policy? How could you design an experimental study to estimate the impact of running on life expectancy?

3. A researcher conducts a cross-sectional analysis of workers and finds a positive correlation between time spent on a computer at work and wages. The researcher concludes that computer use increases wages and advocates a policy of computer training for all children. What is a possible problem with this analysis?
4. In the 1970s, researchers at the RAND Corporation conducted a social experiment to investigate the relationship between health insurance coverage and health care utilization. In this experiment, samples of individuals were induced to trade their normal insurance policies for new RAND policies that offered various coinsurance rates (i.e., different rates at which the insurance would reimburse the individual for health care expenses). In 1993, the Clinton administration used the results of the RAND experiment to predict how health care utilization would increase if insurance coverage were made universal. What problems might arise in using the social experimentation results to predict the impact of universal coverage?
5. A four-year study in Tennessee randomly assigned children in kindergarten through third grade into classes of different sizes. The results of this experiment indicated that the smaller class sizes improved test scores [Krueger, 1999]. However, about 10 percent of the students in the study switched classes during the course of the experiment. Explain how such switching might lead to biased estimates of the impact of lowering class size. Under what conditions would switching be compatible with unbiased results? Give some examples of reasons for switching that would lead to biased results and some that would not.
6. Suppose that five states reduce income taxes in a given year. You are interested in estimating whether the tax cut has increased saving, and you find that the saving rate for residents of these five states increased by 2 percent in the year after it was introduced. Can you reasonably conclude that the tax cut caused the increase in saving? How would you conduct a difference-in-difference analysis to estimate the impact on saving? What assumption must hold for the difference-in-difference analysis to be valid?
7. The budget proposal submitted by the Bush administration in 2006 projected increasing deficits over time, that is, a growing gap between expenditures and revenues. A contentious debate ensued. On one side, critics of the administration argued that larger deficits would lead to higher interest rates, while some supporters of the administration argued that it would have no impact on interest rates. The following table gives some historical data on deficits and interest rates. For each year, the deficit is the difference between revenues and expenditures measured in current dollars; a negative figure is a deficit, and a positive figure is a surplus.

Year	Deficit	Interest rate
1980	$ −73.8	15.2%
1985	−212.3	9.9
1990	−221.2	10.0
1995	−164.0	8.8
2000	236.4	9.2

On the basis of these data, what inference could you make about the relationship between federal deficits and interest rates? Explain why inferences based on these data alone might be problematic.

Chapter Three

Tools of Normative Analysis

The object of government is the welfare of the people. The material progress and prosperity of a nation are desirable chiefly so far as they lead to the moral and material welfare of all good citizens.

—PRESIDENT THEODORE ROOSEVELT

Pick up a newspaper any day and you are sure to find a story about a debate concerning the government's role in the economy. Should income taxes be cut? Do we need to subsidize the purchase of medicine for the elderly? Is it advisable to use public land in Alaska for oil exploration? The list is virtually endless. Given the enormous diversity of the government's economic activities, some kind of general framework is needed to assess the desirability of various government actions. Without such a systematic framework, each government program ends up being evaluated on an ad hoc basis, and achieving a coherent economic policy becomes impossible.

▸ WELFARE ECONOMICS

welfare economics

The branch of economic theory concerned with the social desirability of alternative economic states.

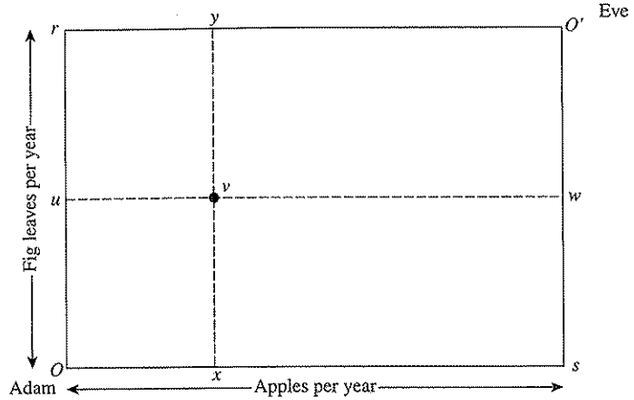
The framework used by most public finance specialists is **welfare economics,** the branch of economic theory concerned with the social desirability of alternative economic states.[1] This chapter sketches the fundamentals of welfare economics. The theory is used to distinguish the circumstances under which markets can be expected to perform well from those under which markets fail to produce desirable results.

Pure Economy Exchange

We begin by considering a very simple economy. It consists of two people who consume two commodities with fixed supplies. The only economic problem here is to allocate amounts of the two goods between the two people. As simple as this model is, all the important results from the two good–two person case hold in economies with many people and commodities.[2] The two-by-two case is analyzed because of its simplicity.

[1] Welfare economics relies heavily on certain basic economic tools, particularly indifference curves. For a review, see the appendix at the end of the book.
[2] See Chapter 11 of Henderson and Quandt [1980] where the results are derived using calculus.

Figure 3.1
Edgeworth Box
The Edgeworth Box depicts the possible distributions of two commodities—in this case, apples and fig leaves—between Adam and Eve. The length of the box (*Os*) represents the number of apples that are available each year, and the height of the box (*Or*) represents the number of fig leaves that are available each year. At point *v*, Adam consumes *Ou* fig leaves and *Ox* apples, while Eve consumes *O'y* apples and *O'w* fig leaves.



Edgeworth Box

A device used to depict the distribution of goods in a two good–two person world.

The two people are Adam and Eve, and the two commodities are apples (food) and fig leaves (clothing). An analytical device known as the **Edgeworth Box** depicts the distribution of apples and fig leaves between Adam and Eve.[3] In Figure 3.1, the length of the Edgeworth Box, *Os*, represents the total number of apples available in the economy; the height, *Or*, is the total number of fig leaves. The amounts of the goods consumed by Adam are measured by distances from point *O*; the quantities consumed by Eve are measured by distances from *O'*. For example, at point *v*, Adam consumes *Ou* fig leaves and *Ox* apples, while Eve consumes *O'y* apples and *O'w* fig leaves. Thus, any point within the Edgeworth Box represents some allocation of apples and fig leaves between Adam and Eve.

Now assume Adam and Eve each have a set of conventionally shaped indifference curves that represent their preferences for apples and fig leaves. In Figure 3.2, both sets of indifference curves are superimposed onto the Edgeworth Box. Adam's are labeled with *A*'s; Eve's are labeled with *E*'s. Indifference curves with greater numbers represent higher levels of happiness (utility). Adam is happier on indifference curve A_3 than on A_2 or A_1, and Eve is happier on indifference curve E_3 than on E_2 or E_1. In general, Eve's utility increases as her position moves toward the southwest, while Adam's utility increases as he moves toward the northeast.

Suppose some arbitrary distribution of apples and fig leaves is selected—say, point *g* in Figure 3.3. A_g is Adam's indifference curve that runs through point *g*, and E_g is Eve's. Now pose the following question: Is it possible to reallocate apples and fig leaves between Adam and Eve in such a way that Adam is made better off, while Eve is made no worse off? A moment's thought suggests such an allocation, at point *h*. Adam is better off at this point because indifference curve A_h represents a higher utility level for him than A_g. On the other hand, Eve is no worse off at *h* because she is on her original indifference curve, E_g.

