Scarcity and Options

Chapter 1 introduced the science of economics as the study of how people make choices in the face of scarcity. There are two aspects of choice that are often confused: distinguishing the menu (the set of options) from the actual choice**.** An option is one possible outcome of a decision; a fairytale princess with three suitors; each prince represents an option; she can choose only one of them, unless bigamy is a legal practice in that kingdom. When a friend takes you to lunch, the waiter brings you that menu; the menu represents options, not choices. If you chose everything on the menu, you lose a friend, and perhaps pay the bill by washing dishes.

Scarcity means that we cannot choose all the options on the menu. A choice situation typically represents a fleeting opportunity to select one option from a menu of several **mutually exclusive** options. After the princess selects one suitor, the other two will go away, disappointed at best, homicidally angry at worst.[1] The rejected suitors will pick other princesses, or even commoners. Picking one option means sacrificing the other options. When you select a dinner from a restaurant menu your money and your appetite fade away; you will have to wait until your next visit to that restaurant to try other delicacies.

This chapter concerns options in an environment of scarcity. Typically people combine scarce resources to **produce** goods and services that they or others value. In a market economy (presented in more detail in Chapters 4 through 6) businesses typically **specialize** in the production of goods; they exchange that commodity for money, used to buy the products of other businesses. Businesses succeed (earn a profit) when their revenue exceeds their costs. In a command economy (inside the business), rewards follow conformity; if you and the boss disagree about what is best for the company, the boss's opinion is decisive. In a traditional economy, a family, the organizing principal is "all for one and one for all," or "from each according to ability, to each according to need."

Economists assume that each person aspires to achieve the outcome that is best for them. The business owner maximizes profit because the owner (entrepreneur) keeps all revenue left over after costs have been paid. The government or corporate bureaucrat obeys orders because that increases job tenure and facilitates promotion. Parents value the welfare of all family members and are willing to sacrifice their own wellbeing to increase the wellbeing of their children or spouse – but only to a point. Economists formalize this theory by assuming that people – alone and in groups – aspire to maximize their welfare, constrained (limited by) the resources at their disposal. Rational decisions increase **utility** (another name for wellbeing); irrational decisions actually make people worse off. A problem is that not everyone pursues the same ends; what appears irrational to an observer my make perfect sense to the person being observed.

[1] If you have seen a performance of *Into the Woods*, you know that both of the princes in that play regretted their choice, an outcome commonly known as *buyer's remorse.*

Production Possibilities and Opportunity Cost

We now develop **production possibilities,** an important economic tool that depicts the consequences of allocating scarce resources efficiently. Consider a farmer who has five different plots of land that have different production *potentials*. While each plot could produce a maximum of 200 tons of corn per acre if all that resource is planted with corn, each plot differs in the potential for wheat production, also measured in tons per acre. Table 2-1 presents the production possibilities for each plot of land.

Table 2-1

Plot	Maximum Wheat (tons)	Maximum Corn (tons)	Opportunity Cost/Corn	Opportunity Cost/Wheat
α	500	200	2.5	0.4
β	400	200	2	0.5
χ	300	200	1.5	0.67
δ	200	200	1	1
ε	100	200	0.5	2
Maximum	1500	1000		

Although each plot of can produce the same amount of corn, they do not all produce corn **efficiently**. Producing 200 tons of corn on plot α means giving up 500 tons of wheat, so each ton of corn on plot α has an **opportunity cost** of 2½ tons of wheat. By contrast, growing 200 tons of corn on plot ε means sacrificing only 100 tons of wheat, or ½ ton of wheat per ton of corn. The opportunity cost of growing *wheat* on plot α is only 0.4 tons of corn per ton of corn, while the opportunity cost of growing wheat on plot ε is 2.0 ton of corn per ton of wheat.

Land is a scarce resource. There is a limited amount available (five plots), and using land for one crop means sacrificing the other. To grow wheat, the farmer must sacrifice corn; to grow corn, the farmer must sacrifice wheat; and if he grows nothing, he sacrifices the more valuable of the two.[2] If he is to produce efficiently, the farmer should prioritize resources according to **comparative advantage.** A resource has a comparative advantage in the production of one commodity if it produces that commodity at a lower opportunity cost than another resource can. Hence, plot α has comparative advantage in the production of wheat (relative to plots β through ε), while plot ε has a comparative advantage in the production of corn (relative to plots α through δ). Do not think that comparative advantage always means that a resource has an absolute advantage. While plots α and ε can produce 200 tons of corn, plot ε has the comparative advantage in corn. In the United States, Hawaii has a comparative advantage in tourism, while New York has a comparative advantage in banking. Nevertheless, while New York clearly has more banks than Hawaii does, New York also has more tourists, simply because New York has a larger population and more hotel rooms than Hawaii does.

[2] By producing nothing, it would seem that the farmer sacrifices *both* wheat and corn, and in a sense he does. Had he grown wheat, he would have sacrificed corn; by growing neither wheat nor corn, he sacrifices both (since he gets neither). However, it was never possible to get both maximum wheat and maximum corn; using land for one crop implied the sacrifice of the other crop.

By allocating resources in order of their comparative advantage[3] the farmer can maximize the output of wheat for each rate of output for corn (or vice versa). We call the *menu* of efficient output combination a **production possibility table**. In Table 2-2 below, we start with combination A, where only wheat is produced on each plot of land. Combination A is efficient because, given 0 corn, 1500 tons is the maximum possible wheat. One efficient combination is *A* (0, 1500). If the farmer decides to produce 200 bushels of corn instead of 0, he must sacrifice some wheat. Transferring plot ε from wheat to corn *minimizes* the opportunity cost. Using plot ε to produce corn, we lose only 100 bushels of wheat. Our second efficient combination is *B* (200, 1400). For each efficient combination, we increase corn by 200 units by using the remaining plot in wheat production that has the lowest opportunity cost (that is, has a comparative advantage in corn). Hence, our remaining efficient points are *C*(400, 1200), *D*(600, 900), *E*(800, 500), and *F*(1000, 0).[4]

Combination	Wheat	Corn
A	1500 tons	0
B	1400 tons	200 tons
C	1200 tons	400 tons
D	900 tons	600 tons
E	500 tons	800 tons
F	0	1000 tons

Table 2-2

A picture of the production possibility table, Table 2-2, is the **production possibility curve** in Figure 2-1. We pick corn as the independent variable and plot alternative corn harvests on the horizontal axis. This decision makes wheat production the dependent variable because, given the available resources (five plots of ground), and efficient production, increasing the output of corn implies decreasing the output of wheat. The most distinguishing characteristic of a production possibility curve is its **negative slope: as corn increases, wheat decreases**. Note also that the slope of the production possibility curve changes as we move left to right along the horizontal axis. This is because we start producing corn with the resource that has the lowest opportunity cost, so as we produce more and more corn, the **opportunity cost of producing the last unit of corn increases.** This **bowed-out shape** of the production possibility curve is also known as **the law of increasing (relative) opportunity cost.** That is, if economies use resources efficiently, they will discover as the output of the commodity plotted on the horizontal axis increases, the opportunity cost of the other becomes greater, making the slope of the production possibility curve become progressively steeper.

[3] That is, plot α has a comparative advantage in wheat production relative to all other plots, and plot ε has a comparative advantage in corn relative to all other plots. However, plot β has a comparative advantage in corn relative to plot α, and a comparative advantage in wheat relative to plots χ, δ, and ε.

[4] Note that Table 2-2 represents a *menu of options*, showing the maximum amount of wheat that can be produced for each combination of corn. Once crops were actually planted, however, changing the mix of crops would be much more difficult, given that he would spend labor ripping out seeds or seedlings, then replowing and replanting.

