Chapter 1

Introduction

Economists have always studied the *economic problem*. The nature of the economic problem, however, has changed over time. For the *classical school* of economists (including Adam Smith (1723–1790), David Ricardo (1772–1823), Karl Marx (1818–1883), and John Stuart Mill (1806–1873)), the economic problem was to discover the laws that governed the production of goods and the distribution of goods among the different social classes: land owners, capitalists, workers. These laws were thought to be like natural laws or physical laws, similar to Newton's law of gravitational attraction. Forces of history, and phenomena such as the Industrial Revolution, produce "universal constants" that govern the production of goods and the distribution of wealth.

Toward the end of the nineteenth century, however, there was a major shift in the orientation of economics, brought about by the *neoclassical school* of economists. This group includes William Stanley Jevons (1835–1882), Leon Walras (1834–1910), Francis Ysidro Edgeworth (1845–1926), Vilfredo Pareto (1848–1923), and Alfred Marshall (1842–1924). The neoclassical revolution was a shift in the emphasis of the discipline, away from a search for natural laws of production and distribution, and toward a new version of the economic problem, the analysis of decision making by individuals and firms.

In this book we will describe *modern microeconomics*, which mostly follows the neoclassical path. For us, and for the majority of contemporary microeconomists, the economic problem is the problem of the "economic agent," who lives in a world of scarcity. Economists focus on the fact that resources are limited or *constrained*. These constraints apply to men, women, households, firms, governments, and even humanity. On the other hand, our wants and needs are unlimited. We want more and better material things, for ourselves, our families, our children, our friends. Even if we are not personally greedy, we want better education for our children, better culture, better health for people in our country, and longer lives for everyone. Economics is about how decision makers choose among all the things that they

want, given that they cannot have everything. The economic world is the world of limited resources and unlimited needs, and the economic problem is how to best meet those needs given those limited resources.

The key assumption in microeconomics, which could be taken as our credo, is this: economic agents are rational. This means that they will choose the best alternatives, given what is available, given the constraints. Of course we know that (to paraphrase Abraham Lincoln) some of the people behave irrationally all the time, and all of the people behave irrationally some of the time. But we will take rationality as our basic assumption, especially when important goods and services, and money, are at stake.

Economics applies the scientific method to the investigation and understanding of the economic problem. As with the natural sciences, such as biology, chemistry, or physics, economics has theory, and it has empirical analysis. Modern economic theory usually involves the construction of abstract, often mathematical models, which are intended to help us understand some aspect of the economic world. A useful model makes simplifying assumptions about the world. (A completely realistic economic model would usually be too complicated to be useful.) The assumptions incorporated in a useful model should be plausible or reasonable, and not absurd on their face. For instance, it is reasonable to assume that firms want to maximize profits, even though some firms may not be concerned with profits in some circumstances. It is reasonable to assume that a typical consumer wants to eat some food, wear some clothing, and live in a house or an apartment. It would be unreasonable to assume that a typical consumer wants to spend all his or her income on housing, and eat no food. Once a model has assumptions, the economic analyst applies deductive reasoning and logic to it to derive conclusions. This is where the use of mathematics is important.

Correct logical and mathematical arguments clarify the structure of a model and help us avoid mistaken conclusions. The aim is to have a model that sheds some light on the economic world. For example, we might have a logical result such as this: if we assume A, B, and C, then D holds, where D = "when the price of ice cream rises, the consumer will eat less of it." If A, B, and C are very reasonable assumptions, then we feel confident that D will be true. On the other hand, if we do some empirical work and see that D is in fact false, then we are led to the conclusion that either A, B, or C must also be false. Either way, the logical proposition "A, B, and C together imply D" gives us insight into the way the economic world works.

Economics is divided between *microeconomics* and *macroeconomics*. Macroeconomics studies the economy from above, as if seen from space. It studies aggregate magnitudes, the big things such as booms and busts, gross domestic product, rates of employment and unemployment, money supply, and inflation. In contrast, microeconomics takes the close-up approach to understand the workings of the economy. It begins by looking at how individuals, households, and firms make decisions, and how those decisions interact in markets. The individual decisions

result in market variables, quantities demanded by buyers and supplied by sellers, and market prices.

When people, households, firms, and other economic agents make economic decisions, they alter the allocation of resources. For example, if many people suddenly want to buy some goods in large quantities, they may drive up the prices of those goods, employment and wages of the workers who make those goods, and the profits of the firms that sell them, and they may drive down the wages of people making other goods and the profits of firms that supply the competing goods. When a microeconomist analyzes a market in isolation, assuming that no effects are taking place in other markets, he or she is doing what is called *partial equilibrium analysis*. Partial equilibrium analysis focuses on the market for one good, and assumes that prices and quantities of other goods are fixed. *General equilibrium analysis* assumes that what goes on in one market does affect prices and quantities in other markets. All markets in the economy interact, and all prices and quantities are determined more or less simultaneously. Obviously, general equilibrium analysis is more difficult and complex than partial equilibrium analysis. Both types of analysis, however, are part of microeconomics, and we will do both in this book. Doing general equilibrium analysis allows the people who do microeconomics to connect to the aggregates of the economy, to see the "big picture." This creates a link between microeconomics and macroeconomics.

