

ECONOMIC PRINCIPLES:
Seven Ideas for Thinking ...
About Almost Anything

by
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Fourth Edition

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NOTE TO INSTRUCTORS

What does the world need another principles textbook for? That's a legitimate question, and the answer is mostly personal. I began teaching economic theory in 1982 as a teaching assistant. Within a couple of years I was lecturing and wondering why most textbooks were i) long, ii) similar in content, iii) boring, iv) expensive, and v) so darned politically correct. Several years later I co-authored a third year textbook with the intention of writing a book that would avoid most of the pitfalls in other books. No doubt every textbook writer starts with the same objectives. I discovered the publishing industry is structured in such a way that it is almost impossible to write outside the mold.

In order for publishers to make money on a book they have to cater to the “average” student, in the “average” class, being taught by the “average” instructor. They must keep an eye open for unconventional topics or missing chapters. They also have to worry about books “offending someone.” Printing a conventional textbook is expensive and involves a substantial risk. It also involves significant costs to correct mistakes. All of these factors lead to the bland books we see in the market place. So the first reason for writing, and publishing, a book on my own is to simply have a book I can use that I like. Because this is an electronic book, McInnes Creek Press faces few of the constraints a traditional publisher faces in updating the book.

The second reason for writing and publishing this book is price. The nature of conventional textbook publishing means it is almost impossible to produce a reasonably priced book. When marketing a book, publishers “fish” for customers by sending every potential teacher a free copy, followed up by a visit from a sales representative. In addition to the book there is a litany of “supplements”: instructor guides, overheads, test banks, study guides, software, perhaps even Internet support. These supplements cost money and these costs get built into the price of the book. The bottom line is students pay over \$100 for a typical textbook. So the second reason for writing and publishing this book is to produce a basic book with a low price.

Aside from a low price for a living book, there are some other features that make this book different:

- First, the book is relatively short. I focus on the essential ideas in microeconomics. The book is not encyclopedic, and hopefully it doesn't read like a dictionary either.
- Second, the book is quite visual. To aid instructors and students the most important ideas are boxed. There are lots of graphs and tables.
- Third, the book is full of interesting examples, applications, and even jokes. I've tried to avoid examples about widgets or gadgets, and most examples are real and (at least I think) interesting.

- Fourth, the overriding emphasis is on *explanation*. There is the odd discussion of policy implications, but I've kept them to a minimum. This might offend some economists, but I believe the most important aspect of a principles course is to teach students how to think like an economist, and this begins with explaining behavior.
- Fifth, the book is full of questions. I've avoided questions like "repeat what is on page 45," and have included questions that make students think.
- Sixth, the book has not been edited for political correctness. I don't go out of my way to make gratuitous offenses, but I have no idea if the number of female names equals the number of male names, or if I've used enough examples outside my own personal culture. I've simply written a text to interest the reader, convince them economics is useful, and perhaps whet their intellectual appetite.
- Seventh, an entire part of the book is devoted to transaction cost economics. I believe the principles of economics apply not only to the volume and terms of trade, but also to how that trade is organized.
- Eighth, this book is about economic principles, not mathematical economic details. There is no discussion of Giffen goods, utility functions, general equilibrium, expected utility, or the like. Years ago, after teaching a first year class production possibility curves, budget constraints, indifference curves, and demand curves, I came to realize that 90% of the students in the class only saw four downward sloping lines. They didn't have enough economic background to appreciate the difference between the curves. Since then I've found a focus on the key important ideas leads to much better prepared students for intermediate theory.
- Finally, my hope is this book truly becomes a living book. As it gets used I hope you send me your comments and suggestions on improvements. As an online book it can be easily modified to fit individual classes or instructors. In this respect I'd like to thank Suki Badh, Les Marshall, and Bill Sjostrom for their assistance and encouragement.

NOTE FOR THE NAPSTER GENERATION

If you've read the note to instructors, you'll know that a major objective of this book is to supply a cheap text for students. I'm setting the price of this book at \$15 because I think that's pretty cheap for you, and covers the cost of writing, publishing, and distributing the book. No doubt, it will take you about two seconds to figure out that once the file has been purchased it costs nothing to copy it to the other students in the class. I understand this completely, but that doesn't make it right.

One non-paying student informed me by email: "I did not steal your book, I just didn't pay for it." Cyber space seems to have created a perverse ethic: if you *can* take something, its okay to do so. For the record, the material in this book is copyrighted, and it is illegal to transmit the file beyond your personal use.

Putting the book on line is an experiment. If it works, and if it works well, my guess is that others will soon follow. If it fails, then this book will no doubt be packaged in a hardcopy form, and will cost \$40 to produce. Bookstores will mark the book up to \$80, and future students won't be given the option of a \$15 book.

So before you pirate the book and sell out your soul for a mere \$15, think about the fact that if enough of you steal the book you'll only have to look in the mirror for the reason why books are so expensive.

Finally, there's no better way to learn economics than by practicing it. I've included review questions to every chapter. These are easy questions that simply help you review the chapter material. You should do all of these and check with the answers provided at the end of the chapter. The problems in each chapter are very good, if I do say so myself. They are also quite hard and the most obvious answer is usually wrong. Work on these as much as you can. At the end of each chapter you'll find the answers to the odd-numbered questions.

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CHAPTER 1

INTRODUCTION

Let me tell you a story about Arthur Wellesley, the first Duke of Wellington. Everyone knows he led the British Army in their combined attack against Napoleon in the battle of Waterloo. However, did you know Wellesley had no formal military training? In fact, he didn't even want to be a soldier, he wanted to be a politician. Wellesley was the second son of a moderately wealthy family. Most of the family resources were devoted to his older brother who was groomed from birth to be Prime Minister, and so the family problem was: what to do with Arthur? The solution was found in 1787 when the family purchased an ensign commission for him in the army. Today one joins the military voluntarily and receives a wage. The Wellesley family actually *paid* to have their son become a junior officer. However, Arthur never showed up for work. Not discouraged, the family bought him better and better commissions, so that by 1794 he'd moved up seven ranks to the position of colonel in charge of his own regiment. To that point he'd seen no military action and had received no military training. Unfortunately for Arthur, as colonel he had no choice but to assume responsibility and report for duty. His first attempts at leadership were against Napoleon in the low countries where he was quickly and soundly thrashed, but managed to find his way home. Later he was assigned to the Spanish peninsula to again fight Napoleon. This time his ability to form alliances and an innate sense of logistics eventually allowed him to oust the French Emperor. Of course, the story ends happily with the ultimate victory at Waterloo, the peerage, the prime-ministership, and all the fame and wealth that went with it.

What's so striking about this story is that someone would pay to be a soldier. What's even more striking is that virtually all of the officers in the British Army (and the other armies of Europe) purchased their commissions. Any Tom, Dick, or Arthur who wanted to lead an army only needed a few thousand pounds, and away they could go. What a strange institution. Strange as well, was that in the navies of Europe, one *never* purchased an officer's commission. There, a complicated set of patronage appointments were made, so that someone like Horatio Nelson could rise to the rank of admiral so quickly he never learned to sail very well. *Why do you think commissions were sold in the army but not in the navy?*

Sticking with the nautical theme, let me tell you another story. Admiral Sir Clodisley Shovell was leading five ships home from victory over the French near Gibraltar in 1707, when he encountered severe fog. Consulting his officers, he determined they were safely in open sea. However, on board was an ordinary seaman who had been keeping a record of the ship's position. Out of concern for his own safety, the seaman approached the Admiral to warn him of the shore close by. Admiral Shovell had the man hanged on the spot! Several hours later, four of the five ships ran into the Scilly Isles off the tip of England and 2000 troops (including the Admiral) were lost. *A tragic story, but why do you think they hung the poor sailor who was trying to save the ship?*

The problem for Admiral Shovell, and for any other sailor prior to the nineteenth century, was he couldn't tell where he was. Ever since the ancient Greeks, men at sea were able to tell what their latitude was by the position of the sun. But even by the time of Admiral Shovell they still had no way of knowing their longitude. The problem of longitude was perhaps the greatest scientific puzzle of the eighteenth century. Many of the greatest minds worried about it and tried to solve it. In fact, in 1714 the British Parliament set a prize of £20,000, a King's ransom, for anyone who could find a reliable method to determine the position of a ship at sea. The solution fell to a humble clock maker

John Harrison, who devoted his life to building four separate frictionless clocks, the last of which eventually became known as the Chronometer. The chronometer is a very precise clock, and works to determine longitude because once one knows the exact time at home and the exact time at sea, it is easy to figure out how far away home is. John Harrison's solution was so unusual, so bold, so ... unscientific that it took him over forty years to claim his prize. But there is no denying the fact he wouldn't have even tried to invent anything without the prize incentive. *Why did the king offer a prize? Why didn't he set up a university and pay people to invent a Chronometer?*

Now here are two personal questions: *Do you find any of these questions interesting? Do you think of any of them as economic?* If you think these questions are interesting, then you're probably going to find this book interesting. If you think these questions are obviously economic, then you're probably too smart for this book and you should be reading something more advanced. If you like these types of questions, but can't understand how they relate to "Economics" then you're the person this book is aimed at.

1.1 What is Economics?

Everyone seems to have an incorrect notion of what an economist is. To test this hypothesis go ask a grocer, a barber, or your mother what an economist does. They'll probably tell you "they figure out what the interest rate should be"; or "they study the business community." If you talk to my wife she'll tell you they're people who talk about money but never have any. The problem is, most of our understanding about economics comes from either the business page of the newspaper or from watching "economists" talk about the stock market on TV programs. From these sources we conclude i) economists have an answer for everything; ii) they only worry about financial markets, GNP, interest rates, inflation, and government debt; iii) economics involves a lot of facts that are hard to remember ... but probably easy to look up; and iv) economics is pretty darn boring!

What is economics? It's not any of those things just mentioned. What is economics? Here it is:

Economics is a particular way of thinking about behavior.

Notice I didn't say it was a way of thinking about "market" behavior, or "rational" behavior — economics is about any type of behavior, and it applies to *every* aspect of our life. Economics addresses issues like: why did the divorce rate increase so much in the 1970s and 80s? Why do firms use coupons, rather than just lower their prices and save printing costs? Why do we think only children (those without siblings) are more "spoiled" than children with lots of siblings? Why can't parents sell their children? Why can't anyone sell their kidney or their driver's license? Why does Canada import oil and produce oil at the same time? Why are auto parts the largest export from Canada to the U.S. and yet also the largest import? Why would some firms be non-profit and how do they stay in business? Why were some people allowed to duel with pistols while others would be charged with murder for the same activity? Why were the American and Canadian frontiers settled with homesteads rather than land sales? Some of these questions may appear more economic than others, but that's just because you're biased to thinking economics is only about the business section of the newspaper when, in fact, it covers the entire thing.

1.2 The Economic Way of Thinking

If economics is a way of thinking about behavior, what is the nature of the economic way of thinking? A key feature of economic thinking is its formality; that is, economic thinking is constrained by a number of *explicit* assumptions that have come to be known as *economic principles*. These economic principles force us to see and interpret the world a certain way. Just like the case of the wife, who was married to a man who thought he was dead. The wife took the man to doctor after doctor, but no one could convince the man he was alive. Finally, one doctor asked the man: “does a dead man bleed?” “No” was the reply. Upon hearing this the doctor took his scalpel and cut the man’s finger, which of course, started to bleed a great deal. “What do you know,” cried the man “dead men do bleed!”

The dead man had a theory about himself: he thought he was dead. This theory influenced how he interpreted the events around him. Likewise, in economics, our model based on economic principles influences how we see the world. Many people think this, in and of itself, makes economics special, but in fact, it really just makes it a religion ... like all of the other sciences. That might sound like a ridiculous thing to say, so let me defend it a bit.¹

¹ In an email exchange on the SFU campus, a member of the faculty from the physics department stated the following:

In every introductory level course I teach in physics or astronomy I inform my students, among other things, that I am an atheist. I feel that definition of my frame of reference is necessary because knowledge of that frame may usefully inform a student’s understanding of some things I will have to say while teaching, since I have the idea of Natural Law in the sciences which makes me intolerant, for example, of claims for miraculous events. I tell my astronomy students that when I ask, for instance, for the age of the Earth, I will expect a number nearer to 4.5 billion years than to six thousand. I emphasize that they need not *believe* what they write on my examinations, but I really do expect the doctrinally correct answer to be given. They must be able to explain the bases in radioactive clocks for these claims in a coherent manner even though they do in reality buy the rantings of some “Creation Scientists” who can explain them away. Moreover I tell them that I will not waste class time (but that I am willing to waste some limited out of class time) debating relative merits of our two world views. I do all of these things without the qualification of having taken even a single course in comparative religion and without ever having been an adherent to a religion, let alone a theologian qualified to discuss the nuances of transubstantiation or the unity of the Trinity.

That’s about as religious as a scientist can get. The passion and honesty varies from one academic to another, but we all believe that our particular paradigm is true ... otherwise, why would we devote our lives to it?

This book is about the set of assumptions called economic principles. Many of these assumptions are not observable or testable in any meaningful way, and ultimately economists accept them by faith (some economists don't really believe them, and you have to wonder why they ever became economists!). These principles, when put together, form a basic *economic model*, which in turn is what economists use to analyze everything from why vegetables are cheap in the summer, to why mules were used in southern U.S. agriculture but not in the north. Economists believe this model, ... they have faith in it. This is what's meant by "economics is a religion." If this were a book on sociology, biology, or any other subject, it would simply be about a different set of beliefs. Again, this isn't the least bit unusual, because ...

Everyone uses "models" to function in life.

It is important to realize everyone operates with some type of "model" in mind. It's like the three scientists (a physicist, biologist, and mathematician) who were watching a building when two people went in and three came out. "We must have made a measurement error" said the physicist. "No" replied the biologist, "there must have been some reproduction." "Well I don't know what's going on," said the mathematician, "but if one more person enters the building it will be empty." Everyone interprets the world around them through a set of beliefs, and these beliefs we call a "model."

It would be impossible to interact with other humans or nature without some model to guide us. We all have a pretty decent model of local moving bodies. So much so I venture we all can imagine what happens if you jump in front of a bus moving 50 miles per hour! When it comes to explaining the way people behave, there is no shortage of models either. The sociologist, psychologist, and other social scientists all have different models. Feminists, marxists, and other "ists" have different models. And, of course, Joe Blow down at the local diner probably has a pretty explicit model of behavior as well. If everyone thinks with various types of models in mind, then the question comes up: what model should we think with? Hopefully, after reading this book you'll agree the economic model, or way of thinking, is particularly useful.

The point of having a good model is it makes us better thinkers. Consider the following riddle: *A cow starts walking along a mountain path at 9AM one morning, and eventually makes its way to the top of the mountain by 6PM the same day. The exhausted cow lays down for the night, but starts out early the next morning at 8:30AM and is down at the bottom by 2:00PM. Is there a spot on the path where the cow was at the same time each day?*

Hmmmm. That seems difficult to think about, and your first reaction is probably only by *chance* would such an unlikely event occur. But let's use a simple model to figure this out. Consider the graph below in Figure 1-1.

On the vertical axis is plotted the elevation of the mountain; on the horizontal axis is the time of day. The upward sloping line represents the trip on the first day, while the downward sloping line shows the trip on the second day. Clearly there is one spot where the two lines cross. This represents the same elevation and time for each day. Riddle solved!

However, the power of the model becomes clear when we extend it a little bit. What would happen if the cow didn't continuously go up the hill? Suppose the cow went up, then down, and

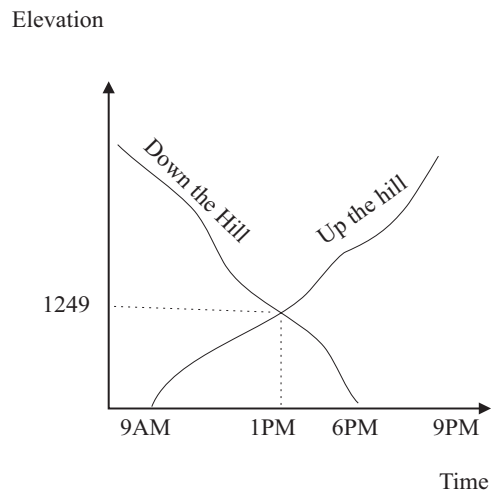


Figure 1-1
A Model of A Cow Going Up a Mountain

then back up again? Would there still be a spot the cow was at the same time each day? Would there be more than one spot?

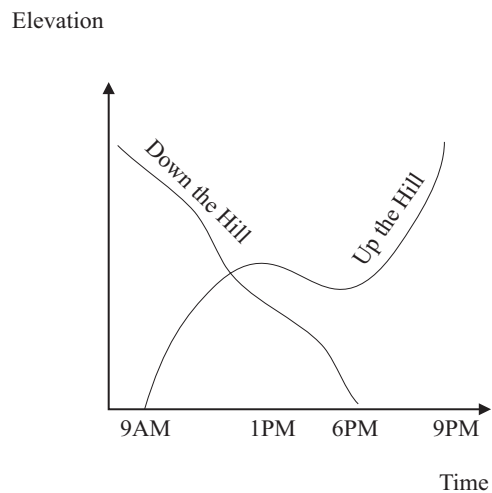


Figure 1-2
A Model of A Cow Going Up and Down and Up a Mountain

Figure 1-2 shows this simple change might make no difference to the answer. In Figure 1-2 there is still just one time of day when the cow is at the same elevation. However, if you can visualize it, it is also clear the upward sloping line *could* cross three times at most, meaning there could be three locations that satisfy the riddle. The point is, a simple little graph makes a seemingly intractable problem suddenly very easy to come to terms with.

The “cow on the mountain model” has a number of characteristics which make it attractive. The model is formal, testable, simple, and is consistent with the general facts of the world (that is, we didn’t have the cow fly to the top!). In economics we’d like our model to be characterized by these features as well. These features are what make economics a ... science. Laying out our assumptions so they can be examined, creating models that can actually be tested and refuted, and coming up with theories which we believe are true, is all part of the scientific process. So sure, economics is a religion because we accept a lot of concepts on faith, but it is also scientific because we test our models and rely on logic to sift through the competing theories of explanation. Let’s think a little more about these scientific characteristics.

1. Formality can be helpful.

A formal model is explicit about the assumptions it makes ... the model “lays all of its cards” on the table, so to speak. This doesn’t mean the model is automatically great, or true, or useful. It just means we want to be honest about what we’re assuming. By being honest with our assumptions, we’ll have a better idea of where our model needs fixing when it fails to explain some behavior. There is a famous, in fact it is the most famous, joke about economists. The joke starts with three men stranded on an island with a can of beans and no can opener. The first man, a steel worker, proposes they open the can of beans with a rock. The second man, a physicist, suggests they magnify the sun’s rays with his eye glasses until the can explodes. The third man, an economist, starts off his proposal by saying: “first, let’s assume we have a can opener.” Economists are constantly criticized for the assumptions they make, especially assumptions that seem unrealistic.² Everyone makes assumptions in life, just like the steel worker and the physicist, but like the economist on the island, we’re going to be explicit about our assumptions.

2. Our model should be testable.

Aristotle had a beautiful model to explain the movement of planets: the earth was the center of the universe and all the heavenly bodies moved around the earth in perfect circles. It is a beautiful model, just as you can see in Figure 1-3.

There was just one little problem with this beautiful model, ... it was wrong! By wrong I mean it made predictions that didn’t come to pass. Based on the model astronomers would predict the sun should be a point A in the sky, when it ended up at point B. What to do?

Having a model fail happens all the time because models are just simple representations of the world around us. Think about it. If a model was as complex as the world it was describing, it wouldn’t be much use. Aristotle’s model is extremely simple and was adequate for some purposes, but unfortunately it was false and of no use for navigation. But being false isn’t such a bad thing. In fact, it is a good thing if you’re interested in learning about something: a false model tells you what doesn’t work. Knowing what doesn’t work isn’t the same as knowing the truth, but it’s better than

² There is a long tradition in economics of defending unrealistic assumptions in economics. For example, it is true that unrealistic or even false assumptions can still lead to true conclusions. However, in this book I want to convince you most assumptions we’ll make are true.

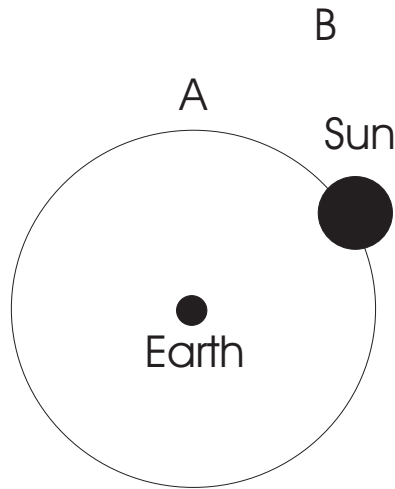


Figure 1-3
Aristotle's Model of Heavenly Bodies

nothing. When a model is capable of being shown wrong, we say it is *testable*. Aristotle's model of the planets, though simple, was also testable.³

Having a testable model is one of our goals. Having a model fail, however, is a real bummer. Especially when you've spent half a lifetime investing in learning about the model. When models fail, the "scientist", "economist", or "Joe Blow down at the diner", is faced with a choice. They can either take the high road and reject the model, or they can take the low road and "insulate" their model from testing. Early astronomers insulated Aristotle's model by saying bodies like the sun moved in smaller epi-circles along the larger circular path. When this didn't work out, they simply added more epi-circles. You can see the result in Figure 1-4:

No doubt this was known as the snowman theory of planetary motion. Though insulating a model from testing might comfort the model user, it ultimately is a useless exercise, and one that doesn't fool anyone in the long run. Perhaps you've heard the story of the college president who wants to improve the reputation of his school. He's told the best way to do this is to create a few elite departments. One advisor suggests it would be good to work on the mathematics department because it won't be too expensive, all they need is a pencil, some paper and a wastebasket. A second advisor suggests it would be even better to work on the economics department, since they don't even need wastebaskets!

A good model is one that potentially could end up in the wastebasket. It is ultimately of no

³ We don't want to get too involved in high foolutin' philosophy, but you probably know we can never tell if a model is True. To know if a model is actually true would require an infinite amount of knowledge which we will never have. A model can work and work and work, and though our confidence in it builds, the failure may just be around the corner. This is what is known as the "problem of induction".

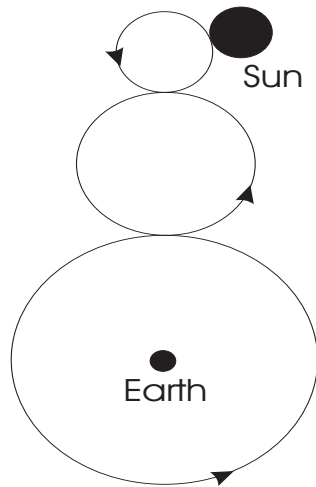


Figure 1-4
Aristotle's Untestable Model of Heavenly Bodies

use to say “it will either rain tomorrow or it won’t”. We want to shut this back door and have models make predictions that potentially could be wrong. These types of models are useful.

A testable model is a useful model.

3. Simple Models are Better Than Complicated Models.

Other things being equal, we want a model to be simple and easy to use. The nice feature of the “cow on the mountain” model is it is so easy to think about and modify. The ugly feature of the “epi-circle” theory of planetary motion is it is so difficult to calculate where a planet should be. If we have two theories predict the same thing, but one is much more complicated than the other, then we want to pick the simpler one. Remember, a model is made for a purpose; we’re ultimately trying to think systematically about social behavior. It’s hard enough to do, so if we can do it with a simple model, then that’s the road we want to take. Besides, if it isn’t simple, how can we impress our boss at the annual Christmas party?

4. People are Fundamentally the Same

In 1776 modern economics got its start with the publication of Adam Smith’s *The Wealth of Nations*. In it he stated:

The difference of natural talents in different men is, in reality, much less than we are aware of; and the very different genius which appears to distinguish men of different professions, when grown up to maturity, is not upon many

occasions so much the cause as the effect of the division of labour. The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature as from habit, custom, and education. When they came into the world, and for the first six or eight years of their existence, they were perhaps very much alike, and neither their parents nor playfellows could perceive any remarkable difference. About that age, or soon after, they come to be employed in very different occupations. The difference of talents comes then to be taken notice of, and widens by degrees, till at last the vanity of the philosopher is willing to acknowledge scarce any resemblance.

[Book 1 Chapter 2]

Since that time economic models have been characterized by a particular view of mankind: *human beings are fundamentally the same across time and space*. This doesn't mean everyone is exactly the same. Rather it means our motives and natures are the same. More specifically, we're characterized by the economic principles we will be elaborating throughout this book. Hence, when an economist comes across a fact like the British use cloth napkins at dinner time, while most North Americans use paper napkins, he does not say "well, the British are just different than the North Americans. They're 'uppity', they like cloth, and they aren't smart enough to know the advantages of paper." Rather, the economist naturally thinks that since people in Britain and North America are fundamentally the same, it must be something in their local circumstances that manifests in the different choices over mouth wiping material.

John Stuart Mill, another early economist put it this way:

Of all vulgar modes of escaping from the consideration of the effect of social and moral influences on the human mind, the most vulgar is that of attributing the diversities of conduct and character to inherent natural differences.

[Book 2, Chapter 9]

Economists don't think the Swiss are genetically great watch makers, the German's born great engineers, or the Japanese naturally industrious. Rather, the economist views all people as having similar natures that obey certain economic principles. When people are placed in different situations with different opportunities, then they behave differently.

This basic assumption often puts economists at odds with certain groups of people, and in bed with others. In recent times feminists and aboriginals often have a hard time with economic principles because of the reluctance of economists to assume men and women or natives and non-natives are fundamentally different in terms of their preferences and what motivates them. On the other hand, in the 19th century Evangelical Christians formed a coalition with economists (like J.S. Mill) because they also believed all individuals are similar in nature. This latter partnership, in fact, gave economics the name of the *dismal science*.⁴

⁴ The history of the phrase dismal science, along with the connection with the anti-slavery movement is found in David M. Levy, *How the Dismal Science Got Its Name: Classical Economics*

The story is quite interesting. Most people think the phrase “dismal science” comes from the common perception of Malthus. Thomas Malthus was a 19th century economist who believed population growth would outstrip the production of food, and as a result famine would eventually reign — dismal indeed. As it turns out, the phrase dismal science comes from a description of economics by Thomas Carlyle, a 19th century essayist. Carlyle was upset with economists like John Stuart Mill who, though not a Christian, had aligned himself with them in the anti-slavery movement. Carlyle, felt blacks were equivalent to cattle and therefore felt slavery was justified. Carlyle made the “dismal science” statement in an 1849 essay called “An Occasional Discourse on the Negro Question.” In it he states:

Truly, my philanthropic friends, Exeter Hall Philanthropy is wonderful; and the Social Science — not a “gay science,” but a rueful — which finds the secret of this universe in “supply-and-demand,” and reduces the duty of human governors to that of letting men alone, is also wonderful. Not a “gay science,” I should say, like some we have heard of; no, a dreary, desolate, and indeed quite abject and distressing one; what we might call, by way of eminence, *the dismal science*. These two, Exeter Hall Philanthropy and the Dismal Science, led by any sacred cause of Black Emancipation, or the like, to fall in love and make a wedding of it, — will give birth to progenies and prodigies; dark extensive moon-calves, unnameable abortions, wide-coiled monstrosities, such as the world has not seen hitherto! [emphasis added]

Exeter Hall was the center of the Christian anti-slave movement. Carlyle was complaining that economists, with their notions of similarity of men, were in tow with the Christians who opposed slavery. And he was right, they were a coalition. The economists, as we will see, viewed all people as greedy. The Christians viewed all people as sinners. Either way, they both treated all people as fundamentally the same.

Today, issues of explicit slavery are no longer an issue. But the issue of treating all people the same still is. When faced with observations of different behavior — either across time, across space, or across cultures — we do not want our arguments based on assumptions that people are different in fundamental ways. We’re all human, and as humans we are all characterized by certain traits.

1.3 Economic Principles

So what is the *economic* model? What are these assumptions I’ve been alluding to? At this point all I’ll do is list some of them — I’m not even going to spell them out. As you read through the book, refer back to Table 1-1 and see if it starts to make more sense.

ASSUMPTIONS	CONSTRAINTS		
Maximization	Prices		
Substitution	Income		
Demand	Customs	\Rightarrow	Predictions
Cost	Laws		
Etc.	Etc.		

Table 1-1
The Economic Model

In the left hand column we have our assumptions, which from now on we're going to call *economic principles*. These are a collection of ideas that ultimately we'll accept on faith as true. Over the course of the book I'll try to convince you they are true by appealing to your own experiences, evidence others have gathered, and any other rhetorical tool I can muster, but eventually you'll have to accept or reject them on your own ... there is no absolute measure of their truthfulness. In the middle column are listed a number of "constraints". These facts of life are generally observable, and include such things as prices, incomes, laws, peer pressure, and the like. Constraints interact with our principles and together they produce a prediction which we hope explains something we're interested in.

You might be starting to think that economics is rather mechanical. Sure, you have to accept some fundamental principles on faith, but after that you just build a model and away you go. Quite often engineering and other physical science students struggle with economics, and they are puzzled because they realize that on the surface economic models are quite simple mechanically. "Surely if I can do differential equations in a dynamic setting, I can breeze through an economics course" they think. Their error, however, is to ignore the last aspect of economic thinking. Economics is part religion. Economics is part science. But economics is also part art. It takes talent and intuition to play with the ideas we call economic principles. Each idea by itself is quite simple, but they fit together in many different ways. Like a piano with 88 simple keys, an economic argument in the hands of a master makes beautiful music. Many of the questions at the back of each chapter are designed to develop economic intuition. In the words of Dr. Evil of Austin Power fame, "stroke them, pet them, but do not eat them mini-me." Think about these questions, discuss them with other students, roll them over in your mind. In doing that, you will not only learn what the economic principles are, you'll learn how to use them and how to think ... about almost anything!

1.4 The Roadmap

This book is organized in three parts. Part I goes through each one of the economic principles, the basic budget constraint, production, exchange, and equilibrium. Together these concepts make up the basic *neoclassical model* of economics. This model is the basic tool used by every economist to understand the volume of trade and the terms or prices trade takes place at. It is basic, but don't be fooled, it is very powerful. Part II examines some standard complications to the basic model. It looks at choice over time, labor markets, non-competitive markets, and competition policy. Finally, Part III introduces a different type of question: how does trade get organized? This last question introduces us to the concept of transaction costs, and completes the introduction to economic principles. There is an appendix to this chapter to help you out on some of the arithmetic

of the book. Glance at it now just to see some of the issues covered. When you come to the topics later in the book, you can come back to the appendix if you need some help.