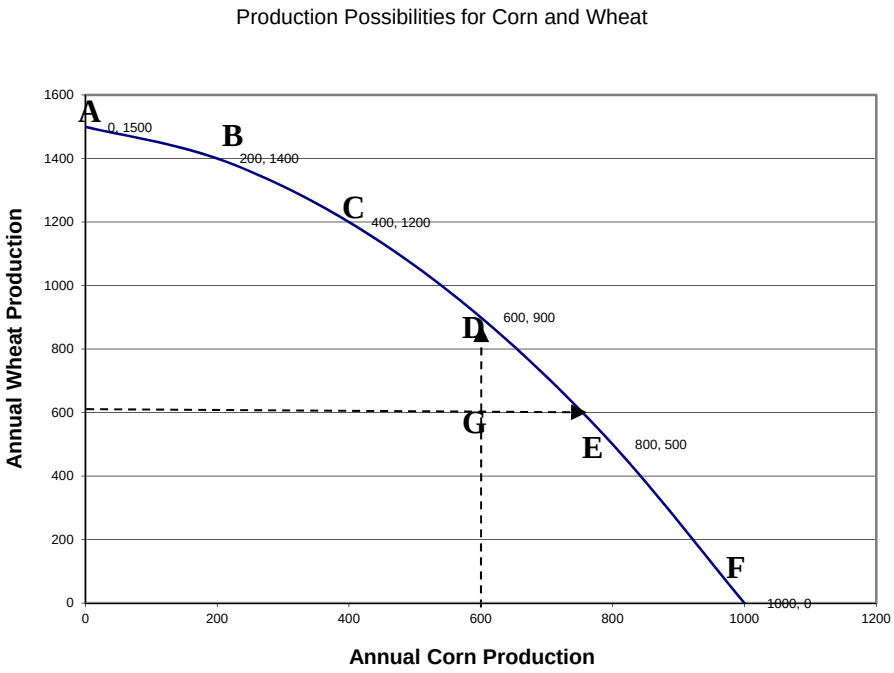


Figure 2-1

Figure 2-1 also depicts point *G***,** which can be produced using plots α and ε for wheat and*β,χ*, and *δ* for corn, yielding 600 tons of corn and 600 tons of wheat. Point *G* is clearly possible since it is within the confines of the production possibility curve. However, because it is inside of the production possibility curve, not on the curve, point *G* is inefficient. The dashed arrows through point *G* show that it is inefficient because it would have been possible to produce more wheat (corn constant), or more corn (wheat constant). By producing inefficiently the farmer would produce less output (revenue) without reducing his resource use (cost).

Every collection of people—families, businesses, governments, schools, countries, or the world—confronts the ubiquitous condition of scarcity. If the organization responds **efficiently** to scarcity, it will fashion **incentives** that push production or consumption to its production possibility curve. Inefficient organizations always produce or consume less than they would if they were organized efficiently. While conflict within organizations typically involves the **distribution** of the resources of the organization, the study of economics helps us understand how changes in distribution affect incentives and the efficiency of that organization. While distribution determines the relative size of the slices of pie people receive, ultimately it is efficiency that determines the size of the pie.

Production Possibilities and Profit Maximization

Next we turn to the issue of economic efficiency and profit maximization. We assume that each of the five points in Figure 2-1 require an equal outlay for land (all five plots are used), labor (all must be planted, tilled, and harvested), and equipment (rental payments for tractors, harvesters, and so forth). Since profit equals revenue minus cost, the farmer would wish to produce that combination of corn and wheat that maximizes revenue. If we know the prices of wheat and corn, we can also measure the opportunity

cost of wheat in terms of dollars, since each ton of corn not produced is equivalent to an amount of money that is sacrificed. Table 2-3 adds extra columns showing the revenue from each combination of corn and wheat and different potential prices.[5]

Table 2-3
Production Possibilities and Revenue Scenarios

			1	2	3	4	5	6
Combination	Wheat	Corn	P_w = \$300	P_w = \$300	P_w = \$300	P_w = \$300	P_w = \$300	P_w = \$300
	tons	tons	P_c = \$100	P_c = \$200	P_c = \$350	P_c = \$500	P_c = \$700	P_c = \$1000
A	1500	0	\$450,000	\$450,000	\$450,000	\$450,000	\$450,000	\$450,000
B	1400	200	\$440,000	\$460,000	\$490,000	\$520,000	\$560,000	\$620,000
C	1200	400	\$400,000	\$440,000	\$500,000	\$560,000	\$640,000	\$760,000
D	900	600	\$330,000	\$390,000	\$480,000	\$570,000	\$690,000	\$870,000
G	600	600	\$240,000	\$300,000	\$390,000	\$480,000	\$600,000	\$780,000
E	500	800	\$230,000	\$310,000	\$430,000	\$550,000	\$710,000	\$950,000
F	0	1000	\$100,000	\$200,000	\$350,000	\$500,000	\$700,000	\$1,000,000

Scenario #1 in Table 2-3 assumes that the price of wheat (P_w) is \$300 and that the price of corn is only \$100 per ton. Producing only wheat (*A*) would maximize revenue, and hence, on the assumption that all combinations have the same cost, combination *A* would also maximize profit. Although the farmer could produce 200 tons of corn by reducing wheat by only 100 bushels (that is, producing combination *B* instead of combination *A*), the corn gained would have a lower market value than the wheat sacrificed. In mathematics, we cannot compare quantities of different products unless we have a *common denominator*; in economics that common denominator usually is price.

In scenario #2 we imagine that corn sells for \$200 per ton and the price of corn (P_c) is \$300 per ton. The value of combination would still be \$450,000 since a change in the price of corn does not affect revenue if no corn is produced. *If* the farmer produced combination *A*, he would realize \$450,000 (1,500 times \$300) in revenue. However, by producing combination *B instead of* combination *A*, the same cost would have generated more revenue, \$460,000 instead of \$450,000. Sacrificing 100 tons of wheat (worth \$30,000) implies a gain of 200 tons of corn (worth \$40,000); this choice makes economic sense. The farmer would prefer combination *B* to combination *A* because combination *B* generates more revenue and no more cost. Under the prices depicted in column 4, combination *B* would not maximize profit. Notice that I have also computed the revenue for prospects *C, D, G, E,* and *F*. Simple economic logic can show that these prospects are inferior to prospect *B*. Producing combination *C* instead of combination *B* implies sacrificing \$60,000 worth of wheat (\$300 x 200) to produce an extra \$40,000 worth of corn (\$200 x 200). Producing *D, G, E,* or *F* would mean sacrificing more than \$60,000 in wheat to produce an extra \$40,000. By comparing the opportunity costs of the different prospects to their **relative prices**[6], the profit-maximizing producer can easily determine the *best* (profit-maximizing) prospect (combination).

[5] As we will see in Chapter 5, farmers are typically **price takers** whose prices are set by the competitive market for wholesale agricultural commodities.

[6] Relative prices are the ratio of prices; in column 4, the relative price of corn is \$200/300 or 2/3 or 67%. Purchasing 3 tons of corn means not buying 2 tons of wheat.

Scenario #3 in Table 2-3 posits that the price of corn has increased to $350, while the price of wheat remains at $300. In this case producing prospect *B* would no longer maximize profit. This is because prospect **C** now generates $500,000 of revenue, while prospect *B* produces only $490,000; sacrificing $60,000 worth of wheat ($300x200) generates $70,000 worth of corn ($350 x 200), increasing revenue, and profit, by $10,000. Switching from prospect *C* to prospect *D* would not be profitable, since the farmer would sacrifice $75,000 of wheat revenue to generate $70,000 in corn revenue. And since switching from *C* to *D* would not be profitable, switching from *C* to *E*, *F* or *G* would not be profitable either. In fact, switching to prospect *G* would never be profitable.

Scenario #4 involves yet another increase in the price of corn, in this case to $400 per ton. Now prospect *D* is better than prospect *C*; sacrificing 300 tons of wheat, worth $90,000, allows the farmer to produce 200 tons of corn worth $100,000; it's not the physical quantity of the commodities that determines which prospect is most important, it is the relative market value of those commodities. Under scenario #5, when the price of corn has increased to $700, prospect *E* is now the best prospect; it is worth sacrificing 400 tons of wheat to get 200 tons of corn, since corn sells for more than twice as much as wheat.

Finally, in scenario #6, we imagine that corn sells for $1000 per ton, while wheat sells for $300. Since the price of corn is more than three times the price of wheat, the farmer is willing to sacrifice 500 tons of wheat to produce 200 tons of corn. If the price of corn is high enough, the farmer will specialize in corn; if the price of wheat is high enough (relative to corn), the farmer would specialize in wheat. There are scenarios that favor each of the points on the production possibility curve, but none of these scenarios would ever favor prospect *G*, the point inside the production possibility curve in Figure 2-1. Whenever it is possible to produce more of one commodity without sacrificing the other, that prospect is *inefficient* and inefficient production can never maximize profit.

