 'Interferences with the equilibrium'.

Further, there are situations where the market mechanism's solution is inefficient and further still, situations where the market mechanism fails to provide an equilibrium solution. These situations are dealt with in Chapters 14 and 15 where situations of asymmetric information and situations of externalities are discussed.

Definition: Equilibrium is defined as a state of balance between two forces. Stable equilibrium is one where the forces tend towards this point of balance constantly despite slipping off from the equilibrium.

The next related question which we need to answer is: Can equilibrium price or quantity change to another level, or can an equilibrium shift? This will be answered in Chapters 2 and 8 where these aspects will be dealt in detail.

1.11 Total, Average, and Marginal Magnitudes

Total magnitude is the cumulative marginal magnitude. Marginal magnitude is the contribution made by the last additional unit to the magnitude in question. Average magnitude is the magnitude per unit.

We now address the second analytical technique, that of optimization, and the working tools associated with it. With the help of these working tools, it is possible to solve optimization problems without any in-depth knowledge of calculus.

We will understand the concept of total, average, and marginal in relation to one magnitude—revenue. The concept, principles, and relationships amongst these will not change with the changes in magnitude. For instance, the magnitude could be utility, product, or cost. Whatever be the magnitude, the underlying concept and relationships will be the same.

We start by taking a hypothetical linear demand relationship for a good, Q. The schedule of data corresponding to the hypothetical linear demand equation given as $P = 10 - Q$, is listed in Table 1.1. The first two columns of the table show the values of Q and P derived from the hypothetical equation.

If the first two column entries are multiplied, that is, if price is multiplied by quantity, it would give us the total magnitude which, in this case, is the total revenue. If the seller sells two units of Q at Rs 8 per unit, he gets

Table 1.1 Total, Average, and Marginal Revenue

1	*2*	*3*	*4*	*5*	*6*
Quantity	*Price (AR)*	*Total Revenue (TR)*	*MR (upward approximation)*	*MR (downward approximation)*	*MR (better approximation) Average of 4 and 5*
0	10	0	9	–	–
1	9	9	7	9	8
2	8	16	5	7	6
3	7	21	3	5	4
4	6	24	1	3	2
5	5	25	–1	1	0
6	4	24	–3	–1	–2
7	3	21	–5	–3	–4
8	2	16	–7	–5	–6
9	1	9	–9	–7	–8
10	0	0	–	–9	–

a TR of 16. It must be noted that the price is always expressed per unit. The third column in Table 1.1 gives us the TR, which is PQ.

If PQ is the total magnitude, the revenue per unit is the average magnitude, which will be called average revenue. So average revenue is nothing but TR/Q or $PQ/Q \equiv P$. Price is, therefore, average revenue. Column 2 of Table 1.1 is also the column corresponding to average revenue. In terms of geometry, the relation between total magnitude and average magnitude can be seen in Fig. 1.4. Total revenue assumes an inverted U-shape. The average revenue is the slope of the line from the origin to the relevant level of Q. The slope of this line is the height TR reached along the curve divided by the horizontal length represented by the distance Q. If we want to find AR for $Q = 3$, the height reached along the TR curve is 21 and the horizontal length represented by the distance Q is 3. Therefore, slope of the line from the origin to $Q = 3$ along the TR curve is $21/3 = 7$. The AR thus derived is plotted in Fig. 1.5.

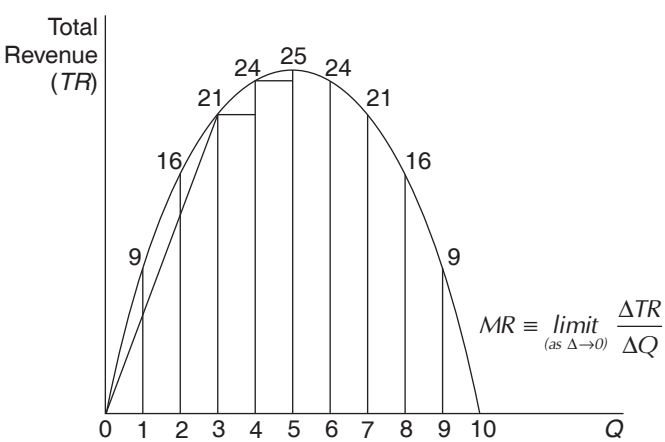

Fig. 1.4 Total Revenue Function

That takes us on to the definition of marginal magnitude. Conceptually, marginal magnitude is a change in the total magnitude due to the