REVIEW QUESTIONS

1. A traditional definition of economics is “The study of the allocation of scarce resources among competing means.” How does this relate to the definition provided in this chapter?
2. What is the difference between a “model” and a “theory”?
3. Is there anything unscientific about making assumptions and assuming they are true?
4. What does it mean to say a theory is “falsifiable,” “testable,” “operational”?
5. In the chapter it was argued that people are assumed to be fundamentally the same. How can economists hold to such a notion when people are so different? That is, some are short, others tall. Some people are women, others are men. In what dimensions do we assume people are the same?
6. Why do you think Admiral Shovell had the sailor hung for keeping track of his position?

Review Question Answers

1. *The definition given in this chapter is much more general, but entirely consistent with this more traditional definition. Almost all human behavior is about “allocating” something. When you decide what to purchase at a store you’re allocating your income (which is scarce) across a set of goods. When you play football, you’re allocating time (which is scarce) to that sport instead of some other activity. We’ll see in the next chapter that scarcity and competition are implications of our first economic principle: maximization.*
2. *Generally speaking, we think of a theory as “couched” within a model. We have a theory of gravity, but in order to test it we need to build a model. The model may be physical or theoretical, but the model contains a number of assumptions which must be satisfied for a proper test of the theory. For example, in a few chapters we’ll have introduced something called “the law of demand.” We can think of that as a theory. But in order to test this theory we’ll need to know what prices and income are. We’ll have to understand the context in which it is being applied. All of these extra things are part of the model. This is, in part, what makes testing theories so difficult. When a test fails, did it fail because the model wasn’t right (e.g., we assumed income was 100k, when in fact it was actually 50k) or was the theory itself flawed. In this book we will be fairly loose with the distinction between model and theory.*
3. *Not at all. In fact, every body of knowledge necessarily rests on a set of assumptions.*
4. *All of these things refer to a situation where the model could be wrong. If we have a theory that predicts it may or may not snow tomorrow, then that theory is true by definition. It is a tautology. Such a theory is not testable, operational, or falsifiable.*
5. *The economist means that everyone is the same in terms of the principles of behavior. For example, in the next chapter we will assume that everyone is greedy. The economist assumes everyone is that way, regardless of their skin color, religion, sex, location, or age. The economist does not assume that everyone faces the same constraints in life, or that people are identical in every respect.*
6. *In the age of sail, when death at sea was common, food was poor, and living conditions left something to be desired, mutiny was an ever present reality. One of the key methods of preventing mutiny, was to have only those in command aware of the tools of navigation. If the ordinary seamen could determine where they were, then they could find safe refuge. By keeping the seamen ignorant of location, the navies of the world raised the cost of mutiny.*

Appendix 1

ARITHMETIC APPENDIX

1.1 Discrete vs Continuous Variables

Students are constantly confused by the difference between discrete and continuous variables, so if it bothers you, know that you are not alone. For the purpose of introducing a new concept, it is often useful to start with a discrete example. However, once the concept is known, it is often easier to analyze a problem using continuous variables. Thus economic textbooks are constantly switching from one to the other, and it does get confusing after awhile.

A *discrete* variable is one that takes on only whole number values: 1, 2, 3, 4, 5... n . In economics we often use discrete numbers when we're talking about people or goods. It doesn't make much sense to talk about 3.5 people, nor does it make much sense to ask your grocer if you can buy $1/3$ of an apple.

A *continuous* variable is one that takes on any real (positive) value. A continuous variable could have a value of 1, 2, 2.5 or 2.56987320. When you purchase gasoline for your car, you can stop the pump at any time up to two decimal places, you don't have to buy 1, 2, or 30 gallons exactly. We would consider the gasoline purchase, then, a continuous variable.

For now that may be all you need to know. You should stop reading this appendix now and return to its various sections when you are having problems in the text that are related to discrete vs. continuous variables.

I Discrete vs Continuous Variables And Demand Curves

When we are using a discrete variable our graphs tend not to be smooth. Consider Figure A1, which shows a demand curve for a good which can only be purchased in discrete units. The demand curve is downward sloping like it should be, but it isn't a "curve." Rather the demand function has "steps." Each step tells us how much the consumer would have paid at most in order to purchase that discrete unit. Thus, the consumer would pay \$25 for the first unit, \$20 for the second, etc. The demand function is not smooth because the good itself is not continuous. The lumpiness in the nature of the good, leads to the step like shape to the demand function.

When a variable is continuous, our graphs start to take on smooth shapes. In Figure A2, we have a good which is continuous, and as a result the demand function is a smooth curve. We like to work with smooth curves because they're easy to draw and can be represented by nice mathematical functions. In addition, even for goods which must be purchased in discrete units, when we aggregate up across all of the people in a market, the discreteness goes away ... at least in a practical sense.

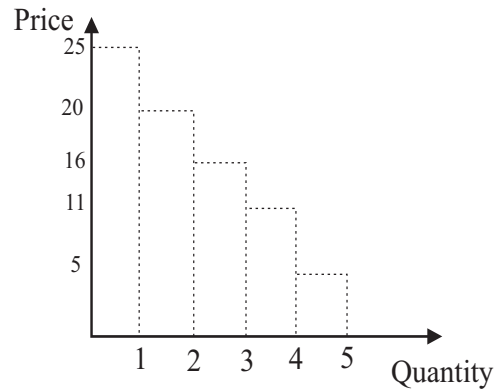


Figure A-1
A Discrete Demand Curve

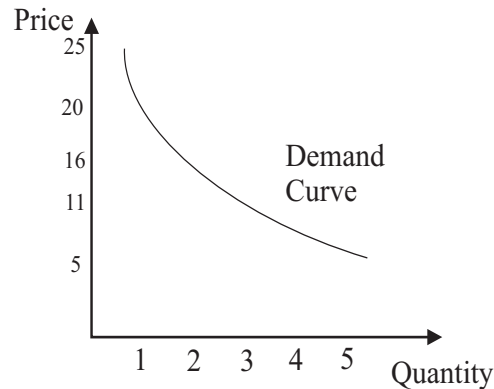


Figure A-2
A Continuous Demand Curve

Discrete vs. Continuous Variables and Elasticity

The difference in discrete vs. continuous variables comes up in the context of elasticity. Consider the case of own price elasticity: the percentage change in the quantity demanded of a good, divided by the percentage change in its own price. When a variable is discrete, we have no choice but to measure the elasticity across a discrete segment of the demand function. If the good can only be purchased in units of 1, 2, or 3, etc., it makes no sense to find the elasticity at a point. As a result, we need to calculate an *arc* elasticity. However, even if the good can be consumed in a continuous fashion, we may still want to calculate the elasticity over a discrete (read “large”) price change. Consider Figure A-3 where we have two points on a demand function. These points may have come from the demand function in Figure A-1 or from Figure A-2, in either case we are going to calculate the elasticity over a discrete distance.

Since we are moving a discrete distance along the demand function we must calculate the elasticity

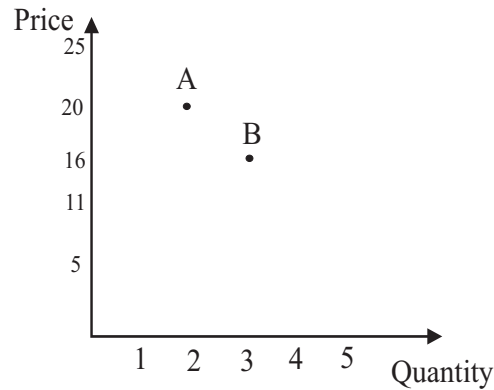


Figure A-3
A Discrete or Arc Elasticity

using the formula:

$$\begin{aligned}
 E_{11} &= \frac{\% \Delta Q_1}{\% \Delta P_1} \\
 &= \frac{\Delta Q_1 / Q_1}{\Delta P_1 / P_1} \\
 &= \frac{\Delta Q_1}{\Delta P_1} \times \frac{P_1}{Q_1}.
 \end{aligned}$$

The Δ in this equation means “discrete change.” The dilemma here, as mentioned in Chapter 5, is that with a discrete elasticity there is an ambiguity over what price and quantity to plug into the formula. Should it be the price and quantity at point A, or B, or some price and quantity in between? The answer is, there is no answer. It also isn’t a big deal, it is just the ambiguity that arises over measuring elasticity over a discrete range.

If we did not consider a discrete range for measuring the elasticity, then we would be measuring the elasticity at a point, say point A in Figure A-3. The advantage of using point elasticities is the ambiguity goes away. The disadvantage is that the Δ gets replaced by a derivative sign. This is only a problem if you haven’t had calculus. Since I’m assuming you have not, we just won’t go there.

Discrete vs. Continuous Variables and Marginal Values

The other place students get confused over this issue is in the discussion of marginal value. A marginal value is the maximum the consumer is willing to pay for a *change in the quantity* of the good. The key is, how big is this change in the quantity? If it is a large change, then the marginal value is discrete, if it is an extremely small amount, then the marginal value is continuous.

The best way to see this is to consider Figure A-4. In the left graph the consumer must make a discrete change in the consumption of the good. Hence the consumer moves from 3 units to 4

units. As a result, the marginal value is the area under the demand curve from 3 to 4. On the other hand, in the right graph the consumer is able to make a continuous change in the consumption of the good. This means the consumer can move from something like 3.99999 to 4 units. As a result, the marginal value is the area under the demand curve from 3.99999 to 4, which in a practical sense is just a vertical line as shown. In the left hand graph we say the discrete area is the marginal value of the *fourth* unit. In the right hand graph we tend to say the height of the demand curve is the marginal value of four units.

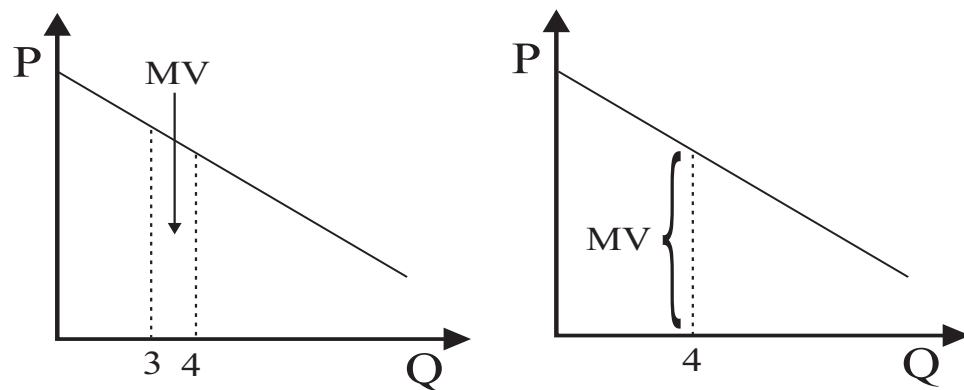


Figure A-4
Discrete vs Continuous Marginal Value

PART I

EXCHANGE AND PRODUCTION

Part I of this book analyzes some very famous problems in economics. First, we'll be interested in *trade*. We want to know why people trade, how much they trade, and what determines the terms of that trade. Second, we'll be interested in *production*. We'll look at costs and output, and we'll see what the conditions are for the optimal level of output. Finally, we'll put these ideas together and discuss competitive markets. Once we've built our basic model we'll analyze market behavior (like taxes or quotas) and non-market behavior (like home heating or bargaining). The material covered in Part I entails the fundamentals of the economist's bag of tools.

CHAPTER 2

MAXIMIZATION

What motivates people? What makes us do the things we do? Is it some type of emotion like love or hatred, some sense of higher calling like altruism or religious faith, or are we hard wired in some instinctive way? For an economist there is only one source of motivation: greed. Adam Smith, in the *Wealth of Nations* put it most famously in the following words:

But man has almost constant occasion for the help of his brethren, and it is in vain for him to expect it from their benevolence only. He will be more likely to prevail if he can interest their self-love in his favour, and show them that it is for their own advantage to do for him what he requires of them. Whoever offers to another a bargain of any kind, proposes to do this. Give me that which I want, and you shall have this which you want, is the meaning of every such offer; and it is in this manner that we obtain from one another the far greater part of those good offices which we stand in need of. It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages.

[Book 1, Chapter 1]

Today economists call this “self-love” maximization, but that’s almost a marketing strategy to tone things down a bit. The bottom line is that economists view all behavior as effort to improve one’s “situation” or “well being”. Economists have a word to describe this well being: *utility*. Individuals get utility from things they value, whether friends, food, or fun. When economists say that people are maximizers (greedy) they mean people try to get as much utility as possible.

PRINCIPLE #1

Maximization: *All individuals are always motivated by greed.*

What a depressing way to start a theory of human behavior. In fact, if you meet anyone who rejects the economic way of thinking, 9 times out of 10 they reject it because they simply can’t accept this as a universal motivation. It’s either the greed aspect of maximization they don’t like, or its the “all” and “always” parts. It’s bad enough that economists think people are greedy, but why must it be so ubiquitous? Even a lot of economists tone things down a bit and often say that people are “self-interested” not greedy. By self-interest some economists simply mean greed, which means at best its a politically correct distinction without a difference. Others think of self-interest as including actions like altruism, which means it includes literally everything and so at worst “self-interest” is a subtle way of opening up the back door of non-testability. We’re going to be honest and upfront and call maximization for what it really is: greed. Don’t despair, though, economics is about *explaining*

behavior, not condoning actions or suggesting hedonistic lifestyles. Keep in mind that what we're after is a model that's good at helping us understand the world around us, and if that means starting with a "darker" motivation, so be it.

Let's start thinking about maximization by considering what it is not. Maximization doesn't mean that people are always smart or correct. Thomas Watson, chairman of IBM in 1943 was a great business man, worried about maximizing the profit of his fledgling computer company all the time, but he also said "I think there is a world market for maybe five computers." Bill Gates, now one of the richest men in the world, no doubt still remembers his 1981 remark that "640K ought to be enough [memory] for anybody." And H. M. Warner, part owner of Warner Brothers and no stranger to making money, once quipped in 1927 "who the hell wants to hear actors talk?" Individuals are greedy, and though that greed might drive them to learn, experiment, and think about an issue, there's no guarantee they'll be right. Smart and dumb people are greedy. Quite often, as students go on in economics and come face to face with some tough mathematical maximization problem, they come to believe that only smart people can solve such problems. It just ain't so.

Greed also doesn't mean that "more is always preferred to less". To say that people always want more of some good is to say that they are never satisfied ... they're nonsatiated. Quite often economists make this assumption just to make their technical models work better, but it isn't a necessary tool in our tool box, and certainly shouldn't be confused with maximization. You can probably think of lots of things that you don't want more of, but that doesn't mean you're not selfish.

Greed is the bedrock assumption for economists. It's what makes an argument "economic" and what makes economists so unpopular with others at a cocktail party. For an economist there is no other motivation for individual behavior. For example, a non-economic argument could be one based on *altruism*. Altruism, practically by definition, is non greedy behavior. When the general public observes Mother Teresa spending her life working with orphans and lepers they see a woman behaving altruistically, someone who unselfishly gives of herself to others. The economist is more skeptical. They see someone doing the best they can under a given set of circumstances, and someone who achieved a great deal of fame in the process (not to mention the Nobel money). Arguing over whether Mother Teresa was an altruist or not is ultimately futile since any given behavior is consistent with greed or altruism; that is, in and of themselves, both motivations are unobservable. For example, when someone walks to the middle of a high bridge and jumps off, were they maximizing? Anyone can say "yes, the gains to jumping were greater than the costs." And when someone helps another, it is easy to offer an explanation that somehow the return to helping is greater than the cost.¹ Still, this is the first economic principle, so if it is directly unobservable, why would economists want it?

Maximization is held so strongly by economists because it has several implications that are so strongly observed in the world around us. These include scarcity, exchange, and equilibrium. All of these concepts will be developed in this book, but they merit some introduction now.

¹ In biology, the theory of evolution is based on maximization. Biologists have no problem coming up with maximizing explanations for all types of apparently "altruistic" behavior shown by one species to another.

2.1 Scarcity

People confuse scarcity with rarity all of the time. When something is rare, it simply means that it is in short supply — there isn't much of it around. Lots of things are rare: sunshine in November in Vancouver or Dublin is rare; the anthrax virus is rare; multiple murders by strangers with hockey sticks are very rare. To be scarce means more than to be rare. To be scarce means that more people want a good than is available, when the good is free.² When a good is scarce it might also be rare, but it doesn't have to be. If you live in Seattle, Washington, tickets to the Washington Huskies football games are scarce, but they aren't that rare (the stadium holds almost 80,000 people). If you live in Manchester, England, the same could be said about Manchester United soccer matches (Old Trafford stadium seats about 68,000 people). Likewise, just because something is rare, doesn't mean that it is scarce. The anthrax virus is rare, but since no one wants it, it is not scarce.

Scarcity exists when the price of a good is zero and people want more than is available.

Scarcity is a result of greed. When everyone is greedy — always striving to improve their utility — and when the world is a place of relatively fixed endowments where goods are produced by the sweat of the brow, scarcity is just a fact of life. If people were just content with what they had, or if the disaster in the garden of Eden had never happened, we wouldn't live in a world of scarcity ... there would be ample for everyone.

Scarcity has several implications that we're all familiar with. Since the world is full of scarcity, there just isn't enough of everything to go around, and what's more ... there never will be enough. This is the paradox of the western world. The west lives in a society with abundant riches. Our streets aren't paved with gold, but compared to many places on earth, Westerners are the kings and queens of consumers. And yet, are we more content than others? Hardly. Do we have "enough" yet? No. As a student, you've probably had a thought like "if I could just make \$50,000 a year, I'd be laughing." Or maybe the number is \$100,000, or perhaps even a million dollars. When I was a student, I remember \$30,000 was a wage one could aspire to. Alas, it doesn't matter what the number is you pick, when you get there you only want a bigger number. And it doesn't stop with money. The kids never behave well enough, appreciate their parents enough, the wife is never (fill in the blank) enough. It's never enough. You know it, and that's maximization at work in your life.

One of the facts of life that results from scarcity is that we are faced with making choices. Since there is never enough of things we want, both as a society and individually, the only way we can get more of one thing is to give up something else. If I want more income to buy a new car, then I have to give up some of my spare time in order to work more. If the government of British Columbia decides to spend more money on health care, then it means less money is available for education and other government services. Milton Friedman made this fact famous when he said "there's no such thing as a free lunch", and he was right; it is unavoidable.

² We'll see later on that this means scarce goods always have a positive price.

2.2 Equilibrium

The most difficult implication to understand about maximization is equilibrium. By equilibrium economists mean a situation where no one wants to change their behavior. Consumers settle on a bundle of goods to buy, firms settle on prices to charge and quantities to produce, families settle on a specific number of children, etc. As we'll see in later chapters an equilibrium will always be reached when individuals and firms maximize. People finish trading and producing when all of the potential gains from doing so are exploited. To put it crudely, and to borrow a gambling metaphor, no money is left on the table when there's an equilibrium. The reason is quite simple: if people get together to increase wealth, and they don't fully exploit every opportunity to do so, then they haven't maximized.

One of the easiest examples to understand equilibrium is rush hour traffic. When someone leaves their office to head home in the evening, there are often several ways home. At the very least, if they are taking the freeway home, then there are several lanes on the freeway, all leading in the same direction. Which lane should be taken?

Well, in equilibrium, it doesn't matter which lane you take. When you enter the freeway, suppose the left lane is traveling faster. As a maximizer you'll want to get home as quickly as possible, just like everyone else, so you switch into the left lane. However, by switching you slow that lane down a little and increase the speed of the right lane. If there is still a difference in speed someone else will do the same thing and move into the left lane. Again the speed in the left lane slows a little and the right lane speeds up. The end result, the equilibrium, occurs when each lane is moving at the same speed. When all the lanes are moving at the same speed, there are no more gains from switching ("trading") lanes: all the gains from trading lanes have been exploited. As a result, when you enter the freeway, it doesn't matter which lane you take, they'll all get you home at the same time.

"The Margin"

Economists often analyze equilibrium with a concept called "the margin". In the above example an economist might say: "there's no marginal benefit to changing lanes in equilibrium." What this means is that the marginal or incremental lane changer is indifferent between changing lanes and staying put.

Indifference: *letting someone else choose for you.*

Someone who is indifferent between two options is neither better nor worse off with either option. There once was a lazy, but quick thinking, lad who was down on his luck. He decided to go to his rich uncle for a loan. "I don't give my money away" declared the rich uncle, "but I'll tell you what. I have a man come by and cut my grass for \$20. I'll give you \$25 for the same job." "Let the man keep the job," said the poor nephew, "but I'll take the \$5." Now that's exploiting the concept of indifference.

Once we understand the marginal person in traffic, it makes sense to talk about the “intra-marginal person.” This is the person for whom there is some gains from trading lanes. Suppose that everyone is in the right lane on the freeway heading home. The first person to switch to the left lane is certainly better off. So is the second, third, and forth driver. Perhaps the two lanes don’t equalize in speed until the 3033rd driver moves over. The first 3032 drivers are “intra-marginal”, while the 3033rd driver was the marginal one. For the marginal driver, the gains from moving over to the other lane just equal the costs. As a result that driver is *indifferent* between driving in either lane. We will see this concept over and over again.

Using Economics to Make Lots and Lots of Money

Unfortunately, the concept of equilibrium that results from maximization, has one nasty little implication. There is no way a student of economics can use an economic model to “save the world” or more hedonistically “make abnormal profits.” Let’s start with the concept of making a lot of money, piles of money, ... without working too hard for it. If you go to any party over the next couple of weeks and tell someone that you’re taking an economics class, you’ll almost be guaranteed to have someone ask: “what do you think will happen to the interest rate next week?” or “is now the time to get back into technology stocks?” The question might vary a little (what’s a good mutual fund to invest in, what’s going to happen to GNP or the inflation rate), but the drift will be the same. Everyone thinks that if we could just “understand” the economy we’d all be rich.

And why shouldn’t people think this way, since everyday we’re bombarded with pitchmen telling us that they’re rich because they do understand how the world works. We turn on the TV and we see show after show with “professionals” telling us everything about the future, from politics to real estate prices. Whether it’s Tommy Vu or Wall Street Week the story is the same. In fact, let’s take two examples.

Figure 2-1 is the cover of a 69 page booklet that arrived in my mailbox . Inside you read about Ken Roberts, investor/author/publisher, who asks the question: “In the next 10 years: where are home prices headed? where are car prices headed? ... where are medical costs headed?” If we want, we “can learn how to make money no matter what is happening in the world.” Inside are testimonials from “real people” about how they’ve managed to turn \$400 into \$4000 in just a few weeks, and how investing the Ken Roberts way has given financial freedom to so many. In fact, Jan R. of Arkansas writes: “...I never thought I would be close to [my father]. You have brought us together ... Thanks a million times over.” A fortune, peace of mind, and even reconciliation, and all you have to do is pay \$195 for the manual and course! Inside, Mr. Roberts gives a hint at some of the valuable lessons you’ll learn. Page after page contains pictures of stock market price graphs with little arrows showing you where he bought and where he sold. It turns out, that in order to make money, all you have to do is buy low and sell high! Amazing, why didn’t I think of that?

When faced with the likes of Mr. Robert’s booklet, the skeptical economist asks: “why is Mr. Roberts willing to sell me such information for a mere \$195?” Could it be that Mr. Roberts actually makes his money selling books rather than pick up easy money on Wall Street? The principle of maximization, with its implication of equilibrium tells us, of course you won’t get rich with Mr. Roberts.

Its not just that there are no \$500 bills lying around Wall Street, unfortunately, there aren’t any easy grades lying around either. Figure 2-2 shows a leaflet that was distributed around campus

The World's Most Powerful Money Manual & Course

The story is fascinating. The facts are phenomenal. Unless you have all the money you want or are scheduled for a life-saving operation, you have nothing more important to do than read this manual. It will take you about 30 minutes. And by the end of the day, you'll be showing it to your spouse, your friends, and your next-door neighbor.

IMPORTANT: This is not junk mail. Inside are names, dates, and facts you can put to use right now — as you're reading — to learn how to become truly independent.

Figure 2-1
Making Money Without Trying

a few years ago, stating something similar to Ken Robert's investment strategy. For a mere \$25 a student can obtain an easy "A" (the equivalent of a first in Britain). Although I didn't purchase the Ken Robert manual, I did buy the cheating book by Michael Moore, ... just in case. As expected, it offered just enough information that the author couldn't be arrested. The first 39 pages claim that cheating is OK because: everyone does it; nobody finks; professors don't care; university is a rip off anyway; and you have to cheat in life, so you might as well practice now. The last half of the book is devoted to how to copy answers from the person beside you. It contains real gems like: sit by a friend, develop hand signals, and wear a hat. Like Mr. Roberts, there's no real secret here either.

To make "easy" money, obtain a "free" A grade, or get the girl/boyfriend of your dreams without trying is to earn an above normal rate of return, and in equilibrium, these do not exist. It would be like getting on the freeway tonight and being the only person in your city to notice that no one is the left lane.

We must be skeptical of anyone suggesting they have a sure way of making money. The thing is, if anyone is in possession of such knowledge, why aren't they using it themselves? Why does Mr. Roberts let us in on his little investment secret for a mere \$195? If his claims are true he could be infinitely wealthy by exploiting the knowledge himself. It just doesn't make any sense. When someone gives you advice about how to make money, that's probably what it is worth ... nothing. At the very least, you should check out their own asset position before you take any action.

Perhaps you're wise enough to know that forms in the mail announcing you've just won a million dollars if only you'll send \$20 to claim your prize, are bogus. But are you wise enough to know that no one at your university can give you this type of information as well ... not even your local economics professor? If any economist knew the price of corn next week, he'd have a Faustian knowledge that would lead him to infinite riches, and he sure as shootin' wouldn't tell you.

Harold Demsetz, a great economist at UCLA, learned this lesson the hard way. In telling the story of how he left the University of Chicago for UCLA he states:

The second reason for moving to UCLA was financial. I had joined a small group of business school colleagues in the purchase of long-term treasuries. We were speculating heavily, having put up only 5 percent of the price of the bonds. The rate of growth of the money supply had turned down. Being strong believers in monetary theory, we expected the economy and interest rates to turn down also. Interest rates did not fall immediately, or for a very long time after our purchase. I found myself sending margin to my broker as frequently as one feeds a pet dog. My proverbial "shirt" was lost. Reuben Kessel dryly observed that we still have a lot to learn about interest rates. Were Reuben still alive, he would be pleased to learn that my understanding of interest rates has improved considerable. Now, I lose a much smaller fraction of my wealth speculating on changes in these rates (which are sure to come).

[p. 9, 1988]³

³ Harold Demsetz, *Ownership, Control, and the Firm* (New York: Basil Blackwell, 1988).

Cheating 101:

The benefits and fundamentals of earning the "Easy A."



Finally a helpful book for students has been written exploring the benefits and techniques for cheating. Learn the best and safest methods of ensuring good grades with the least amount of effort. This innovative work addresses cheating as a realistic issue on campus and helps students examine the best routes for academic short-cuts in classes that are anything but educational and important. Take charge of useless time wasted studying. Read how the best win in the classroom and conquer meaningless exams and term papers.

Order this unique book and start getting better marks immediately!



PROBLEM



SOLUTION

This is the opportunity you have been looking for! Don't let it pass you by. Grab a pen now and order the book that is taking North American campuses by storm and start enjoying University.

O.K. This is what I have been looking for! Here is my \$19.95 (please add \$5.00 for taxes and postage). Please rush me a copy of Cheating 101. Make check or Money Order payable to: CONCERNED MARKETING CORPORATION.

Mail to:

CMC

P.O. Box #6004
6417 Fraser Street
Vancouver, B.C.
V5W 4B5

NAME _____

ADDRESS _____

CITY _____ PROV. _____ Postal Code _____

Figure 2-2
Cheating 101

Perhaps I still haven't convinced you yet. Of course people like Mr. Roberts and Mr. Moore are not to be trusted, and Mr. Demsetz, well he's just one guy. If you want to make money you have to really know what you're talking about. If you still think like that, consider the case of Long Term Capital Management. This was a company started by Wall street insider John Meriwether, and two Nobel prize winning economists: Robert Merton and Myron Scholes. LTCM managed to get people to invest 4.8 billion dollars with them. They would use this money to buy up to 160 billion dollars worth of stocks and bonds, plus derivatives (fancy word for fancy financial contracts) worth 1 trillion dollars on paper. That's trillion, not billion. LTCM was the poster child for hedge fund companies in the mid 1990s. People were dumping money at the front door of headquarters just to get a piece of the action. And what was the action? LTCM was attempting to capitalize on tiny spreads in financial markets around the world. They were, according to one executive, "picking up nickels and dimes off the sidewalks."

LTCM might work as follows. Suppose there were two United States treasury bills, one that matures in 29 years another that matures in 30 years. Suppose also that a difference in yield exists between the two bonds, perhaps 50¢. What LTCM did was bet that this difference would disappear, since the two bonds are essentially the same. They would bet by selling short on the low yielding bond and buying the high yielding one. On a 1 million dollar bet they would make \$5000 ... hardly anything to write home about. But wait, with 4.8 billion in the bank, they took out loans in the form of margins. They would buy the 1 million worth of bonds with only \$10,000 on margin. Now the \$5000 is a 50% return.

Alas, it turned out there not only aren't \$500 dollar bills on the sidewalk, there weren't any nickels and dimes either. Instead of converging, many of these spreads started to diverge. LTCM lost money, banks started to call the margins, and 4.8 billion quickly became 600 million. With almost 1 trillion in derivatives, the Federal Reserve Bank actually stepped in and bailed LTCM out. Even Nobel prize winners can lose money ... big time.

Using Economics to Save the World

Perhaps you're not interested in making money. Perhaps you're more idealistic and you want to save the world ... or at least work in the urban planning department of your local city. Can economics tell you what type of social programs are best for your area? Whether or not rent controls on apartments are a good thing or a bad thing? What the optimal rule for the Bank of Canada is for the money supply? Many economists would say "Yes!!". Alas, we cannot, at least not if we're going to stick with our principle of maximization.

When the economist assumes that everyone is always greedy then, as mentioned, all gains from trade are maximized. If they weren't then the individuals didn't maximize and something is seriously wrong with our logic. Our model will always be based on the idea that individuals have done the best they can. How then, can an economist come along and say that he knows a better way? It is impossible.⁴

Not that a little faulty logic has ever stopped economists from continually doing this. In fact,

⁴ This seems to explain why business students generally hate economics. The business major rejects the notion of equilibrium. Every business major thinks they'll invent a great mouse trap, they never assume that the best trap is already invented.

the profession is littered with stories of policies gone wrong, with often tragic outcomes. There is an old joke of an engineer, a doctor, and an economist all arriving at the gates of Heaven only to find out that the one spot available is being allocated to the person with the oldest profession. “That’s me!” says the doctor. “Eve was created from Adam through a surgical procedure.” “Hold on,” said the engineer. “God created the Heavens and Earth from chaos, and that was an engineering act, so I get to go in.” “Not so fast,” said the economist. “Where do you think the chaos came from?”. Economists get the policy wrong all the time because their model is not designed to do policy implications. The economic model is designed to explain behavior, not tell people what to do. When people behave inconsistently with what an economic model says they should do, then its time to scrap the model, not tell people to change their behavior!