Production Possibilities and Discrimination

Now we address the relation between production possibilities, profit maximization, and discrimination. Table 2-4 presents the production potential of 26 job applicants for the ECONO Motel. Based on infallible aptitude tests, the personnel manager predicts the number of rooms the applicant could clean and the number of guests the applicant could register for the 180-room motel each day. While each applicant is equally adept at registering guests at 10 per day, they differ markedly in their aptitude for cleaning. For instance, Alice could clean 26 rooms per day or register 10 guests; the opportunity cost of each guest registered would be 2.6 rooms not cleaned. By contrast, Zorro could clean only 1 room in the time he could register 10 guests; his opportunity cost of registering 1 guest is only 0.1 room. It follows that Zorro has the lowest opportunity cost, while Alice has the highest opportunity cost of guest registration, and that Zorro has the highest opportunity cost of room cleaning (10 guests not registered per room cleaned), while Alice has the lowest opportunity cost of room cleaning (10/26 or 0.385 guest not registered per room cleaned).

In Figure 2-2, I depict the production possibilities for the 26 job applicants, plotting the number of rooms cleaned on the horizontal axis and the number of guests registered on the vertical axis. If they registered no guests, the 26 job applicants could clean a

total of 351 rooms (26 + 25 + ··· +1 = 351), although there are only 180 rooms to clean. The point (0, 351) would be technically efficient, but not economically efficient, since the staff would end up cleaning 171 rooms that had already been cleaned and would have no people in them. Assigning people to guest registration in ascending order of their opportunity cost of guest registration allows us to complete the other points on the production possibility frontier. The key point on the production possibility curve that registers 180 guests into 180 cleaned rooms would maximize profit. I have labeled that point ***P.***

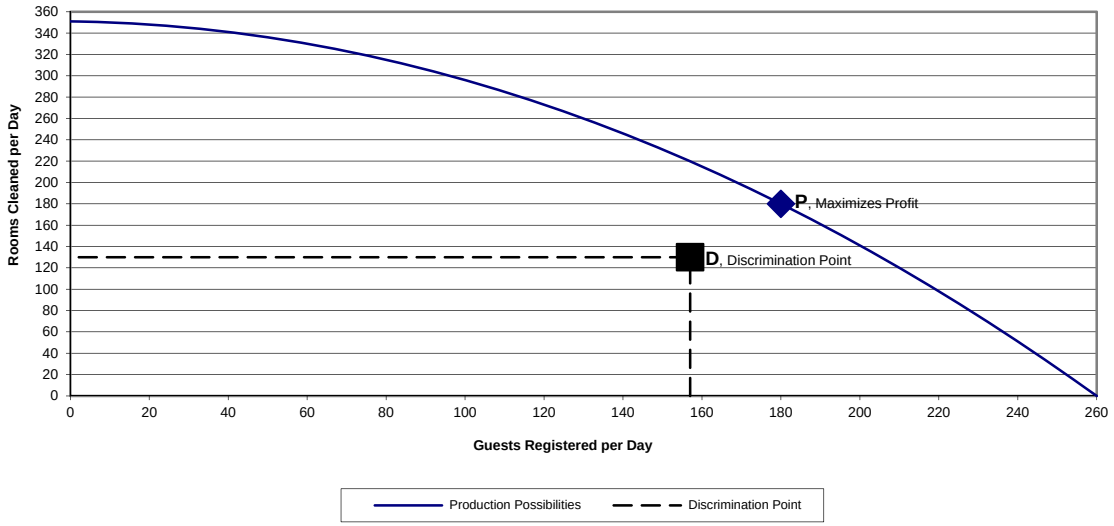
Table 2-4
Predicted Productivity of Motel Staff

Employee	Potential Cleaning	Potential Registration	Opportunity Cost per guest registered
Alice	26	10	2.6
Bob	25	10	2.5
Cathy	24	10	2.4
Don	23	10	2.3
Ellen	22	10	2.2
Fred	21	10	2.1
Gwen	20	10	2
Harry	19	10	1.9
Irene	18	10	1.8
John	17	10	1.7
Karen	16	10	1.6
Larry	15	10	1.5
Molly	14	10	1.4
Nate	13	10	1.3
Olivia	12	10	1.2
Paul	11	10	1.1
Qiana	10	10	1
Ralph	9	10	0.9
Susan	8	10	0.8
Tom	7	10	0.7
Ula	6	10	0.6
Vincent	5	10	0.5
Wanda	4	10	0.4
Xerxes	3	10	0.3
Yolanda	2	10	0.2
Zorro	1	10	0.1

If the manager were an economist, she would understand that incentives rule behavior. Suppose that all the male job applicants require at least $150 per day to agree to work for the ECONO motel, while the female applicants require $100 per day; we call these minimum daily wage rates each gender's **reservation wage.** If the manager offered $19 per guest registered or $10 per room cleaned, the job applicants would sort themselves out on the basis of their own self-interest. Each applicant could expect to earn $190 per day working in guest registration, which would exceed the reservation wage of either men or women. Alice ($260), Bob ($250), Cathy ($240), Don ($230), Ellen ($220), Fred ($210), and Gwen ($200) would earn more per day by cleaning rooms than by registering guests. These applicants would prefer to work cleaning rooms if those jobs

were otherwise equally desirable or undesirable.[7] Presumably Harry would be indifferent between the two jobs, since he could earn $190 per day at either. Allowing workers to sort themselves out would staff the eight workers with the lowest opportunity costs to work as room cleaners (cleaning 180 rooms per day), leaving 18 workers to register 180 guests per day. If each room rents for $50 per day, renting 180 rooms would generate $50*180 = $9,000 per day. Total wages for 18 registration clerks at $190 per day plus $10 per room for 180 rooms would be 18*$190 + 180*$10 = $3420 + 1800 = $5220. Subtracting labor costs from revenue generates **gross profit** of $9,000 – $5,220 = $4,780.

Figure 2-2
Produciton Possibilities for ECONO Motel



Now suppose that instead of allocating labor on the basis of comparative advantage and worker choice, the manager is convinced that guest registration is a man's job and room cleaning is a woman's job. He decides to hire each applicant at his or her reservation wage, so that 13 men receive $150 each, and 13 women receive $100 each. This **wage discrimination**—paying workers based on their reservation wages, rather than on the basis of their productivity—would reduce the motel's wage bill to $150(13) + $100(13) = $3250. However, assigning women to room cleaning without regard to productivity would reduce the number of rooms cleaned to 157, and the number of guests registered to 130. With only 130 rooms rented, revenue would fall to 130(50) = $6500, causing gross profit to decline to $6500 – $3250 = $3250. So Figure 2-2 gives the first glimpse of what will be a recurring theme—discrimination based on prejudice, like assigning jobs based on sexual stereotypes instead of on relative ability makes both workers and employers worse off. In this case, even the men, who appear to benefit from discrimination because they earn $50 more per day than women do, actually end up losing at least $40 per day because of the inefficiency of discrimination.

[7] We will see in Chapter 9 that, when jobs are relatively unattractive, economists predict that workers in those occupations will require **compensating wage differentials** to counteract work in undesirable jobs.

Other Applications of Production Possibilities

Production possibility curves are useful for depicting many types of economic trade-offs that result from scarcity. Even when resources are used efficiently it is impossible to produce more of one good unless some other good is sacrificed. Because production possibility curves are two-dimensional, we can only depict trade-offs of two goods at a time. Nevertheless, if we make the types of trade-offs mutually exclusive and exhaustive, we find that production possibility curves efficiently depict many types of economic choices.

Scarcity and Student Time

If you are a college student, a more relevant issue is the choice between study time that produces good grades, and other uses of time that produce other forms of happiness.[8] For the student, we will consider the allocation of time between studying and other activities: market work, household production, leisure, and personal maintenance. Fortunate is the student who enjoys education, for education time can also serve as leisure time. Lucky is the student with an understanding employer (the intern), since education time may also count as work time, allowing the student to learn without sacrificing income. Ultimately, the student must confront the fact that education has an opportunity cost; the greatest cost of education is the opportunity cost of time.