We now move on to begin our study, and we do so by considering how individual households make consumption decisions. This is called the *theory of the consumer*.

Part I

Theory of the Consumer

Chapter 2

Preferences and Utility

2.1 Introduction

Life is like a shopping center. A consumer enters it and sees lots of goods, in various quantities, that she might buy. A *consumption bundle*, or a *bundle* for short, is a combination of quantities of the various goods (and services) that are available. For instance, a consumption bundle might be 2 apples, 1 banana, 0 cookies, and 5 diet sodas. We would write this as $(2, 1, 0, 5)$. Of course the consumer prefers some consumption bundles to others; that is, she has tastes or *preferences* regarding those bundles.

In this chapter we discuss the *economic theory of preferences* in some detail. We make various assumptions about a consumer's feelings about alternative consumption bundles. We assume that when given a choice between two alternative bundles, the consumer can make a comparison. (This assumption is called *completeness*.) We assume that when looking at three alternatives, the consumer is rational in the sense that, if she says she likes the first better than the second and the second better than the third, she will also say that she likes the first better than the third. (This is part of what is called *transitivity*.) We examine other basic assumptions that economists usually make about a consumer's preferences: one says that the consumer prefers more of each good to less (called *monotonicity*), and another says that a consumer's *indifference curves* (or sets of equally desirable consumption bundles) have a certain plausible curvature (called *convexity*). We describe and discuss the consumer's rate of tradeoff of one good against another (called the *marginal rate of substitution*).

After discussing the consumer's preferences, we turn to the *utility function*. A utility function is a numerical representation of how a consumer feels about alternative consumption bundles: if she likes the first bundle better than the second, then the utility function assigns a higher number to the first than to the second, and if she likes them equally well, then the utility function assigns the same number

to both. We analyze utility functions and describe *marginal utility*, which, loosely speaking, is the extra utility provided by one additional unit of a good. We derive the relationship between the marginal utilities of two goods and the marginal rate of substitution of one of the goods for the other. We provide various algebraic examples of utility functions; in the appendix, we briefly review the calculus of derivatives and partial derivatives.

In this chapter and others to follow, we often assume that there are only two goods available, with x_1 and x_2 representing quantities of goods 1 and 2, respectively. Why only two goods? For two reasons: first, for simplicity (two goods gives a much simpler model than three goods or five thousand, often with no loss of generality); and second, because we are often interested in one particular good, and we can easily focus on that good and call the second good "all other goods," "everything else," or "other stuff." When there are two goods, any consumption bundle can easily be shown in a standard two-dimensional graph, with the quantity of the first good on the horizontal axis and the quantity of the second good on the vertical axis. All the figures in this chapter are drawn this way.

In this chapter we focus on the consumer's preferences about bundles of goods, or how she feels about various things that she might consume. In the shopping center of life, though, some bundles are *feasible* or *affordable* for the consumer; these are the ones that her budget will allow. Other bundles are *nonfeasible* or *unaffordable*; these are the ones her budget will not allow. We will focus on the consumer's budget in Chapter 3.

2.2 The Consumer's Preference Relation

The consumer has preferences over consumption bundles. We represent consumption bundles with symbols such as X and Y. If there are two goods, X is a vector (x_1, x_2), where x_1 is the quantity of good 1 and x_2 is the quantity of good 2. The consumer can compare any pair of bundles and decide which one is better, or decide they are equally good. If she decides one is better than the other, we represent her feelings with what is called a *preference relation*; we use the symbol $\succ$ to represent the preference relation. That is, $X \succ Y$ means the consumer prefers bundle X over bundle Y. Presented with the choice between X and Y, she would choose X. We assume that if $X \succ Y$, then $Y \succ X$ cannot be true; if the consumer likes X better than Y, then she had better not like Y better than X! Obviously, a consumer's preferences might change over time, and might change as she learns more about the consumption bundles. (The $\succ$ relation is sometimes called the *strict preference relation* rather than the *preference relation*, because $X \succ Y$ means the consumer definitely, unambiguously, prefers X to Y, or *strictly prefers* X to Y.)

If the consumer likes X and Y equally well, we say she is *indifferent* between them. We write $X \sim Y$ in this case, and $\sim$ is called the *indifference relation*. Sometimes we will say that X and Y are indifferent bundles for the consumer. In

this case, if presented with the choice between them, the consumer might choose X, might choose Y, might flip a coin, or might even ask us to choose for her. We assume that if $X \sim Y$, then $Y \sim X$ must be true; if the consumer likes X exactly as well as Y, then she had better like Y exactly as well as X!