2.3 Why Believe in Maximization?

If maximization can’t make abnormal rates of return nor save the world, why keep the maximization assumption? On what grounds do economists hold such faith to it? The word “maximization” also makes it sound as if people are calculating machines, constantly assessing the costs and benefits of everything. Just by introspection we know that this doesn’t seem right. When I got up this morning I poured myself a bowl of Raisin Bran, just like I do most mornings. I didn’t think about it in any calculating way. I didn’t try to maximize any function or perform a complicated optimization problem.

Economists believe in maximization because it works.

The first reason why economists believe that individuals are motivated by greed is because it seems to generally explain so much behavior. For example, we’ve already seen that greed provides an explanation for scarcity. As we go through this book, we’ll see that the principle of maximization helps us understand trade, pricing, and institutions. When something works, it’s wise to pay attention to it.

Understanding the world around us isn’t simply a matter of philosophical interest. Economists can make a pretty decent living as consultants because understanding markets is a valuable skill. Firms want to know what the characteristics of the demand for their products are. Governments want advice on the distributional effects of economic policies. And legal firms want economic advice in anti-trust law cases that involve complicated pricing practices. Thus, if the principle of maximization is the correct way to think about the world, we want to use it even if it doesn’t save the world or produce abnormal rates of return.

Economists believe in maximization because it is the only type of behavior that survives.

A more subtle grounds for accepting the principle of maximization is that if people did not maximize then they wouldn’t survive. Greed has a survivability characteristic similar to the concept of natural

selection. Most biologists believe that any animal that has a characteristic that allows it to out compete other animals will tend to survive and proliferate until eventually it is the only type of animal left. Likewise, individuals compete with other individuals, both at an individual and firm level. Those individuals that behave in a maximizing way survive and proliferate. Those that do not die out. In the end all we are left with are individuals that are maximizers.⁵ Let's start with some silly examples and work up to some more serious ones.

Consider the cartoon shown in Figure 2-4. The humor in the cartoon comes from the fact that Zog and his buddy are about to be eaten. This is non-maximizing behavior if ever there was any. Suppose that there was another pair who just happened to stand outside the trap when using it. They stood outside not because they thought about it, but just by some fluke they stood outside. That pair would end up surviving, and if they continued to stand outside the trap when using it, and why wouldn't they ... they aren't thinking about it, they would continue to survive and would show their children where to stand as well. Since only maximizing strategies survive, the only thing we observe is trappers standing outside their traps. The rest get eaten or starve to death, just like poor old Zog.

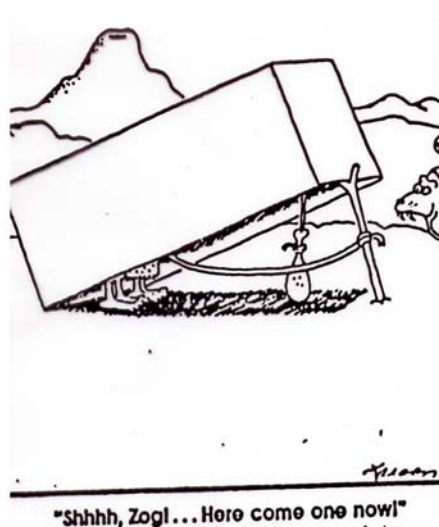


Figure 2-4
How Not to Catch a Tiger

⁵ This argument was first articulated by Armen Alchian in "Uncertainty, Evolution, and Economic Theory" *Journal of Political Economy* (1950).

The point is, maximizing behavior survives whether you are aware of what you're doing or not. Lots of people are successful in life, even though they don't know why what they do is successful. Perhaps you recall seeing a movie called *Phar Lap*. It was the story of an unbeatable Australian horse, named Phar Lap appropriately enough, who was owned by a trainer with a strange view of how to train horses. This trainer thought that the best way to condition a horse was to work it to the point of death. If the horse stopped working, then he'd beat the crap out of it. As it turned out, when he owned Phar Lap he won every race, and he would brag to others about his superior methods of training. Once he sold Phar Lap, he went broke because all of his other horses died in the training program. The maximizing strategy of winning a horse race in Australia at the time was to own Phar Lap. The fact that the trainer didn't understand this didn't make him less successful. Just because you're rich and successful doesn't mean you're smart, it only means you're doing the maximizing strategy ... a fact of life poor faculty members remind themselves of every morning.

We should not reject the principle of maximization because in our hearts we don't think of ourselves as greedy, opportunistic, cold calculating machines. Nor should we reject it because no one in our lives admit to maximizing anything. We are the people who survived, and what we're doing is the maximizing strategy whether we know it or not. I can safely predict that everyone reading this book has eaten nutritious food over the past thirty days. I can predict this because only those who did so would be alive right now to read the book. Those who starved themselves, or those who started to consume gasoline instead of water, simply are not around. Likewise, when an economist looks at a firm, he is confident that the firm is maximizing its profit, whether the firm's owner is aware of it or not. Had the firm not maximized profits, it would have gone out of business ... driven out by other firms that were doing the maximizing strategy. Since maximization is the only strategy that survives, economists assume that all individuals are maximizers. It is a little like the first law of biology: If your parents didn't have any children, then you probably won't have any either.

What is being maximized

We've talked a great deal about the process of maximization and what it implies. But what are people maximizing? Economists use a funny word to capture the object of a consumer's maximization: utility. Every time you consume any bundle of goods, you get utility or satisfaction from that bundle. Consumers try to get as much utility as possible. When we discuss firms, the object of maximization is more observable: profit. profit is simply the difference between revenues and costs.

Consumers maximize utility, firms maximize profits.

2.4 The Panglossian Dilemma

Taking maximization seriously leads to a conclusion that many simply find unacceptable: everything must be optimal ... in its own way. When selfish individuals go about to produce and exchange in such a way that all gains from trade are maximized, then no better outcome is possible. If a better outcome was possible, then the individuals didn't maximize and we have a contradiction.

Have you ever complained about something? Perhaps you wish that there was a pizza restaurant closer to your home. "Darn!" you're always saying, "I wish there was a closer pizza restaurant

near my home.” People complain all of the time and this would suggest that the world is not optimal. Well, the question is: why don’t you invest in a restaurant? Perhaps you say “no one will lend me the money.” But why will the banks, your friends, and your parents not lend you the money? Is it because you cannot guarantee that you will pay it back and there is some cost of risk in opening up a restaurant? If so, then this cost must be factored in and now perhaps the restaurant doesn’t look like such a good investment.

To say that the world is optimal doesn’t mean that the world is perfect or that we cannot imagine a better world. It simply means that the world we live in is the best we can do under the circumstances. If you don’t agree with this, then you’re an entrepreneur, not an economist, and you should go make your fortune.

2.5 Summary

The principle of maximization is the first and most fundamental idea in economics. Every economic model, no matter how simple or complicated, assumes people are maximizing. So important is this idea that without it an argument simply is not economic. As we’ve seen, maximization has a number of implications. We live in a world of scarcity. If goods were freely available, we would demand more than is supplied. Furthermore, we live in an equilibrium. Markets out of equilibrium are markets where the gains from trade are not maximized. Equilibrium means that economic knowledge can only earn a normal rate of return — it cannot lead to easy fortunes or solutions to economic problems. Finally, the principle leads to the counter intuitive result that the world is optimal.

REVIEW QUESTIONS

1. What is the difference between assuming people are maximizers and assuming are never satiated (ie. more is preferred to less)?
2. Is there any behavior at all, which we can confirm is not the result of maximizing behavior? In other words, is maximization, by itself, testable?
3. If something is scarce, is it a good? If something is a good, is it scarce?
4. Why is “choice” the result of scarcity?
5. What is the difference between “intra-marginal” and “marginal”?
6. Why would maximization survive over other forms of motivation?

PROBLEMS

1. Alexander Pope once wrote: *In spite of pride; in erring reason's spite, One truth is clear; whatever is, is right.* Is Pope's conclusion consistent with the principle of maximization?
2. John Kennedy once stated *Some men look around and ask why? I dream of things that could never be, and ask why not?* Why does the principle of maximization force economists to ask "why", rather than ask "why not"?
3. I had a neighbor one time who planted an entire orchard of fruit trees at a 45 degree angle under the theory that they would bear more fruit. What common observation would make an economist skeptical of such a claim? As it turned out, all of his trees died, but he could have been a genius who really did discover how to increase fruit yields. What does this suggest about the economists ability to judge innovations in general?
4. The practice of open grazing in the Western United States was discovered when cattlemen let their cattle loose during the civil war during their absence. On returning to the ranch many discovered that their cattle had gained more weight on the open range than they had on closed fields. Does this accidental discovery of a new ranching method mean that the farmers were not maximizing their wealth before the discovery?
5. A classic scene in Old West movies has the old prospector running into town yelling "Gold! Gold! I've discovered Gold!" Given the principle of maximization, what's wrong with this scene?
6. There used to be a car called the "Sterling" that ran a series of advertisements that used successful people as their pitchmen. In one commercial a man is sitting on a stool and he says "I met him in the Hotel Astoria when he was just a scrawny kid, he didn't look like much, but I saw a champion." Then the camera moves away and we read "Angelo Dundee, trainer of Mohammed Ali". Then it comes back to Mr. Dundee who then tells us to buy the Sterling. The message of the commercial is pretty clear: Dundee was a great trainer, able to see talent in Mr. Ali, so he must be able to see talent in the car. Is it necessarily true that Dundee must have been a great trainer?
7. The whole world knows how a small handful of men were able to hijack four airplanes on September 11, 2001 and use them as bombs to kill thousands of people. Explain how a small number of hijackers use the principle of maximization to gain control over 40 to 60 people?
8. On the fourth plane hijacked on September 11, 2001 the passengers, through the use of cell phones, found out that their plane would crash. Explain why this information made the principle of maximization work against the hijackers? Had the passengers been kept in the dark, what do you think would have happened to that plane? In future hijackings, what do you think hijackers will insist regarding the use of phones?
9. One of the most useful things one learns in economics is "Friedman's Law for Finding Men's Washrooms." This Law states: Men's rooms are adjacent, in one of the three dimensions, to ladies' rooms." Why is this an application of the principle of maximization?
10. In the early 1980's, when the Polish people had to stand in long lines in order to purchase

most consumer goods, the government ordered that every third place in line be reserved for pregnant women. This was presumably done to reduce their discomfort. What do you think happened to the number of pregnant women standing in line? What do you think happened to the number of pregnant women in Poland?

11. “When I go to McDonalds, I can buy as many Big Macs as I’d like. Therefore, they are not scarce.” True or False, explain your answer.
12. “Michael Jackson doesn’t face any scarcity because he’s rich” True, false, explain.
13. Are beautiful sunsets a scarce good? Briefly state why or why not.
14. Explain why newspaper machines expose all of the papers upon purchase, but candy machines dispense one item at a time.
15. It is a “well known fact” that the correlation between investor return and education level for stock brokers is negative — better brokers usually have less education. Is this consistent with the notion of maximization or a refutation of it? That is, do you think those brokers that went on to college would have been better brokers by not going?
16. Certain professions are very attractive to their members and very badly paid. Consider the stereotype of the starving artist. Is the association between job attractiveness and low pay accidental, or is there a logical connection? How is this related to which lane I should take home on the freeway in rush hour?
17. Two bedouins are arguing in the desert that their camel is the worst in all of Arabia. The fight goes on for some time before one of them thinks up the following bet. They will race their camels to an oasis two miles away, the last person to get there wins — his camel obviously being the slowest. The men mount their camels, and start the race. Several hours later, a wise man (who understood maximization) comes by and asks the men why they are sitting on their camels, going nowhere in the hot sun, when there is an oasis two miles away. The men get off, tell the wise man their problem. The wise man whispers two words to the men, and they immediately race off (on the camels) to the oasis. What did the wise man tell them?
18. “Socialism: Cooperation instead of competition” reads the bumper sticker. In what sense is competition a form of cooperation? What type of cooperation do you think is intended in the sticker? Is this a form of competition for scarce resources?

Review Question Answers

1. *Maximization is a motivation. It is the reason why people do things — at least that's what economists think. Nonsatiation, is just a matter of preferences, and many times it isn't true. I might have some allocation in my life which is an absolute bliss point. If I ever reach this point, I would be in heaven. To have such a point would be a violation of "more is preferred to less." But as a maximizer I would want to reach such a point! Thus there is no contradiction in being a satiated maximizer. However, in this book we'll generally assume there's always something individuals want more of.*
2. *I don't think so, at least not until we can peer into the hearts of men and measure motivation. If you pick any type of behavior whatsoever, it is easy to come up with a maximizing explanation. If a person jumps into a blazing fire to save some people, we can say "he's no altruist, he just wants to be famous ... pure greed." Whether or not you find this plausible or not is beside the point. Maximization, just by itself, is not a testable theory. It is consistent with everything.*
3. *If something is scarce, then it must be a good. If it is scarce, then people want it, which is the definition of a good. If something is a good, it may not be scarce. Water is a good. But you may be in a situation where there is so much water, that it is not scarce.*
4. *When goods are scarce it means that there is more wanted than is available. This the definition of scarcity. Hence, a choice must be made over who gets how much of the good.*
5. *For this answer you should refer to the appendix to chapter 1.*
6. *To maximize is to do the best under the given circumstances. If you do less than the best, and someone else does better, then that person will out compete you. He'll gather more food, make more weapons, and eventually overpower you in some dimension. If you do not copy the maximizing strategy you or your business will simply disappear and we won't observe that type of behavior anymore. The principle of maximization is equivalent to the biological theory of "survival of the fittest."*

Odd Numbered Problem Answers

1. *I think Pope comes close, but in the end it is not the same as the principle of maximization. Pope understands there is a hidden order to the world that overrides individual motivations and thinking, but maximization doesn't suggest anything about the "rightness" of an allocation. If we want to define "rightness" as "optimal", then they're the same, but this was not the intention of Pope or the interpretation of those who still read him.*
3. *This is a true story, and the neighbor was a biologist with a theory of different types of sap in fruit trees. The economist should be skeptical because driving past commercial orchards one never sees trees planted on an angle. Tree producers have a strong interest in finding the best environment for growing trees, and it seems reasonable they would have tried this procedure, even by accident over the past several thousands of years. Still, this could have been the proverbial "better mouse trap." It shows that economists have no tool to evaluate innovations. On the contrary, the principle of maximization tends to make us quite skeptical.*
5. *No one would spend their life hunting for gold and then give the information away. The scene only makes sense if the miner is pointing in the wrong direction.*
7. *Every hijacker makes it known that the first person to attempt a takeover will be killed. Often the hijackers make a demonstration that they are willing to kill by killing someone randomly. Collectively there is no way a group of hijackers could stand an assault by 40 to 60 people, but of course, no one wants to be the first one to attack. If there is no first person, there's no attack and the hijackers gain control. This is a major problem with getting infantry to fight in battles, and most infantry formations are designed to make sure the first mover is not at such a disadvantage.*
9. *Builders want to minimize costs, and one simple way to do this is to have male and female washrooms use the same set of pipes. This means the washrooms must be adjacent to each other in one dimension. A very useful implication when looking for a washroom in a foreign airport.*
11. *If Big Macs were not scarce, then they would be free. They are not free, therefore, they are scarce. This question can be used to get the students to start thinking about prices, price taking, demand, and supply, before any of these things are introduced.*
13. *Again, the student needs to think on his own about demand and supply. Anyone who's spent more than 2 weeks in Hawaii knows a nice sunset isn't very scarce after a while. Some people have no affection for sunsets, no matter how few they look at.*
15. *This observation makes it appear students who enter college get taught information which makes them a worse broker. However, this question is really about maximization and self selection. If, given the principle of maximization, an instructor can't teach anyone how to be a great stock broker, those who are naturally good at it will not go to college. If they are good at it and stay in the business, then you get the observed correlation.*
17. *Switch camels.*

CHAPTER 3

SUBSTITUTION

The second important idea in economics is the principle of substitution. The principle of substitution simply states that everyone is willing to trade some amount of one good, for some amount of another. All goods are substitutes when they all provide us with some amount of enjoyment. If a good doesn't provide a person with enjoyment (what economists call "utility") then the item isn't a good, it's a bad.

PRINCIPLE #2

Substitution: *everyone is willing to trade some amount of one good for some amount of another.*

If we were to put it crudely, the principle of substitution essentially states that everyone has their price. If I want you to give up something, then all I have to do is give you enough of some other good, and you'll part with what I want. Like the principle of maximization, substitution is hardly a noble characteristic, but in terms of explaining behavior it is very successful.

We run into substitution everyday of our lives. Children at a dinner table are often bribed with dessert if they'll just eat a little bit more broccoli and carrots. Essentially the parents are exploiting the child's willingness to trade a bad thing (broccoli) for a good thing (dessert). If the parents resort to threatening a spanking to get the child to eat the broccoli, again they are exploiting the child's willingness to trade one bad thing for another. When a shopper goes to Safeway for some fruit, but notices that mangos are \$2.40 each, while plums are a mere \$.20 per pound, they tend to buy more plums and fewer mangos. The fact that different types of fruit satisfy the shopper's desire means that he views plums and mangos as substitutes. In fact, if fruit was really expensive, the shopper would consume, more of some other type of food, like cookies, and less fruit. There's no end to what goods substitute for others.

Before we go on, three things need to be said. First, substitution is an act of the will. One is *willing* to substitute one good for another. The principle of substitution isn't referring to forced consumption, but rather addresses what people are willing to do. Second, the principle of substitution only says that everyone is willing to substitute one good for another, but it doesn't say how much. It might take a twelve plum payment to get you to give up one mango, but for me it might take 60, or perhaps 2. It is just a matter of taste, and there's no reason why tastes are the same across people. The principle of substitution only states that if you want me to give up one mango, there is some amount of plums (or other goods) you can give me that will make me do it. Third, there is a relationship between what someone is willing to pay and what someone is able to pay. To be able to pay for something, literally means that you have enough resources (income) to make the payment. Just because someone is able to pay for something, doesn't mean he's willing to do so. You're no doubt able to purchase illegal drugs, but I would guess you're likely unwilling to do so. If you are willing to pay for something, then you must also be able to pay for it. It makes no sense to say you're willing to pay for something when you can't afford it. People get the relationship

between ability and willingness to pay mixed up all the time. It is far better to watch a person's actions than listen to their words. Consider the following story:

A taxi driver from the Bronx dropped off a passenger one day and then immediately felt sicker than he had ever felt in his life. Fearing that he might be mortally ill, he drove immediately to Park Avenue, where he had seen signs for the offices of many doctors. Locating an office, the cabbie burst in demanding to be seen at once. The receptionist, fearing the man might die, called a doctor, who concluded it was a simple case of indigestion. "How much do I owe?" asked the cabbie to the receptionist. "Oh, \$150 will do," she replied. "\$150!" shrieked the cabbie. "That's highway robbery, that's outrageous, that's out of the question." The cabbie kept on yelling and making such a fuss that the doctor finally came out to calm him down. Finally he said "just pay what you think you should." "Fine," said the cabbie, "here's \$15." The doctor took the money, and before the cabbie left he said "You know, Park Avenue is the most expensive place in New York for doctors, and you must know that. Why did you come here?" "Listen doc, when it comes to my health, price is no object."

With those three thoughts in mind, consider some possible objections to the principle of substitution. "I don't care what you pay me, I'll never give up my life." People say things like this all of the time. Let's think of "giving up my life" in two ways: dying now, or shortening your lifespan. In terms of the latter, there are just a million ways we trade off years of life for other goods. Consider all of the vices you have in your life. Perhaps you smoke, drink excessively, eat a lot of pizza (for breakfast), drive too fast, sleep with multiple partners, drink too much coffee, and don't get enough sleep ... sounds like the average undergraduate lifestyle. Anytime you engage in such behavior you reduce your expected lifespan. Why do we do such things? Because in doing them we get enjoyment from the activities. Essentially we're trading off one good for another: satisfaction now for a shorter life later.

"Fine" you say, "but there's no amount of any good you could give me that would make me kill myself". Perhaps, but what this might mean is that the price is simply very high. Quite often when people are tortured they beg to be killed rather than endure the torture. The terrorists who bombed the World Trade Center were willing to trade what they believed would be future in paradise for a suicide mission on that day. Other people have given their life for friends, family members, defending their faith and the like. No one gives up their life for any amount of potato chips, but for some price we do find examples.

If a person is willing to trade their own life against some other good, perhaps they are unwilling to trade, say, their child's life or their parent's life for some amount of other goods. Again, in terms of life expectancy, we do this all the time. If I drive my children to school, rather than have them ride the bus I increase the probability of a fatal car accident in exchange for more convenience. One of the most spectacular examples of endangering children's lives came about in the late 1980s in Seattle. A local hospital was charging its patients by the day, and the day began at midnight. Every evening a group of women in various stages of labor gathered in the parking lot, and rushed the emergency room at the stroke of twelve. You can just imagine the tortured men and women, waiting anxiously through each contraction, knowing that if they could just hold off a few more minutes

they could save themselves \$600. Although the hospital eventually solved the problem by charging patients by the hour, it still provides a remarkable example of a parent's willingness to trade off their newborn child's welfare for a few hundred dollars.

In an old Calvin and Hobbes cartoon, the two characters are having a conversation "If I've learned one thing in life," says Calvin, "It's that everyone has his price. Raise the ante high enough and there's no such thing as scruples! People will do anything if the price is right." "What's your price?" says Hobbes. "Two bucks cold cash up front" replies Calvin. "I don't know which is worse. That everyone has his price, or that the price is always so low" quips Hobbes. Indeed, when we start to look around, the principle of substitution doesn't seem that surprising. It is only surprising how low the price is. The TV show 60 Minutes had a segment where an office in a hotel was set up across from a state legislature in order to pay legislators to vote a certain way on a piece of legislation. The producers of the show set the price at something like \$5000 thinking they might get one or two takers. To their surprise, at one point the elected officials were actually lined up outside the hotel room door.

I had a Canadian friend who was adamant she could never live in the United States, so great was her malevolence for the country. Yet all it took was a cute American boy to get her to change her mind. In all religious faiths, no matter how seriously and sincerely the individuals take their beliefs, they all agree sin continues in their lives as they substitute the pleasures of obedience for the pleasures of the flesh. No matter what aspect of our life we treasure, the truth is some sell out at high prices, others at low ones — but everyone sells out at some price.

3.1 Trade-offs are Everywhere

The key to understanding substitution is to realize that we constantly make trade-offs in our life. If we want a nicer home in the country, we have to drive an old Honda Civic; if we want newer, more fashionable clothes, we have to give up eating at our favorite Chinese food restaurant every Friday. We want to get our homework done, but it's hard work with payoffs down the road, laziness has immediate rewards. To say that trade-offs are made everywhere is to say that nothing, when it comes to our actions, is sacred ... we are willing to sacrifice everything.

Most of the time our substitutions are innocent enough, and strictly a matter of personal choice. However, quite often when we trade-off one thing for another we hurt other people, and as a result we sometimes make promises not to substitute or we pay penalties for doing so. Consider the marriage vow to "forsake all others." This is a promise not to substitute another individual for your spouse. Of course, people cheat on their spouse all the time, but they do so with some penalty, and that penalty surely discourages some cheating. Note though that even though a married individual may not commit adultery, at the margin, they are constantly forsaking their partner for things like a golf game, time with the kids, or "girls night out." Substitutes are everywhere.

At a social level we often create institutions that try to limit the type of substitutions people make. Many laws are designed to restrict behavior and prevent us from substituting into choices that would hurt others. Traffic laws, for example, impose costs on trading speed for safety.

Although everyone makes trade-offs, it is important to understand that not everyone makes the *same* trade-offs. There was an old Rabbi and a Priest who played chess every Thursday for

many years. One day the Priest asked the Rabbi “have you ever eaten pork.” The Rabbi got a little uncomfortable and finally admitted he’d tried pork when he was younger. “But” said the Rabbi, “have you ever been with a woman?” The Priest became very uncomfortable, but finally admitted he’d been with a woman, when he was young, before he took his vows. “Ah” said the Rabbi, “it’s better than pork, isn’t it?” Priests and Rabbis are both religious men who make different trade-offs in their lives. Everyone has different preferences, and these manifest in different amounts of goods we’re willing to trade off. Some students are willing to buy this book; that is, they are willing to sacrifice consumption of other goods they could have had with the money. Other students are not willing to buy this book, which means they prefer the consumption of other goods. Everyone has different tastes or preferences.

3.2 The Fallacy of Priority in Consumption

How often have you heard comments like “Every Canadian needs adequate health care”; “Our freeway needs to be expanded to handle the increased traffic flow”; or “Unless new reserves of water are found, the current supply will not meet our needs.”? Each one of these statements contains the notion of *necessity* and each one ignores the concept of substitution.

To say that an individual “needs” something is to say that there is a priority in consumption and that an individual will not live if the need is not met. To have a priority in consumption would imply that individuals first satisfy their most important need (say breathing), then satisfy their second need (say eating), then their third (say housing), and so on until their income is exhausted or they run out of needs. Though common, such a view grinds against the way individuals actually behave. People desire many goods simultaneously and they generate utility from combinations of goods. Different combinations can generate the *same* amount of satisfaction. Like the logger who was convicted of killing and eating a seagull. When asked by the judge what the bird tasted like the logger replied: “Not bad, sort of a cross between a spotted owl and a bald eagle.”¹

Look around in the building you’re currently sitting in. Perhaps you’re at home, at school, or at the campus coffee shop. Safety is something that everyone values, but look around. How safe is the building you’re currently in? How many fire exits are there? If there’s one, why aren’t there two or three? The reason is that though safety is of value, other attributes of the building are of value as well. The building’s appearance, its ability to function, and of course its cost (the value of other consumption) are all important. No one designing a building considers only one aspect. The different parts of the building are traded off in such a way that the value of the building is maximized.

Trade-offs, trade-offs, trade-offs. This trait of human behavior is neither good nor bad in and of itself. It is simply a fact that every thing we desire, from love, honesty, beauty, truth, virtue, cars, wine, and song, are all substitutable ... at least at the margin.

¹ The actual combinations individuals consume depends on their preferences and on the prices they face ... but now we’re getting ahead of ourselves.

3.3 Marginal Value

An important idea that comes from the principle of substitution is *marginal value*. Marginal value (MV) is the maximum amount an individual is willing to sacrifice, or give up, in order to obtain an additional amount of another good. For ease of discussion we'll assume that the additional amount of the other good is one unit. Hence the marginal value is the maximum amount one is willing to give up of one good to get one extra unit of another good.

Marginal Value: *the maximum amount of one good an individual is willing to sacrifice to obtain one more unit of another good.*

Marginal values exist because people are willing to substitute one good for another. They are important because they provide a measure of value for goods. For example, if Sally is willing to give up 5 apples for one hot dog, then the marginal value of the hot dog is 5 apples. Notice that value is measured *in terms of other goods*. Value is a *relative* concept, and only has meaning in terms of one good relative to another. If Sally was willing to give up 7 bananas for one hot dog, then her marginal value of hot dogs, in terms of bananas would be 7.

In order to understand marginal value, we must understand the concept of *indifference* which was raised in the last chapter. Suppose Sally is offered two different bundles of goods, as shown in Table 3-1.

Sally		
	Apples	Hot Dogs
A	2	6
B	3	4

Table 3-1

Suppose that Sally tells us she is indifferent between the two separate bundles. By indifferent she means that she is willing to let anyone else choose which bundle she will consume. Suppose that Sally actually has bundle A (2,6). If Sally is to increase her apples to 3, what is the *maximum* number of hot dogs she is willing to sacrifice? The answer is 2, and this 2 is the marginal value of the third apple.

If Sally has a friend named Tamara who is indifferent between the two bundles in Table 3-2.

Tamara	
	Apples Hot Dogs
A	2 6
B	3 2

Table 3-2

It should be clear that the MV of the third apple for Tamara is 4 hot dogs. To the economist we would say that Tamara likes apples more, at the margin, than Sally because she is willing to sacrifice more to get an extra one.

Most of the time, when an economist speaks of marginal value, they say it is the maximum number of dollars one is willing to sacrifice in order to obtain the next apple, or whatever. This is only done for convenience. The dollars simply represent other goods and are not valued in and of themselves. As mentioned, value is based on sacrifices of real goods.

3.4 Exchange

Exchange or trade takes place every day in our lives. Often the trades are formal and legal, like when I fill up my car with fuel and have to pay the gas attendant. Other times the trades are very informal and not enforceable at law, like when I tell my son I'll take him to a movie if he helps me mow the lawn. Very seldom do two or more people get together when some type of trade doesn't take place. Even a conversation can be thought of in terms of an exchange. In fact, we tend to avoid conversations that are "one-sided"; that is, where no exchange takes place.

There are two big misconceptions about trade: trade takes place because one party has "too much" of something; trade involves exchanging items of "equal" value. Both of these statements are wrong. Trade doesn't take place just because someone has a surplus of something. If, as our first principle states, we're all maximizers, then it is unlikely that we ever think we have too much of anything. In my entire life I've never owned more than one car at a time, yet that hasn't stopped me from trading several of them. On the other hand, I've often had too many dandelions in my yard and yet I've never managed to trade any of them.

Trade does not occur just because someone has a surplus.

Likewise, trade never happens when individuals value goods equally. When people value goods equally, there is no point to trading. People engage in trade only when their *marginal* values are different. When marginal values are different, trade can make everyone better off.

Trade takes place when individuals have different marginal values

Let's consider another set of bundles of apples and hot dogs for Sally and Tamara — the ones shown in Table 3-3.

Sally			Tamara		
Apples	Hot Dogs	MV	Apples	Hot Dogs	MV
9	13		5	17	
		5			2
10	8		6	15	
		4			1
11	4		7	14	

Table 3-3

The table shows three bundles of apples and hot dogs for both Sally and Tamara, and as before, let's assume that Sally is indifferent between her three bundles, and that Tamara is indifferent between her three. Also, let's assume that Sally actually has the middle bundle of (10,8) and that Tamara has the middle bundle (6,15). Finally, note that the marginal value of apples in terms of hot dogs is listed for each.