Table 2-5 presents a *hypothetical* **production function** for a student whose educational output is measured in her GPA, calibrated in a 4.0 scale. The first column shows the hours of study and the second column shows the *maximum* GPA the student can expect from studying efficiently. She apparently is taking no crib courses, because the most she can produce from 0 study time is a GPA of 0.0.[9] As the time spent studying increases, GPA increases, albeit at a decreasing rate.[10] The first five hours of study increase the GPA from 0 to .76, for study productivity (increase in GPA per hour spent) of 0.15. Increasing study time to 10 hours increases GPA (study time has a positive **marginal product**), but the change in GPA is smaller (only 0.14 points per hour). Eventually, if the student spends 50 hours studying, her GPA reaches 4.0. The last 5 hours had a positive, but very small **marginal product**: only .04 points overall, or about .01 per hour. However, if she spent more than 50 hours, her GPA would actually decline, as fatigue and confusion scrambled her brain!

[8] My first article, published when I was a Ph. D. economics student at Syracuse University, "Education and Income: Analysis by Fable," *The American Economist*, Fall1972, hypothesizes that students are best motivated by making education an enjoyable experience. By the time they get to college, they're hooked on learning!

[9] If we count class attendance as study time, a 0 means never showing up for class, thereby missing all exams and scoring 0% in all classes. Such an outcome is clearly possible, and, if our "student" places no value on education, that outcome would be efficient.

[10] That is, she experiences *diminishing returns* to study time, which also implies *increasing opportunity cost.* Diminishing returns to studying reflects efficiency; studying the most important concepts first implies studying concepts of lesser importance as more time is spent studying.

Hours Studying	Best Grade	Study Productivity	Hours Studying	Best Grade	Study Productivity
0	0.00				
5	0.76	0.15	55	3.96	-0.01
10	1.44	0.14	60	3.84	-0.02
15	2.04	0.12	65	3.64	-0.04
20	2.56	0.1	70	3.36	-0.06
25	3.00	0.09	75	3.00	-0.07
30	3.36	0.07	80	2.56	-0.09
35	3.64	0.06	85	2.04	-0.1
40	3.84	0.04	90	1.44	-0.12
45	3.96	0.02	95	0.76	-0.14
50	4.00	0.01	100	0.00	-0.15

Table 2-5

Table 2-6 rearranges the information in Table 2-5, now relating hours of leisure (168 hours per week minus study hours) to the resulting grade. Table 2-6 depicts the student's options as involving two goods, leisure time and the GPA (and the underlying education the GPA measures). Because a student must devote some time to personal maintenance, say 68 hours per week, I subtract 68 hours from the 168 available to reach 100 hours that could be allocated between leisure and study.[11] According to Table 2-6, as leisure time increases from 0 to 50, the student's GPA also increases. Devoting less than 50 hours to leisure would be inefficient, since as leisure time increases, the GPA also increases. If one does not experience a trade-off, one is not allocating resources efficiently. Since increasing leisure increases the GPA, the opportunity cost of leisure is actually negative from 0 to 50 hours. How could opportunity cost be negative? When I gain one good thing by doing another good thing, I am clearly better off and the choice between goods is moot. Only with 55 or more hours of leisure time (118 or more hours of non-study time) does the trade-off between studying and leisure become economically relevant.

Table 2-6
Production Possibilities: Leisure versus Grades

Leisure Time	Best Grade	Opportunity Cost	Leisure Time	Best Grade	Opportunity Cost
0	0.00				
5	0.76	-0.15	55	3.96	0.01
10	1.44	-0.14	60	3.84	0.02
15	2.04	-0.12	65	3.64	0.04
20	2.56	-0.1	70	3.36	0.06
25	3.00	-0.09	75	3.00	0.07
30	3.36	-0.07	80	2.56	0.09
35	3.64	-0.06	85	2.04	0.10
40	3.84	-0.04	90	1.44	0.12
45	3.96	-0.02	95	0.76	0.14
50	4.00	-0.01	100	0.00	0.15

In Figure 2-3 we plot *efficient* combinations of non-study time and the GPA. Not studying at all and earning a GPA of 0 is an **efficient allocation of time** as long as the student has spent her available time doing something beneficial to her. Be careful not to mistake disagreement over the desirability of activities as disagreement about efficiency.

[11] If the student is earning tuition or spending money by working outside of class time, then some of the available 100 hours are not leisure, unless the job is so enjoyable that she would do it for free.

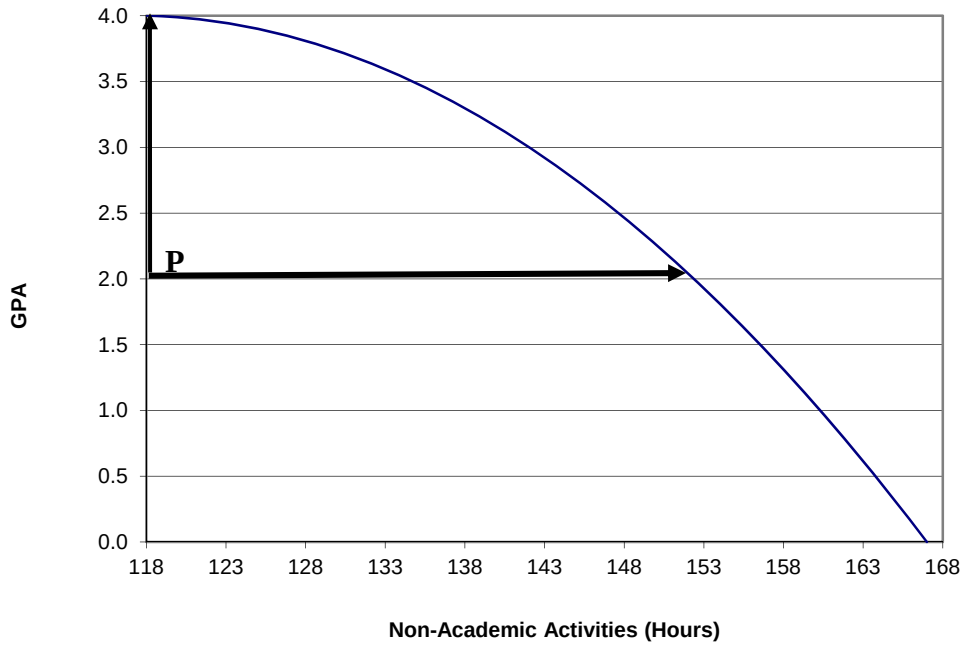
Parents frequently finance their children's education with the expectation that students will allocate sufficient time to earn good grades, and more importantly, actually learn something. Parents, however, cannot directly acquire the education for their children; the students must allocate time to study. If the student takes the opportunity to party and flunks out of school, they clearly allocated their time differently than their parents had hoped. But did the student really "waste" time? Not if they enjoyed the parties! Parents should give some thought to the incentives students face when they attend college. At good universities, students encounter true academic freedom for the first time in their lives. All students learn from the experience—some in the classroom and others in the barroom.

In our example, spending 100 hours studying would have also produced a GPA of 0, but that allocation of time would not be efficient. Assuming that she does not like confusion, she literally wasted 100 hours that she could have spent in other pursuits, like partying or earning an income. Spending more than 50 hours studying would never be efficient; hence, the minimum non-study time is 118 hours (168 hours per week minus 50 hours studying). Because of the decreasing marginal productivity of study time, the slope of the production possibility curve is bowed out from the origin. The 118 hours of non-study time and the minimum GPA implies 168 hours of non-study time.

The diagram suggests that there are two possible reasons why students may not achieve a 4.0 GPA. First, and most likely, they do not know how to study efficiently—they spend upwards to 50 hours per week staring at books and doodling on paper, only to squeak by with a 2.0. At point ***P*,** a student comes to class unprepared, sleeps through class (because of inadequate personal maintenance), then rushes to cram for a test the night before an exam. He barely passes, but is frustrated because there is no extra time available. If he (1) read the text before lectures, (2) actively participated in class discussions, and (3) joined a study group that reviewed material as the class progressed, he could (4) get a good night's sleep the night before the exam. That is, from point *P*, the student could increase his grade without spending any less time on non-study activities, or could achieve the same grade and allow much more time for non-study activities. Or, if satisfied with a 2.0, efficient studying would "create" an extra 35 hours of leisure.