Can Adam's welfare be further increased without doing any harm to Eve? As long as Adam can be moved to indifference curves farther to the northeast while still

[3] Named after the great 19th-century economist F. Y. Edgeworth.

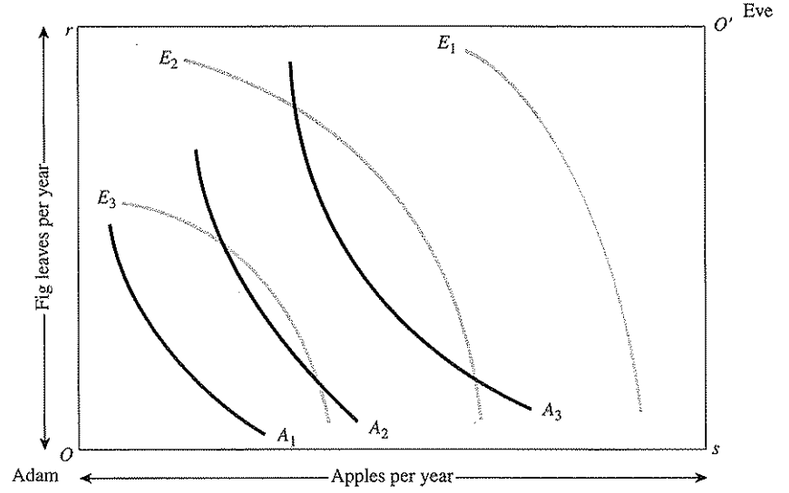


Figure 3.2
Indifference curves in an Edgeworth Box
Adam and Eve each have a set of indifference curves that reflect their preferences for fig leaves and apples. Adam is happier the farther he can move toward the northeast of the box. Eve is happier the farther she can move toward the southwest of the box.

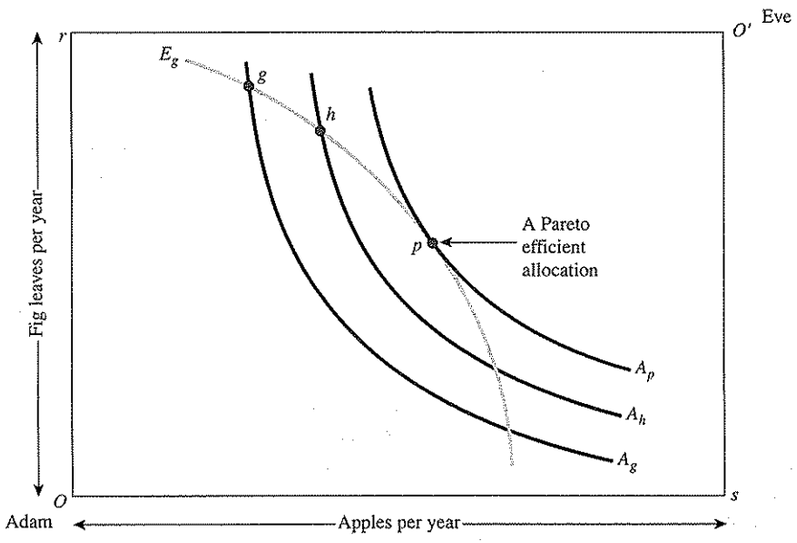


Figure 3.3
Making Adam better off without Eve becoming worse off
Moving from point *g* to point *h* to point *p* leaves Eve's utility unchanged but improves Adam's utility. At point *p*, it is impossible to make one of them better off without hurting the other. Therefore, point *p* represents a Pareto efficient allocation.

remaining on E_g, it is possible. This process can be continued until Adam's indifference curve is just touching E_g, which occurs at point *p* in Figure 3.3. The only way to put Adam on a higher indifference curve than A_p would be to put Eve on a lower one. An allocation such as point *p*, at which the only way to make one person better off is to make another person worse off, is called **Pareto efficient.**[4] Pareto efficiency

Pareto efficient

An allocation of resources such that no person can be made better off without making another person worse off.

[4] Named after the 19th-century economist Vilfredo Pareto.

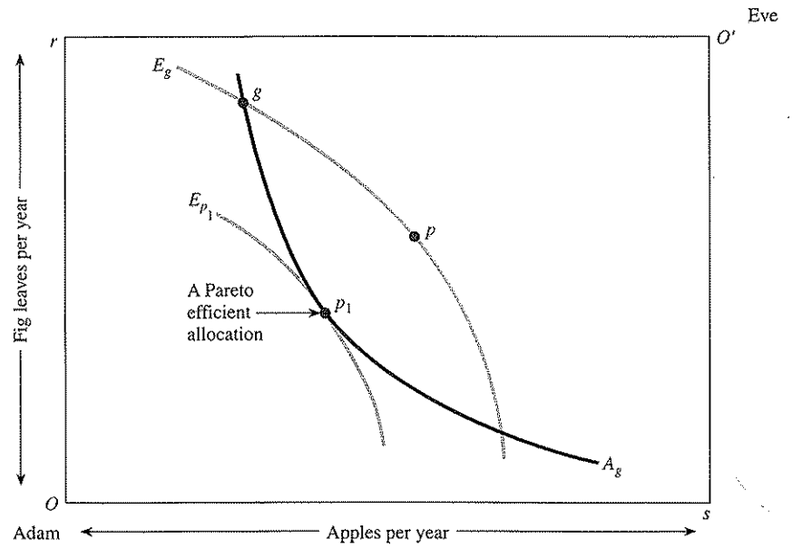


Figure 3.4
Making Eve better off without Adam becoming worse off
Moving from point g to point p_1 leaves Adam's utility unchanged but improves Eve's utility. At point p_1, it is impossible to make one of them better off without hurting the other. Therefore, point p_1 is a Pareto efficient allocation.

is often used as the standard for evaluating the desirability of an allocation of resources. If the allocation is not Pareto efficient, it is "wasteful" in the sense that it is possible to make someone better off without hurting anybody else. When economists use the word *efficient*, they usually have the idea of Pareto efficiency in mind.

Pareto improvement

A reallocation of resources that makes at least one person better off without making anyone else worse off.

A related notion is that of a **Pareto improvement**—a reallocation of resources that makes one person better off without making anyone else worse off. In Figure 3.3, the move from g to h is a Pareto improvement, as is the move from h to p.

Point p is not the only Pareto efficient allocation that could have been reached by starting at point g. Figure 3.4 examines whether we can make Eve better off without lowering the utility of Adam. Logic similar to that surrounding Figure 3.3 suggests moving Eve to indifference curves farther to the southwest, provided that the allocation remains on indifference curve A_g. In doing so, we isolate point p_1. At p_1, the only way to improve Eve's welfare is to move Adam to a lower indifference curve. Then, by definition, p_1 is a Pareto efficient allocation.