If Sally and Tamara know one another, will they trade with one another? Since their marginal values at the bundle they are endowed with are different, the answer is yes, they will engage in trade. Sally and Tamara might come up with their own terms of trade (price), but to make matters easy let's assume that the price at which they can trade is 1 Apple = 3 Hot Dogs. This price is pulled out of the air, to help you understand the example, try another price.²

The first thing to note is that Sally has a MV for apples of 4, which means that she's willing to sacrifice up to 4 hot dogs to get one more apple. Since she can purchase an apple for 3 hot dogs, she certainly will try to increase her amount of apples. Tamara on the other hand, only has a MV for apples of 1 hot dog. In fact, the MV of giving up one apple for her is 2 hot dogs. Since she can sell an apple for 3 hot dogs, this obviously would appeal to her. In fact, Tamara will trade one apple to Sally in exchange for 3 hot dogs. This would leave Sally with a bundle of (11, 5) and Tamara a bundle of (5,18). Since Sally was indifferent between her starting bundle and the third one in the

² See if you can figure out the limits on the price such that each person is not made worse off because of trade.

table (11, 4), she is better off with the new bundle. Likewise, since Tamara was indifferent between her starting bundle and the first one (5, 17), she is also better off with the new bundle.

Mutual voluntary trade makes both parties better off.

Think about this result for a moment, because it is quite remarkable. Without increasing the total amount of goods available to consume, both people were made better off with trade. Why? Because they both valued the goods differently. The person with the higher marginal value for apples (Sally) got more apples, while the person with the higher marginal value for hot dogs (Tamara) got more hot dogs. Wealth was created in the form of a higher level of utility by rearranging the combinations of goods that each consumed. Furthermore, all that was required was for each person to know what they liked, and for a price to exist. No third party was required to make the exchange for the individuals, they were able to do it on their own.

The fact that mutual voluntary trade is beneficial to all parties involved is one of the most fundamental ideas in economics, and it is an idea that many people oppose very strongly. Have you ever heard comments like the following: if Canada exports logs to Japan, this is bad because it exploits our resources at home, but if Canada imports logs from say the United States this is bad because it creates unemployment in our forests. Or what about this: if Canada imports American TV programs this is bad because it destroys our culture, but if we export our cultural products to the US it is also bad because our product becomes Americanized and we lose our identity (eg. there are too many American hockey teams, its not a Canadian sport any more!). Sentiments like this simply ignore the fact that mutually voluntary trade makes both parties better off. Trade has costs, no doubt about it. When Sally trades with Tamara she had to give up three hot dogs. However, she gained an apple which was worth more. There's no point in just looking at costs when discussing trade. The benefits must also be considered, and more than this, we know that the benefits with mutually voluntary trade exceed the costs.

3.5 Summary

The second principle in economics is substitution. Though it is easy to admit substitutes exist, the relentless application of the idea to all goods is harder for some to swallow. Individual behavior speaks otherwise, however. In all things, important and un, we demonstrate our willingness to trade one thing for another. Nothing is sacred according to the way we act towards all things we value. From substitution we get the concept of marginal value: the maximum we are willing to sacrifice to obtain one more unit of a good. With the concept of marginal value we saw that trade takes place when these marginal values are different.

REVIEW QUESTIONS

1. In your own words, what is the principle of substitution?
2. When you go to a store and purchase something like a shirt, what are you substituting for what?
3. When you go to work, what are you substituting for what?
4. Is the principle of substitution related to the principle of maximization?
5. How is marginal value related to indifference?
6. Do people trade things of equal value? Is this fair?

PROBLEMS

1. At a local gym a fellow walks up to the equipment counter and asks “how much to rent a squash racket?” The girl behind the counter says \$3.50 per hour. To which the reply is “I can’t afford that.” What did the fellow really mean?
2. A poster of the leaning tower of Pizza reads: “Mediocrity: It takes a lot less time and most people won’t notice the difference until it’s too late.” Explain in terms of the principle of substitution.
3. Vancouver, like most cities in North America, is surrounded by suburbs. To get to the city commuters have to cross one of several bridges on relatively small freeways during the morning rush hour. It is constantly heard that the solution to congested traffic is to “have one more bridge” or “more lanes of freeway”. Yet, when one looks at the traffic in a town like Seattle where there are approximately the same number of people, but the freeway system is much larger, the rush hour times are similar. How is it that rush hour times are not reduced when freeway capacity is increased?
4. “Some goods are so necessary, there are no substitutes for them. Gasoline is one such example. No matter what the price people still have to travel to work.” What are some ways people substitute out of gasoline when the price increases?
5. School Boards throughout the province of British Columbia are being required to upgrade their buildings to withstand serious earthquakes. Do increasing the earthquake standards on school buildings necessarily make schools a better place? What are some things that are likely to be sacrificed by doing this?
6. “Anything worth doing is worth doing well.” Comment from an economic point of view.
7. The Boeing 767 uses less than 110 pounds of fuel per seat per 1000 miles. The older 727 uses 155 pounds. The Boeing 767 costs far more per seat to purchase, however. Which of the planes should an airline purchase if it is interested in efficiency? Does the price of fuel affect the answer?
8. Reintroducing wolves into Wyoming has led to reduced numbers of cattle, elk, and other animals. This is an example of what economic principle?
9. Complete the following conversation:

Kessel: When people say that they cannot afford something, they really mean that they prefer to buy something else.

Stigler: I can’t afford a battleship.

Kessel: You could rent one for a short period, say 10 microseconds.

Stigler:

10. Assume the following bundles of goods are given to John and Mary:

	John			Mary		
	Meat	Fruit	MV Meat	Meat	Fruit	MV Meat
a)	0	12		0	16	
b)	1	8		1	10	
c)	2	5		2	5	
d)	3	3		3	1	

- i) Calculate the MV of meat for both.
- ii) Assume that John and Mary are indifferent between their respective combinations a,b,c, and d, and that the price of one meat is three and one-half fruit. If both start at combination c, show how they both can be made better off by trading.

Review Question Answers

1. *Well, I don't know what your own words are, but mine are in the box on page 38!*
2. *You're giving up some money, in exchange for the shirt. Money is not valued for its own sake, however. That money could be used to purchase any other commodity. So, in fact, when you buy the shirt you're sacrificing some other good that has a price equal to the shirt.*
3. *You're giving up some leisure time for dollars. Again, the money is only an intermediary good, so you're really giving up leisure time in exchange for goods to be purchased with the income.*
4. *People could still be maximizers even if they were unwilling to trade one good for another. (Economists have a name for this type of idealized behavior: consumption in fixed proportions.) Likewise, someone might be willing to trade one good for another, even though they were motivated by something other than maximization. Thus the two principles are independent of each other.*
5. *We use the notion of indifference to calculate marginal value. To find marginal value we need to know what the maximum amount is you would sacrifice to obtain more of some good. But to find this, we need to know those bundles with which you are indifferent.*
6. *People trade when they value things differently at the margin. If the marginal values are the same, then they will not engage in trade. To trade things of different value seems "unfair." However, both people are made better off by the exchange, and that is the true measure of whether or not the trade will take place or not. As economists, we are not interested in what is fair or not, as if we could tell what is. Rather, we're interested in explaining behavior.*

Odd Numbered Problem Answers

1. *He really meant “I’m not willing to pay that much for a racket.” Everyone has access to \$3.50.*
3. *When a new lane is added to a freeway it lowers the driving time for a given amount of traffic. However, the volume of traffic never stays the same. If the commute time is lowered, there are fewer car pools and fewer people taking the bus which immediately adds to congestion. People in the suburbs might decide to start work in the city, surrounding municipalities decide to develop more subdivisions, and people move from the city to the suburbs as the freeway grows in size. The result is an amount of congestion practically the same as before the expansion.*
5. *Upgrading for earthquakes costs dollars that come from the school board budgets. Hence, a better protected school is one with fewer other resources like teachers, computers, and library books.*
7. *The efficient one critically depends on the price of fuel. The 767 only becomes profitable when fuel costs are high.*
9. *As I recall, Stigler said he couldn’t afford a battleship for a year. The point being, there are some things in life we literally can’t afford. Kessel though makes the good point that most of the time people confuse willingness and ability to pay.*

CHAPTER 4

THE LAW OF DEMAND

4.1 Diminishing Marginal Value

Think of something you really like. Perhaps you've fallen in love and you really like that person. When you first met your current "special person", do you recall how you'd do anything to spend time with them. Miss work ... no problem. Skip your brother's 12th birthday party ... he'll have other birthdays. Lie to your parents on where you're sneaking off to ... you've lied to them before. If you're like most people you are willing, and often do, make tremendous sacrifices to be with your new love.

Now, fast forward to the present. Perhaps you've dated for a year or two, perhaps you've even married your sweetheart. Do you still long to spend the same amount of time together? Are you sooooo willing to sacrifice time with your other friends, time at school, or time on your career, just to be with this one person? The answer is absolutely not. If you've never experienced this scenario, ask yourself if you're willing to sacrifice a lot to spend more time with your parents, your brother or sister, or someone else who you've spent much time with.

Perhaps love isn't your thing. If you're human though, one thing you'll be needing is some water. Everyone needs some water to survive, but most of the water we consume has nothing to do with survival. Any one stuck in a desert, or on a lifeboat in ocean, knows that when it comes down to having water for survival purposes, it is worth an incredible amount. For those who live in arid places like Arizona or New Mexico, there's enough water to live on, but driveways are swept and lawns kept to a minimum. In arid climates people value water at the margin more, and they use water-recycling gadgets, low flow toilets, water softeners for better washing, automatic faucets, and water is often charged for. For those who live in Vancouver, where there's water water everywhere and every drop can drink, water is treated as if it was worth nothing. Everything from cars, homes, and driveways get washed, kids run through sprinklers, hot tubs are refilled weekly, taps are left running, water is free in restaurants without asking, toilets use 5 gallons per flush, lawns are watered without restrictions, heavy industrial users of water move in, and leaks in the water system are not repaired.

This phenomenon holds for everything. The more you have of anything, the less you are willing to give up to get more of it. Economists call this *the law of diminishing marginal value*, and it is our third economic principle. Let's be a little more careful with our definition:

PRINCIPLE #3

Diminishing Marginal Value: *The maximum one is willing to sacrifice at the margin for a good, per unit of time, declines the more one has of that good — other things held constant.*

Let's take this definition apart a little. Notice the "maximum one is willing to sacrifice at the margin" is simply the definition of marginal value, so the definition says MV falls the more you have. The "per unit of time" part of the definition means that we're talking about a rate of consumption and not a total amount. For example, diminishing MV means the MV of eggs *per week* falls, the more eggs *per week* you consume. Finally, the "other things held constant" means that when the amount of the good increased, nothing else (like your income, other prices, preferences, ... nothing) changed. If we ignore the "other things held constant" caveat, then some obvious things become mysteries. On September 10, 2001 the price of a ride to the top of the Sears tower in Chicago cost \$12, and there was a line of people waiting to go up. On September 12, 2001 the price was lowered to zero. Yet, reportedly, very few people went up the tallest building in Chicago on the 12th. That seems puzzling until you remember the world changed a little on September 11th. So the law of diminishing marginal value is a very specific thing.

Thus far we have made three assumptions regarding the nature of human preferences: every one is greedy (maximization), everyone has their price (substitution), and everyone values a thing less at the margin the more they have of it (diminishing marginal value). From just these three principles we've already been able to draw several conclusions. First, we live in a world of scarcity. Second, voluntary exchange makes everyone better off. We're almost ready to discuss the really big implication of these ideas. However, before we can introduce demand functions, we need to make a slight detour and discuss incomes and prices.

4.2 (Real) Income and (Relative) Prices

We're going to make some very simple assumptions about incomes and prices in order to analyze choices individuals make. First, we're going to assume that people have fixed incomes, and cannot borrow any money from the bank to enhance that income. Second, we're going to assume there are only two goods: 1 and 2. The prices for these goods are known: p_1 and p_2 .

These prices, furthermore, are going to constitute the entire cost of goods 1 and 2. There are no additional time costs, no entry fees, or no costs imposed on or by third parties. Budgets and prices obviously constrain individuals on what they are *able* to consume. If someone says "I can't afford a new motor home," then they mean the cost is greater than their income. That's pretty obvious, but the phrase "I can't afford it" gets abused all the time.

One of the most important things to understand about economic decisions is that they depend on *real income* and *relative prices*. Real income is a measure of how many actual goods one can consume, and is given by the nominal income an individual has (just the number of dollars) divided by some type of price level. You are probably familiar with the consumer price index (CPI), which is a complicated index used to measure real income. For us, we're going to measure real income with a simple formula:

$$\text{Real Income} = M/p_2.$$

In this formula M is simply the number of dollars the consumer has, and is called the nominal income. For our price level, we're simply going to use the price of our other good, good 2. In measuring real income this way it becomes apparent the level of real income depends on the price index used. To use the real income measure above means real income is measured in terms of how much good 2 can be consumed. If we had calculated real income using the price of good 1 we would have measured it in terms of the amount of good 1 consumed. For example, if you have \$250 and

prices are $p_1 = 10$ and $p_2 = 5$, then real income in terms of good 2 is 50, and is 25 in terms of good 1. This means at most the consumer could consume 50 units of good 2 or 25 units of good 1. Real income is a measure of a consumer's purchasing power in terms of goods.

Economists are interested in real income because changes in it cause changes in behavior. Any Canadian is well aware of the fact that the Canadian dollar trades at about \$.63 for a U.S. dollar. That is, it only takes 63¢ American to buy one loony. Does this mean the standard of living is necessarily lower in Canada? Well, not generally. What we really need to know is the real income of a Canadian versus an American. The first thing one notices when looking at nominal salaries between the two countries is that often the Canadian ones are higher for a given occupation. But the prices in Canada are generally higher as well. If you live near the border, check out the price of Big Macs on either side. At the time of writing they are around \$3.80 Can and \$2.20 U.S. It's not clear which real income is higher.¹ If you live in one city and are considering a job in another, you don't just think about the salary the company is willing to pay you. You'll want to know about the cost of housing, food, and taxes in the new community. In other words, you want to know about the *real* income you'll face.

Nowhere is this more true than in the context of inflation. Inflation is an increase in the money supply relative to the amount of goods and services available in an economy, and it causes all prices to go up... including wages. In a pure inflation the prices of all goods might go up by 10%, but if incomes go up by 10% as well, no one is better off or worse off. Real incomes have not changed.

Relative prices are like real income in that they measure how many other goods one must sacrifice to obtain more of another good. We will represent relative prices by:

$$\text{Relative Price} = p_1/p_2.$$

In other words, we will measure the price of good 1 in terms of how much of good 2 must be given up. If the price of good 1 is \$15 and the price of good 2 is \$3, then the relative price is 5. That means, every time a person buys one unit of good 1, they could have purchased 5 units of good 2.

Like real income, economists are interested in relative prices because people respond to them rather than nominal prices. Again returning to the example of inflation, all prices since WWII have generally increased. A Chevy Nova in 1978 cost \$6000, whereas a similar car today costs around \$20,000. Given that all prices have increased, including incomes, it would not be correct to say that the amount sacrificed for the car has more than tripled.

A relative price is a physical exchange rate of one good for another. For convenience, prices will most often be denoted in terms of dollars. Hence a price of \$12 really means that \$12 worth of other goods are being exchanged for one unit of the current good. Unless otherwise stated, we'll assume that the price of good 2 remains the same. Hence any change in the nominal price of good 1 will mean that its relative price has changed as well.

¹ Truth be told, real incomes are higher in the U.S. The point, however, is that one simply cannot compare the nominal incomes across the two countries.

Behavior depends on Real Income and Relative Prices, not nominal income and nominal prices.

When people believe their behavior depends on nominal incomes and prices, rather than real income and relative prices, economists say they suffer from “money illusion.” They think their wealth has gone up or down because their nominal income has gone up or down. A humorous example of money illusion and real income is found in Mark Twain’s classic story *A Connecticut Yankee in King Arthur’s Court*, where the hero attempts in vain to convince a group of workers the difference between real and nominal values.

“In your country, brother, what is the wage of a master bailiff, master hind, carter, shepherd, swineherd?” The smith’s face beamed with joy. He said: “With us they are allowed the double of it! And what may a mechanic get — carpenter, dauber, mason, painter, blacksmith, wheelwright, and the like?” “On the average, fifty milrays: half a cent a day.” “Ho-ho! With us they are allowed a hundred! With us any good mechanic is allowed a cent a day! I count out the tailor, but not the others — they are all allowed a cent a day, and in driving times they get more — yes, up to a hundred and ten and even fifteen milrays a day.”

And his face shone upon the company like a sunburst. But I didn’t scare at all. I rigged up my pile-driver, and allowed myself fifteen minutes to drive him into the earth — drive him all in — drive him in till not even the curve of his skull should show above ground. Here is the way I started in on him. I asked: “What do you pay a pound for salt?” “A hundred milrays.” “We pay 40. What do you pay for beef and mutton — when you buy it?” That was a neat hit; it made the color come: “It varieth somewhat, but not much; one may say 75 milrays the pound.” “We say 33. What do you pay for eggs?” “Fifty milrays the dozen.” “We pay 20. What do you pay for beer?” “It costeth us 8.5 milrays the pint.” “We get it for 4; 25 bottles for a cent. What do you pay for wheat?” “At the rate of 900 milrays the bushel.” “We pay 400. What do you pay for a man’s tow-linen suit?” “Thirteen cents.” “We pay 6. What do you pay for a stuff gown for the wife of the laborer or the mechanic?” “We pay 8.4.0.” “Well, observe the difference: you pay eight cents and four mills, we pay only four cents.” I prepared, now, to sock it to him. I said, “Look here, dear friend, what’s become of your high wages you wee bragging so about, a few minutes ago?” — and I looked around on the company with placid satisfaction, for I had slipped up on him gradually and tied him hand and foot, you see, without his ever noticing that he was being tied at all. “What’s become of those noble high wages of yours? — I seem to have knocked the stuffing all out of them, it appears to me.”

But if you will believe me, he merely looked surprised, that is all! He didn’t grasp the situation at all; didn’t know he had walked into a trap, didn’t

discover that he was in a trap. I could have shot him, from sheer vexation. With cloudy eye and a struggling intellect, he fetched this out:

“Marry, I seem not to understand. It is proved that our wages b double thine; how then may it be that thou’st knocked therefrom the stuffing? — an I miscall not the wonderly word, this being the first time under grace and providence of God it hath been granted me to hear it.”

Well, I was stunned; partly with this unlooked for stupidity on his part, and partly because his fellows so manifestly sided with him and were of his mind — if you might call it mind. My position was simple enough, plain enough; how could it ever be simplified more? However, I must try:

“Why look here, Brother Dowley, don’t you see? Your wages are merely higher than ours in name, not in fact.” “Hear him! They are the double — ye have confessed it yourself.” “Yes, yes, I don’t deny that at all. But that’s got nothing to do with it; the amount of the wages in mere coins, with meaningless names attached to them to know them by, has got nothing to do with it. The thing is, how much can you buy with your wages? — that’s the idea. While it is true that with you a good mechanic is allowed thou three dollars and a half a year, and with us only about a dollar and seventy-five—” “There — ye’re confessing it again, ye’re confessing it again!” “Consound it, I’ve never denied it I tell you! What I say is this. With us, half a dollar buys more than a dollar buys with you — and therefore it stands to reason and the commonest kind of common sense, that our wages are higher than yours.”

He looked dazed; and said, despairingly: “Verily I cannot make it out. Ye’ve just said ours are the higher, and with the same breath ye take it back.” “Oh, great Scott, isn’t it possible to get such a simple thing through your head? Now look here — let me illustrate. We pay four cents for a woman’s stuff gown, you pay 8.4.0., which is 4 mills more than double. What do you allow a laboring woman who works on a farm?” “Two mills a day.” “Very good; we allow but half as much; we pay her only a tenth of a cent a day; and—” “Again ye’re conf—” “Wait! Now, you see, the thing is very simple; this time you’ll understand it. For instance, it takes your woman 42 days to earn her gown, at 2 mills a day — 7 weeks’ work; but ours earns hers in 40 days — two days short of 7 weeks. Your woman has a gown, and her whole 7 weeks’ wages are gone; ours has a gown, and two day’s wages left, to buy something else with. There — now you understand it!”

He looked — well he merely looked dubious, it’s the most I can say; so did the others. I waited — to let the thing work. Dowley spoke at last — and betrayed the fact that he actually hadn’t gotten away from his rooted and grounded superstitions yet. He said, with a trifle of hesitancy: “But — but — ye cannot fail to grant that two mills a day is better than one.”

“Shucks! Well, of course I hated to give it up. But alas, it didn’t crush. No, I had to give it up. What those people valued was high wages; it didn’t seem to be a matter of any consequence to them whether the high wages would buy anything or not.”

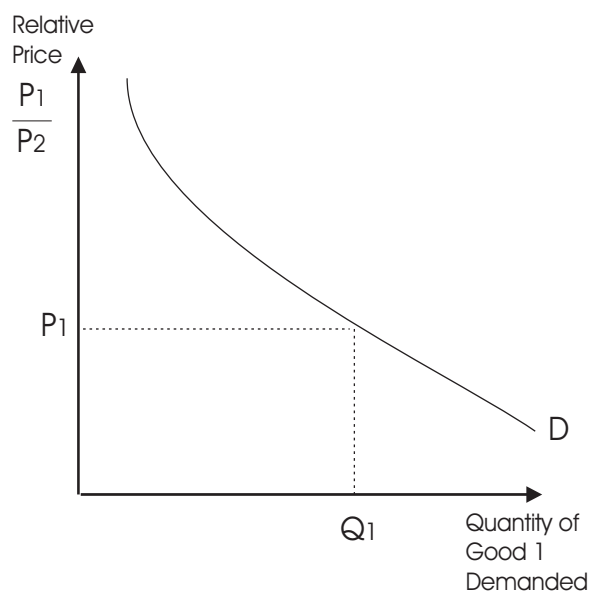


Figure 4-1
A Demand Curve

When the relative price of good 1 goes down, it means that for a given amount of real income, the opportunities to consume good 1 increase. Think about it. If you've got \$100 and goods 1 and 2 cost \$5 and \$4, then the maximum amount of good 1 you can consume is 20 units. If the price of good 1 falls to \$2, then the maximum amount of good 1 available to consume is 50 units. Now the question is, if the price of good 1 falls, and the amount a consumer is *able* to buy increases, will the consumer be *willing* to consume more? The amazing answer to this is yes, and this universal reaction to a change in price is called the Law of Demand.

4.3 The Law of Demand

The law of demand is, perhaps, the most powerful idea in economics. In this section I'm going to introduce you to the concept and discuss how it is related to diminishing marginal values, relative prices and real incomes, but the basic definition of the law of demand is pretty simple:

Law of Demand: *There is an inverse relationship between a good's price and the quantity demanded, other things held constant.*

The easiest way to proceed is to visualize what this relationship looks like. Figure 4-1 is a graph of a demand curve.

Notice that the relative price of good 1 is on the vertical axis, and that the quantity of good 1 demanded is on the horizontal axis. For convenience we'll often write the relative price simply as P , especially when referring to a specific price as in the graph, but keep in mind this is not a nominal price. Figure 4-1 has a demand curve that is not a straight line. Although the demand curve can take on any shape — as long as it is downward sloping — for additional convenience we'll often draw them as simple straight lines.

The law of demand states that there is an inverse or negative relationship between the price and quantity of a good demanded, but why is this so? Why is the demand curve downward sloping? It lies this way because of our three principles we've assumed thus far. A demand curve tells us the *maximum* amount someone is willing to spend for incremental units of good 1, other things constant. But this is, by definition, the marginal value, and we know that marginal value diminishes the more one has of good 1. Thus, the height of the demand curve is not just equal to the price, it is also equal to the marginal value, and the more of a good one has, the lower the marginal value is. This means that the demand curve must slope downwards.

As a consumer moves down their demand curve the process of substitution is taking place. When the relative price of good 1 falls, consumers use more of this good to generate utility for themselves. As they substitute into this good, they substitute out of other goods. Thus, when you go to the grocery store and you notice that mangos are only 25¢ each, you buy a lot of them and cut back on the seedless grapes and other fruits that haven't changed in price. This doesn't mean you stop buying other fruits, it just means that you buy less of them and more mangos.²

But there is more than just substitution going on with the demand curve. There is maximization! In Figure 4-1, when the price is P_1 , the consumer demands a quantity of Q_1 . Any less than this amount and the consumer's marginal value would have been higher than the price. Hence the consumer would want more. Any more than this amount and the consumer's marginal value would have been less than the price. Hence the consumer would want less. This means the price quantity combination (Q_1, P_1) is an equilibrium for the consumer — the consumer has maximized his utility by choosing Q_1 when faced with price P_1 . At this equilibrium it is true that the relative price of the good is equal to the marginal value.

A consumer is in equilibrium when Relative Price = Marginal Value.

To find the equilibrium quantity then is quite easy. For any given price you just draw a horizontal line until it reaches the demand curve. That quantity is the *quantity demanded* by the consumer when he faces that price.

² It's not always true that less of other goods will be consumed. More on this in the next chapter.

4.4 The Law of Demand is Everywhere

The law of demand is one of the most useful ideas you'll ever learn, and it explains so much of the world around us. For example, you've probably noticed that vegetables and fruit are cheaper when they are in season than when they are out of season. Why is that? The answer is the law of demand. When there is lots and lots of fruit around, every individual has a low marginal value of fruit. In order for farmers to get consumers to eat the extra fruit, it is necessary to lower the price. When consumer's face a lower price they consume more fruit because they maximize their utility by equating the lower price to their marginal value.

You may have seen the law of demand in action at local gas stations. Have you ever noticed how many cars line up for gas when there is a price war? When there is a price war the "price of gas today" is cheap relative to the "price of gas tomorrow." When consumer's face a lower relative price, they consume more, and there are line ups at the gas station.

You've probably seen the law of demand at work in department stores. Have you ever been in a K-Mart store when the "Blue Light Special" happens? A clerk with a flashing blue light on a high pole walks through the store. Where the clerk stops, those goods are marked down by some drastic amount. Usually there are so many people following the blue light one has to avoid being stampeded. If the law of demand didn't hold, we wouldn't observe mobs of people following the blue light promise of lower prices. In fact, imagine what the Blue Light Special would be like if demand curves were upward sloping: "Attention shoppers, follow the Blue Light, where it stops ... all prices doubled!" Not likely.

If you live close to the American border (and what Canadian doesn't), you might have noticed a change in your cross border shopping habits over the past ten years. In the late 1980s the exchange rate between the US and Canadian dollar was around 83¢. At that price many Canadians crossed the border to do grocery and clothing shopping. In fact, several shopping malls and gas stations were built just on the US side of the border to accommodate this shopping. However, over the last decade the Canadian dollar has depreciated considerably relative to the US dollar. At an exchange rate of 63¢, many fewer Canadians are willing to cross the border to do their shopping. A falling exchange rate is the equivalent to a rise in the price of US goods. Given the law of demand, when consumers face a higher price they reduce the amount they consume. After the bombing of September 11, 2001 security at the border crossings increased considerably. This led to longer crossing times. The increased waiting time is another component of the cost of US goods, and this increase in the wait further reduced the amount of shopping done in the US. All according to the law of demand.

Not all applications of the law of demand are so straightforward and obvious. Sometimes the law of demand can be very subtle. Several years ago in Seattle a grocery store called Tradewell launched an advertising campaign against its main rival Safeway. In the ad an interviewer approaches a customer coming out of the Tradewell store and inspects what groceries have been purchased. In the ad you can hear the interviewer mumble to himself "Okay, you've got a box of Corn Flakes, a dozen eggs, some lettuce, ... oh, some chocolate bars... etc." After doing this the interviewer says "Let's go over to Safeway and buy the *exact* same bundle, and see if the total bill is higher." Sure enough, the next clip shows the customer coming out of Safeway with the same bundle of goods and the bill is higher. No matter who came out of the store the result was always the same and the commercial always ended with the interviewer saying "and there you have it folks; Tradewell, where you always trade well for the lowest prices."

Now a skeptic might think the entire affair was simply staged. However, the experiment is actually a clever exploitation of the law of demand. When a consumer goes to Tradewell they face a host of different products and prices. The consumer has a demand for each good, and for a given set of prices they maximize their utility by choosing quantities of goods that set their marginal values equal to the prices they face. Given that every consumer is a maximizer, this process cannot be improved upon. This maximization process involves tradeoffs. If cream cheese is on sale at Tradewell the consumer substitutes into cream cheese, and away from goods that have higher prices. If chocolate bars are particularly expensive at Tradewell the consumer substitutes out of chocolate bars and into sweets with lower prices. Hence, when the customer comes out of Tradewell, the bundle of groceries is biased towards goods that were low in price at Tradewell. Assuming the prices of identical goods at Safeway and Tradewell are not identical (because of in-store specials and the like), if you force a customer to buy the Tradewell bundle at Safeway it *must* cost more.

Let's consider this case a little more carefully. Suppose the two stores each carry the same items and each have the same regular prices, with the only difference being that different items are on sale throughout the week. For example, both Tradewell and Safeway might carry Captain Crunch cereal for \$5 a box, but for one week Tradewell might have it on sale for \$3. Similarly Safeway might have meat on sale for \$8 a package, while the package costs \$10 at Tradewell, and a box of frozen peas might be \$9 at Tradewell, but only \$7 at Safeway. How could one ever tell which store has the cheapest prices?

For simplicity, let's suppose that the consumer has the same demand for each one of the goods, and that the demand is given by the simple function:

$$Q = 11 - P.$$

This equation means that if the price of Captain Crunch is \$5, then the consumer wants 6 boxes (11 minus 5). If the price of meat is \$8, then consumer wants 3 packages. Looking at Figure 4-2 we can see how much the consumer would demand at Tradewell and how much he would spend.

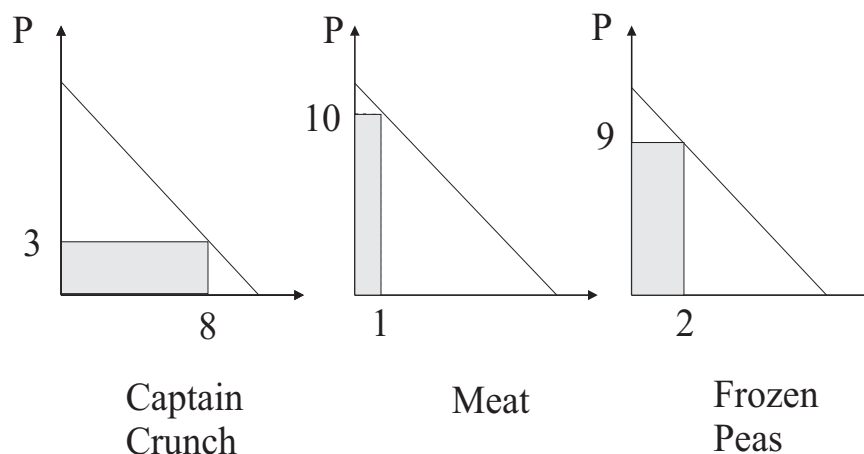


Figure 4-2
Prices at Tradewell

The shaded areas on the graph tell us how much the consumer spent on each good at Tradewell. For example, the consumer spent \$24 on Captain Crunch (3×8). Can you figure out how much the

consumer would have spent at Safeway? We can take the information from the graph and put them into Table 4-1.