I suspect that many students are frustrated, not because of the reality of the trade-off between education and other uses of time, but because their inefficient use of their time results in a suboptimal combination of both non-study time and grades. There is no doubt that some students achieve low grades because they study too little. But I suspect most students receive low grades because they study inefficiently. In past semesters, I allowed students to bring prepared notes to class, believing that they would spend less time trying to memorize material (true), and spend more time learning the material (false). Last semester a majority of the class failed their exams because of inadequate (and I believe, inefficient) preparation. To the extent that my allowing them to bring notes to class was part of the problem, I have tried to rectify that problem. However, I still encourage you to spend time understanding the material rather than memorizing it.

Figure 2-3
A Student's Production Possibilities



Consumption, Investment, and Economic Growth

Figure 2-4 shows one of the trade-offs between the production of **consumption goods**—goods that are used to generate satisfaction in the year they were produced—and **capital goods**, which are commodities that produce other commodities. We draw production possibility curves following two assumptions: (1) that available resources are fixed, and (2) that technological possibilities are fixed during the period in question. Given that a country's land is fixed by international boundaries, the two important variable factors of production are **capital** (any output of the production process that is also an input into the production process in later periods) and **labor** (human time devoted to market production instead of one of the other three uses of time).[12] For the time being, we will treat the labor force (the number of person-hours available for work) as fixed. We will also assume full employment.[13] We also assume away obviously inefficient outcomes, like producing only capital goods, so that the population starves.

If the economy is operating at point *D***,** its resources are allocated inefficiently. Perhaps farmers are trying to program computers, while computer scientists are attempting to grow crops from silicone. In a market economy both types of operations would fail; farmers would return to growing crops, while computer scientists would return to writing computer code. Merely by encouraging each person to pursue his or her self-interest, the market would allocate resources efficiently. In other systems of economic

[12] Household production, personal maintenance, or leisure

[13] Full employment does not mean that every person who wants to work actually has a job, since some unemployment always exists in a free-market economy in which employers can fire unproductive workers and workers can quit dead-end jobs. So throughout this text we will refer to full employment as a condition when the number of available jobs equals the number of people looking for jobs.

organization efficiency might not be achieved so easily. In a traditional economy, one typically follows the father's (boys) or mother's (girls) occupation. Tradition understates talents for nontraditional roles. In a command economy, disagreeing with the boss is can get you fired, instead of improving efficiency.

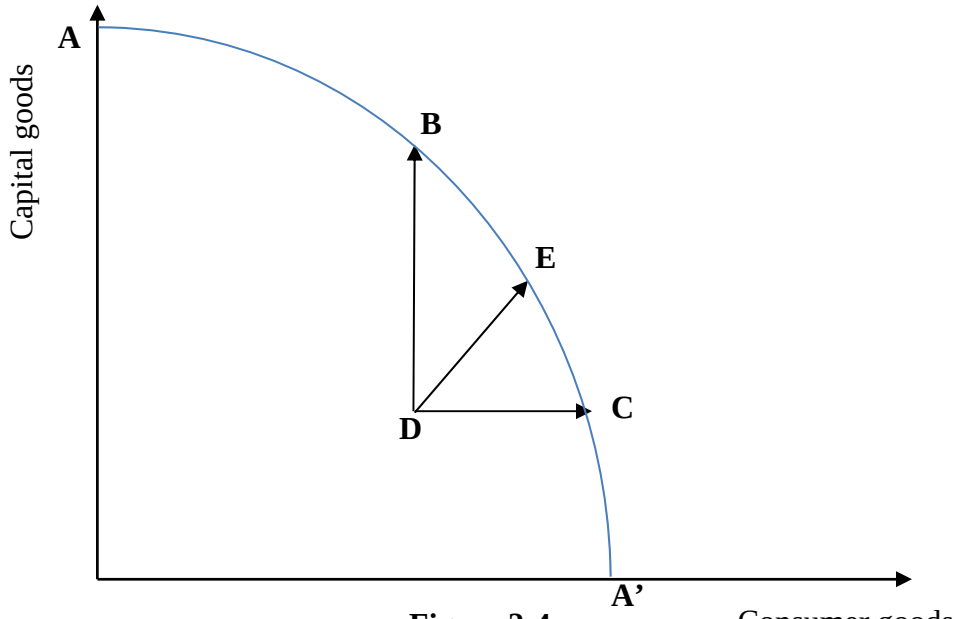


Figure 2-4

Figure 2-5 adds two additional production possibility curves to depict alternative futures resulting from the current choice between consumer goods and investment goods. We start with the production possibility curve *AA'*, which depicts the position of the production possibility curve in the first year of the analysis. Suppose further that the country in question produced at point *A'*, which is the horizontal intercept of the original production possibility curve, with C_{max} of consumer goods and no investment goods. In this case, the production possibility curve would shift toward the origin, from *AA'* to *DD'* ("*D*" for decline) because failure to replace depreciated capital goods would reduce the resources available for production in the next year. Since capital goods automatically depreciate just through the passage of time, any business, and the economy as a whole, must replace worn-out or obsolete equipment or the production possibility curve will shift inwards.

At point *A'*, the economy produces C_{max}, so that capital production is zero.[14] The next year, the production possibility curve shifts inward as machines wear out and are not replaced. At point P_0 the economy produces just enough capital goods to keep the production possibility curve stationary. The next year, the production possibility curve remains at AA'. Producing at point P_1 instead of point P_0 in the current year decreases the production of consumer goods and increases the production of capital goods. N**et investment** occurs when capital production exceeds depreciation**.** The next year the production possibility curve shifts to the right.

[14] Here we are assuming a *closed economy*, which does not rate with other economies. An *open economy* could produce C_{max}, but trade some of its consumer goods for another economy's capital goods, thereby investing.

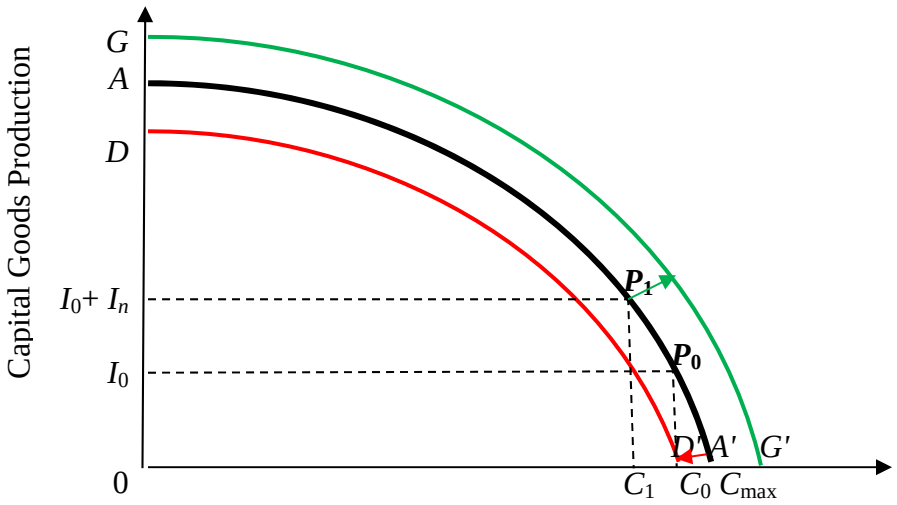


Figure 2-5

To retain the position of the production possibility curve at *AA′*, the economy would have to reduce the output of consumer goods from C_{max} to C_0, which would free enough resources to produce I_0 units of consumption goods.[15] American tax law recognizes the depreciation of plants and equipment as a necessary cost of doing business and allows companies to deduct the cost of depreciation from their taxable income, based on various formulas. A prudent company will set aside (save) money to buy new equipment (that is, invest) when it is timely to do so. Companies that do not replace capital equipment are declining; unscrupulous owners of such companies will often unload those businesses on unsuspecting buyers (who are definitely not investors!) right before those companies fail.