So far, we have been looking at moves that make one person better off and leave the other at the same level of utility. In Figure 3.5 we consider reallocations from point g that make *both* Adam and Eve better off. At p_2, for example, Adam is better off than at point g (A_{p_2} is further to the northeast than A_g) and so is Eve (E_{p_2} is further to the southwest than E_g). Point p_2 is Pareto efficient, because at that point it is impossible to make either individual better off without making the other worse off. It should now be clear that starting at point g, a whole set of Pareto efficient points can be found. They differ with respect to how much each of the parties gains from the reallocation of resources.

Recall that the initial point g was selected arbitrarily. We can repeat the procedure for finding Pareto efficient allocations with any starting point. Had point k in Figure 3.6 been the original allocation, Pareto efficient allocations p_3 and p_4 could have been isolated. This exercise reveals a whole set of Pareto efficient points in the

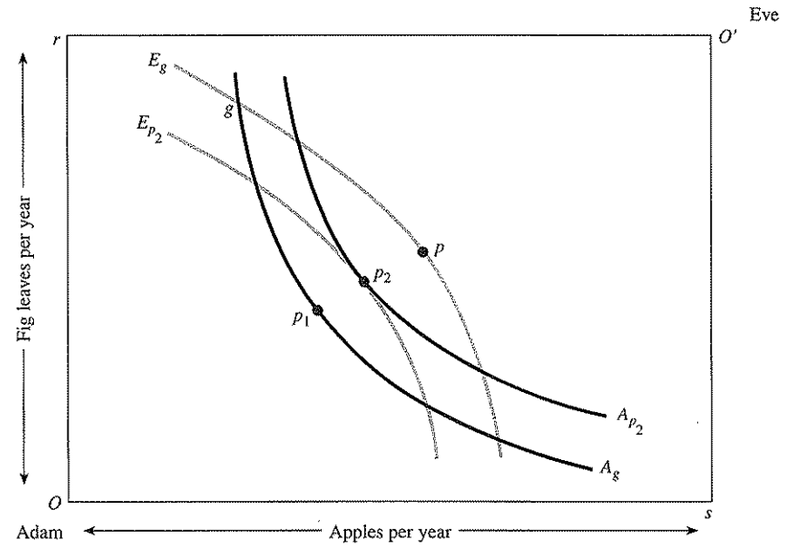


Figure 3.5
Making both Adam and Eve better off
Moving from point g to point p_2 makes both Adam and Eve better off. At point p_2 it is impossible to make one of them better off without hurting the other. Therefore, point p_2 is a Pareto efficient allocation.

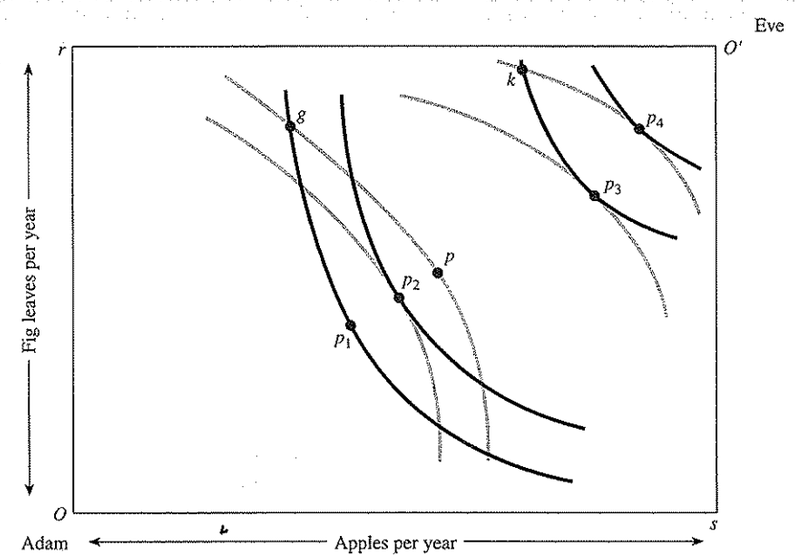


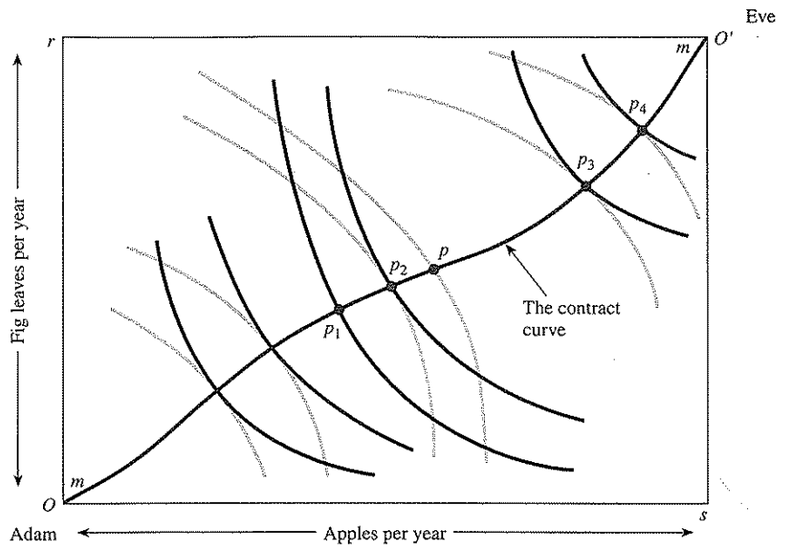
Figure 3.6
Starting from a different initial point
If instead we started at point k, we again would be able to reallocate the goods to make one person better off without hurting the other. A movement to either p_3 or to p_4 would represent a Pareto improvement.

Edgeworth Box. The locus of all the Pareto efficient points is called the **contract curve,** and is denoted *mm* in Figure 3.7. Note that for an allocation to be Pareto efficient (to be on *mm*), it must be a point at which the indifference curves of Adam and Eve are barely touching. In mathematical terms, the indifference curves are tangent—the slopes of the indifference curves are equal.

contract curve

The locus of all Pareto efficient points.

Figure 3.7
The contract curve
Any point in the Edgeworth box in which Adam's indifference curve is just touching (tangent to) Eve's indifference curve is a Pareto efficient point. The locus of all the Pareto efficient points is called the contract curve.



In economic terms, the absolute value of the slope of the indifference curve indicates the rate at which the individual is willing to trade one good for an additional amount of another, called the *marginal rate of substitution* (*MRS*).[5] Hence, Pareto efficiency requires that marginal rates of substitution be equal for all consumers:

$$MRS_{af}^{\text{Adam}} = MRS_{af}^{\text{Eve}} \tag{3.1}$$

where MRS_{af}^{Adam} is Adam's marginal rate of substitution of apples for fig leaves, and MRS_{af}^{Eve} is Eve's.