TABLE 4-1

<i>Shopping at Tradewell</i>			
	Price	Quantity	Total Spent
Captain Crunch	3	8	24
Meat	10	1	10
Frozen Peas	9	2	18
Total Spent			\$52

<i>Shopping at Safeway with Tradewell Quantities</i>			
	Price	Quantity	Total Spent
Captain Crunch	5	8	40
Meat	8	1	8
Frozen Peas	7	2	14
Total Spent			\$62

When the consumer shops at Tradewell they spend a grand total of \$52, but when we force the consumer to buy the same bundle at Safeway the total expenditure shoots up to \$62. The reason is quite simple. At Safeway Captain Crunch is not on sale, yet we're forcing the consumer to buy as if it was. Likewise, the other two goods are on sale at Safeway, and yet we're forcing the consumer to ignore these lower prices. By compelling the consumer to not maximize, the consumer ends up doing worse.

The irony of this whole affair is that if Safeway did the same thing with their customers, they would have found total expenditures were always lower at Safeway. To check your understanding, work through the problem with the consumer shopping at Safeway first, and then force the consumer to shop at Tradewell with the Safeway bundle. Under this case the consumer spends \$82 in Safeway and \$84 at Tradewell. Obviously this is not a wise procedure for determining which store has the lower prices, but it is a great example of how tricky the law of demand can be.³

³ There is obviously a limit to how far the prices at the two stores can diverge before this experiment will not work. For example, if Safeway was giving its food away (that is, if every price was zero) then every bundle would be cheaper at Safeway. The Tradewell ad was relying on the assumption that prices at Safeway will on average resemble prices at Tradewell.

4.5 Direct, but Objectionable Examples of the Law of Demand

Although we experience the law of demand constantly in our daily lives, most non-economists are uncomfortable in applying it to everything. When the price of sugar goes up, everyone agrees that the consumption of sugar will fall, but what if the good in question is gasoline, insulin, or sacred native territory?

We often hear people say gasoline is a necessity. “How could consumers use less gas when the price goes up? It’s a necessity!” Yet when gas prices increase, consumers have no problem consuming less gas. They car pool, use the car less often, buy a smaller car, move from a two car to a one car family, take the bus, purchase a motor cycle, get a push lawn mower, stop washing their hands with gas, stop starting fires with gas, convert to solar power, and on and on.

Gasoline is something we might consider essential until we take a closer look at our own driving habits, but what about the case of insulin? Insulin is a miracle drug for people who suffer from diabetes, a condition where a pancreatic hormone for regulating sugars is lacking in the body. Diabetics need insulin to live, but the amount of insulin required is not fixed, and is still subject to the law of demand. There are many things a diabetic can do to help their condition. Changes in diet and the combination of different foods, for example, can alter how much insulin is needed. Exercise and weight loss are important factors in controlling insulin resistance. And reducing stress also alleviates some of the diabetic problems. Dieting, exercise, and avoiding stress are things that take time and effort. If insulin is cheap, the diabetic will use insulin as a substitute for these activities. As insulin becomes more expensive, the diabetic will use less insulin and substitute into different meals, sports, and occupations. As a result the law of demand holds for a drug like insulin, just like it holds for gasoline. The same holds for every other type of good you can imagine.

Essentially, to deny the downward slope of the demand function is to deny the principle of substitution. For every good there is a substitute, which means when the price of something goes up, people substitute into other goods that provide utility at lower relative prices. Substitutes are everywhere, and so demand curves are always downward sloping.

Still, many people are not convinced. What would the law of demand say about mandatory seat belt laws? If a seat belt lowers the drivers chance of getting hurt in an accident, then there should be more accidents! “Wait” you cry. “No one wants to get into an accident.” Of course not. But everyone wants to get places faster and listen more to the music on the radio than pay attention to the car at the next intersection. As objectionable as it strikes us, the truth of the matter is that when seat belt laws are introduced there are more accidents, more passenger injuries, and more pedestrians hit. Lowering the cost of driving poorly, leads to more poor driving. If you don’t agree with this, consider the following thought experiment: how safely would you drive, if instead of the nice airbag in your car, there was a 6 inch dagger coming out of the steering wheel, pointed right at your chest? Sobering thought, isn’t it?

The list goes on and on. In over 30 of the United States, individuals are able to carry a concealed handgun and use it in their self defense. The individuals with weapons have to be trained, acquire a permit, and cannot have a criminal record. Survey results show that these weapons are pulled out (not necessarily shot) about 2 million times each year to prevent crimes. The number of individuals in any given state that actually apply for a weapon is quite small, between 2% and 4%. However, even with this low take up rate the effects are quite large. It turns out that violent crime rates fall with the introduction of right to carry laws. Murder rates in these states fell by 8%,

rape by 5%, robbery by 3%, and aggravated assault by 7%. Interestingly, for crimes that involved stealth, such as burglary, crime rates increased.

The reasoning is just based on the law of demand. If a criminal is going to engage in an activity where he or she now stands a slight chance of running into a weapon, the cost of crime increases dramatically. Given the small number of individuals that actually carry a weapon, it might seem unreasonable that there should be such a large effect on crime. However, what if you knew that the chance of a serious car accident was 2%? That is, in the next 50 times behind the wheel, you would probably be involved in a serious accident that might kill you. No doubt you would stop driving. Unlike driving, the benefits to most crimes are not very high. Hence it is not unreasonable that the effect of the law should be so large. Also note the fact that criminals substitute into crimes of stealth where they are less likely to run into people, suggests that even criminals act according to our principles.

One additional finding is worth noting. Concealed weapon laws had a much larger impact on protecting women than men. When an additional woman carries a concealed hand gun it reduces the murder rate by about 3 to 4 times more than when an additional man carries a concealed handgun. This no doubt reflects the larger marginal gain of a hand gun to a woman than to a man. Criminals prey on those they think will be the easiest victims. Robbing an elderly woman is much easier than taking on a large adult male. The marginal benefit of women carrying weapons, then, is much greater.

All of this is simply a direct implication of the law of demand. However, many people find the suggestion that more guns can lead to less crime verging on insanity. Still, let's push the implications of the reasoning even further. After the terrorist attacks of September 11, 2001 there was a tidal wave of suggestions on how to improve the safety of airlines. Sky marshalls were suggested. But given the hundreds of thousands of flights each day, it was quickly realized that the employment of so many marshalls would have a prohibitive cost. Locking the pilots in the cabin has been suggested. But the problem is that the promise to not open a locked door, when a flight attendant has their life threatened, is not very credible. More security has been added to airports, but spot testing has already shown this to have little effect. What would be a cheap, effective deterrent?

What would happen to a hijacker's ability to take a plane if a random and unknown 2% of the passengers were licensed to carry a concealed hand gun? Suppose the guns were designed such that they wouldn't pierce the plane's envelope. The answer is that the plane would probably never be taken over. The only way a small group of people can hold a large group hostage is to exploit each individual's personal desire to live. The hijackers simply let the crowd know that the first person to attack them will die, and no one wants to be the first person. However, when the first person is armed with a weapon of their own, and have the element of surprise on their side, it is difficult to see how the hijacker could win. At the very least, policemen and other individuals we allow to carry weapons all the time should be allowed to carry their weapons on board. In fact, they should fly for free! Such a policy would seem to raise the price of hijacking so much there should be no hijackings. Yet, try to make this suggestion at your next social gathering and see how people start to move away from you. The law of demand often has direct, but unpopular implications.

4.6 Indirect Evidence for the Law of Demand

The famous investments of the Hunt brothers during the late 1970s in an effort to corner the

silver market is an interesting case of indirect evidence for the law of demand. In the summer of 1979 the price of silver was \$8/ounce. Throughout the 1970s a wealthy Dallas oil man Nelson Bunker Hunt and his brother William Herbert had been accumulating silver, and by the summer of 1979 had control of 42 million ounces. Beginning in the fall of that year, the price of silver began to rise sharply, and by January 1980 the price of silver was an unprecedented \$50/ounce. The Hunt brothers, by this time had gained control of 280 million ounces of silver — equivalent to the annual world silver production. On the surface, the Hunt brothers look like an exception to the law of demand — as the price increased, the quantity of silver they demanded increased. In fact, the Hunt brothers were just an example of behavior commonly known as speculation. Is speculation a counter example to the law of demand?

It turns out that speculation is a nice example of downward sloping demand curves. Recall that demand depends on the relative price (p_1/p_2), not the nominal price. With speculation the two prices that matter are the price today and the expected price tomorrow of the good in question. In the case of the Hunt brothers, they were not so much concerned with the price of silver on a given day, but what they thought the price would be in the coming weeks. We might think of the relative price as: $P_{\text{today}}/P_{\text{tomorrow}}$. If the price of silver today is \$8, and you expect the price tomorrow to be \$8, then the relative price is 1, and a certain amount of silver is demanded today. But if the expected price of silver tomorrow is \$50, then the relative price today is $8/50=.16$. Silver is an absolute bargain today and the quantity demanded today increases. Just as shown in Figure 4-3.

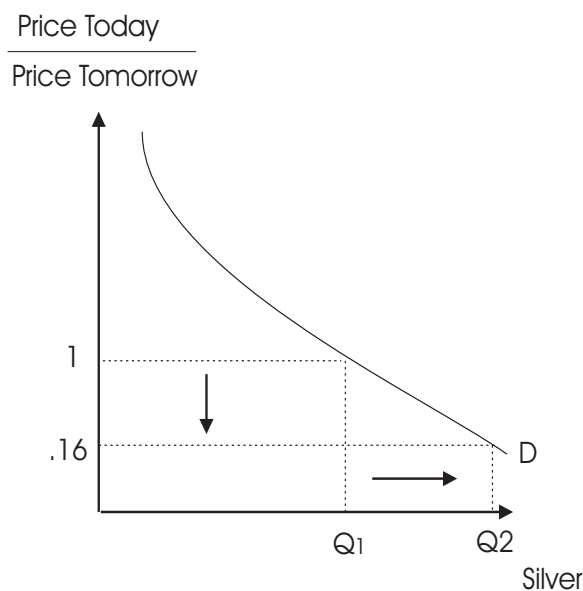


Figure 4-3
Changes in the Relative Price of Silver

A speculator is by definition someone who thinks the price tomorrow will be higher than the price today. Thus when the price of silver rises today, but the investor thinks it will rise even more tomorrow, then the relative price today actually falls! Given the law of demand, the speculator should buy more today. Rather than being a counter example to the law of demand, the Hunt brothers are actually a testimony to it.

An even more subtle example of the law of demand is called the Alchian-Allen theorem, after the two economists who first articulated it. Suppose there is a commodity called leather sandals made in Spain, which can be broken down into two goods: high quality sandals, and low quality sandals. In Spain the high quality sandals sell for \$10, while the low quality ones sell for \$5. In other words, the relative price in Spain of high quality sandals is 2 pairs of low quality sandals. Further suppose that in order to ship the sandals to North America it costs \$10/pair independent of the quality. The relative price in North America is now $20/15=1.33$. Now the relative price of high quality sandals is down from 2 to 1.33. As Figure 4-4 shows, the law of demand predicts that there will be a higher proportion of good sandals relative to bad sandals consumed in North America than in Spain.⁴

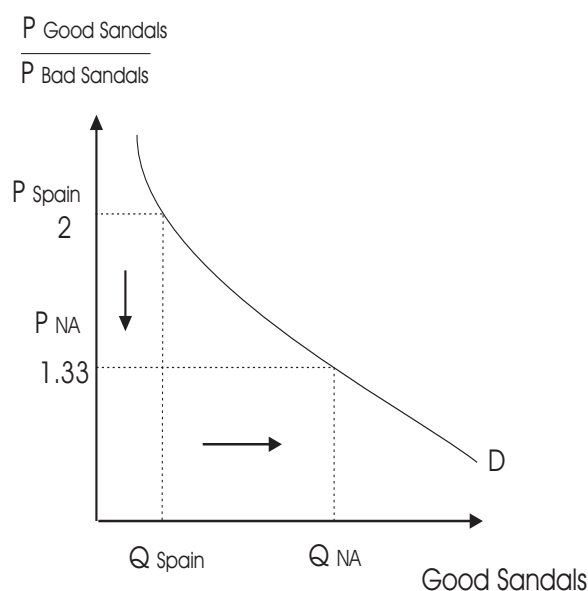


Figure 4-4
Transportation Charges and the Demand for Good Sandals

This is a remarkable result and holds for all goods that are traded over large distances. In fact, the Alchian-Allen theorem is often called “shipping the good apples out” because of the observation that the better apples grown in the Pacific Northwest find their way to distant parts of North America that do not grow apples. In general, the foreign place consumes less of the good, but a higher fraction of their consumption is of high quality. Many examples of this relative price effect abound: Alaskans eat less beef than Texans, but more of it is deboned; Canadians drink less French wine than the French, but the proportion of expensive wine is higher; New Yorkers consume fewer grapes than Californians, but they consume a higher proportion of high quality grapes; and on and on. Essentially what is happening is consumers are substituting into the relatively cheaper

⁴ A further implication of the law of demand comes from the relative consumption of other goods to sandals. Since both types of sandals are more expensive in North America relative to other goods, North Americans should consume fewer Spanish sandals than people in Spain.

commodity, even though both goods are becoming more expensive. The critical lesson here is that moving up and down a demand curve involves substitution.

A fixed charge applied to a high and low quality good, lowers the relative price of the high quality good, and results in a higher relative consumption of the high quality good.

This result of a change in relative prices goes beyond mere transportation charges. Whenever there is a fixed charge added to two separate prices, it lowers the relative price of the high quality good. Hence couples with children go out less often, but to more expensive events, than similar couples without children because they must pay for a baby sitter and the baby-sitting fee is independent of where they go. For example, suppose there is a discount movie house that charges only \$1 per show, and a first run movie theater that charges \$8 per show. Before a couple has children, the relative price of the expensive theater is 8. That is, the couple sacrifices eight low quality movies for every high quality movie they see. Once the couple has a child they must pay a baby-sitting fee which is independent of the type of movie they attend. If the baby-sitter charges \$20 for the evening, then the relative price of the two types of entertainment becomes $28/21 = 1.3$. Now the relative price of the expensive movie falls a great deal. Instead of giving up eight low quality movies, they essentially give up one. Faced with this choice, the couple will substitute into the higher quality of entertainment. Because both prices have gone up, however, the couple will demand less movies overall.

As with transportation charges, the number of examples one can imagine that involve fixed charges is only limited by your imagination. For example, nice homes are built on expensive lots rather than cheap ones because the fixed lot cost lowers the relative price of the expensive home, gold bindings only go on hardback books not paperbacks because the fixed printing cost lowers the relative price of the hardback book, and tailored suits use more expensive cloth than suits sold off the rack because the fixed tailor fee lowers the relative cost of the expensive cloth. All are examples of changes in relative prices brought about by fixed charges, and how these bear on the law of demand.

You might be wondering, if the high quality items tend to be shipped out, why do you have to go to Maine to get a great lobster, or Vancouver to get a great salmon? The answer, of course, is just the law of demand once again. It doesn't really matter if the salmon gets shipped to you, or you get shipped to the salmon — there is still a fixed transportation charge. Let's suppose that you are traveling from Chicago to Vancouver for the sole purpose of sitting down at the Pan-Pacific Hotel dining room and eating the best salmon in the house. Suppose there are two Salmon prices on the menu: high quality, costing \$50, and low quality costing \$25. Suppose also your travel costs are \$1000. The relative price for you of the good salmon is $1050/1025$. The relative price for a local Vancouverite is 2. Since your relative price is extremely close to one, you buy the expensive salmon. Now you know the reason why travelers often return home boasting about the food on their adventures.

4.7 Total Value vs Marginal Value

If the height of the demand curve at a given quantity is the marginal value, then the area under the demand curve up to that quantity must be the *total value*. For example, if the consumer is willing to pay \$12 for the first apple, and \$10 for the second apple, then the value of two apples would just be the sum of \$22. Consider Figure 4-5, where we'll think of marginal value in its discrete form: the value of each additional apple. Notice in this figure the labeling on the vertical axis is simplified to P_1 rather than the relative price.

Total Value: the maximum amount one is willing to pay for a given quantity rather than have none at all.

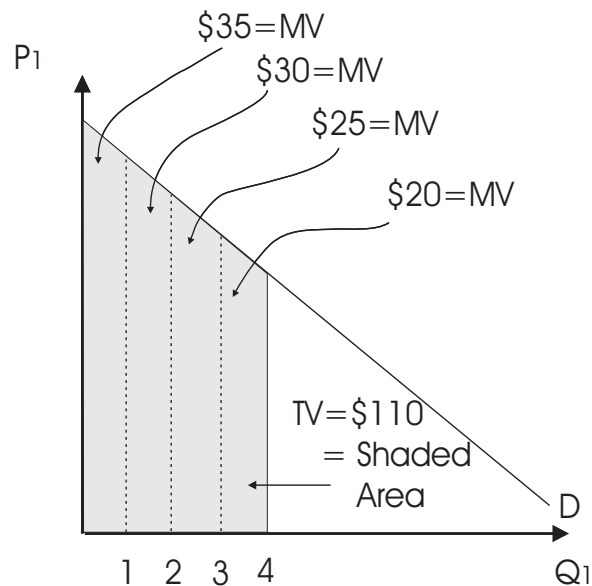


Figure 4-5
Marginal Values and Total Values

In Figure 4-5 the consumer is willing to pay \$35 for the first unit of good 1. This means that the marginal value of the first unit is \$35. For the second unit the consumer is willing to pay \$30. This means that in order to go from having one unit to two units the consumer is willing to pay an additional \$30. However, it also means that the consumer is willing to pay \$65 for two units, rather than have none at all. The \$65 is the consumer's *Total Value* of two units. Notice that the marginal value continues to fall the more the consumer demands. For the third unit the marginal value is \$25, and the fourth unit only has a marginal value of \$20. However, the total value continues to rise: \$90 for three units, and \$110 for four units. The total value for 4 units is shaded in Figure 4-5. This inverse relationship between marginal and total value is a fundamental property of demand curves.

There is an inverse relationship between total value and marginal value.

Total value is just the sum of all the marginal values, and is graphically represented as the area *under* the demand curve. The difference between marginal and total value explains a number of paradoxes that arise in life over the ambiguous use of the word value. For example, a 19th century paradox of value arose from the observation that falling grain prices always accompanied a bumper grain harvest. If more grain is always better, why did the price fall, indicating that consumers valued the grain less? The answer, of course, is that more grain increases the total value, but lowers the marginal value. Since prices equal marginal values, not total values, the prices also fall.

This is what is commonly known as the water-diamond paradox, after a stylized example. Water is necessary for life while diamonds are of only minor importance, yet water is generally very inexpensive and diamonds are pricey. Similarly, you may have noticed that at various times Coca-Cola sells for two to three times the price of gasoline, yet most of us think that gasoline is more valuable than Coke. Once again, we see an abuse of the term value. As shown in Figure 4-6 where the total value is the shaded area, gas has a high total value and a low marginal value, while Coke has a high marginal value and a low total value. If people were given the choice: you must give up either gasoline or coke, they would certainly abandon the latter.

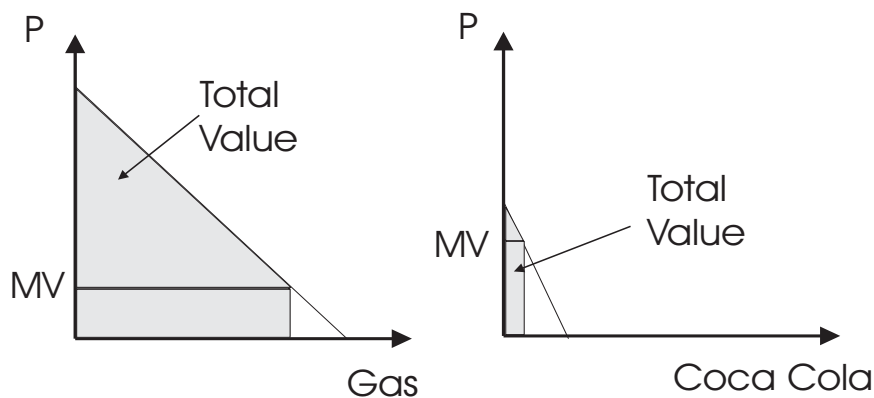


Figure 4-6
The Gasoline / Coca Cola Paradox

The difference between MV and TV has a number of daily personal applications. Have you ever had a near fatal experience? Perhaps you had a serious car accident or a close friend or relative almost died? At those times many people sense a reevaluation of the things they value, and express sentiments like “it really makes you appreciate what is important in life.” People make vows to spend more time together, take time off work, smell the roses, etc., and yet when the tragic moment passes, they tend to live as they always did. What is going on?

The answer lies in the difference between MV and TV. Most of our lives are spent at the margin. We divide our time and income up and we choose to spend an hour here, a dollar there. Thus it is natural for us to often think about values in terms of marginal values because in choosing optimal quantities we set MVs equal to prices. In tragic moments though, when a child suddenly disappears, your parents are caught in a house fire, or life flashes before your eyes, you are faced with an all or nothing situation. Now you have to make decisions based on total values, not marginal ones. Things, like children or parents, that had high total values and low marginal values become much more important than they were before. When life returns to normal, we again go about our days making marginal decisions.

One final point to be made about marginal values is that they tend to equalize across people and goods when prices are equal. Figure 4.7 shows the author's demand curves for old Seinfeld episodes and The Simpsons. Each show takes thirty minutes and plays at approximately the same time of day, so for the sake of argument the price in terms of hours is equal across the two shows. Given the cost of watching the shows, I watch 12 hours of Seinfeld each week and 1 hour of the Simpsons. Clearly I have a higher total value for Seinfeld because the area under the demand curve for Seinfeld (up to 12 hours) is larger than the area under the demand curve for the Simpsons (up to the 1 hour). But notice that the marginal values of each show (the height of the demand curves at 12 and 1) are equal. As long as the MV of a Seinfeld episode is greater than its price, I'm better off consuming an additional episode. The same is also true for Homer and his family. The optimal amount to watch is determined when the relative price equals the marginal value. Since the price is the same for both shows, the MV for each show is equal, which means that at the margin I'm indifferent between the two shows. This equalizing across the two margins is the result of maximizing behavior and occurs for the same reason that the speed of traffic across the lanes on a highway tend to equalize. Can you see why?

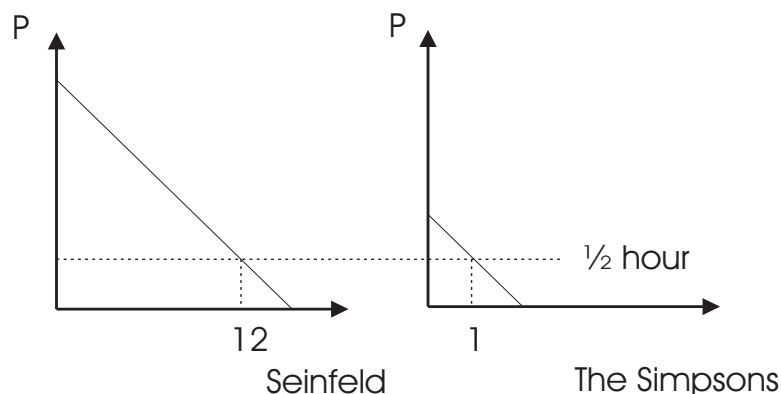


Figure 4-7
Equal Marginal Values When Costs are the Same

4.8 Total Expenditure and Consumer's Surplus

If the area under the demand function is the total value a consumer places on a good, then we can divide this area into two parts. Consider Figure 4-8, which simply repeats Figure 4-1. When

the consumer buys a quantity of Q_1 at a price of P_1 , he spends an amount of $P_1 \times Q_1$. This amount is equal to the consumer's total expenditure — it's how much the consumer spends, and is equal to the boxed area on the graph. On the other hand, if the area under the demand curve is how much the consumer is *willing* to spend, and the bottom shaded rectangle is how much money the consumer *has* to spend, then the difference between these two is the “surplus” the consumer gets from consuming. This consumer's surplus is the triangular area above the total expenditure.

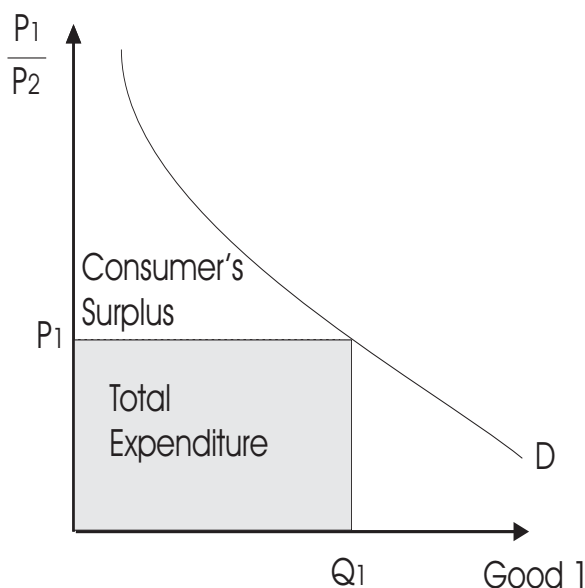


Figure 4-8
Consumer's Surplus and Total Expenditure

For example, suppose you want to buy a motorcycle, let's say the new Yamaha V-Star cruiser. If you're like my friend Mike you might be willing to pay \$8000 for such a bike. The \$8000 is the total value of the bike to Mike. However, the bike only sells for around \$6000. If Mike buys the bike, his total expenditure is \$6000, and his consumer's surplus is \$2000. That \$2000 represents how much better off Mike is from buying the bike rather than not having it at all. In other words, the consumer's surplus is a measure of the gains from trade to the consumer. As such, it is a very valuable tool for assessing various issues involving trade, and it is something we will use over and over again.

One application of consumer's surplus can be found in the Tradewell/Safeway example. Recall what's at issue is which store offers the better prices. The experiment conducted by Tradewell failed to determine an answer, but one solution would be to examine the total consumer's surplus at each store. Figure 4-9 shows the demand for each good, along with their prices and consumer's surpluses at each store.⁵ The consumer's surplus at Tradewell is \$34.50, while at Safeway it equals \$30.50. Thus we see that Tradewell does offer the better deal overall.

⁵ Recall these demand curves come from the equation $Q = 11 - P$. We're just assuming this simple demand curve applies to all three goods for simplicity. Having complicated demand

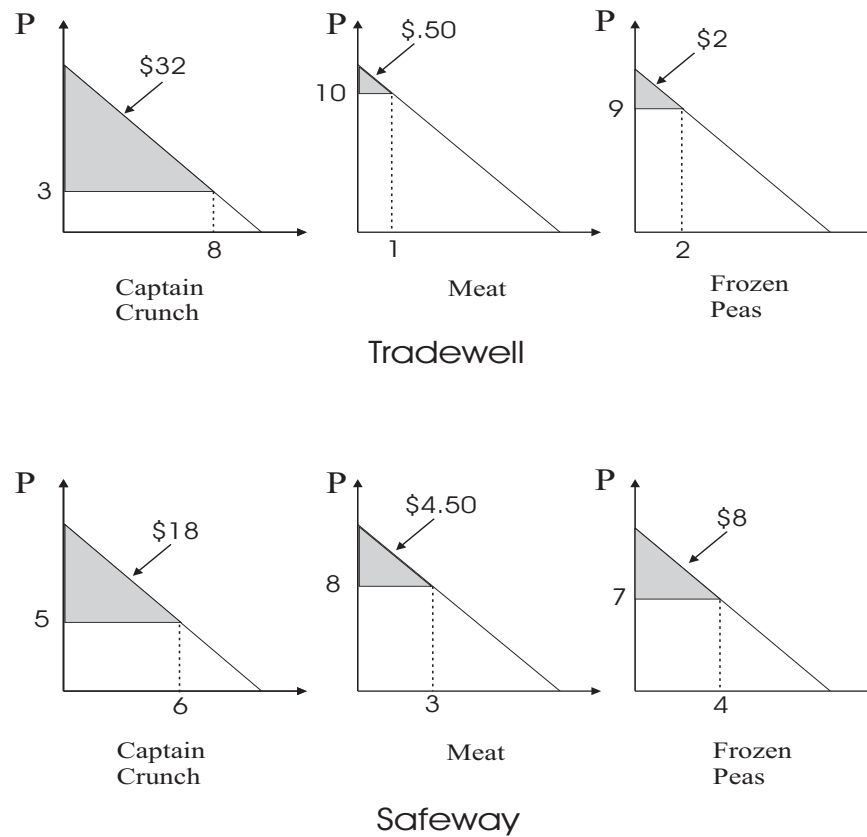


Figure 4-9
Consumer's Surplus at Tradewell and Safeway

4.9 Summary

This chapter has introduced you to the *law of demand*, one of the most significant ideas in all of social science. The law of demand, with its simple, intuitive relationship between prices and quantities, has many subtle and strong implications. Like the principle of substitution, the law of demand applies to anything people value. Furthermore, as we saw with speculation and shipping the good apples out, the law of demand has many indirect implications as well. Throughout the rest of the book we will use the concepts of this chapter many times.

curves, or different demand curves for each good would be more realistic, but it wouldn't change the fact that the best way to determine which store has the better prices is to use consumer's surplus.

REVIEW QUESTIONS

1. Tom is talking to Emily: “Yesterday I went to a movie and the price was \$13. Do you know I have to work 1.5 hours to pay for that movie, and I could have bought a t-shirt with that money.” Identify the nominal price, the relative price, and the real income in this statement.
2. If the price of American dollars falls relative to the Canadian dollar do more Americans or Canadians cross the border to shop?
3. Suppose an individual’s demand for potato chips is given by the equation: $Q = 35 - 5P$. What is the quantity demanded when the price is \$10, \$7, \$6, and \$3?
4. From question (3), if the price was \$3, what would be the total amount spent on potato chips? What would be the consumer’s surplus? What would be the total value?
5. Is it inconsistent for a parent to yell at their child to “stop bugging them” one minute, but then get upset if the child goes missing the next?