A country that replaced only its depreciated capital goods would invest resources to produce I_0 units of capital goods, which would imply a reduction of consumer goods (saving) equal to $C_{max} - C_0$. The value of its **gross domestic product** would equal $\boldsymbol{GDP_0 = p_cC_0 + p_kI_0}$, where p_c is the price of a consumer good and p_k is the price of a capital good.[16] Gross domestic product is the current market value of all goods and services produced in an economy during a calendar year, measured in current prices. Hence, p_c is the average price of consumer goods and p_k is the average price of capital goods. Since businesses would save just enough funds to pay for the p_kI_0 investment in capital goods, households would be spending all their income on consumer goods.[17]

[15] We label the production of capital goods as I_0 because society would have invested I_0 worth of capital goods in replacing depreciated equipment. Since the capital stock remains constant, this would represent gross investment of I_0, but net investment (investment minus depreciation) of zero.

[16] Note that some of the consumer goods would actually be government services such as fire protection (a consumer service) or highway construction (an investment good). Furthermore, some of the output of consumer goods might be sold to other countries (exports) and some goods consumed by households might have been produced in other countries (imports). Finally, p_c and p_k are really averages (indexes) of the many different types of consumer and capital goods.

[17] Of course, part of the purchase of consumer goods would be financed in the form of taxes paid to the government. We assume that the government budget is balanced—more later.

Suppose that some households wished to spend more on consumption than their current income would allow, while other households wished to put aside a share of their income for future consumption, say after retirement. These desires give rise to a demand for loanable funds (by would-be borrowers) and a supply of loanable funds (by would-be lenders). In Chapter 4, will learn how the demand and supply of loanable funds determines the market interest rate At this point, we note that if this lending and borrowing activity is restricted to households the distribution of consumption will change, but the total level of consumption would be constant. Debtors would consume more than their present income and would have to reduce their future consumption to pay back the principle and the interest on their loans. Lenders would consume less than their income today, but more than their income in the future. Reallocating a fixed amount of goods between the thrifty and the squanderer would not change the total available to all consumers.

If higher income households wish to save, while lower income households cannot borrow because they have poor credit, the net saving in the household sector (saving minus borrowing) would be positive. Intended consumption spending would decline, from C_0 to C_1. By reducing the production of consumer goods, resources are available to increase investment from I_0 to I_1. By moving from point P_0 (C_0, I_0) to P_1 (C_1, I_1), net investment (production of capital goods minus depreciation) would equal I_n. Next year, when new equipment comes online, the production possibility curve would shift out from *AA'* to *GG'* (depicting economic growth). Hence, by reducing consumption in the present (delaying gratification), saving allows for positive net investment and economic growth (the payoff).

There is an important distinction that often confuses many students. The act of saving occurs among households when consumption spending is less than disposable income (i.e., income after taxes). Saving can take several forms, including **hoarding** (e.g., stuffing money into a mattress), or **lending**, which means that the saver transfers the purchasing power to a borrower, who typically pays interest, to direct investment by plowing profits into the family business.[18] People must pay interest and repay the principle by reducing future consumption. *Lending money is not, by itself, an investment*. An **investment** occurs when economic agents use funds to purchase commodities that produce other commodities. Often, when a saver makes a loan, they are actually assuming the creditor position of another lender. When I buy a corporate bond, I am actually buying an IOU issued by a business and initially sold to another person. The *investment* occurred when the business used the proceeds of that **initial public offering** (the only time the business receives money from the sale of stock) to expand its plant, buy new equipment or inventories, or hire researchers to develop new products. If we call the purchase of the bond an investment, we must call the sale of the bond by another person a *disinvestment*, and an investment plus a disinvestment would cancel each other. To me, this is

[18] In the hopes of avoiding confusion, economists typically treat this transaction as two steps; the household lends money to the family business, and then the business invests those funds to purchase commodities that produce other commodities.

more confusing than simply attributing saving (and lending) to households and investing (and borrowing) to businesses.[19]

Public Goods versus Private Goods

Another important application of production possibility curves shows the allocation of resources between the private sector (businesses and households) and the government. The United States and most of the world are mixed economies with a dominant private sector and a public sector that supports the private sector and sometimes modifies market outcomes, redistributing income or modifying incentives.

Two indispensable functions of government are the protection of property rights and the enforcement of contracts. Unless these services were equally available to all, the economy would degenerate into loot and pillage causing little or nothing to be produced. Economists refer to commodities that are consumed by everyone once produced as **pure public goods**. Technically, pure public goods are scarce before they are produced, in that scarce resources (e.g., for police services to protect property and for judicial services to dispense justice) must be allocated to produce these services. However, once these services are produced, they are available to all residents of the economy, regardless of whether they pay for them or not. Businesses cannot sell pure public goods because they cannot withhold the commodity from people who refuse to pay. Whether you believe the war in Iraq (or the war on terror) is a good or a bad idea, it is clear that all Americans share in those benefits or costs. The Iraq war is financed by a combination of taxes and borrowing; the cost of the war is not the money used to finance it, but the alternative benefits that resources used to fight the war could provide (finding Osama bin Laden, universal health care in the United States, dispatching economists to Mexico to improve that economy, using financing from China to expand American businesses). The government must finance the war; however, the government could turn the fighting of the war entirely to private contractors like Halliburton.

By contrast, **private goods** are scarce in both production and distribution. Delivering an apple to market requires land, labor, capital, and entrepreneurship. If I purchase an apple and eat it, that apple is no longer available to others. Other examples of private goods are food, clothing, shelter, cardiac bypass surgery, or a personal computer. The market does a particularly good job at producing and distributing private goods. If people like Jonathan apples more than they like Granny Smith apples, the price of Jonathan apples will increase and the price of Granny Smith apples will decrease. Eventually apple orchards will cut down their Granny Smith trees and plant Jonathan apple trees.

Imagine an economy trying to operate at point *A* in Figure 2-6, producing only private goods. Private firms could not sell property protection or contract enforcement, so these activities would not occur.[20] Trade would require barter for lack of a universally acceptable form of money. While it would be possible for people to carry weapons to protect their own property, it is likely that those with the most lethal weapons would turn to larceny. If people could hire judges to produce a favorable verdict, would the outcome

[19] There are times when people can invest: They can buy additional computers for their own business, or they can invest in *human capital*, such as an education, which we will discuss in Chapter 8.

[20] While private security companies do augment government police services, an economy with *only* private security services would degenerate into loot and pillage, as discussed in chapter 3.

constitute justice? Hence, Figure 2-6 shows that increasing the production of public goods would also increase the production of private goods; a system of anarchy, where everyone protected their own property and enforced their own contracts, would not constitute an efficient allocation of resources.

At the other extreme, suppose we imagine a Marxist paradise, where all property is held in common and all output is shared equally.[21] There is a broad consensus that the social experiment in "communism" was a miserable failure, and that not only was it impossible to operate a system by distributing income equally, but that so-called communist countries produced fewer goods and services for everyone than would a comparable capitalist economy. Nevertheless, there have been some attempts—such as medieval monasteries and Israeli kibbutzim—where groups at least try to overcome egoism and live a life of applied altruism. In fact, as I will argue in Chapter 6, the ideal family is organized according to the Marxist dictum, "From each according to ability, to each according to need." So, we imagine point *X*, where there is a zero output of private goods and a positive quantity of public goods. The point is that by allowing unequal distribution of consumption—that those who produce more get more—increases total output of both public and private goods from point *X* to point *Y*.

Note that a society composed of egoistic economic agents would not wish to operate along the segment ***AB*** or the segment ***XY***, because either scenario would allocate resources inefficiently. The appropriate production possibility curve would imply at least P_0 units of private goods and at least $\boldsymbol{G_0}$ units of public goods. Hence, the origin of the appropriate production possibility curve has its origin associated with positive rates of output of both public and private goods. This implies that radical egalitarians—those who wish to treat all goods as public goods in the sense that all people consume equally (or consume enough to have the same standard of living)—will necessarily sacrifice some of both public and private output to achieve their goal. On the other hand, anarchists would also strive for an inefficient allocation of resources. I wonder how much radical ideology stems from an actual willingness to impose huge sacrifices on society to achieve ideological purity and how much radical ideology springs from a basic ignorance of economic reality.