Production Economy

The Production Possibilities Curve So far we have assumed that supplies of all the commodities are fixed. Consider what happens when productive inputs can shift between the production of apples and fig leaves, so the quantities of the two goods can change. Provided the inputs are efficiently used, if more apples are produced, then fig leaf production must necessarily fall and vice versa. The **production possibilities curve** shows the maximum quantity of fig leaves that can be produced along with any given quantity of apples.[6] A typical production possibilities curve is depicted as *CC* in Figure 3.8. As shown in Figure 3.8, one option available to the economy is to produce *Ow* fig leaves and *Ox* apples. The economy can increase apple production from *Ox* to *Oz*, distance *xz*. To do this, inputs have to be removed from the production of fig leaves and devoted to apples. Fig leaf production must fall by

production possibilities curve
A graph that shows the maximum quantity of one output that can be produced, given the amount of the other output.

[5] The marginal rate of substitution is defined more carefully in the appendix at the end of this book.
[6] The production possibilities curve can be derived from an Edgeworth Box whose dimensions represent the quantities of inputs available for production.

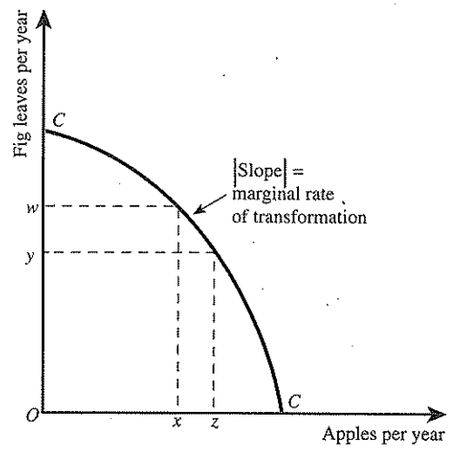


Figure 3.8
Production possibilities curve
The production possibilities curve shows how production can be shifted between one good (apples) and another (fig leaves). If inputs are used efficiently, then an increase in the production of apples leads to a decrease in the production of fig leaves, and vice versa. The rate at which the economy can transform apples into fig leaves is known as the marginal rate of transformation.

distance *wy* if apple production is to increase by *xz*. The ratio of distance *wy* to distance *xz* is called the **marginal rate of transformation** of apples for fig leaves (MRT_{af}) because it shows the rate at which the economy can transform apples into fig leaves. Just as MRS_{af} is the absolute value of the slope of an indifference curve, MRT_{af} is the absolute value of the slope of the production possibilities curve.

marginal rate of transformation
The rate at which the economy can transform one good into another good; it is the slope of the production possibilities frontier.

It is useful to express the marginal rate of transformation in terms of **marginal cost** (*MC*)—the incremental production cost of one more unit of output. To do so, recall that society can increase apple production by *xz* only by giving up *wy* fig leaves. In effect, then, the distance *wy* represents the incremental cost of producing apples, which we denote MC_a. Similarly, the distance *xz* is the incremental cost of producing fig leaves, MC_f. By definition, the absolute value of the slope of the production possibilities curve is distance *wy* divided by *xz*, or MC_a/MC_f. But also by definition, the slope of the production possibilities curve is the marginal rate of transformation. Hence, we have shown that

marginal cost
The incremental cost of producing one more unit of output.

$$MRT_{af} = \frac{MC_a}{MC_f} \tag{3.2}$$

Efficiency Conditions with Variable Production When the supplies of apples and fig leaves are variable, the condition for Pareto efficiency in Equation (3.1) must be extended. The condition becomes

$$MRT_{af} = MRS_{af}^{\text{Adam}} = MRS_{af}^{\text{Eve}} \tag{3.3}$$

To see why, we use an arithmetic example. Suppose that at a given allocation Adam's MRS_{af} is ½, and the MRT_{af} is ¾. By the definition of MRT_{af}, at this allocation two additional fig leaves could be produced by giving up three apples. By the definition of MRS_{af}, if Adam lost three extra apples, he would require only *one* fig leaf to maintain his original utility level. Therefore, Adam could be made better off by giving up three apples and transforming them into *two* fig leaves, and no one else would be made worse off in the process. Such a trade is *always* possible as long as the marginal rate of substitution does not equal the marginal rate of transformation.

Only when the slopes of the curves for each are equal is it impossible to make a Pareto improvement. Hence, $MRT_{af} = MRS_{af}$ is a necessary condition for Pareto efficiency. The rate at which apples can be transformed into fig leaves (MRT_{af}) must equal the rate at which consumers are willing to trade apples for fig leaves (MRS_{af}).

Using Equation (3.2), the conditions for Pareto efficiency can be reinterpreted in terms of marginal cost. Just substitute (3.2) into (3.3), which gives us

$$\frac{MC_a}{MC_f} = MRS_{af}^{\text{Adam}} = MRS_{af}^{\text{Eve}} \tag{3.4}$$

as a necessary condition for Pareto efficiency.

▸ THE FIRST FUNDAMENTAL THEOREM OF WELFARE ECONOMICS

Now that we have described the necessary conditions for Pareto efficiency, we may ask whether a given economy will achieve this apparently desirable state. It depends on what assumptions we make about the operations of that economy. Assume that: 1) All producers and consumers act as perfect competitors; that is, no one has any market power; 2) A market exists for each and every commodity. Under these assumptions, the so-called *First Fundamental Theorem of Welfare Economics* states that a Pareto efficient allocation of resources emerges. In effect, this stunning result tells us that a competitive economy "automatically" allocates resources efficiently, without any need for centralized direction (shades of Adam Smith's "invisible hand"). In a way, the First Welfare Theorem merely formalizes an insight that has long been recognized: When it comes to providing goods and services, free-enterprise systems are amazingly productive.[7]

A rigorous proof of the theorem requires fairly sophisticated mathematics, but we can provide an intuitive justification. The essence of competition is that all people face the same prices—each consumer and producer is so small relative to the market that his or her actions alone cannot affect prices. In our example, this means Adam and Eve both pay the same prices for fig leaves (P_f) and apples (P_a). A basic result from the theory of consumer choice[8] is that a necessary condition for Adam to maximize utility is

$$MRS_{af}^{\text{Adam}} = \frac{P_a}{P_f} \tag{3.5}$$

Similarly, Eve's utility-maximizing bundle satisfies

$$MRS_{af}^{\text{Eve}} = \frac{P_a}{P_f} \tag{3.6}$$

Equations (3.5) and (3.6) together imply that

$$MRS_{af}^{\text{Adam}} = MRS_{af}^{\text{Eve}}$$

[7] "The bourgeoisie, during its rule of scarce 100 years, has created more massive and more colossal productive forces than have all preceding generations together," according to Karl Marx and Friedrich Engels in *The Communist Manifesto*, Part I [Tucker, 1978, p. 477].

[8] This result is derived in the appendix at the end of this book.

This condition, though, is identical to Equation (3.1), one of the necessary conditions for Pareto efficiency.