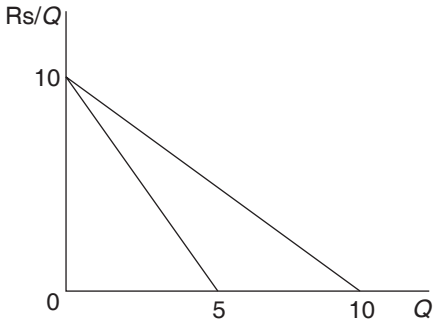

Fig. 1.5 MR and AR (Derived from Fig. 1.4)

smallest possible change in the independent variable, which here is Q. This, the reader would realize, is nothing but the slope of the total revenue curve. Therefore, the marginal magnitude, which here is marginal revenue, is geometrically the slope along the *TR* curve.

To algebraically approximate the slope of the *TR* curve at $Q = 3$, we can see what happens to *TR* when Q increases by one unit from $Q = 3$.

The ΔTR and ΔQ are the horizontal and vertical legs of the small triangle shown between $Q = 3$ and $Q = 4$ in Fig. 1.4, and the slope $\Delta TR/\Delta Q$ between $Q = 3$ and $Q = 4$ is an approximation of the slope at $Q = 3$, an upward approximation. We could also approximate the slope at $Q = 3$ as that between $Q = 2$ and $Q = 3$. This would be a downward approximation. The marginal revenue approximated using upward approximation is given in Col. 4 of Table 1.1, and the downward approximation in Col. 5. A third approximation, which is better than the first two, is the average of the two approximations. This is given in Col. 6 of the table. In general, the approximation becomes better as we reduce ΔQ, to get closer to the slope at a particular Q. In the limit, ΔQ has to tend to zero. Therefore, a precise estimation of *MR* can now be defined as the following:

$$MR \equiv \lim_{(\text{as}\,\Delta \to 0)} \frac{\Delta TR}{\Delta Q}$$

This is nothing but the concept of 'derivative' in calculus, and thus, marks the entry of calculus into micro and managerial economics.

To summarize, marginal magnitude is a slope measure of the total magnitude. To get a precise measure of the slope at a particular Q, the variation in Q has to be as small as possible, with the variation tending to zero; this is nothing but the concept of derivative.

Now we are ready to make inferences about the values that a marginal magnitude takes at various levels of Q and its relationship with the average magnitude.

Inference 1 When a total magnitude is rising, the corresponding marginal magnitude is positive. This is evident from Fig. 1.4, wherein we can see that as along as *TR* is increasing, the slope along the *TR* curve must be positive. Using calculus, when $dTR/dQ > 0$, the total revenue function is increasing, and dTR/dQ is nothing but the marginal revenue function.

Inference 2 When the total magnitude is falling, the corresponding marginal magnitude is negative. In calculus terms, when $dTR/dQ < 0$, that is, the marginal magnitude is negative, the total magnitude is decreasing.

Inference 3 When the total magnitude reaches a maximum or a minimum, the corresponding marginal magnitude is zero.

Each of these inferences can be verified with the data provided in Table 1.1.

Inference 4 When the average magnitude falls/rises, the marginal magnitude falls/rises at a rate faster than the average, and so will lie below/above the average magnitude.