PROBLEMS

1. "Water is so precious for life, and without it everything dies. Therefore, we must treat it with care and look after it. Unfortunately, we abuse water. We waste it watering our lawns, flushing out toilets, and washing our cars." If water is so valuable, why are we so frivolous with it?
2. Children are fond of asking parents "What's your favorite 'blank'?" Where they may be asking about a color, television show, or morning cereal. What notion of value are they implicitly using? If you ask a child, however, what is their favorite toy, friend, or parent(!), they often say "all of them are my favorite". What notion of value are they using in this answer and why would they give this answer?
3. Suppose that a large company owns an underground parking lot that has spots currently worth \$200/month. Initially the company provides the parking for free to its employees with the condition that they are not allowed to sublet the spot. After a change in management, the company removes the free parking privileges and charges the employees \$200/month for the spot. If there are only two types of cars (good cars that rent for \$1000/month and bad cars that rent for \$500/month), what would you predict would happen to the average quality of car parked in the lot after the increase in fee?
4. What does the law of demand predict will happen to the number of abortions when abortion is made legal? How would you respond to the comment: "the law of demand doesn't apply to desperate women seeking an abortion."?
5. In the 1970s the United States adopted a policy to reduce speed limits to 55 miles per hour on its freeways in order to save fuel. Speed limits on secondary roads were not changed. If we think of the cost of using different roads simply in terms of the amount of time it takes to get from point A to B, what did this policy do to the relative price of using freeways versus using secondary roads? Driving on freeways is much safer than driving on a secondary road. What impact do you think the 55 mph speed limit had on the overall death rate from car accidents in a given state?
6. Every country in the western world has some type of safety net system to help the poor. In creating such laws it is necessary to define who the poor are. In an effort to obtain the money in such plans, what types of substitutions do you think will be made by some individuals if the poor are defined as:
 - a. individuals with an income less than \$13,000.
 - b. single parents.
 - c. blind people.
7. Provide a law of demand type explanation for why urban families have fewer children than rural families.
8. Why do you think women and seniors are more likely to participate in volunteer activities like churches, the red cross, and fraternal societies, than men and people under 65?

9. Most life insurance policies are void if the policy holder commits suicide within a short time of obtaining the policy. These probation periods are usually either 12 or 24 months. How many months after a policy has been taken out do you think coincide with the highest for number of suicides? Which number of months do you think have the lowest?
10. We often hear expressions like “free to choose”; economics is often called “choice theory”; in religious circles there are debates about “freewill”. Given our basic principles of economics would you say that individuals have freewill? How would you reconcile this with the following quote from a national newspaper regarding the sensational Lorena Bobbit marriage case: “Lorena Bobbit had no choice but to cut off her husband’s penis. She was abused from the beginning of the marriage, and enough was enough.”
11. “It wouldn’t matter if you raised the price of gas to \$5 per gallon, consumption of gas would not change, because people need gas.” Does this make any sense? Use a graph in your answer.
12. British Columbians have the highest per capita use of real Christmas trees than any one else in North America. The head of the Christmas Tree Grower’s Association says this is due to “our love of real trees”. What is a better explanation
13. The ancient mariner said “Water, water, everywhere, and all the boards did shrink. Water, water, everywhere, nor any drop to drink.” (For those of you who don’t know, the mariner was on the ocean.) Would there have been a water-diamonds paradox for the ancient mariner? Explain.
14. When I lived in Seattle I attended the University of Washington Husky football games regularly. Now that I live Vancouver B.C. (100 miles away), what do you think has happened to (i) the quantity of live Husky games I attend and (ii) the quality of seat I now sit in? Briefly explain your answer.
15. It has been reported that Canadians on average spend more money on perfume than they do on post secondary education. Would this mean that Canadian’s value perfume more than education?
16. In Spain good sandals cost \$6, while cheap ones cost only \$3. Spanish sandals, however, are subject to a \$12 duty and shipping fee when brought into Canada. Predict the relative consumption of good and cheap sandals, here and in Spain. What about the relative consumption of sandals to other goods, here and in Spain?
17. At some public hearings over their decision to allow various firms to use “dirty” fuels, like coal, as a substitute for natural gas. At a hearing a spokesman for the Canadian Lung Association got up and said “When you can’t breath, nothing else matters”. In what sense was this person confusing marginal and total value. Draw a graph to explain your answer, and be careful to indicate what is on the demand curve.
18. It is often observed that when a “war on drugs” takes place, the number of deaths by overdose increases. How is this a subtle implication of the law of demand?
19. Fact number one: the price of gas throughout most of the 1990s was about \$2 per gallon; in 1980 the price was about \$1.20 per gallon; and in 1972, the price was about 40 cents per

gallon. Fact number two: in the 1970s there was a massive movement towards small cars with four cylinder engines (Pintos, Hondas, Toyotas, etc.). Fact number three: in the 1990's there was a large movement towards larger vehicles with six and eight cylinder motors (eg. SUVs, Vans, Suburbans, etc.). Why would there be an increase in the demand for large gas consuming vehicles when the price of gas increased? Make sure this answer can also explain why there was a move towards small vehicles in the 1970s.

20. Suppose that in 1985, the prices of steak and potatoes were, respectively, \$3 and \$.50 per pound. In 1995, after some inflation, the prices became \$4 and \$.60, respectively. Other things equal (including a person's inflation-adjusted, or "real" income), how would you expect this person's consumption of steak and potatoes to have changed?
21. I get paid, like most people, once every two weeks. Like most people, I spread my income around so that I consume about the same everyday. I don't go from "feast to famine". Using the appropriate graph, show why this behavior is consistent with economic principles.
22. Prior to unleaded gasolines all cars used leaded gas, with the more expensive gas containing more lead. It turned out that lead was a major pollutant, and in the 1960's, in an effort to mitigate pollution a tax of \$.10/gallon was placed on all gas in the hope that it would reduce the level of gas consumption and lower the amount of pollution. Can we say, unambiguously, that such a tax would lower pollution from leaded gasoline? Why or why not?
23. Joe's, and poor student, has a demand for meat given by

Price	12	11	10	9	8	7	6	5	4
Quantity Demanded	1	2	3	4	5	6	7	8	9

In the market place the price of meat is \$8. However, the government has introduced a "meat stamp" subsidy program for students. Students can purchase \$1 of meat stamps for \$.50. Each student is limited, however, to how many meat stamps they can buy. At most Joe can buy \$80 worth of meat stamps (for \$40).

- a. Assuming Joe cannot trade meat and meat stamps (that is, he must use them for his own meat consumption), how much meat will Joe buy and at what total expenditure?
 - b. What is the consumer's surplus to Joe of being able to purchase meat stamps? That is, how much better off is Joe when he is allowed to buy the meat stamps?
 - c. If Joe can resell the meat stamps to non-students, how much meat will Joe buy?
 - d. Which case would Joe prefer, the case where he must use the stamps, or the case where he is allowed to sell them? Why?
24. Once I took my children skating. Afterwards my eldest daughter bought a hot chocolate, and by the time we reached the car, she still had not finished. "You'd better not spill that in my car" I told her. Sure enough, 5 seconds later, she spilled the drink on her lap and on the seat. I got angry, and she replied, "You love your car more than you love me!" I responded that this was partly true, and then told her why. What economic concepts did I tell her about?

25. Video Jones (VJ) likes to play arcade games. There are two arcades in the town where he lives. No other close substitutes are available. Arcade A and Arcade B differ only with respect to the way they price their games. Arcade A charges 50 cents per game, with no admission charge. Arcade B charges 40 cents per game after customers pay a weekly admission fee of \$5. Reproduced below is a portion of VJ's demand schedule for arcade games.

Price	Games/Week
\$.55	25
.50	50
.45	75
.40	100
.35	125

- a. In order to gain the most from his purchase of arcade entertainment, which arcade should he patronize? (Assume VJ's demand schedule is not affected by payment of a weekly fee.)
 - b. Suppose Arcade B raised the weekly admission fee to \$11. If VJ purchased from Arcade B, would he receive any consumer surplus? In this case would he purchase from Arcade A or Arcade B?
26. Does the fact that garbage men make more money than the average high school teacher mean that society values garbage removal more than education? If not, what does it mean?
27. Many seminars are presented by job candidates for faculty positions in the economics departments of North American universities. Typically, several current faculty members go out to dinner with the candidate after the seminar. If the department were to subsidize this activity by reimbursing current faculty a flat amount, say, \$15.00 per dinner, how would this affect:
- a. The number of dinners attended by faculty?
 - b. The quality of the dinners, ie. would the subsidy lead to consumption of more costly, or less costly dinners?
28. "In 1979–80 the Vancouver real estate market went crazy. People would buy properties, the price would rise, then they would buy more. The demand for housing was upward sloping!" What's a more reasonable explanation that is consistent with the law of demand?
29. Explain the economics behind the following quote from the newspaper: "Among the reasons for a larger, more expensive home is the lot cost. Just two years ago, lots in some areas sold for \$60,000. It doesn't make sense to build a \$50,000 home on lots that cost up to \$150,000 today."
30. Parent use a number of methods to discipline their children. Two long standing methods are to spank or withhold goods. How do you think the frequency of spanking varies with income within the family? (Hint: What happens to the number and quality of goods to withhold as income changes?)

31. In Joni Mitchell's 1973 hit song *Big Yellow Taxi* she has the famous lyrics:

Don't it always seem to go

That you don't know what you've got till it's gone?

They paved paradise and put up a parking lot.

How would you interpret these sentiments using the economic ideas discussed in this chapter?

Review Question Answers

1. *The nominal price is \$13. When Tom talks about how long he'd have to work for the movie, he's using the notion of real income. When he compares the movie to how many shirts he could buy for the same money, he's using the notion of relative price.*
2. *American dollars have become cheaper. The quantity demanded will, therefore, also increase. This means more American goods will be purchased, and more Canadians will cross the border to shop in the United States.*
3. *If the price is \$10, then nothing will be demanded. Likewise at a price of \$7. When the price falls to \$6, then the quantity demanded is $35 - 6 \times 5 = 5$. Therefore 5 bags of chips are demanded. At a price of \$3, there are 20 bags demanded.*
4. *If the price was \$3, then $3 \times 20 = \$60$ would be spent. The triangle above this price is $\$4 \times 20 / 2 = \40 . So consumer's surplus is \$40. The total value is the sum of these two, so total value is \$100.*
5. *No, it is not inconsistent. The marginal value of the child might be very low, but the total value could be enormous.*

Odd Numbered Problem Answers

1. *For many communities around the world, water is not very valuable at the margin. In Vancouver, where it rains 60 inches in a year, and where the snow pack provides storage for the summer, water is used at zero marginal costs. As a result, it gets used for many frivolous things. In Mesa Arizona, where water is much more scarce, water is more valuable at the margin and is used more sparingly. This says nothing about the total value of water in Vancouver or Mesa.*
3. *This is a shipping the good apples out type of question. The cost of parking has increased by \$200/month because there is no subletting allowed. Hence, the average quality of car should increase.*
5. *It raised the relative price of using the freeway. Freeways often are not as convenient as secondary roads, but we use them to go faster. It has been shown that lowering the speed limit on freeways marginally lowers deaths, but the number of deaths on secondary roads go up, as does the total death rate.*
7. *Wages for women tend to be higher in urban centers. Since children are time intensive for women, higher wages mean the cost of children are higher. Hence urban families have fewer children, closer together than rural families.*
9. *The 13th and 25th months have the highest rates of suicide, and the 11th and 23rd months have the lowest.*
11. *The statement is arguing the elasticity of demand is zero. That is, there are no substitutes for gasoline. This of course is false, and when the price of gas increases, there is a fall in the quantity demanded. In the figure, for any demand curve with some elasticity there will be a fall in the quantity demanded.*

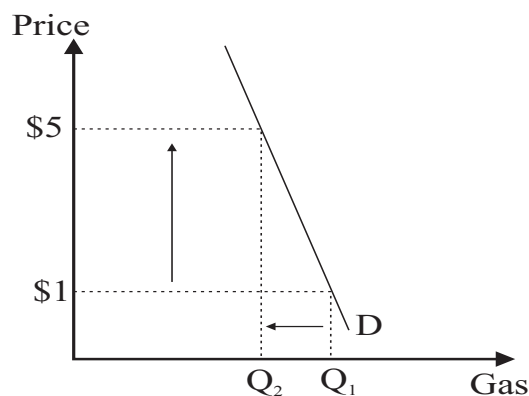


Figure 4-11

13. *No. The mariner had no freshwater, and would have paid much more for a glass of water than for a diamond.*

15. No, it only means they spend more. The total value placed on post secondary education could be higher.
17. Allowing more dirty fuels means there is less clean air to breath, it doesn't mean there is no clean air to breath. If we think of dirty fuels as adding to the cost of consuming clean air (because one has to move, buy filters, etc), then we have:

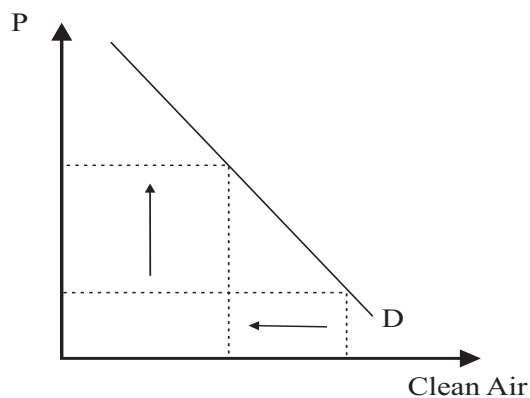


Figure 4-17

19. So, over time the nominal price of gas increased, but there was a movement towards smaller, then larger vehicles. The real price of gasoline was higher in 1974 than it was in 1986. Thus in the 1970s there was a serious movement to develop cars with better gas mileage. From the mid 80s until the mid 90s there was a continual fall in the real price of gas, and this led to the demand for more powerful cars.
- 21.

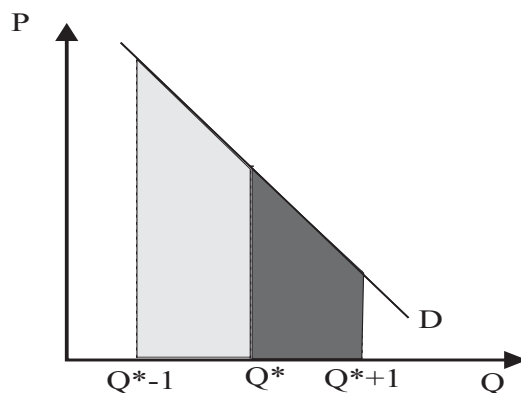


Figure 4-21

Suppose I have two days in between paychecks. If I consume $Q^* + 1$ on the day I get paid, and $Q^* - 1$ on the day I don't, then on payday my total value is the area under my demand curve up to

$Q^* + 1$. On the day I don't get paid my total value is the area of the demand curve up to $Q^* - 1$. If I consumed the same each day, the total value for the two days would be two times the area under the demand curve up to Q^* . Hence we have to compare the two shaded areas to see which method gives me the highest value. Since my MV is falling, I don't get as much marginal value on feast days as I do on famine ones. Thus, I should consume the same each day.

23.

- a. The price is now \$4 for the first 10 units. Joe will buy 9 units at this price for \$36.
- b. The total consumer's surplus without the stamps is \$12.5. With the stamps the CS is \$40.5. So he is better off by \$28 with the stamps.
- c. Now he'll buy 10 units of meat. He'll sell 5 units at \$8, and consume the other 5.
- d. Joe prefers the case where he can sell the extra five units of meat for \$40. This makes him \$12 better off.

25.

- a. He should go to B. With arcade A he only gets a surplus of \$2.5. With Arcade B his surplus is \$5 (\$10-\$5).
- b. Now he has a surplus of \$-1, at arcade B. So he should go to A.

27.

- a. This lowers the price of dinners relative to other activities, so more will go.
- b. The subsidy raises the relative price of expensive dinners, so less costly dinners will be ordered.

29. This is the third law of demand again. The expensive lot lowers the relative price of an expensive home.

31. She's talking about the difference between marginal and total value. When there are lots of trees around, we enjoy them, but behave towards them based on the value of the marginal tree. When all of the trees are gone, we realize we had a paradise, and we miss the total value we once had.

CHAPTER 5

TECHY ISSUES OF DEMAND

5.1 Changes in Demand

Very few of the simple things in a book on the principles of economics confuse students as much as the distinction between *changes in demand* and *changes in the quantity demanded*. It is unfortunate the language of each statement is so similar when the concepts are so different.

A change in demand refers to a *shift* in the demand curve. When the demand curve shifts out to the right, we say there is an increase in demand. When the demand curve shifts in to the left, we say there is a fall in demand. Examples of changes in demand are shown in Figure 5-1.

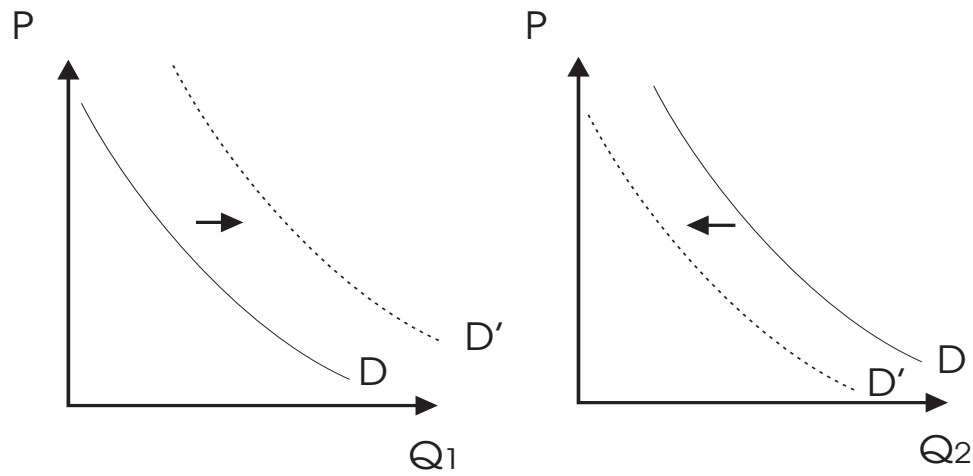


Figure 5-1
Changes in Demand

In the left hand graph the demand curve has shifted to the right, meaning there is an *increase* in demand for good 1. In the right hand graph the demand curve for good 2 has *decreased*. Both of these shifts are what economists call “changes in demand.”

You might be wondering: what brings about a change in demand? Recall in the discussion from last chapter that demand curves depended on our principle of diminishing marginal value, which in turn depended on the phrase “other things held constant.” Three exogenous parameters implicitly held constant in the discussion of demand were income, the prices of other goods, and tastes or preferences.

Changes in Demand result from changes in exogenous parameters.

Changes in Tastes

Let's start with individual tastes. Clearly everyone has different tastes for different things. You like Pepsi, I like Coke. Some people are vegetarians, but other people won't let anything green touch their plate unless it's jello. Whatever the dimension, whether colors, flavors, people, or cars, all of us are simply bent in different directions. For example, there was once a personal advertisement which read: "Farmer, 35 years old, looking for wife between age 30 and 35 who owns her own tractor. Send replies to box number 12, and include picture of tractor." To be more explicit, having different tastes simply means that we have different marginal values *and* different rates at which those marginal values might diminish. That is, everyone's demand curves have different heights and slopes. Although each of us satisfies the first three principles of economics, there is still plenty of room in our theory for everyone to be different.

The left hand graph in Figure 5-1 has an initial solid demand curve in it simply called D. The height of that demand curve is the marginal value that individual places on good 1. If, for whatever reason, a person suddenly liked good 1 more than previously, what would happen to the marginal value? Practically by definition, the marginal value would increase. In other words the demand curve would shift up and out. So an increase in the taste for some good would lead to an increase in the demand for the good. Likewise a decrease in the taste for some good, would lead to a decrease in the demand, similar to the right hand graph in Figure 5-1.

Economists seldom talk about changing tastes because we simply can't observe them. In other words, economists generally assume tastes are constant and don't change over time. Most of the time this seems like a reasonable thing to do. My tastes for most goods I consume seem reasonably constant over time. However, if one is considering changes in consumption over an individual's lifetime, then changes in taste seem inevitable. When I was a child I couldn't stand ethnic foods, but now I love them. No doubt you've noticed changes in your own tastes as you've moved into adulthood.

Changes in Income

By now you might have caught on that changes in demand result from changes in those things "held constant" when drawing the initial demand curve. If you're thinking that way, then keep it up because you're right. When we draw a demand curve we assume that an individual's income is held constant. But what if an individual's income goes up? What happens then?

The answer, unfortunately, is that it depends on the nature of the good. Some goods are what economists call "normal." For these goods an increase in income leads to an increase in demand, just like the left hand graph in Figure 5-1. Thus, if clothing was a normal good, when your income increased, you would buy more clothing — makes sense.

However, when your income increases you might actually buy less of some goods. If you do, then economists call these types of goods "inferior" goods. For example, if your income goes up you might buy fewer canvas shoes and more leather shoes. The canvas shoes would be inferior and the leather shoes would be normal.

Normal Goods: *When income increases the demand for normal goods also increases.*

Inferior Goods: *When income increases the demand for inferior goods decreases.*

Changes in Other Prices

The last thing we assumed was being held constant was “other prices,” or the price of good 2 in our simple case. When the prices of other goods change there is a relatively complicated impact on the consumer. First, when the price of good 2 changes, this changes the relative price p_1/p_2 . Hence if good 2 becomes cheaper, then the relative price of good 1 increases. As a result, people substitute out of good 1 and into good 2. This is our old friend the *substitution effect*. However, if you recall, demand also depends on the level of real income, which we defined as M/p_2 . So when the price of good 2 changes it changes the level of real income. As we’ve just seen, when real income changes sometimes we increase the consumption of good 1 and other times we decrease consumption, depending on whether good 1 is normal or not.

What this all amounts to is that we cannot say what will happen to the demand for good 1 when the price of good 2 changes. Sometimes the demand will increase, other times the demand will decrease. As with changes in income, however, we can categorize the different effects. If the demand for good 1 increases when there is an increase in the price of good 2, then the two goods are called “substitutes”. So, for example, if the demand for butter increases when the price of margarine increases, then we would say that butter and margarine are substitutes. If, on the other hand, the demand for good 1 decreases when there is an increase in the price of good 2, then the two goods are called “complements.” Hence, if the demand for bread decreases when the price of butter increases, we say that bread and butter are complements.

Substitute Goods: *When the Price of good 2 increases the demand for good 1 also increases.*

Complement Goods: *When the price of good 2 increases the demand for good 1 decreases.*

The use of the word “substitute” in this context is an unfortunate historical accident. In chapter 3 we noted that all goods are substitutes for one another in that they all provide utility and people are willing to trade anything they value for some amount of anything else they value. We will basically stick with our chapter 3 definition, and will explicitly note when we switch to this more detailed definition of a “substitute.”

You may also have noticed there really are no testable implications that come out of changes in demand curves. When one of our parameters (tastes, income, or other prices) changes, essentially anything can happen. In terms of explaining behavior, then changes in demand are not very useful

unless we know i) what the change was, and ii) what the nature of the good is. Sometimes economists have a very good idea on whether a good is normal or not, or whether it is a complement or not. For the purposes of learning the principles of economics, however, these empirical matters are generally beyond our concern.

5.2 Changes in Quantity Demanded

A change in demand is a shift in the demand curve that results from a change in a parameter. A *change in the quantity demanded* is a movement along a demand curve that results from a change in the price of the good. Let's refer to Figure 5-2, to help us understand the difference.

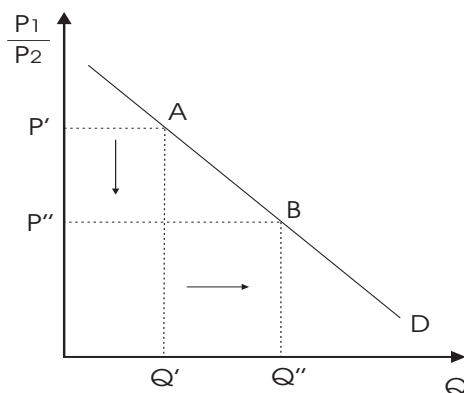


Figure 5-2
Changes in the Quantity Demanded

When the relative price of good 1 is P' then the equilibrium quantity of good 1 that the consumer demands is Q' . When this price falls to P'' , the *quantity demanded* increases to Q'' — this is the law of demand. Notice that the demand curve did not shift; that is, there was no change in the demand curve. This is because income and other prices have not changed. The fall in price resulted from a fall in the price of good 1. Although the demand curve did not change, there was still a change in the quantity demanded.

Changes in Quantity Demanded result from changes in the relative price.

This distinction is important because without it people get themselves in all types of trouble. If you hear someone say “fall in demand” it is important to know whether this is in reference to shift in the demand curve or a fall in quantity demanded. When we finally get to understanding how prices are determined, this distinction will be crucial.

5.3 Elasticity

We have seen how the quantity demanded of a particular good responds to a change in an exogenous variable like income or other prices; however, how do we compare measures of responsiveness? To make meaningful comparisons we need a unit-free measure — one that is not based on a particular measure like quarts or gallons. In this section we will develop a general unit-free measure of responsiveness — known as *elasticity* — that economists use in a variety of contexts. There's an old joke about a wife who always cuts her husband's meat before he eats it. "Would you like me to cut your steak into four pieces or eight?" she asks one night at dinner. "Oh, four tonight dear," he replies. "I'm on a diet." A characteristic of elasticity is a little like that joke. Although elasticity is a very useful tool, a number of its elements are quite arbitrary, and can influence the actual number you end up with as your answer. In learning about elasticity, try to keep in mind the economics behind the arithmetic.

Also when learning about elasticity, keep in mind the following three step procedure. First, generally speaking, elasticity is a percentage change of a dependent variable due to a percent change of an independent variable. Second, when it comes to prices and quantity demanded, keep in mind that the quantity demanded depends on price (not the other way around). Therefore, the quantity demanded is the dependent variable and price the independent variable. Finally, once you understand this relationship, simply apply the given formula.

The Own Price Elasticity

Suppose that you were working for a firm that sells rolls of unfinished paper to various clients around the world, and suppose that your boss has come to you and told you that they're thinking of lowering the price of each roll by 36¢ and they expect that sales will increase by three million rolls — given the law of demand. Your boss then asks you: Is that change in quantity demanded big? Will it increase or decrease revenue? Furthermore, suppose your boss tells you that he wants to know if this change in quantity demanded is big relative to sales of finished paper, which has fallen in price by \$2 per tonne. Wouldn't it be nice if there was some type of standardized measure of demand that would be independent of the unit of prices or quantity, and which could easily tell you what will happen to revenues when there is a price change? Well, elasticity is such a concept.

The Own Price Elasticity measures the percentage change in the quantity demanded of good 1 ($\% \Delta Q_1$) for a given percentage change in the price of good 1 ($\% \Delta P_1$). The formula for elasticity is quite simple:

$$\begin{aligned} E_{11} &= \frac{\% \Delta Q_1}{\% \Delta P_1} \\ &= \frac{\Delta Q_1 / Q_1}{\Delta P_1 / P_1} \\ &= \frac{\Delta Q_1}{\Delta P_1} \times \frac{P_1}{Q_1}. \end{aligned}$$

The subscripts on E tell us that we're dealing with the price and quantity of good 1. The last expression is quite informative. It says that the own price elasticity is equal to the inverse slope of the demand curve (the first term) multiplied by the relative sizes of the price and quantity. It is important to remember that an elasticity is *just a number*. From this simple little equation any negative number is possible, although it is a convention in economics to drop the negative sign. Before we get to what these numbers mean, let's do a simple example. Consider Figure 5-3 where several prices and quantities are listed along the demand curve.

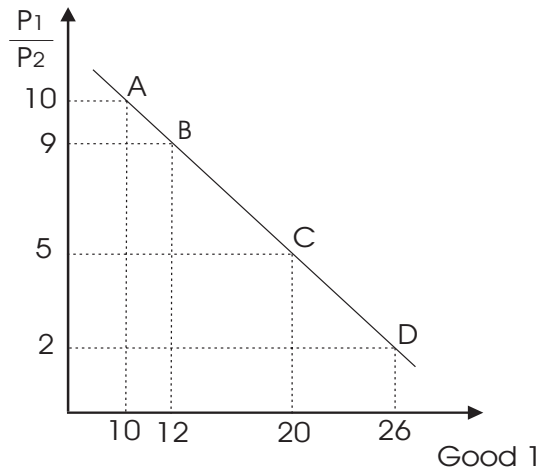


Figure 5-3
Elasticity Changes Along the Demand Curve

The slope of this demand curve is $-1/2$, (or $1/2$ as we'll treat it) which means that $\Delta Q_1/\Delta P_1$ is 2. Since the demand curve is linear, this $1/\text{slope}$ term of the elasticity formula is always 2. Which means to calculate the elasticity of demand at any point we simply have to multiply this number by the fraction P_1/Q_1 . Hence at point A the elasticity is 2; at B the elasticity is $18/12$ or $3/2$; at C the elasticity is $1/2$; and at point D the elasticity is $2/13$. Notice that the elasticity is falling as we move down the demand curve. Also notice that even though the demand curve has a constant slope, the elasticity is not constant.

But what do these numbers mean? The own price elasticity takes on three types of values (ignoring the negative sign). If the number is greater than 1 the demand curve is *elastic*. This means the percentage change in quantity demanded is larger than the percentage change in price. A small change in price leads to a relatively large change in the quantity demanded. If the number is equal to 1 the demand curve is *unitary elastic*. This means the percentage change in quantity demanded equals the percentage change in price. A change in the price leads to the same relative change in quantity demanded. Finally, if the number is less than 1 but greater than 0 the demand is *inelastic*. Now the percentage change in quantity demanded is smaller than the percentage change in price. This is every seller's dream — a large change in the price leads to a relatively small change in the quantity demanded. Figure 5-4, draws some extreme cases of demand elasticities to get the point across.

The three graphs in Figure 5-4 are quite unrealistic. The left hand side graph is an example

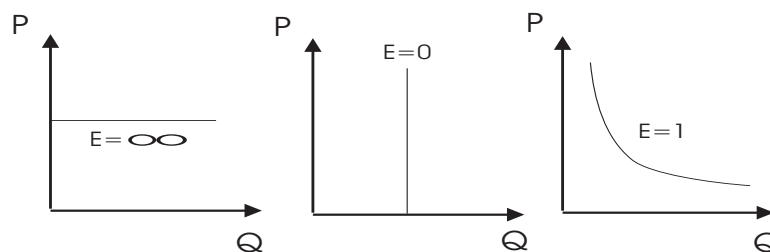


Figure 5-4
Different Own Price Elasticities

of infinite elasticity. This would be the case where a slight rise in price leads to nothing being sold, and a slight fall in price leads to the whole world at your doorstep. Such a demand would suggest a perfect substitute exists for the good, and so consumers are unwilling to tolerate any increase in price. The middle graph represents the case of perfect inelasticity. Here any rise in price results in the same quantity demanded. No matter what the price, consumers demand the same amount. Such a demand curve violates our principle of substitution which states that as the price increases consumers substitute into other goods. It also violates our notions that people have finite wealth levels. At some point, as the price of a good increases enough, you run out of money and have to buy less of a commodity. The final graph is a very special case as well. If the demand function happened to take on the following functional form: $k = p \times q$, where k is just some constant number, say 16, then the elasticity of demand is unitary everywhere.