However, as emphasized in the preceding section, we must consider the production side as well. A basic result from economic theory is that a profit-maximizing competitive firm produces output up to the point at which marginal cost and price are equal. In our example, this means $P_a = MC_a$ and $P_f = MC_f$, or

$$\frac{MC_a}{MC_f} = \frac{P_a}{P_f} \tag{3.7}$$

But recall from Equation (3.2) that MC_a/MC_f is just the marginal rate of transformation. Thus, we can rewrite (3.7) as

$$MRT_{af} = \frac{P_a}{P_f} \tag{3.8}$$

Now consider Equations (3.5), (3.6), and (3.8), and notice that P_a/P_f appears on the right-hand side of each. Hence, these three equations together imply that $MRS_{af}^{\text{Adam}} = MRS_{af}^{\text{Eve}} = MRT_{af}$, which is the necessary condition for Pareto efficiency. Competition, along with maximizing behavior on the part of all individuals, leads to an efficient outcome.

Finally, we can take advantage of Equation (3.4) to write the conditions for Pareto efficiency in terms of marginal cost. Simply substitute (3.5) or (3.6) into (3.4) to find

$$\frac{P_a}{P_f} = \frac{MC_a}{MC_f} \tag{3.9}$$

Pareto efficiency requires that prices be in the same ratios as marginal costs, and competition guarantees this condition is met. The marginal cost of a commodity is the additional cost to society of providing it. According to Equation (3.9), efficiency requires that the additional cost of each commodity be reflected in its price.

▸ FAIRNESS AND THE SECOND FUNDAMENTAL THEOREM OF WELFARE ECONOMICS

If properly functioning competitive markets allocate resources efficiently, what role does the government have to play in the economy? Only a very small government would appear to be appropriate. Its main function would be to protect property rights so that markets can work. Government provides law and order, a court system, and national defense. Anything more is superfluous. However, such reasoning is based on a superficial understanding of the First Welfare Theorem. Things are really much more complicated. For one thing, it has implicitly been assumed that efficiency is the only criterion for deciding if a given allocation of resources is good. It is not obvious, however, that Pareto efficiency by itself is desirable.

To see why, let us return to the simple model in which the total quantity of each good is fixed. Consider Figure 3.9, which reproduces the contract curve *mm* derived in Figure 3.7. Compare the two allocations p_5 (at the lower left-hand corner of the box) and q (located near the center). Because p_5 lies on the contract curve, by definition it

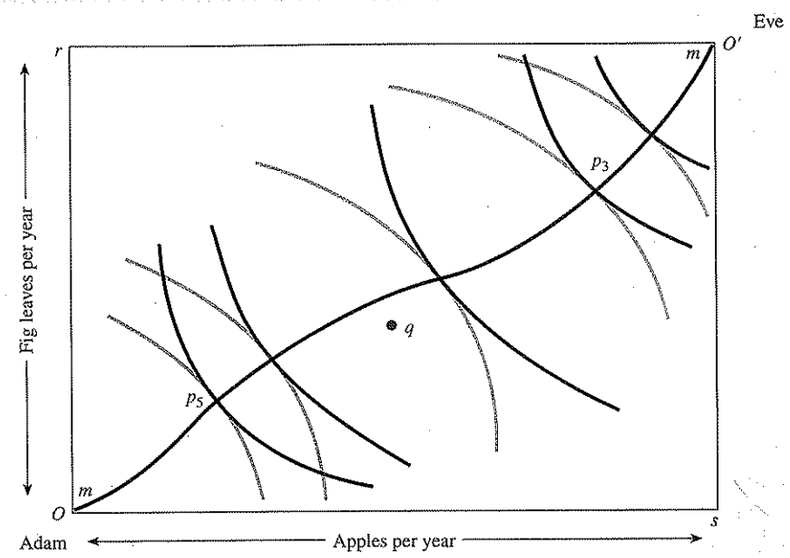


Figure 3.9
Efficiency versus equity
Point p_5 is Pareto efficient and point q is not. However, society might prefer point q because it provides a more equal distribution of the two goods.

is Pareto efficient. On the other hand, q is inefficient. Is allocation p_5 therefore better? That depends on what is meant by better. To the extent that society prefers a relatively equal distribution of real income, q might be preferred to p_5, even though q is not Pareto efficient. On the other hand, society might not care about distribution at all, or perhaps care more about Eve than Adam. In this case, p_5 would be preferred to q.

The key point is that the criterion of Pareto efficiency by itself is not enough to rank alternative allocations of resources. Rather, explicit value judgments are required on the fairness of the distribution of utility. To formalize this notion, note that the contract curve implicitly defines a relationship between the maximum amount of utility that Adam can attain for each level of Eve's utility. In Figure 3.10, Eve's utility is plotted on the horizontal axis, and Adam's utility is recorded on the vertical axis. Curve UU is the **utility possibilities curve** derived from the contract curve.[9] It shows the maximum amount of one person's utility given the other individual's utility level. Point $\tilde{p}_5$ corresponds to point p_5 on the contract curve in Figure 3.9. Here, Eve's utility is relatively high compared to Adam's. Point $\tilde{p}_3$ in Figure 3.10, which corresponds to p_3 in Figure 3.9, is just the opposite. Point $\tilde{q}$ corresponds to point q in Figure 3.9. Because q is off the contract curve, $\tilde{q}$ must be inside the utility possibilities curve, reflecting the fact that it is possible to increase one person's utility without decreasing the other's.

utility possibilities curve
A graph showing the maximum amount of one person's utility given each level of utility attained by the other person.

All points on or below the utility possibilities curve are attainable by society; all points above it are not attainable. By definition, all points on UU are Pareto efficient, but they represent very different distributions of real income between Adam

[9] The production possibilities curve in Figure 3.8 is drawn on the reasonable assumption that the absolute value of its slope continually increases as we move downward along it. The more apples produced, the more fig leaves given up to produce an apple. However, there is no reason to assume this holds for the trade-off between individuals' utilities. This is why UU in Figure 3.10 is wavy rather than smooth.

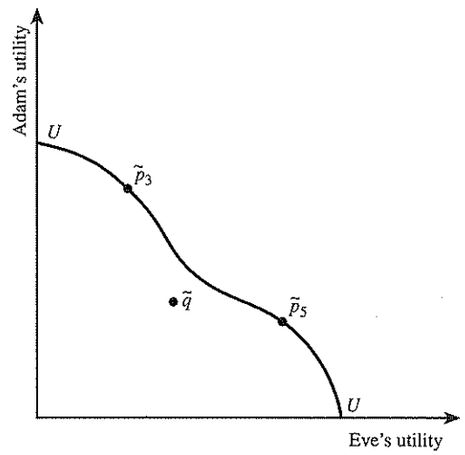


Figure 3.10
Utility possibilities curve
The utility possibilities curve shows the maximum feasible amount of one person's utility given the other person's utility level. Points on the curve are Pareto efficient, and points within the curve are not Pareto efficient.

and Eve. Which point is best? The conventional way to answer this question is to postulate a **social welfare function,** which embodies society's views on the relative deservedness of Adam and Eve. A social welfare function is simply a statement of how society's well-being relates to the well-being of its members. Think of it this way: Just as an *individual's* welfare depends on the quantities of commodities she consumes, *society's* welfare depends on the utilities of each of its members. Algebraically, social welfare (W) is some function $F(\ )$ of each individual's utility:

$$W = F(U^{\text{Adam}}, U^{\text{Eve}}) \tag{3.10}$$

social welfare function
A function reflecting society's views on how the utilities of its members affect the well-being of society as a whole.