Except for ideological extremists, conservatives and liberals have honest disagreements over the proper sizes of the public sector and the private sector because: (1) many goods are neither purely private goods nor purely public goods, and (2) governments **distribute** commodities (especially services) differently than markets do. Consider education: Is education a public good or a private good? Well, the answer is both. Clearly public schools and private schools coexist; education can be financed with tax revenue and made available to all children, or financed by tuition and restricted to students based on ability to pay, race, gender, or religion. Today few people argue that elementary education should be a pure private good, limited only to families that can pay tuition; such a policy would drive a nail into the image of the United States as the land of equal oppor-

[21] I once suggested to an economics class that "pure communism" would be a good definition of "heaven." One of my students, who styled himself as a non-ordained fundamentalist Christian minister, claimed that heaven would have to be a capitalist system, since communism is evil. When I asked him how this squares with *scripture*, he got very angry, dropped the course, and complained to the dean. Thank (somebody) for academic freedom.

tunity. However, **libertarians**[22] and **statists**[23] differ strongly about how education should be produced. Libertarians argue for vouchers or other payment schemes that place a premium on educational choice. They believe that competition among schools will encourage students to achieve educational excellence, much as such competition drives private, not-for-profit universities. Statists (some of whom are employed by public schools) argue that government is necessary to standardize education and that vouchers would benefit the rich more than the poor. They often care more about control than about educational success.

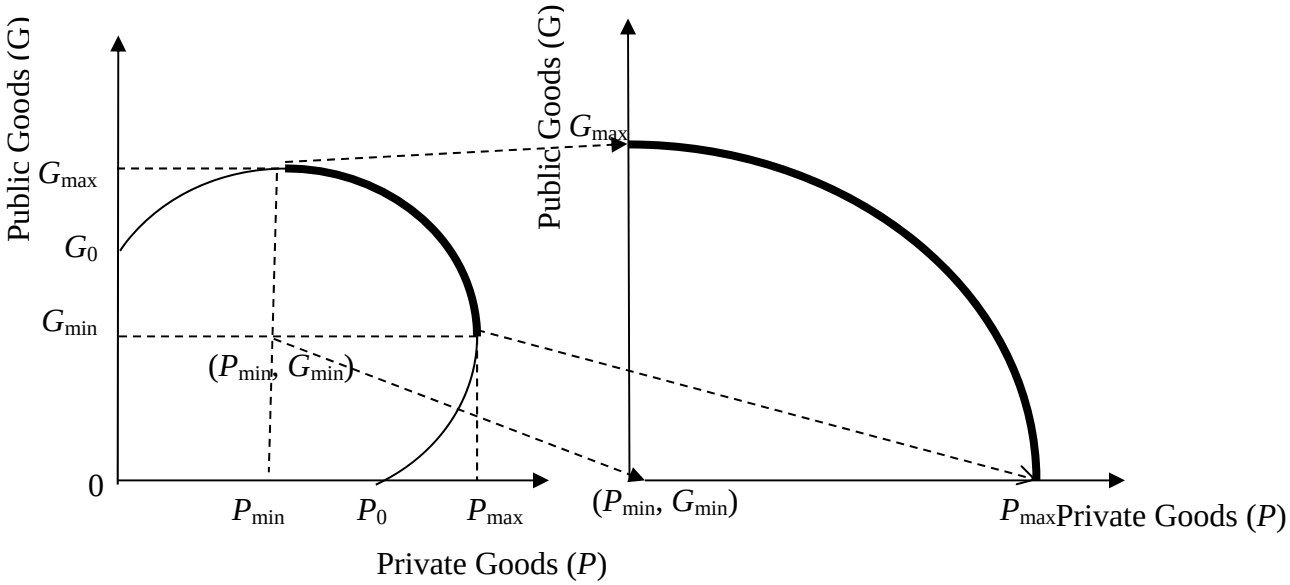


Figure 2-6

Next, consider health care. Some aspects of health care are pure public goods; smallpox could only be eradicated when all vulnerable populations were vaccinated, regardless of willingness or ability to pay. The more people are vaccinated, the lower is the incentive by the remaining vulnerable population to get treated, since few people remain who can pass the disease along. Most medical care is clearly a private good since physicians treat patients one at a time, drugs or transplants consumed by one patient are not available to others, and so forth. In some countries, particularly authoritarian ones, physicians and other health professionals work directly for the state and can be fired by the state medical monopoly if they run afoul of the government. Canada and most European countries have a system of public finance and private production for health care. The government uses tax revenue to finance health care on an urgency of need basis; it is unu-

[22] "LIBERTARIANS support maximum liberty in both personal and economic matters. They advocate a *much* smaller government; one that is limited to protecting individuals from coercion and violence. Libertarians tend to embrace individual responsibility, oppose government bureaucracy and taxes, promote private charity, tolerate diverse lifestyles, support the free market, and defend civil liberties." http://www.theadvocate.org/quiz/html

[23] "STATISTS want government to have a great deal of power over the economy and individual behavior. They frequently doubt whether economic liberty and individual liberty are practical options in today's world. Statists tend to distrust the free market, support high taxes and central planning of the economy, oppose diverse lifestyles, and question the importance of civil liberties." http://www.theadvocate.org/quiz/html

sual for a Canadian to wait long for cardiac bypass surgery, but face lifts are another matter. The United States is also a mixed system, but much more health care is financed by private sources. Senior citizens, the poor, and government employees receive government-financed health care; members of the military and veterans receive government-produced health care. Everyone else must pay for their health insurance from employer-provided insurance or out of pocket. Recently, some major American companies, most notably General Motors, have begun to falter as the cost of employer-provided health care has priced their products out of the market.

Financing Public Goods

Figure 2-6 shows that not all possible combinations of public goods are economically efficient. Henceforth, we will concentrate on efficient options, where producing more public goods implies producing fewer private goods, and vice versa.[24] Along the production possibility frontier between the maximum amount of public goods (given the minimum level of private goods) and the maximum amount of private goods (given the minimum level of public goods), producing more private goods implies producing fewer public goods, and vice versa. Suppose we consider point (P_{max}, G_{min}) as the ultimate libertarian point (maximum size of the private sector) and point (P_{min}, G_{max}) the ultimate statist point (the largest government sector the economy could tolerate). The ultimate libertarian point would rely on private schools, private health care, no government-sponsored income transfers. The extreme statist point would entail socialized medicine, government-produced education for all children[25] regardless of parental income, and sufficient government transfers to eradicate poverty and perhaps even allow for equal economic opportunity from birth, which the government also regulates. The point is that there would still be some public goods in the (efficient) libertarian economy and much economic inequality (resulting from unequal effort or merit) in the (efficient) statist economy. Hence, it will always be necessary to finance public and private goods together.

Chapter 4 will discuss supply and demand, the means by which markets allocate private goods through competitive markets. The process of determining the amount of public goods to produce is called *public economics, public finance*, or *public choice*. The basic idea is that citizens select government decision makers who decide on the level of public goods to be provided. **Taxation** is the coercive transfer of purchasing power from the private sector (households and firms) to the public sector (national, state, and local governments). Democratically elected governments typically buy factor services in much the same way that businesses do; the most obvious exceptions are eminent domain, whereby the government "takes" property for public use, but must pay "just compensation," and the draft, whereby the government confiscates labor services.[26]

[24] Recent cries to shut down the federal government by TEA party demonstrators is an example of ideology trumping common sense. A federal shutdown that compromised the government's ability to pay interest on government bonds would destroy the credit of the USA and create another Great Depression, devastating the world's economy.

[25] This phrase begs the question: equal educational inputs (i.e., the same quality teachers and classrooms) or equal educational outcomes (college graduation for everyone).

[26] The Vietnam War was particularly unpopular because of the use of the draft, whereby young men were given the choice between military service and prison. While the government no longer employs a military draft, it still requires citizens to serve on juries with little or no compensation.

Figure 2-7 reprises Figure 2-6 by assuming that the economy is operating at the libertarian bliss point (P_{max}, G_{min}). Next, suppose that voters elect a liberal government that proposes increasing government services from G_{min} to G_c. By imposing taxes equal to the market cost of resources used to generate those services, the government first reduces consumption (from P_{max} to P_c), and then transfers those resources to government use by hiring land, labor, capital and entrepreneurial services necessary to produce the G_c goods. Note: public goods require government *finance*, not necessary government *production.* Government-financed student loans allow students to attend private universities, while public universities employ college professors directly. Medicare and Medicaid finances private-sector produced health care, in contrast to Veterans' Administration (VA) hospitals that operate as government entities.