Until this point we've been calculating elasticities at a *point* along the demand curve. This is very simple to do when the demand curve is a straight line, but requires some calculus (don't worry ... we won't do any calculus) when the demand curve is non-linear. It is also possible to calculate the elasticity between two points on a demand curve, whether the demand is linear or not. In doing so one is actually calculating an *average* elasticity between the two points. This type of elasticity is called an *arc elasticity* as opposed to a point elasticity. Although the same formula is used, there is a minor complication in deciding which price and quantity combination should be used. Should the initial price/quantity be used, the terminal price/quantity, or some price/quantity combination in between. Which one is used will slightly alter the answer you get, but the bottom line is that the choice is quite arbitrary. For example, we could calculate the elasticity of demand between points A and D in Figure 5-3 using point D as the reference point.

$$E = \frac{26 - 10}{10 - 2} \times \frac{2}{26} = \frac{2}{13}$$

Similarly we could calculate the elasticity of demand between points A and D in Figure 5-3 using the average price and quantity as our reference point.

$$E = \frac{26 - 10}{10 - 2} \times \frac{6}{18} = \frac{2}{3}$$

The arc elasticity is easy to calculate relative to the point elasticity when the demand curve is not a straight line because it only requires two data points. On the other hand, the arc elasticity is just

an average, and is not very accurate. Which one you use depends on the information you have, the complexity of the demand curve, and how good you are with numbers. What we gain for ease, we lose in accuracy since it is only an average ... a classic case of substitution.

Arc Own Price Elasticity is an average elasticity between two points on a demand curve.

Elasticity and Total Revenue

One of the useful aspects of own price elasticity is it tells us quite a bit about how total revenue and price move together.¹ When the demand for a good is elastic then total revenue and price move in the opposite direction. A fall in price, leading to a large change in quantity demanded, leads to an increase in total revenue. When the demand is inelastic, total revenue and price move in the same direction. A rise in price leads to a small fall in quantity demanded, and this leads to an increase in revenue.

Suppose the demand for a product is $Q = 12 - P$, where Q is the quantity demanded and P is its price. The table below lists several points along this demand curve.

TABLE 5-1

Elasticity and Total Revenue

Price	Quantity	Elasticity	Total Revenue
11	1	11	11
9	3	3	27
7	5	1.4	35
5	7	.71	35
3	9	.33	27
1	11	.09	11

Notice how total revenue increases as the price initially falls, but as price continues to fall and as the elasticity continues to get smaller the total revenue eventually falls as well. To see if you understand this relationship recalculate the elasticities and total revenues assuming the demand curve becomes $Q = 16 - P$ and $Q = 12 - 2P$.

Income Elasticities

¹ Total revenue is how much the seller generates from a sale. Total expenditure is how much the consumer spends. Without taxes the two are identical.

When income changes there is a shift or change in demand which will lead to a change in the quantity demanded for any given price. We can measure an income elasticity of demand the same way we measure an own price elasticity. The only difference is that now we replace the price term with income, and now it is important whether or not the answer is positive or negative. The income elasticity is given by

$$E_{1M} = \frac{\Delta Q_1}{\Delta M} \times \frac{M}{Q_1}.$$

Where ΔM is the old income minus the new income, and ΔQ_1 is the quantity demanded at the old income minus the quantity demanded at the new income. As mentioned before, when income changes we can say nothing about whether the demand for good 1 will increase or decrease. This even holds across people. Joe might respond to an increase in his income by buying more fresh fish while another person — say Rena — may respond to an increase in her income by buying less of it. For Joe fresh fish is a normal good, while for Rena it is an inferior good. Nevertheless, we can get a good idea of whether, for the average consumer, a particular good is normal or inferior by using aggregate data to compute an average income elasticity of demand. The income elasticity of demand is the elasticity of quantity consumed per capita with respect to per capita income. In empirical studies of income elasticity of demand for a good, aggregate data is used to compute an average demand function. Then, this average demand function is used to compute various average elasticities, including the income elasticity of demand.

A normal good has a positive income elasticity: $E_{1M} > 0$

An inferior good has a negative income elasticity: $E_{1M} < 0$

Cross Price Elasticities

If we want to measure the response in quantity demanded of good 1 with respect to a change in the price of good 2, we can calculate a cross-price elasticity of demand in a similar way we calculated the other elasticities. The cross-price elasticity of demand for good 1 with respect to the price of good 2 is given by the formula:

$$E_{12} = \frac{\Delta Q_1}{\Delta P_2} \times \frac{P_2}{Q_1}.$$

Where ΔP_2 is the old price of good 2 minus the new price, and ΔQ_1 is the quantity demanded at the old price minus the quantity demanded at the new price. When this number is positive the goods are “substitutes” and when this number is negative the goods are “complements.”

A complement has a negative cross price elasticity: $E_{12} < 0$

A substitute has a positive cross price elasticity: $E_{12} > 0$

5.4 Elasticity Miscellany

Knowing arithmetic doesn't make you a mathematician, but every mathematician must know arithmetic. The same is true for elasticity. Just knowing the formulas and relationships doesn't make you an economist, but it's pretty hard to think like an economist without knowing what elasticity is. Let's consider some "economics" of elasticity.

Elasticity and the definition of goods

Let's go back to own price elasticity, which is by far the most interesting and useful elasticity concept. As alluded to, the size of the elasticity is a reflection of the degree to which substitutes exist for the good: high numbers mean more elastic and more substitutes. But this is really just a reflection of how the good is defined to begin with. Suppose a good is defined very broadly: say food. If data is collected on average food prices and quantities, and an elasticity of demand is calculated, what would you expect the number to be like? One would think the demand would be quite inelastic since there are few decent substitutes for "food." If on the other hand, the good was a box of *Special K* cereal, then we would expect the demand for such a narrowly defined good to be very high. Other cereals, hot cereals, eggs and bacon, fruit, and all the other things people can eat for breakfast are great substitutes. So the elasticity of demand is sensitive to how the good in question is defined.

Less obvious is the relationship between the budget share for a good and its elasticity. Some goods are expensive and use up a large fraction of one's budget. Housing, car payments, ... alimony, are large expenses. Snacks, pens, and flowers for the wife are small expenses. When a good takes up a large share of the budget then it will tend to have a larger elasticity. Changes in the price of large ticket items have a big effect and induce a larger quantity response. On the other hand, when the price of bubble gum doubles, it has little impact on my budget and therefore a smaller impact on the quantity demanded.

Elastic Demand: *Lots of substitutes. Large budget shares.*

Inelastic Demand: *Small numbers of substitutes. Small budget shares.*

Elasticity in two seconds

It turns out there is a nifty little graphic trick to determine the point elasticity for any linear demand function. Figure 5-5 shows how it works.

Suppose we wanted to calculate the elasticity of the demand curve at point C. If we draw a horizontal line from point C, back to the vertical price axis, we see that the vertical axis can be divided into two segments: A and B. It turns out that the elasticity at point C is equal to A/B; that is, the distance A divided by the distance B. This is a very handy tool for determining the relative elasticity of any

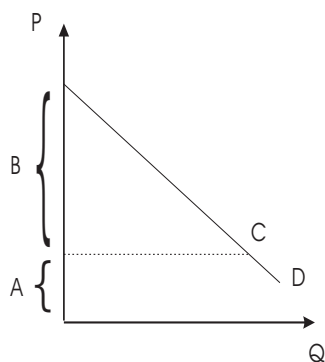


Figure 5-5
Eyeball Calculations of Elasticity

two demand curves plotted on the same graph.² From Figure 5-5 it is clear that $A < B$, and as a result we can say that the demand is inelastic at point C.

Suppose two individuals, Verlyn and Carla, each have a demand for hot dogs, and these demands are represented in Figure 5-6. At a given price, say P' , which demand curve is more elastic? That is, is the elasticity greater at point E or F?

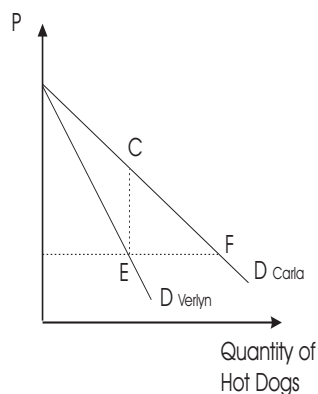


Figure 5-6
More Eyeball Calculations of Elasticity

² If the demand curve is non-linear then there is a slight complication. You simply draw the tangent line to point C and continue this line back to the axis as if it were the demand curve. You then calculate the distances as just stated.

If we use our little trick we can see that the elasticity is the same at both points. To check your understanding, what can we say about the elasticity at point C ?³

The Second Law of Demand

There is an empirical regularity that economists and others have observed for so long it has come to be called the Second Law of Demand (the first law being the inverse relationship between price and quantity ... just in case you've forgotten already!). The second law of demand states that long run demand curves are more elastic than short run demand curves.

Second Law of Demand: *long run demand curves are more elastic than short run demand curves.*

One of the problems in understanding the second law of demand is what's meant by "long run." Most often economists view the long run as a long period of time, when permanent changes are made, and adjustments are made slowly. Likewise short run would mean a short period of time, with temporary changes, and quick adjustments. Still others refer to the long run as the period when the most choices can be made, and the short run as a period when many of our choices are fixed or constrained. It's all quite confusing.

Fortunately for us we don't have to worry too much about such details. We'll think of the long run as meaning periods of time when people make permanent and flexible decisions. Most importantly, in the long run more information is available to make decisions. In the short run, the opposite will be the case. If we think of the long run as a situation where "other things are changing", then we recognize that the demand curve must be shifting over the long run.

Let's think about the demand for gasoline. In 1971 there was a certain demand for gasoline based on the nature of cars, homes, and other factors. In 1971 gasoline was quite inexpensive and lots of people purchased large amounts of gas. I recall, in 1971, my parents often saying "let's jump in the car and go for a drive." "Sunday drives" were a North American pastime in the 60s and early 70s when gas was cheap. Figure 5-7 shows the demand for gas in 1971.

Even though most of you were born a decade after the Arab oil embargo of 1973–74, it was such a dramatic and watershed moment in popular North American culture that you've no doubt heard all about it. Over night the price of gas went up dramatically. What was the response? Individuals cut back the amount of gas consumption, according to the first law of demand. Again this is shown in Figure 5-7 by a movement from point A to B.

Initially all people could do was reduce their driving, turn the heat down in their homes, and car pool a little. But over time a number of things began to change. Insulation was installed in homes that were never insulated. New types of insulation were produced. Pipes were insulated,

³ It's greater than at E or F .

crawlspaces had floors concreted over, and windows became double paned. In my neighborhood a family built a home in the side of a hill, with every wall but the front one covered by Earth! New cars were invented (the Honda civic), and existing cars became smaller and more fuel efficient. Carpool lanes were built and 55 mph speed limits were imposed. Wind, solar, and other forms of energy were developed. Pools became covered with thermal blankets. All of these innovations *decreased* the demand for gasoline, and the demand curve shifted left as in Figure 5-7. At the 1974 price the quantity demanded of gasoline fell to point C. This shift left, caused by the long run adjustments in behavior brought on by the increased price is the Second Law of Demand.

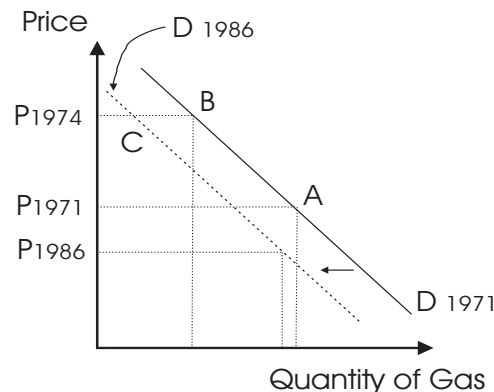


Figure 5-7
The Second Law of Demand

The case of gasoline is interesting because by 1986 the real price of gasoline was at 1966 levels. With this fall in price came increased uses in gasoline. Small muscle cars and SUVs developed, car pool lanes dropped the required passengers from 3 to 2, and interest in alternative energies waned. Although there were these first law of demand effects, the use of gasoline never returned to the 1971 levels. Why? Because when the price of gasoline induced second law of demand changes, these effects were permanent. The insulation put in houses in 1975 was not ripped out in 1986. So even though homes were warmer in 1986 than in 1975, they were heated more efficiently.

5.5 Summary

In chapter 4 we discussed the fundamental inverse relationship between price and quantity, and noted this was called the law of demand. In this chapter we've discussed some of the more technical aspects of demand, starting with the distinction between changes in demand and changes in the quantity demanded. The former results from changes in exogenous parameters assumed to be held fixed, like tastes, income, and prices. The latter results from changes in relative prices. When any of these things change, the subsequent changes in demand can be expressed in unitless numbers called elasticities. These elasticities are simply numbers used to describe how responsive demand is to changes in prices, incomes, and other prices. Elasticity numbers depend critically on how the good is defined. The second law of demand states that over time demand curves become more elastic.

REVIEW QUESTIONS

1. What does it mean to say a variable is exogenous? Endogenous? For a demand function, what are the exogenous and endogenous variables?
2. Are there any testable implications with respect to demand curves resulting from changes in income?
3. If good 1 is inferior, will it more likely be a complement or a substitute to good 2?
4. Why does the elasticity of demand change along a linear demand curve? Does it change along a non-linear one?
5. What is the relationship between elasticity and substitutability?
6. What is the difference between point and arc elasticity?

PROBLEMS

1. Using the little graphical trick discussed in section 5.4, show that the demand curve for 1986 in Figure 5-7 is more elastic at every price than the demand curve in 1971.
2. “The quantity demanded can change, even though the demand has not changed, but if the demand changes, then the quantity demanded must also change.” True or False. Use a graph in your answer.
3. Suppose Barbara spends her entire income on two goods, diet coke and bagels. Her demand curve for diet coke is inelastic. If the price of diet coke rises, will she consume more or less bagels? Show graphically what happens.
4. Transit buses, on a local San Francisco run carry 1000 passengers a day who are each charged \$.50. The marketing Dept. feels that by raising the price to \$.75, ridership will decline by 200 persons to 800 passengers a day.
 - a. What is the estimated elasticity of demand for buses on the run?
 - b. Does this increase in price increase Transit’s profit on these trips? Why?
 - c. Suppose ridership at the new price is only 100 persons per day. What is the actual elasticity?
 - d. Given the true elasticity, should the transit authority raise or lower their price?
5. Answer the following True/False, with a brief explanation why.
 - a. “A straight line demand curve has a constant slope and therefore a constant elasticity.”
 - b. “If total revenue is constant along a demand curve, then the demand is infinitely elastic.”
6. Suppose you own a movie theater and most of your costs (the band, security, the land rental, etc.) are independent of how many people show up. What is likely to be the point elasticity of demand at the price you decide to charge?
7. The city of Toronto currently charges \$12 per week for garbage pick up, and you can put out as many cans of garbage as you like. On average people put out three cans per week. The township is thinking of switching to a plan where each can must have a “tag”, and these tags cost \$4 each. If the switch is made, what will happen to the amount of garbage collected?
8. In a response to suggesting that drugs should be made legal, William Bennet (one time director of the Office of Drug Control Policy in the U.S.), stated the following: “Drugs would become much cheaper — at least one-fifth the cost. Then five times as many people could and would buy them. We would then have five times as many addicts.” What assumption is he making about the elasticity of demand for drugs?
9. It has been reported that business rents in Manhattan have increased since the destruction

of the trade center towers. They have increased so much, that the total rents in the city are higher than they were before. Does this mean that the trade center towers were making a negative contribution to the city? Use a graph in your answer.

10. “The demand to view the *Mona Lisa* painting is completely inelastic because there is only one, and the artist is long dead” True/False/Uncertain. Explain.
11. Suppose an insect destroys 20% of every grower’s raspberry crop. As a result, the price rises from 25 cents to 50 cents per pound. Did the total value of the crop increase?
12. In 1977 Brazil was supplying about one third of the world’s coffee exports. When a frost wiped out about 75% of Brazil’s 1977 crop, the world price of coffee rose about 400%. What was the approximate price elasticity of demand for coffee. Was the demand elastic or inelastic?
13. You are given the following demand curve: $Q = 14 - P$. The table below contains several points along this demand curve.
 - a. Calculate the elasticities over the segments indicated in the table and the total revenue at those points.

P	Q	Elasticity	Total Revenue
11	3		
9	5		
7	7		
5	9		
3	11		
1	13		

- b. Graph the demand curve and label the elasticities along the demand curve. Now, using a separate graph, draw the total revenue curve against quantity. Label the elasticities along this curve.
 - c. What is the relationship between TR and elasticity?
 - d. Assume the demand curve shifts to the right with two more units sold at every price. Recalculate the elasticities for the price intervals, (3-5), (5-7), (7-9), and (9-11).
 - e. Is the new demand curve more or less elastic than the old at each price? At each quantity?
14. Forestry economists have been estimating various elasticities for wood for years. They have found the following: softwood short run demands are very inelastic; the long run cross-price

elasticity of BC softwoods, with softwoods from other parts of the world is quite high; and the long run cross price elasticity of softwoods with other woods is positive, but not as high.

- a. Do these make sense?
 - b. BC and the Pacific Northwest, happen to be very productive in producing high quality timber (old growth, clear wood). Not only this, but our forests are generally much better at regenerating itself than many other forests (especially tropical ones) around the world. Given this, and the elasticities mentioned above, what happens globally when land is set aside from logging in BC? That is, what happens to the price, to the supply of wood, by other countries, and to the amount of wood cut down elsewhere.
 - c. In what sense are the “friends of Clayquot Sound” (a large tract of forest on Vancouver Island that is now protected from logging) also the “enemies of the Amazon rain forest”?
15. Can the demand for a good be inelastic everywhere?

Review Question Answers

1. An exogenous variable is determined “outside” the model. It is a given. Thus in our model we take tastes, incomes, and other prices as given. Our model does not tell us where they come from. An endogenous variable is one that is determined “inside” or “by” the model. For the moment we are taking the own price as exogenous, but as we develop the model this variable, along with the quantity exchanged, will become endogenous.
2. At the general level of our model, there are no testable implications. When income changes the demand curve could shift in or out (the same is true of changes in tastes or other prices). In order to make this testable we would need to know what type of good we are dealing with (e.g., whether the good is normal or inferior).
3. Suppose the price of good 2 goes down. The substitution effect will cause the consumer to purchase more good 2 and less good 1. When the price of good 2 falls, however, the real income increases. Since good 1 is inferior this causes the consumer to purchase even less good 1. Thus both effects work together: price of good 2 goes down, less good 1 is purchased. They are substitutes.
4. You must keep in mind that slope and elasticity are not the same thing. Along a straight line demand curve the slope is not changing, but the elasticity (which is the inverse slope multiplied by a weight) is. Essentially the percentage changes in price and quantity are not constant as you move down a linear demand curve. There is one case (the rectangular hyperbola case) where a non-linear demand curve has a constant elasticity. However, other non-linear demands have changing elasticities as you move down them.
5. Generally speaking, the more elastic a demand curve is, the better are the substitutes.
6. A point elasticity is an exact elasticity. It measures the percentage change in the quantity demanded when there is an extremely small change in price or income. An arc elasticity is an “average” elasticity over a discrete change in prices or income.

Odd Numbered Problem Answers

1. As can be seen in Figure 5-1, the elasticity at point 1 along the 1986 demand curve is A/B , while the elasticity at point 2 on the 1971 demand curve is A/B' . Since the distance A is the same in both cases, the 1986 demand curve is more elastic.

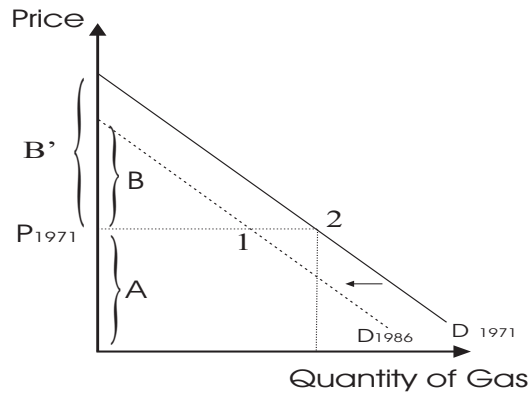


Figure 5-1

3. Since the demand for Diet Coke is inelastic an increase in price leads to more income spent on this good. This means there is less income available for Bagels, which results in a shift inwards for the demand for bagels. Shown in Figure 5-1.

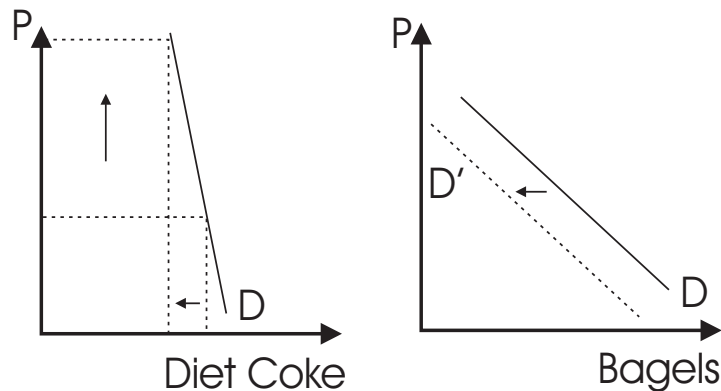


Figure 5-3

- 5.
- a. False. It has a constant slope and a changing elasticity. This follows from the definition of elasticity.

- b. *False. If the demand curve is infinitely elastic, then the more the firm sells, the higher the revenue.*
7. *Unless the demand for garbage pickup is perfectly elastic, the amount of garbage picked up must fall and people will spend less than \$12 per week on their garbage.*
9. *No, it only means the demand for commercial space is inelastic. From Figure 5-9 when the twin towers are destroyed, total rents increase, but total consumer's surplus goes down.*

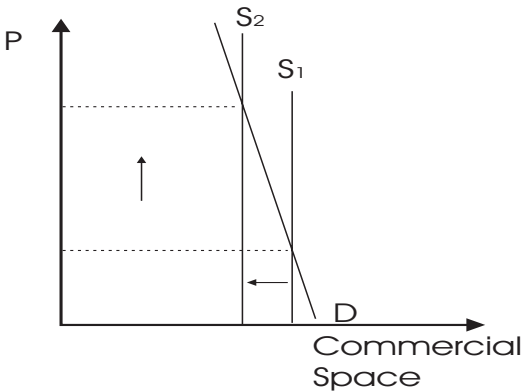


Figure 5-9

11. *No, the total revenue increased, but since there is less crop there must be a lower total value.*

13.

a.

P	Q	Elasticity	Total Revenue
11	3	3.66	33
9	5	1.8	45
7	7	1	49
5	9	.55	45
3	11	.27	33
1	13	.07	13

b.

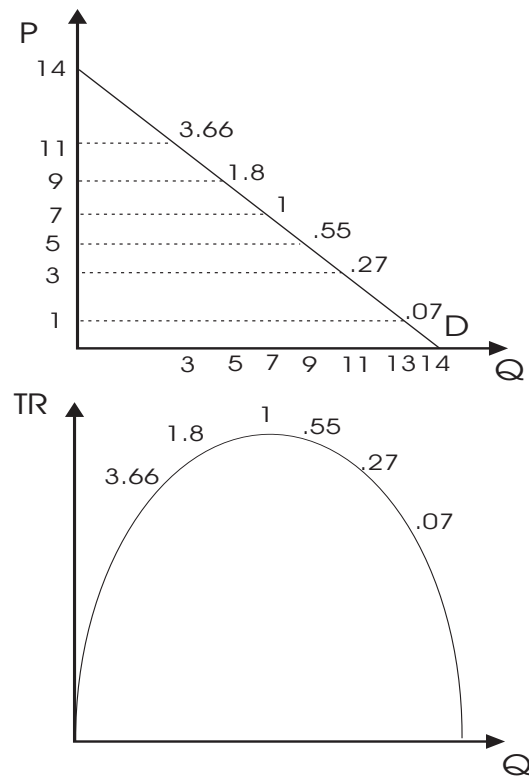


Figure 5-13

c. When the demand curve is elastic and price is falling, TR is increasing. When the demand curve is inelastic and price is falling, TR is also falling.

d.

P	Q	Elasticity	Total Revenue
11	5	2.2	55
9	7	1.28	63
7	9	.77	63
5	11	.45	55
3	13	.23	39
1	15	.06	15

e. At every price the demand curve is less elastic. At every quantity the demand curve is

more elastic.

15. *No. Eventually the consumer would run out of income and the demand would become elastic.*

CHAPTER 6

EXCHANGE WITHOUT PRODUCTION

6.1 Trade with Just Two People

In chapter 3 we saw that voluntary exchange led to both parties being made better off. With our new tool “the demand curve” we can now analyze trade in a very powerful and more complete way. The key to using demand functions in understanding trade is to remember that the height of the demand function is the marginal value — the maximum amount an individual is willing to pay for more of the good. As we saw in chapter 3, when marginal values are different, trade takes place. This means that when the heights of two individual demand curves are different, trade will take place.

Let’s think of two people who live next door to each other: Nelson and Darlene. Darlene has chickens that produce 20 eggs each week no matter what, while poor ol’ Nelson doesn’t own any chickens and buys his eggs from Darlene. Let’s assume that the price for each egg is 10¢ . The demands for Nelson and Darlene are shown in Figure 6-1. D_N is Nelson’s demand curve and D_D is Darlene’s. Note this would be Darlene’s demand curve whether or not she had any chickens.

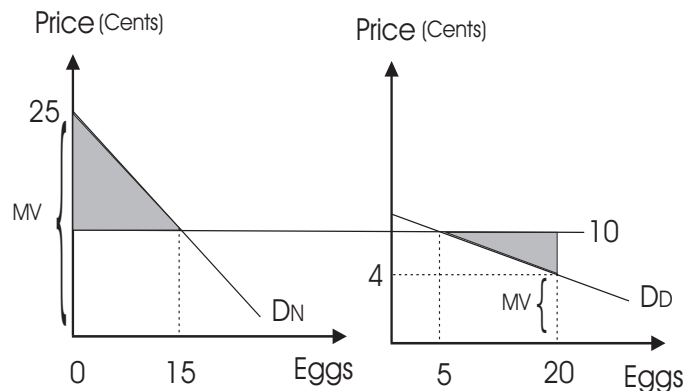


Figure 6-1
Nelson and Darlene’s demand for eggs

Since Nelson has no eggs of his own, his MV is 25, the height of his demand curve above 0. For Darlene, who has 20 eggs each week, her MV is 4, the height of her demand curve above 20.

Since Nelson is willing to pay 25¢ for his first egg, and the price is only 10¢ , Nelson will clearly buy an egg. For this first egg Nelson gains consumer’s surplus of 15¢ ($25 - 10$). But his MV is greater than the price for the second egg as well, and the third, and the fourth ... all the way up to 15 eggs. When Nelson purchases the 15th egg his MV is just equal to 10¢ , which just equals the price. As we’ve seen before, Nelson is now at an equilibrium, he doesn’t want to consume any more or less eggs.

What about Darlene. When Nelson offers 10¢ for the first egg, she takes it because her MV is only 4¢. This makes her 6¢ better off. However, when she sells an egg her MV begins to increase, but until she has only 5 eggs remaining the price remains higher than her MV. At 5 eggs Darlene is also in a position where her MV is equal to the price of 10¢ which means she's in an equilibrium as well.

The shaded area in the left hand graph represents Nelson's *consumer surplus*, which was briefly discussed in section 4.8. The area of this triangle is \$1.12, which is the amount of wealth Nelson gains from entering trade with Darlene. He would have been willing to pay this amount to gain access to the 15 eggs, but he didn't have to — hence it is surplus to him.

The shaded area in the right hand graph is Darlene's *seller's surplus* — a whopping 45¢. This is the amount of wealth Darlene gains from entering trade with Nelson. Seller's surplus is just the difference between the total revenue Darlene gets and her total value of the eggs she sold; that is, it is the price times quantity traded, minus the area under her demand curve.

Consumer's Surplus: *Total value minus the total expenditure of the consumer.*

Seller's Surplus: *Total revenue minus the total value of the seller.*

The sum of consumer and seller surplus is called the *gains from trade*. The amazing thing about voluntary exchange is not just that both parties are made better off. The amazing thing is that the total gains from trade are *maximized*. In the case of Nelson and Darlene, there is no other combination of eggs which leads to a larger sum of seller's and consumer's surplus. The maximization of the total gains from trade is a direct implication of our first principle of economics: maximization. Yet the result is important enough to have its own name: the Theorem of Exchange.

Theorem of Exchange: *All gains from trade are exhausted at the margin.*

The phrase “exhausted at the margin” means that in equilibrium there are no gains from increasing or decreasing the quantity traded. In our little egg example, there are no gains from moving away from the (15,5) distribution of eggs between Nelson and Darlene. At the initial allocation of (0,20), there were lots of gains from trade at the margin, which is why it wasn't an equilibrium, and why Nelson and Darlene were not content to stay at that combination. If you recall the discussion of which freeway lane to take home in chapter 2, you'll note that the same logic was used there. People switch lanes in traffic until there are no gains from switching lanes.

The other amazing feature about exchange is that the gains from trade were maximized without the aid of any third party. Both Nelson and Darlene acted on their own and in their own selfish interest. In doing this they ended up making each other better off. This was one of the great

insights of Adam Smith: private vice can lead to public virtue. We don't get good service at our local Domino's Pizza because the owner is altruistic or because the Pizza police are watching. We get good service because it behooves the owner of Domino's Pizza to provide it. When I'm served well, I return. I get utility from the meal, the owner makes a profit. The gains from trade get maximized.

It isn't quite correct to say this trade takes place without the aid of a third party. Many times economists (especially right-wing ones) forget about a little "helper" that sneaks in under the proverbial table. What happened in our egg example is that an *institution* came to the aid of Nelson and Darlene. This institution is called the *market* and the key aspect of a market is the *market price*. For the next several chapters we're going to assume that the market price works for free. Perhaps it's not too surprising that an allocation mechanism that works for free achieves an outcome that maximizes the gains from trade. Regardless, this assumption is what defines the branch of economics known as *neoclassical economics*. In the third part of the book we'll see what happens when we relax this assumption and assume that the market price is not free.