We assume the value of social welfare increases as either U^{Adam} or U^{Eve} increases—society is better off when any of its members becomes better off. Note that we have said nothing about how society manifests these preferences. Under some conditions, members of society may not be able to agree on how to rank each other's utilities, and the social welfare function does not even exist. For the moment, we simply assume it does exist.

Just as an individual's utility function for commodities leads to a set of indifference curves for those commodities, so does a social welfare function lead to a set of indifference curves between people's utilities. Figure 3.11 depicts a typical set of social indifference curves. Their downward slope indicates that if Eve's utility decreases, the only way to maintain a given level of social welfare is to increase Adam's utility, and vice versa. The level of social welfare increases as we move toward the northeast, reflecting the fact that an increase in any individual's utility increases social welfare, other things being the same.

In Figure 3.12, the social indifference curves are superimposed on the utility possibilities curve from Figure 3.10. Point *i* is not as desirable as point *ii* (point *ii* is on a higher social indifference curve than point *i*) even though point *i* is Pareto efficient and point *ii* is not. Here, society's value judgments, embodied in the social welfare function, favor a more equal distribution of real income, inefficient though it may be. Of course, point *iii* is preferred to either of these. It is both efficient and "fair."

Now, the First Welfare Theorem indicates that a properly working competitive system leads to some allocation on the utility possibilities curve. There is no

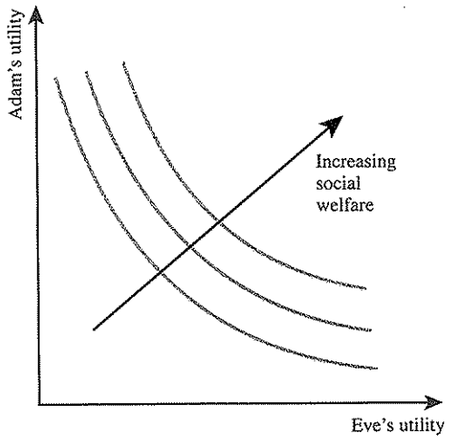


Figure 3.11
Social indifference curves
Social indifference curves show how society is willing to trade off one person's utility for the other's. Social welfare increases as we move toward the northeast.

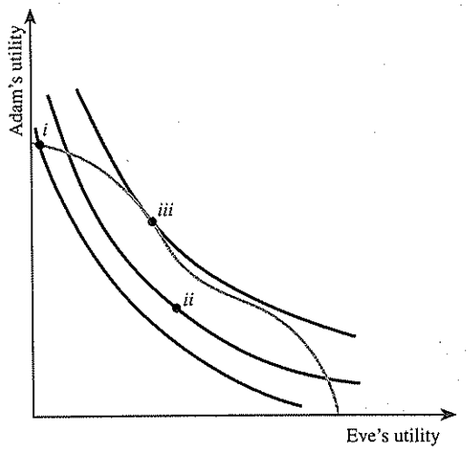


Figure 3.12
Maximizing social welfare
Point *i* is Pareto efficient, but social welfare is higher at the inefficient point *ii*. It is even higher at point *iii*, which is both efficient and "fair."

reason, however, that it is the particular point that maximizes social welfare. We conclude that, even if the economy generates a Pareto efficient allocation of resources, government intervention may be necessary to achieve a "fair" distribution of utility.

Does the government have to intervene directly in markets in order to move the economy to the welfare-maximizing point? For example, does it have to impose ceilings on the prices of commodities consumed by the poor? The answer is no. According to the *Second Fundamental Theorem of Welfare Economics,* society can attain any Pareto efficient allocation of resources by making a suitable assignment of initial endowments and then letting people freely trade with each other as in our Edgeworth

Box Model.[10] Roughly speaking, by redistributing income suitably and then getting out of the way and letting markets work, the government can attain any point on the utility possibilities frontier.

Author Tim Harford [2006] explains the *Second Fundamental Theorem of Welfare Economics* by using the analogy of a 100-meter race. He writes:

> If your goal is to have all the sprinters cross the line together, you could just change the rules of the race, ordering the fast runners to slow down and everyone to hold hands as they crossed the line. A waste of talent. Or you could move some starting blocks forward and some back, so that although each sprinter was running as fast as he could . . . the fastest had to cover enough extra ground that he would end up breaking the tape neck-and-neck with the slowest [pp. 73–74].

Achieving equity through such things as a tax on income is similar to requiring the fast runners to slow down, because it punishes income-enhancing behavior. But a reassignment of initial endowments (for example, a lump-sum tax that does not depend on behavior) is similar to moving the starting blocks of the runners. The *Second Fundamental Theorem of Welfare Economics* shows that this can achieve equity without inhibiting efficiency.

The Second Welfare Theorem is important because of its implication that, at least in theory, the issues of efficiency and distributional fairness can be separated. If society determines that the current distribution of resources is unfair, it need not interfere with market prices and impair efficiency. Rather, society need only transfer resources among people in a way deemed to be fair. Of course, the government needs some way to reallocate resources, and problems arise if the only available mechanisms for doing so (such as taxes) themselves induce inefficiences. We discuss further the relationship between efficiency and fairness in Chapter 16.

In addition to distributional issues, there is another reason why the First Welfare Theorem need not imply a minimal government. This relates to the fact that the certain conditions required for its validity may not be satisfied by real-world markets. As we now show, when these conditions are absent, the free-market allocation of resources may be inefficient as well as unfair.

▸ MARKET FAILURE

In the famous film *Casablanca*, whenever something seems amiss, the police chief gives an order to "round up the usual suspects." Similarly, whenever markets appear to be failing to allocate resources efficiently, economists round up the same group of possible causes for the supposed failure. As suggested earlier, an economy may be inefficient for two general reasons—market power and nonexistence of markets.

Market Power

The First Welfare Theorem holds only if all consumers and firms are price takers. If some individuals or firms are price makers (they have the power to affect prices), then the allocation of resources is generally inefficient. Why? A firm with market power may be able to raise price above marginal cost by supplying less output than a competitor would. Thus, Equation (3.9), one of the necessary conditions for Pareto

[10] The proof requires that several technical conditions be satisfied. For example, all indifference curves have the standard (convex to the origin) shape.

efficiency, is violated. An insufficient quantity of resources is devoted to the commodity.

Price-making behavior can arise in several contexts. An extreme case is a **monopoly,** where there is only one firm in the market, and entry is blocked. Even in the less extreme case of oligopoly (a few sellers), the firms in an industry may be able to increase price above marginal cost. Finally, some industries have many firms, but each firm has some market power because the firms produce differentiated products. For example, a lot of firms produce running shoes, yet many consumers view Reeboks, Nikes, and Adidas as distinct commodities.

monopoly

A market with only one seller of a good.