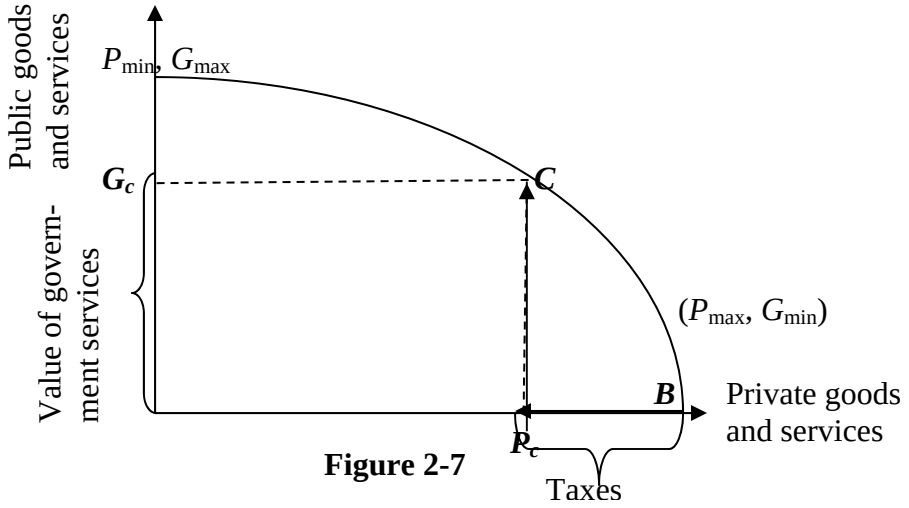


Figure 2-7

Efficiency vs. Fairness: Efficiency Matters

In chapter 10 we will address economic inequality in more detail. At this point I wish to put the issue of efficiency vs. fairness into context for our discussions from chapter three through chapter nine. I have been known to quip that in 33 years of parenting, none of our three kids ever complained "Dad, it's not fair; I got too much." While this is not actually true; we managed to raise three altruistic human beings, it seems true. If one has too much, one can remedy the situation by voluntarily giving some of his/her excess to another. However, if one feels (s)he has too little, the only remedies are to beg, borrow, or steal.

It is nevertheless possible to use the production possibility frontier to consider the issues of efficiency and fairness. In Figure 2-8 we plot the income of southern blacks on the horizontal axis and the income of southern whites on the vertical axis. As we will see throughout the course, Southern segregation, that denied education, employment and business opportunities to African-Americans by suppressing market competition. Jim Crow laws pushed the south inside of its production possibility curve, reducing the earnings of both blacks and whites below their potential. Without understanding what they were doing, white southerners reduced their own incomes (23.5%) in order to reduce black incomes by a greater proportion (50.7%). After Congress passed the Civil Rights Act, both southern black and southern white incomes increased relative to their respective

incomes in the rest of the country. Bigots have long harbored the notion that income distribution is a zero-sum game; that more for the least fortunate implies less for everyone else. We will discover that reality is more complex, and more interesting. Whenever government policy – or social evolution – removes impediments to efficiency, it is possible to make everyone better off.

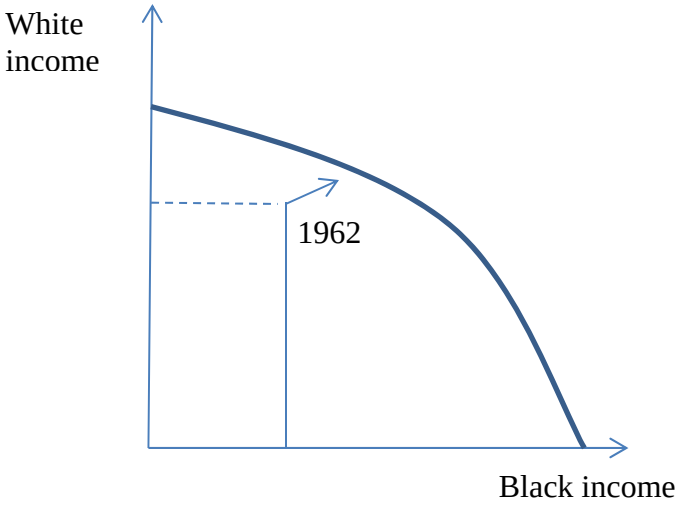


Figure 2-8

Income in the Pre-Civil-Rights South;

When Unfairness Was Also Inefficient

Conclusion

In this chapter we have seen how scarcity limits the options people and firms may pick. When a scarce resource has alternative—but mutually exclusive—uses, the **opportunity cost** of using that resource to produce one commodity is sacrificing the other commodity or commodities that might have been produced instead. By allocating resources in reverse order of their opportunity costs, economists generate production possibility curves that are negatively sloped and bow outward. Market incentives allow individuals to maximize their own well-being and generally result in efficient allocation of resources. Discrimination typically distorts economic incentives and results in inefficient resource allocation. An important trade-off exists between the production of consumer goods (that provide immediate satisfaction) and capital goods, which increase the production of goods in the future, and therefore stimulate economic growth. Another important trade-off exists between private goods (sold in markets) and public goods (financed by government and available to all). We now turn our attention to how households and firms decide among the options available.

Summary

1. Economists illustrate scarcity with a **production possibility** table or diagram, which shows the maximum output of one good that can be produced from each rate of output for the other good.
2. The **opportunity cost** of producing any good is the value of the best alternative sacrificed.
3. A resource has a **comparative advantage** in the production of one good if it has a lower opportunity cost than some other resource has for producing the same commodity.
4. Typically, **production possibility curves** are negatively sloped (due to scarcity) and bowed out from the origin due to increasing opportunity costs.
5. Firms cannot maximize profit unless they allocate resources efficiently. Profit-maximizing firms will pick that point from their production possibility frontier that maximizes the difference between revenue and opportunity cost.
6. Students allocate study time efficiently when they achieve the maximum possible education (GPA) for each allocation of non-study time. Many students do not achieve high grades because they spend their study time inefficiently.
7. The production possibility curve between consumption and investment shows that the economy can grow only if some resources are allocated to the production of investment goods *instead of* being allocated to the production of consumption goods.
8. Because some public goods are necessary markets to function, and because some private goods are necessary to generate work incentives, the production possibility frontiers between public goods and private goods are likely to have positively sloped portions. Rational libertarians and statists would operate only on that portion of the production possibility frontier between public goods and private goods where producing more of one type of good implied producing less of the other.
9. Public goods can be financed by taxation, which reduces consumption, or by borrowing, which reduces investment either domestically or in other countries.

Glossary

Production possibilities: A table or graph, showing the maximum output of one good or service for each rate of output for another. Production possibilities require that all available resources be used efficiently.

Efficiency: A state of affairs wherein it is impossible to produce more of any commodity unless one decreases the output of some other commodity.

Comparative advantage: Having the lowest opportunity cost in the production of a commodity among all the resources available.

Increasing opportunity cost: Production possibility frontiers are negatively sloped because as one produces more of a particular commodity, the opportunity cost of the resources available to produce more of that commodity increases.

Production function: A rule, table, or diagram that shows how the output of a commodity is related to the amount of input(s) used to produce that commodity.

Marginal product: The additional output obtained from the last unit of input used, with other inputs constant.

Consumption goods: Commodities used by households to generate immediate utility.

Capital goods: Commodities that produce other commodities.

Investment: The diversion of scarce resources into the production of capital goods.

Pure public good: A commodity that, once produced, must be consumed by everyone. Examples include property right protection, contract enforcement, and national defense.

Pure private goods: Commodities that are diminished by distribution, such that consumption by one person reduces the amount available for other people. Examples include food and clothing.

Group consumption goods: Commodities falling between the extremes of pure public goods and pure private goods, which can be provided either by the government or by markets. Examples include education, research (information production), and health care.

Comparative advantage: Being the low opportunity cost producer of a particular commodity, compared to one or more other countries.

Comparative disadvantage: Being the high opportunity cost producer of a particular commodity.