At this point, it is necessary to clarify the distinction between average and marginal magnitude. The average is a per unit magnitude, while the marginal gives the change in the total magnitude due to the smallest possible change in Q. In other words, the 'marginal magnitude' gives the contribution made by the last additional unit (called marginal unit) to the total magnitudes. The average magnitude distributes the contribution made by the marginal unit amongst all units. Let us take a series of three numbers, say, 3, 4, 2. The average of this series is 3. Now we add a marginal unit, say, 5, to this series. The marginal unit contributes 5 to the total and the consequence of this on the average is that the average is now $(3 + 4 + 2 + 5)/4 = 3.5$.

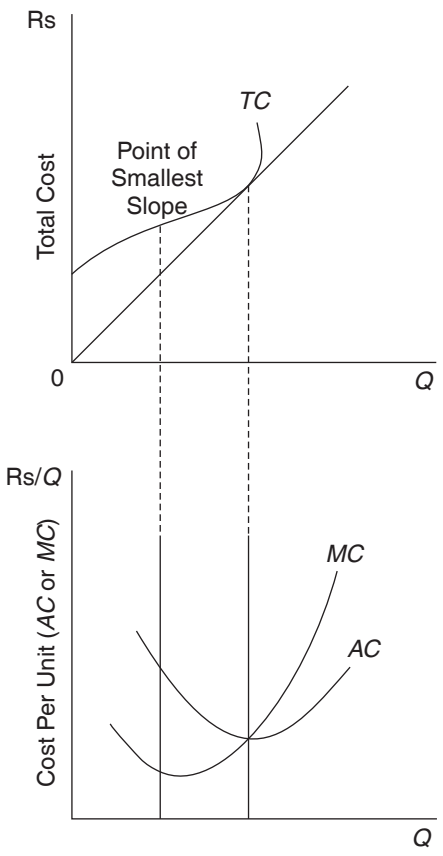

Fig. 1.6 Total, Average, and Marginal Functions

What if the marginal unit had been 3? The new average would have remained 3. Therefore, the average magnitude increases only when the marginal unit's contribution to the total is greater than the previous average. Similarly, the average magnitude falls only when the marginal unit's contribution is less than the previous average. It is the contribution made by the marginal unit which pulls up or pulls down the average, and hence, the fourth inference.

Inference 5 When the average magnitude is neither rising nor falling, the marginal magnitude must be equal to it. Figure 1.4 and the corresponding average magnitude captures only a part of Inference 4, since the average magnitude is a declining function throughout.

Figure 1.6, where the total magnitude is the total cost, has in it both a decreasing slope and an increasing slope,

and so captures both Inferences 4 and 5. The reader can see that when the average cost is rising, the marginal unit lies above the average cost.

Definition: Average magnitude is the total magnitude divided by the number of units, or it is the magnitude per unit. Marginal magnitude is the change in the magnitude due to a change in the units.

The working tools learnt here will be used extensively in later chapters.

1.12 The Concept of Margin

The demonstration of the concept of margin for use in managerial decision-making is a significant contribution made by microeconomics borrowed by managerial economics.

In the face of scarcity, allocation of resources assumes great importance. In order to maximize the benefits, satisfaction, or profit, the proponents of the concept of margin advocate that the decision-maker should, at various points in the decision-making process, ask whether the contribution to the total revenue (marginal revenue) or the contribution to the total utility (marginal utility) exceeds the contribution made by the marginal unit to cost. Basically, the *additional* cost incurred is compared with the *additional* benefits, and as long as the latter exceeds the former, there is an *increase* in the net benefit. There are numerous situations in real life when we are faced with situations requiring decision-making, such as whether to eat the third cup of ice cream, whether to devote an extra eighth hour to the study of a subject, whether to further increase the number of TV spot advertisements, whether to produce an additional block of 100 units of electricity, etc. All of these can be successfully tackled using the concept of margin.

The concept of margin is, thus, the foundation of all managerial decision-making processes. As we proceed, the reader will understand the importance and relevance of this concept in various situations. The reader will also be exposed to situations where ignorance of this concept actually results in wrong decisions.