Nonexistence of Markets

The proof behind the First Welfare Theorem assumes a market exists for every commodity. After all, if a market for a commodity does not exist, then we can hardly expect the market to allocate it efficiently. In reality, markets for certain commodities may fail to emerge. Consider, for instance, insurance, a very important commodity in a world of uncertainty. Despite the existence of firms such as Aetna and Allstate, there are certain events for which insurance simply cannot be purchased on the private market. For example, suppose you wanted to purchase insurance against the possibility of becoming poor. Would a firm in a competitive market ever find it profitable to supply "poverty insurance"? The answer is no, because if you purchased such insurance, you might decide not to work very hard. To discourage such behavior, the insurance firm would have to monitor your behavior to determine whether your low income was due to bad luck or to goofing off. However, to perform such monitoring would be very difficult or impossible. Hence, there is no market for poverty insurance—it simply cannot be purchased.

asymmetric information

A situation in which one party engaged in an economic transaction has better information about the good or service traded than the other party.

Basically, the problem here is **asymmetric information**—one party in a transaction has information that is not available to another. One rationalization for governmental income support programs is that they provide poverty insurance that is unavailable privately. The premium on this "insurance policy" is the taxes you pay when you are able to earn income. In the event of poverty, your benefit comes in the form of welfare payments.

externality

An activity of one entity affects the welfare of another entity in a way that is outside the market.

Another type of inefficiency that may arise due to the nonexistence of a market is an **externality,** which is a situation in which one person's behavior affects the welfare of another in a way that is outside existing markets. For example, suppose your roommate begins smoking large cigars, polluting the air and making you worse off. Why is this an efficiency problem? Your roommate consumes a scarce resource, clean air, when he smokes cigars. However, there is no market for clean air that forces him to pay for it. In effect, he pays a price of zero for the clean air and therefore "overuses" it. The price system fails to provide correct signals about the opportunity cost of a commodity.

Welfare economics provides a useful framework for thinking about externalities. The derivation of Equation (3.9) implicitly assumed marginal cost meant *social* marginal cost—it embodied the incremental value of all of society's resources used in production. In our cigar example, however, your roommate's private marginal cost of smoking is less than the social marginal cost because he does not have to pay for the clean air he uses. The price of a cigar, which reflects its private marginal cost, does not correctly reflect its social marginal cost. Hence, Equation (3.9) is not satisfied, and the allocation of resources is inefficient. Incidentally, an externality can be positive—confer a benefit—as well as negative. Think of a molecular biologist

who publishes a paper about a novel gene-splicing technique that can be used by a pharmaceutical firm. In the case of a positive externality, the amount of the beneficial activity generated by the market is inefficiently small.

Closely related to an externality is a **public good,** a commodity that is *nonrival and nonexcludable in consumption.* Nonrival means that the fact that one person consumes it does not prevent anyone else from doing so as well. Nonexcludable means that it is either very expensive or impossible to prevent anyone from consuming it. The classic example of a public good is a lighthouse. When the lighthouse turns on its beacon, all ships in the vicinity benefit. The fact that one person takes advantage of the lighthouse's services does not keep anyone else from doing so simultaneously, and it is very difficult to prevent others from using the lighthouse.

public good

A good that is nonrival and nonexcludable in consumption.

People may have an incentive to hide how much they value a public good. Suppose that the lighthouse is beneficial to me. I know, however, that once the beacon is lit, I can enjoy its services, whether I pay for them or not. Therefore, I may claim the lighthouse means nothing to me, hoping that I can get a "free ride" after other people pay for it. Unfortunately, everyone has the same incentive, so the lighthouse may not get built, even though its construction could be very beneficial. The market mechanism may fail to force people to reveal their preferences for public goods, and possibly result in insufficient resources being devoted to them.

Overview

The First Welfare Theorem states that a properly working competitive economy generates a Pareto efficient allocation of resources without any government intervention. However, it is not obvious that an efficient allocation of resources is per se socially desirable; many argue that distributional fairness must also be considered. Moreover, we have just shown that in real-world economies, competition may not hold and not all markets may exist. Hence, the market-determined allocation of resources is unlikely to be efficient. There are, then, opportunities for government to intervene and enhance economic efficiency.

It must be emphasized that while efficiency problems provide opportunities for government intervention in the economy, they do not require it. The fact that the market-generated allocation of resources is imperfect does not necessarily mean the government is capable of doing better. For example, in certain cases, the costs of setting up a government agency to deal with an externality could exceed the cost of the externality itself. Moreover, governments, like people, can make mistakes. Some argue that government is inherently incapable of acting efficiently, so while in theory it can improve on the status quo, in practice it never will. While this argument is extreme, it highlights the fact that the fundamental theorem is helpful only in identifying situations in which intervention *may* lead to greater efficiency.

▸ BUYING INTO WELFARE ECONOMICS

These days, vigorous debates over how to organize an economy are occurring in countries as diverse as India, China, and Venezuela. Nevertheless, the same issues arise in developed nations as well: How much of national output should be devoted

to the public sector, and how should public expenditures be financed? The theory of welfare economics introduced in this chapter provides the standard framework for thinking about these issues. There are, however, some controversies surrounding the theory.

First, the underlying outlook is highly individualistic, with a focus on people's utilities and how to maximize them. This is brought out starkly in the formulation of the social welfare function, Equation (3.10). The basic view expressed in that equation is that a good society is one whose members are happy. As suggested in Chapter 1, however, other societal goals are possible—to maximize the power of the state, to glorify God, and so on. Welfare economics does not have much to say to people with such goals. It is no surprise that Iran's Ayatollah Khomeini used to say that economics was for donkeys.

Because welfare economics puts people's preferences at center stage, it requires that these preferences be taken seriously. People know best what gives them satisfaction. A contrary view, once nicely summarized by Thomas O'Neill, former speaker of the House of Representatives, is, "Often what the American people want is not good for them." If one believes that individuals' preferences are ill formed or corrupt, a theory that shows how to maximize their utility is essentially irrelevant.

merit good

A commodity that ought to be provided even if people do not demand it.

Musgrave [1959] developed the concept of **merit goods** to describe commodities that ought to be provided even if the members of society do not demand them. Government support of the fine arts is often justified on this basis. Operas and concerts should be provided publicly if individuals are unwilling to pay enough to meet their costs. But as Baumol and Baumol [1981] have noted,

> The term *merit good* merely becomes a formal designation for the unadorned value judgment that the arts are good for society and therefore deserve financial support . . . [the] merit good approach is not really a justification for support—it merely invents a bit of terminology to designate the desire to do so [pp. 426–427].

Another possible problem with the welfare economics framework is its concern with *results*. Situations are evaluated in terms of the allocation of resources, and not of *how* the allocation was determined. Perhaps a society should be judged by the *processes* used to arrive at the allocation, not the actual results. Are people free to enter contracts? Are public processes democratic? If this view is taken, welfare economics loses its normative significance.

On the other hand, the great advantage of welfare economics is that it provides a coherent framework for assessing public policy. Every government intervention, after all, involves a reallocation of resources, and the whole purpose of welfare economics is to evaluate alternative allocations. The framework of welfare economics impels us to ask three key questions whenever a government activity is proposed:

- Will it have desirable distributional consequences?
- Will it enhance efficiency?
- Can it be done at a reasonable cost?