The reader might notice that the symbols for preference and for indifference are a little like the mathematical symbols $>$ and $=$, for *greater than* and *equal to*, respectively. This is no accident. Furthermore, just as there is a mathematical relation that combines these two, $\geq$ for *greater than or equal to*, there is also a preference relation symbol $\succeq$, for *preferred or indifferent to*. That is, we write $X \succeq Y$ to represent the consumer's either preferring X to Y, or being indifferent between the two. (The $\succeq$ relation is sometimes called the *weak preference relation*.)

Assumptions on Preferences

At this point, we make some basic assumptions about the consumer's preference and indifference relations. Our intention is to model the behavior of what we would consider a rational consumer. In this section we assume that the two goods are desirable to the consumer; we touch on other possibilities (such as neutral goods or bads) in the Exercises.

Assumption 1: *Completeness*. For all consumption bundles X and Y, either $X \succ Y$, or $Y \succ X$, or $X \sim Y$. That is, the consumer must like one better than the other, or like them equally well. This may seem obvious, but sometimes it is not. For example, what if the consumer must choose what is behind the screen on the left, or the screen on the right, and she has no idea what might be hidden behind the screens? That is, what if she does not know what X and Y are? We force her to make a choice, or at least to say she is indifferent. Having a *complete ordering* of bundles is very important for our analysis throughout this book. (In Chapters 19 and 20 we analyze consumer behavior under uncertainty, or incomplete information.)

Assumption 2: *Transitivity*. This assumption has four parts:

- First, transitivity of preference: if $X \succ Y$ and $Y \succ Z$, then $X \succ Z$.
- Second, transitivity of indifference: if $X \sim Y$ and $Y \sim Z$, then $X \sim Z$.
- Third, if $X \succ Y$ and $Y \sim Z$, then $X \succ Z$.
- Fourth and finally, if $X \sim Y$ and $Y \succ Z$, then $X \succ Z$.

The transitivity of preference assumption is meant to rule out irrational preference cycles. You would probably think your friend needs psychiatric help if she says she prefers Econ. 1 (the basic economics course) to Soc. 1 (the basic sociology course), and she prefers Soc. 1 to Psych. 1 (the basic psychology course), *and* she prefers Psych. 1 to Econ. 1. Cycles in preferences seem irrational. However, do not be too dogmatic about this assumption; there are interesting exceptions in the real world. We will provide one later on in the Exercises.

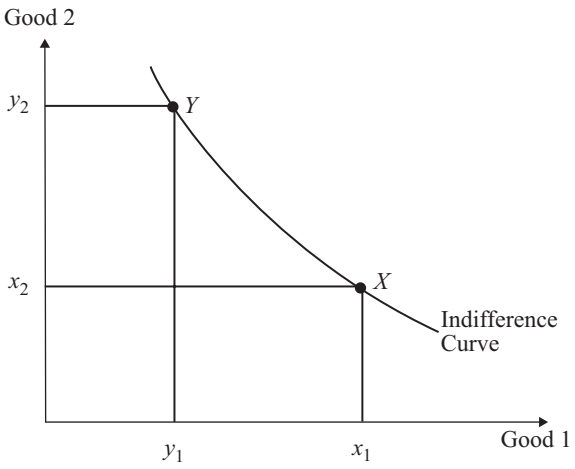

Fig. 2.1. At bundle X, the consumer is consuming x_1 units of good 1 and x_2 units of good 2. Similarly, at bundle Y, she is consuming y_1 units of good 1 and y_2 units of good 2. Because X and Y are on one indifference curve, the consumer is indifferent between them.

The transitivity of indifference assumption (that is, if $X \sim Y$ and $Y \sim Z$, then $X \sim Z$) makes *indifference curves* possible.

An *indifference curve* is a set of consumption bundles (or, when there are two goods, points in a two-dimensional graph) that the consumer thinks are all equally good; she is indifferent among them. We use indifference curves frequently throughout this book, starting in Figure 2.1. The figure shows two consumption bundles, X and Y, and an indifference curve. The two bundles are on the same indifference curve, and therefore, the consumer likes them equally well.

Assumption 3: *Monotonicity*. We normally assume that goods are *desirable*, which means the consumer prefers consuming more of a good to consuming less. That is, suppose X and Y are two bundles of goods such that (1) X has more of one good (or both) than Y does and (2) X has at least as much of both goods as Y has. Then $X \succ Y$. Of course there are times when this assumption is inappropriate. For instance, suppose a bundle of goods is a quantity of cake and a quantity of ice cream, which you will eat this evening. After three slices of cake and six scoops of ice cream, more cake and more ice cream may not be welcome. But if the goods are more generally defined (e.g., education, housing), monotonicity is a very reasonable assumption.

Some important consequences of monotonicity are the following: indifference curves representing preferences over two desirable goods cannot be thick or upward sloping, nor can they be vertical or horizontal. This should be apparent from Figure 2.2, which shows an upward-sloping indifference curve and a thick indifference curve. On any indifference curve, the consumer is indifferent between any pair of consumption bundles. A brief examination of the figure should convince the