Definition: Marginal unit is the last additional unit, and the cost, utility, or product associated with it is the 'marginal cost', 'marginal utility', or 'marginal product', respectively.

SUMMARY

- Managerial economics draws heavily from micro and macroeconomics and other decision sciences.
- It applies these techniques to provide solutions to decision-making situations faced by managers.
- The three fundamental economic problems of what to produce, how to produce, and how to distribute are also the decisions that managers have to take at the firm level.
- The basic model of the theory of the firm states that the objective of the firm is profit maximization. There are other theories, such as the satisficing theory.
- The circular flow model captures the working of a simplified economic system, and enables us to see the role of the consumer, the producer, and the markets.
- Market mechanism provides solutions to the choice problem faced by the consumer and the producer.
- The invisible hand concept of Adam Smith explains how society's welfare is maximized even when individuals behave selfishly to further their own economic interests.
- The concept of opportunity cost is central to managerial economics. This concept emerges from the thesis that since resources are scarce, there is always a trade off. The opportunity cost of a resource is therefore defined as what has to be given up in order to put a resource to the current use.
- The problems of microeconomics and managerial economics can be classified into two broad categories—those requiring use of optimization techniques, and those requiring supply–demand analysis to arrive at equilibrium solutions.
- Equilibrium is defined as a state of balance between supply and demand, which is graphically represented by the point of their intersection.

KEYWORDS

Average Magnitude: It is the magnitude per unit. It is computed by diving the total magnitude by quantity.

Equilibrium: It is a state of balance from which there is no tendency to change.

Firms: Firms produce goods using the resources provided by households.

Households: The members of this institution are owners of resources, which they provide to the firms. Households also lay a demand on the goods produced by the firms.

Invisible Hand: It is a mechanism that ensures maximization of social benefit even when individuals behave and take decisions independently, to maximize the individual benefit.

Marginal Magnitude: It is the change in the total magnitude due to a unit change in quantity.

Optimization: Optimization means arriving at the best possible state within a given set of constraints.

Profits: This is the difference between total revenue and total cost.

CONCEPT REVIEW QUESTIONS

1. Distinguish between microeconomics, macroeconomics, and managerial economics.
2. Explain the theory of the firm.
3. Why do economic profits exist?
4. Explain the concept of invisible hand in your own words.
5. Bring out the role of the market in the circular flow model.

6. Classify the following examples of managerial economic decisions under the three fundamental economic problems—what, how, or for whom:
   - Decision by an auto manufacturer to buy out engines
   - Decision by an oil refinery to get into oil exploration
   - Decision by Xerox whether to offer service facilities
   - Decision by a bank to computerize its operations
7. Explain the concept of equilibrium in economics.
8. In terms of the general relations among total, average, and marginal quantities, which of the following statements are necessarily true:
   - When the total function is rising, the marginal function is rising.
   - When the total function is rising, the marginal function is positive.
   - When the total function is rising, the marginal function lies above it.
   - When the marginal function is rising, the average function is also rising.
   - When the average function is falling, the marginal function lies below it.
   - When the marginal function is neither rising nor falling, the average function is constant.
9. Distinguish between marginal and average magnitude.

NUMERICAL PROBLEMS

1. Mr Chris, belonging to a family whose business has been real estate, is contemplating establishing an independent real estate agency. He estimates the expenditure on the salaries of employees to be Rs 15,00,000, and on rent, supplies, and utilities to be Rs 2,50,000. He would also require Rs 50,000 initially to be invested in assets. While he is making this new business plan, he is an employee of Leo Realtors, where his annual income is Rs 1,00,000. The market rate of interest is 12% per annum. He expects to generate a revenue of Rs 20,00,000. Determine the economic profit/loss of this venture.
2. Compute the marginal and average utilities on the basis of the following total utilities:

X	1	2	3	4	5	6
TU	10	18	25	30	33	35

3. Compute the marginal and average cost on the basis of the following total cost:

X	1	2	3	4	5	6	7
TC	10	18	24	29	36	45	57

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