If the answer to these questions is no, the market should probably be left alone. Of course, to answer these questions may require substantial research and, in the case of the first question, value judgments as well. But just asking the right questions provides an invaluable structure for the decision-making process. It forces people to make their ethical values explicit, and facilitates the detection of frivolous or self-serving programs.

Summary

- Welfare economics is the study of the desirability of alternative economic states.
- A Pareto efficient allocation occurs when no person can be made better off without making another person worse off. Pareto efficiency requires that each person's marginal rate of substitution between two commodities equal the marginal rate of transformation. Pareto efficiency is the economist's benchmark of efficient performance for an economy.
- The First Fundamental Theorem of Welfare Economics states that, under certain conditions, competitive market mechanisms lead to Pareto efficient outcomes.
- Despite its appeal, Pareto efficiency has no obvious claim as an ethical norm. Society may prefer an inefficient allocation on the basis of equity or some other criterion. This provides one possible reason for government intervention in the economy.
- A social welfare function summarizes society's preferences concerning the utility of each of its members. It may be used to find the allocation of resources that maximizes social welfare.
- The *Second Fundamental Theorem of Welfare Economics* states that society can attain any Pareto efficient allocation of resources by making a suitable assignment of initial endowments and then letting people freely trade with each other.
- A second reason for government intervention is market failure, which may occur in the presence of market power or when markets do not exist.
- The fact that the market does not allocate resources perfectly does not necessarily mean the government can do better. Each case must be evaluated on its own merits.
- Welfare economics is based on an individualistic social philosophy. It does not pay much attention to the processes used to achieve results. Thus, although it provides a coherent and useful framework for analyzing policy, welfare economics is not universally accepted.

Discussion Questions

1. In which of the following markets do you expect efficient outcomes? Why?
   a. Flood insurance for beach houses
   b. Medical care
   c. Stock market
   d. Personal computers
   e. Loans for students who wish to attend college
   f. Car insurance
2. Consider an economy with two people, Henry and Catherine, who consume two commodities, bread and water. Suppose that, due to a drought, the authorities decide to allocate exactly half the available water to each person. In order to prevent one person from "exploiting" the other, neither person may trade away any water to the other in exchange for more bread. Set up an Edgeworth Box to depict this situation and explain why it is unlikely to be Pareto efficient.
3. Recently, the California Insurance Commissioner proposed a regulation that would reduce the ability of insurers to use geographic location in determining automobile insurance rates. The change would raise the insurance rates of rural and suburban residents, and lower the rates of urban residents. Is such a policy efficient? Is it likely to improve social welfare?
4. Imagine a simple economy with only two people, Augustus and Livia.
   a. Let the social welfare function be

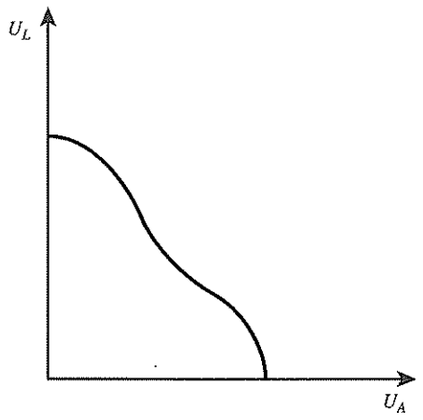
   $$W = U_L + U_A$$

   where U_L and U_A are the utilities of Livia and Augustus, respectively. Graph the social indifference curves. How would you describe the relative importance assigned to their respective well-being?

b. Repeat part *a* when

$$W = U_L + 2U_A$$

c. Assume that the utility possibility curve is as follows:



Graphically show how the optimal solution differs between the welfare functions given in parts *a* and *b*.

5. In recent years, a number of states have instituted taxes on patrons of nude and topless dance bars. Such taxes are known as "sin taxes," because they target behavior that is believed to be sinful. How do sin taxes relate to the notion of merit goods?
6. In each case listed below, can you rationalize the government policy on the basis of welfare economics?
   a. In Los Angeles, the police respond to 127,000 burglar alarm calls per year. There is no charge. (97 percent of the alarms are false.)
   b. Wool and mohair production is subsidized by the federal government.
   c. The federal government regulates cherry frozen fruit pies, requiring that at least 25 percent of each pie by weight contain cherries and that no more than 15 percent of the cherries be blemished. There are no such regulations for apple, blueberry, or peach frozen pies.
   d. In Washington, DC, you cannot become a hairdresser without a license from the city government.
   e. The National Energy Policy Act requires that all new toilets flush with only 1.6 gallons of water. Most American homes have toilets that consume 5.5 to 7 gallons per flush.
   f. The federal government subsidizes the production of electricity from chicken manure. [Note: We are not making this up.]
7. Your airplane crashes in the Pacific Ocean. You land on a desert island with one other passenger. A box containing 100 little bags of peanuts also washes up on the island. The peanuts are the only thing to eat.

   In this economy with two people, one commodity, and no production, represent the possible allocations in a diagram, and explain why every allocation is Pareto efficient. Is every allocation fair?
8. [This problem is for readers who know some calculus.] Suppose that there are only two people in society, Mark and Judy, who must split a fixed amount of income of $300. Mark's utility function is U_M and his income is I_M. Judy's utility function is U_J and her income is I_J. Suppose that

   $$U_M = 100 \times I_M^{1/2} \text{ and } U_J = 200 \times I_J^{1/2}$$

   Let the social welfare function be

   $$W = U_M + U_J$$

   What distribution of the total income between Mark and Judy maximizes social welfare?
9. Consider an economy with two people, Victoria and Albert, and two commodities, tea and crumpets. Currently, Victoria and Albert would both be willing to substitute two cups of tea for one crumpet. Further, if the economy were to produce one less cup of tea, the resources released from tea production could be used to produce three more crumpets. Is the allocation of resources in this economy Pareto efficient? If not, should there be more tea or more crumpets?
10. Indicate whether each of the following statements is true, false, or uncertain, and justify your answer.
    a. If everyone has the same marginal rate of substitution, then the allocation of resources is Pareto efficient.
    b. If the allocation of resources is Pareto efficient, then everyone has the same marginal rate of substitution.
    c. A policy change increases social welfare if, and only if, it represents a Pareto improvement.
    d. An increase in a state's cigarette tax in order to fund education is a Pareto-improving policy.

Part Two

PUBLIC EXPENDITURE: PUBLIC GOODS AND EXTERNALITIES

The theory of welfare economics focused our attention on market failure and distributional considerations as reasons for considering government intervention. The chapters in this section examine the implications for government policy, specifically with respect to public goods and externalities. Chapter 4 introduces public goods. Chapter 5 deals with externalities, with special emphasis on environmental issues. In Chapter 6, we discuss whether our political institutions are likely to respond to market failures with the efficiency-enhancing policies derived in Chapters 4 and 5. Chapter 7 applies our analytical framework to the important issue of government involvement in education. This part concludes with Chapter 8 on cost-benefit analysis, a theory-based set of practical rules for evaluating public expenditure.