In the meantime we need to know how this market price is determined. To begin with, since we only have two trading people, we'll start with a little graphic method that provides a lot of intuition about supply. Then we will work at creating a model of market demand and supply.

6.2 Determining Price with Two People

Consider Figure 6-2. This figure is a three sided box, with the width of the box equal to the total amount of goods available. If we stick with our Nelson and Darlene scenario, the width of the box is 20 eggs. The left hand vertical axis is just the vertical price axis for Nelson, while the right hand vertical axis is the price axis for Darlene. Where things get tricky is in the interpretation of the horizontal axis. If we move from left to right it is just the number of eggs that Nelson gets. If we move from right to left it is the number of eggs that Darlene gets. Essentially there are two scales on the horizontal axis. The way we create this graph is to *rotate* Darlene's demand curve around its vertical axis and then impose it on top of Nelson's. Hence, Nelson's demand curve still looks the same, but Darlene's demand curve is backwards and upward sloping. Although it looks upward sloping, there's still an inverse relationship between price and quantity for Darlene. The more eggs Darlene has, the lower her MV is because for her the quantity of eggs increases from right to left ... get it?

What we see from this graph though is the determination of the equilibrium. Where the two demand curves intersect determines the equilibrium price and quantity. When the price is equal to 10¢ it is true that both individuals have a MV equal to the price, and therefore, both individuals have the same MV. Also, it is clear that the gains from trade are maximized at this intersection.

To say that the gains from trade are maximized is to say that the exchange is *efficient*. Efficiency often refers to "technical" efficiency, which in the lay sense usually doesn't mean anything more than "faster" or "stronger". People think that a chain saw is more efficient than an axe, a tractor is more efficient than a horse. If you study economics, the second comment people make to you after the one on "what's the interest rate next week," will be something based on a misconstrued notion of efficiency. On one occasion I was painting some trim on a house with a group of friends.

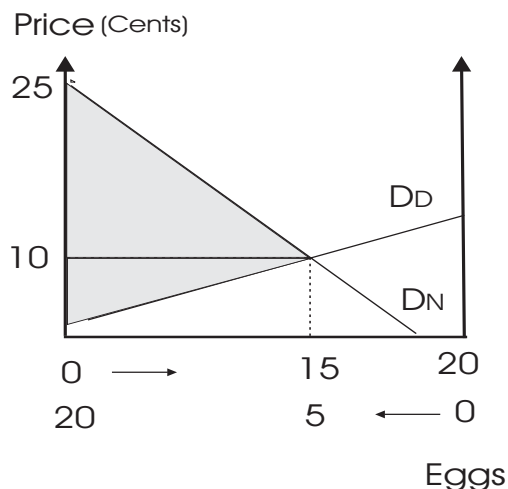


Figure 6-2
Determining the Equilibrium Price

One of my friends came up to me and said “You’ll appreciate this, I’m going to use a roller ... its way more efficient!” What he meant to say was it was faster. When he was done, it took several of us to clean up the mess he’d made getting paint all over the side of the building. It was faster; it wasn’t more efficient.

Efficiency means the gains from trade are maximized.

Figure 6-2 provides some intuition for a result that we’re going to develop in future chapters: supply curves slope upwards. Nelson views Darlene’s demand curve as essentially his supply curve. If he wants more than 15 eggs, he’ll have to pay more than 10¢ because Darlene’s MV increases the more eggs Nelson gets. Generally speaking, supply curves are upward sloping because demand curves are downward sloping. When more is produced in one industry, that means fewer resources are available for use in other industries. Hence the MV of those resources increases in those other industries, and therefore they start to cost more to acquire in the industry that wants to produce more. Alas, we’re getting way ahead ourselves here.

Figure 6-3 shows what would happen if Darlene’s chickens suddenly started to produce more eggs each week. Suppose that instead of 20 eggs, she was getting 30 eggs each week. In terms of the graph, the width of the box now expands to 30 eggs. This means that Darlene’s demand curve shifts to the right. When this happens the intersection with Nelson’s demand curve also shifts to the right and Nelson consumes more eggs (22) and the price of eggs falls (to 7¢). Clearly Nelson is made better off by this development, and this is shown by the increase in his consumer’s surplus. The gains from trade for Darlene have increased as well, and so as we might expect, an increase in the amount of eggs available has increased the total gains from trade.

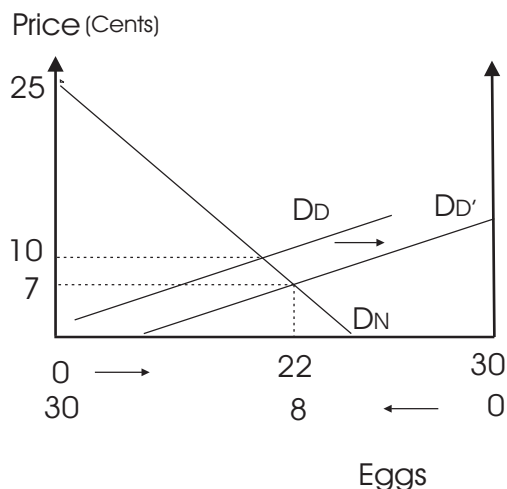


Figure 6-3
A Change in the Supply of Eggs

A Digression on Efficiency: Pareto Optimality

In this book we are going to use the definition of efficiency often attributed to Alfred Marshall, a famous British Economist of the late 19th and early 20th centuries. That is, for us efficiency means to maximize the gains from trade. Quite often, especially when lots of people are involved, some type of action or policy improves the overall amount of wealth in an economy, but reduces the amount of wealth for some individuals. For example, when Canada signed onto the NAFTA trade agreement, it increased the wealth of the country, but hurt some producers who formally had tariff protection from cheaper foreign competition.

An alternative definition of efficiency is called Pareto Optimality. A movement from state A to state B is said to be Pareto optimal if at least one person is made better off by the move and no one is made worse off. Pareto Optimality is a stronger condition than Marshallian efficiency, and as a result any thing which is Pareto optimal is efficient, but the reverse is not true. For example, Canada signing the NAFTA would not be Pareto optimal because some individuals were made worse off. Pareto Optimality is mostly used in welfare economics. Since our concern is explaining human behavior, and since we believe this behavior is best explained by the pursuit of maximizing the gains from trade, we will not use the concept of Pareto Optimality.

6.3 Market Demand and Supply Curves

Although the above method of determining the equilibrium price and quantity traded is very intuitive, the double labeled axis is a little cumbersome, and if we want to add more traders to the model, things would get downright ugly. A better way to determine the equilibrium, and the one we'll consider for the rest of the book is the use of *market demand and supply* curves.

This might sound a little intimidating, but it is really quite simple. Until now we've considered *individual* demand curves. These curves tell us the quantity demanded by a given individual for a

given price. They also tell us the individual’s marginal and total value for any given quantity. A market demand curve is simply a *horizontal* summation of all the individual demand curves in a given market. A market supply curve is simply the sum of all the individual supplies in a given market. The area under the market demand curve will tell us the total value of all the consumers in the market.

Consider Table 6-1 which lists the points on the demand curve for Miriam and Gayle, two people interested in homemade crafted ornaments. For simplicity, these two amount to the entire market for crafted ornaments.

TABLE 6-1

Individual and Market Demands for Crafts

Price	Quantity Demanded by Miriam	Quantity Demanded by Gayle	Total Quantity Demanded
10	0	0	0
9	1	0	1
8	2	0	2
7	3	1	4
6	4	2	6
5	5	3	8
4	6	4	10

Both of the demand curves are simple straight lines (with slopes of -1), but Miriam’s is larger due to her strong preferences for things crafty. Note that when the price of the ornament is \$10, neither one of them demand any. Thus the total amount demanded is also zero. When the price falls to \$9 Miriam buys 1 craft, but Gayle still buys none and the total amount demanded by the market is just 1. In fact, until the price hits \$7, Miriam is the only person in the market, and as a result the market demand will just be her demand curve.

However, notice what happens when the price goes to \$7. At that price Gayle buys one ornament and Miriam buys 3, which means that the total quantity demanded is 4. At every lower price the market demand is the sum of the quantity demanded by each individual. If Miriam and Gayle’s friend Barb decides to join them, then the market demand would simply be the sum of the three individual demand curves. It doesn’t matter how many people join the market the market demand curve is always the sum of quantities demanded by those in the market.

These individual demands and the market demands are drawn in Figure 6-4. Notice that the market demand curve is more elastic than the individual demand curves.

Market demand curves are more elastic than individual demand curves.

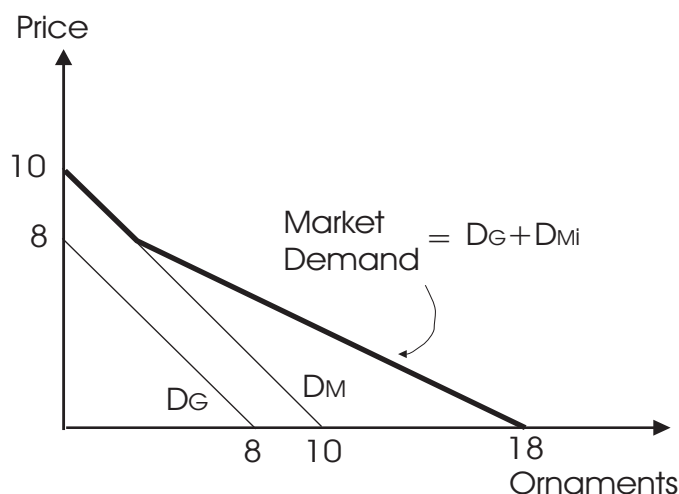


Figure 6-4
Market Demand Curves

Now for something important ... pay attention. Why is the market demand curve more elastic? The reason is that a market demand curve is downward sloping for two reasons. First, when the price of the good falls, everyone who is *in the market* buys more because they substitute out of other goods and into this cheaper one. Second, marginal individuals who were just indifferent to buying ornaments at the higher price now enter the market when the price is lower. These two effects have special names. The first effect is called the intensive margin; the second effect is called the extensive margin.

6.4 Unit Demand Curves (A Special Case)

To help understand the extensive margin, let's consider a special case. There are many things in life, which for various reasons, you only do once or own one of. In most societies we only have one spouse at a time, most people own only one house, furnace, and table saw at one time. It's hard to be pregnant twice at the same time, you register for school only once, and you have only one driver's license. In such situations economists say that individuals have *unit demand curves*. These are special demand functions that simply tell us the total value a consumer has for the first unit of a commodity. Figure 6-5 shows two unit demand curves for hot water tanks in the first two graphs.

Notice that the demand curves are simple rectangles — just the amount one would pay for one unit. Notice also that these two individuals have different total values for the hot water tanks. The first person is willing to pay \$1000 while the second person is only willing to pay \$750. Presumably a market would be made up of hundreds or thousands of individuals, all with different unit demands for hot water tanks.

What does this mean for the market demand curve? Remarkably, the market demand curve looks just like it would if the individuals all had demand curves that were downward sloping. The reason is that although there are no intensive margin changes in the quantity demanded, there are still extensive market changes. As the price of the hot water tanks falls, more individuals enter the

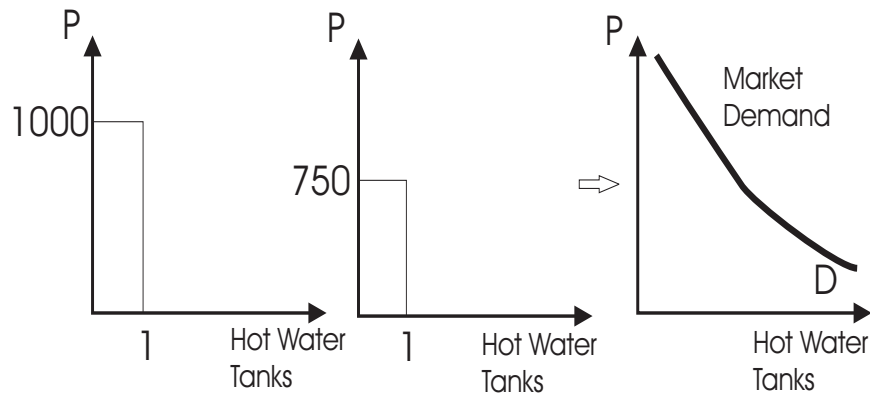


Figure 6-5
Individual Unit Demand Curves and Market Demand

market. Thus the graph on the far right of Figure 6-5 shows a downward sloping line. Every extra unit that is sold represents a new consumer entering the market. The last consumer to enter the market is called the *marginal consumer* because that person receives no consumer's surplus. Those *intra marginal* consumers in the market get consumer's surplus, but the last person does not. Those people who have low unit demands; that is, their total values are still lower than the price, simply are not in the market.

The notion of market demand curves based solely on unit demands on the part of consumers is extraordinarily useful because it allows us to extend the law of demand at a market level in situations where it might not make sense to use it at the individual level. For example, economists would predict that lowering the cost of divorce would increase the divorce rate. For any individual couple, they either get divorced or they don't. A divorced couple cannot divorce a second time. Furthermore, when the cost of divorce goes down, not everyone gets divorced ... most still stay married. But some marginal couples, just indifferent to being married or divorced now become divorced when the cost of divorce falls, and this is predicted by the market demand curve.

The same would be true about predictions regarding crime. Raising penalties for crime won't mean that every criminal ceases such activity, but some of them do ... the marginal ones. Likewise, if the cost of crime goes down, some individuals engage in crime, but not everyone goes out and commits a murder! Consider university enrollment. When the price of tuition goes down, most people don't change their behavior, but the marginal students now enroll. Changes in the extensive margin mean that the market demand curve is downward sloping, even when individuals can only make a dichotomous "in or out" decision.

6.5 Market Supply

Since we're talking about exchange in an economy where supply is just fixed, the calculation of market supply is trivial. Every individual is endowed with some amount of the good in question (this endowment could be zero), and this means the individual supply curves are simply vertical lines. It doesn't matter what the price is, no more or less can exist. To find the market supply curve, we simply add these sums up horizontally. This is shown in Figure 6-6.

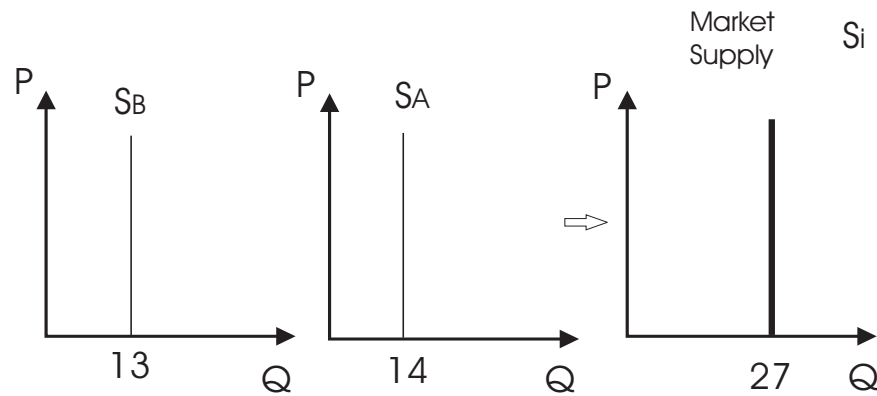


Figure 6-6
Market Supply Curves

To find the equilibrium price and quantity is now quite simple: it is determined by the intersection of the market demand and supply curves, as shown in Figure 6-7.

Equilibrium price and quantity are determined by the intersection of the market demand and market supply curves.

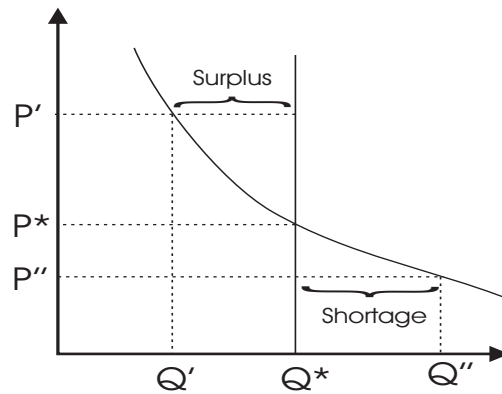


Figure 6-7
Market Equilibrium

When the price is P^* , the total quantity demanded equals the total quantity supplied. If the price was greater than this, say P' , then the total quantity demanded falls, as every individual substitutes out of the good to some extent. Since the quantity demanded at this high price is less than the quantity supplied, a surplus exists. Market pressure will result in the price falling back down to

P^* . If the price was lower than the equilibrium price, say P'' , then the quantity demanded would increase beyond the quantity supplied, and a shortage would result. Again as consumers competed for the good, they would bid the price back up until it once again equaled P^* . At the equilibrium price each individual is in an equilibrium because the price is equal to their marginal value.

We can now see what happens to the equilibrium price and quantity when demand and supplies change. Figure 6-8 shows four graphs. The top two graphs show what happens to the equilibrium price and quantity when the supply increases or decreases. The bottom two show what happens when the demand curve increases or decreases.

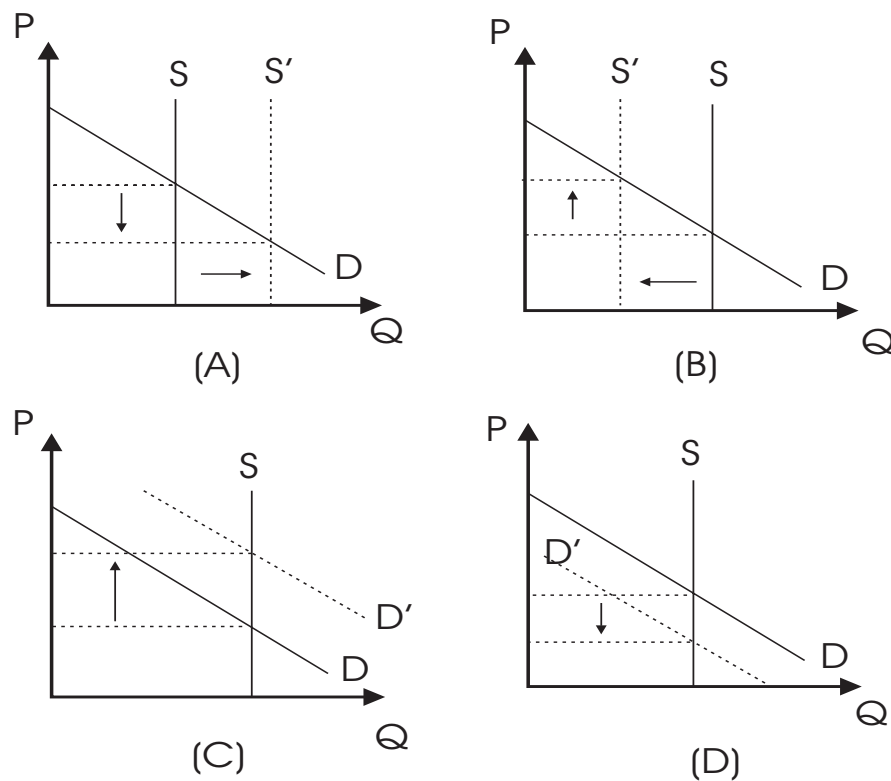


Figure 6-8
Changes in Equilibrium

In panel (a) the supply curve increases and this leads to a fall in price and an increase in the quantity demanded. Notice, and this is important, when the supply curve shifts there is a change in the quantity demanded, but there is no change in demand. A shift in the supply curve does not cause the demand curve to shift. Why does the price fall? If it did not fall there would be a surplus of goods available. At the original price the consumers are not willing to purchase all of the new supply. Hence the price must fall because at the new larger supply the marginal value of consumers is also lower.

Panel (b) shows a similar situation with a reduction in supply. Now the equilibrium price increases and the quantity demanded falls. Had the price not risen there would have been a shortage,

since at the original price consumers demand more than the new lower amount supplied. The rise in price “clears the market” and guarantees that the quantity supplied equals the quantity demanded.

Panel (c) shows the results of an increase in demand when the supply curve is vertical. Since the supply is fixed, there is no change in the quantity demanded, only an increase in price. Panel (d) shows that when the demand curve shifts down there is a subsequent fall in the price. The movements in prices and quantities when there is a shift in either demand or supply is what the average person casually refer to as “the laws of supply and demand.” Well, let’s hope this is what they’re referring too!

6.6 Exchange with Market Demand and Supply

Let’s suppose that we have another small market of two individuals: Rich Mr. Redekop and Poor Miss Mach. Both of the individuals happen to own some rooms in which they live. Miss Mach has 2 rooms, while the wealthy Mr. Redekop has 15. However, each has a demand for rooms that is similar to their endowments. Mr. Redekop has a large demand, while Miss Mach has a much smaller one. These demands and supplies, along with the resulting market demand and supplies are drawn in Figure 6-9.

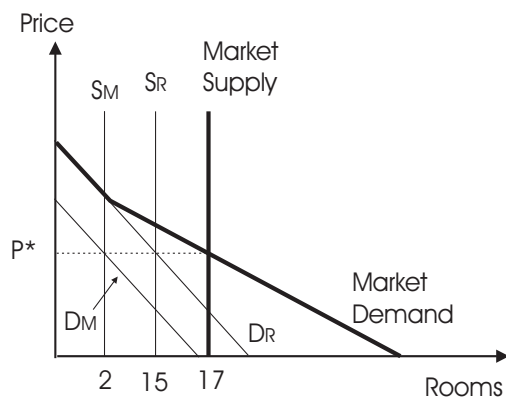


Figure 6-9
Equilibrium in the Room Market

I’ve drawn these curves purposely a certain way, such that at the equilibrium price, P^* , Miss Mach just happens to demand 2 rooms, and Mr. Redekop just happens to demand 15 rooms — their very endowments. Is the price P^* an equilibrium price? At the price P^* the marginal value of rooms for Miss Mach is equal to the price and equal to the marginal value of rooms for Mr. Redekop. There is no other allocation of rooms that could increase the total surplus. So this is an equilibrium.

Now, suppose tragedy strikes. Poor Miss Mach. In an effort to save a little on electricity she was burning candles one night while doing Mr. Redekop’s laundry for a few extra dollars. She fell asleep from exhaustion and the candles caught the sheet she was using for curtains on fire. Luckily

Miss Mach escaped unharmed with the laundry, but the two rooms were destroyed. Did I mention it was Christmas Eve?

What happens now in this market? Suddenly the market supply has gone from 17 to 15 rooms, and all of these rooms belong to Mr. Redekop. With no rooms to live in Miss Mach's marginal value for rooms has increased and is now higher than Mr. Redekop's. As a result she is willing to rent rooms from him. Figure 6-10 shows the post fire situation. At the new intersection of market demand and supply we see that Miss Mach now demands 1 room, and Mr. Redekop is willing to give up this room. The new consumer surplus for Miss Mach is shown as the shaded area under her demand curve. Notice that this is smaller than her consumer's surplus before the fire, but it is larger than the consumer's surplus she would get if she could not rent a room. In fact, in that case her surplus would be zero. The shaded area just above Mr. Redekop's demand curve is the seller's surplus he gets from renting the room. This is the amount of rent for the room minus the marginal value he placed on the room when he consumed it himself (the area under his demand curve for the 15th room). Thus Mr. Redekop is made better off by the misfortune of Miss Mach.

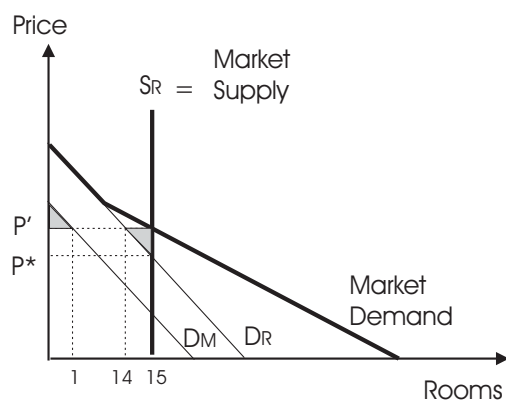


Figure 6-10
Equilibrium with Fewer Rooms

Perhaps you're thinking "such is the injustice of market efficiency." Well, no, such is the injustice of homes burning down. The market price mechanism actually made the situation better. Suppose that in anticipation of Mr. Redekop's opportunistic increase in rental prices, the local government passed a law preventing rents from increasing, just after the fire occurred. Mr. Redekop could rent out a room, but it would have to be at the original price of P^* — no price gouging allowed!

What would be the result of such a move? The result would be Mr. Redekop would not rent out a room. Why should he? If he rents out a room at price P^* , his marginal value increases, which means that the value he places on the room is higher than the rent he'll receive. Since Mr. Redekop is greedy, just like Miss Mach, he won't do anything that makes him worse off. But if Mr. Redekop won't rent out the room, then poor Miss Mach is stuck with living on the street. The good intention of the law has had the unintended consequence of hurting the very person it was supposed to help. When markets work well at allocating goods, preventing the market from working by restricting the movement of prices will lower the total gains from trade.

The real point of this melodramatic section is to help you realize what is behind the concept of a market equilibrium. When the market supply and market demand intersect an equilibrium results not just because the total amount supplied just happens to equal the total amount demanded. In addition to this, every individual is also in equilibrium. Each consumer sets their marginal value equal to the price, and every consumer is content to stay at this quantity because it maximizes their utility and maximizes the gains from trade.

6.7 Applications

Rent Control

With our market model we can analyze all types of things in the world around us. Let's consider rent control when there is a fixed supply of housing available. At various times and in various jurisdictions rent control has been a popular public policy. Essentially what a rent control does is restrict the rent of an apartment from increasing above some ceiling amount. For the purposes of simply demonstrating the price effects, let's assume that the government is perfectly able to enforce the rent control. Hence, landlords and tenants are not able to pay money under the table in order to get around the law.

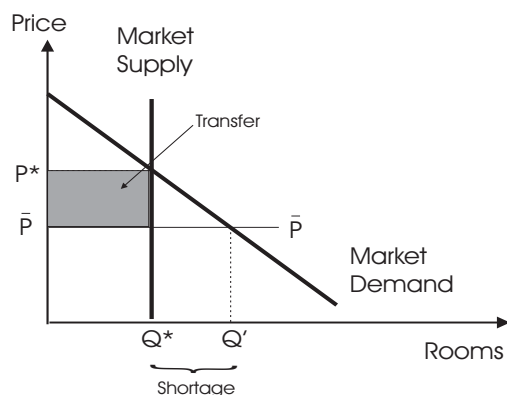


Figure 6-11
Rent Control

Figure 6-11 shows a rental market where the local government has imposed a price ceiling of \bar{P} , which is below the equilibrium price of P^* . The simple result of this is a shortage of apartments is created. At this low price the quantity demanded increases beyond the fixed supply of rooms. The impact is that people would line up or otherwise try to compete for the rooms that are hard to get. The second effect is that for those people lucky enough to get rooms, there is a *transfer of wealth*. This is shown as the shaded area in the figure. This transfer was wealth that used to be seller's surplus and is now consumer's surplus. It results from the fact that the rooms are rented at the lower price. There's a lot more to rent control than these two effects, but we'll have to wait to complicate our model with production before we can analyze them.

This is the first mention of wealth transfers, and more needs to be said about them. A true wealth transfer takes a given amount of money from one person, say \$100, and gives it to someone else. Many wealth transfers in the real world don't work this smoothly. When you donate money to a nonprofit firm like CARE or UNICEF, for every dollar you give, perhaps 60¢ actually gets transferred to the intended recipient. In a true wealth transfer nothing is lost in the transfer. Economists are prone to consider true wealth transfers as neutral in terms of efficiency, because the changes they cause in utility are unobservable. Some people think any wealth transfer from rich people to poor people must increase efficiency because a dollar should be worth more to people who don't have very many. But people who think this way usually aren't rich! Consider the fictitious case of Scrooge and Cratchet in Dicken's *Christmas Carol*. If we took a dollar from rich Scrooge and gave to poor Cratchet, no doubt the latter would be filled with joy. However, Scrooge would be beside himself with angst, and it's not clear if the gain to Cratchet would exceed the loss to Scrooge. As much as we might detest the likes of Scrooges, the point is well taken. In this book we'll stick with the convention of considering true wealth transfers as neutral with respect to efficiency.

Just Lucky

Have you ever seen a graph like the one in Figure 6-12 in a newspaper or book? Quite often these graphs are couched in discussions of the global warming, environmental degradation, and the general end of the earth. The argument usually goes something like: up until now we've been lucky that the supplies of natural resources have been sufficient to meet the consumer demands. However, in the future, as demands continue to grow and as the world's fixed resources begin to decline, shortages are inevitable. Demand will outstrip supply.

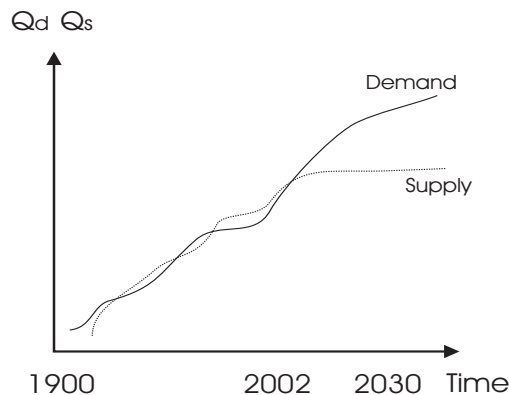


Figure 6-12
Future Shortfalls

What's wrong with this type of analysis is it ignores the equilibrating role of prices. It was no fluke supplies of natural resources just happened to meet demands over the past centuries. As resources become more scarce, prices rise. These rises in prices cause reductions in the quantity demanded until an equilibrium is reached. The equilibrating effect of changing prices means that quantities demanded will always equal quantities supplied. It's not luck ... it's equilibrium.

6.8 Prelude of Things To Come

In the next chapter we will start to discuss costs and production. The next two chapters will have the purpose of understanding the supply curve, and in particular, understanding why it is upward sloping. Before we do so, however, it may be of some use to simply assume the supply curve is upward sloping and consider our example of rent control in order to better understand markets and exchange.

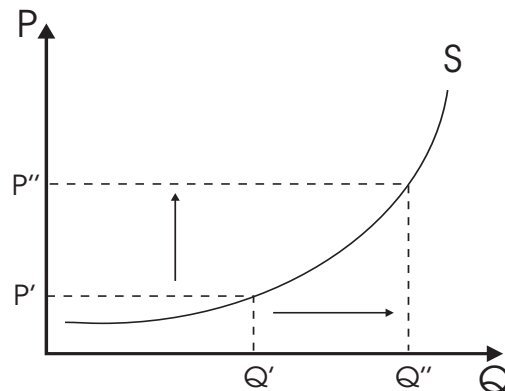


Figure 6-13
An Upward Sloping Supply Curve

What does it mean, at a market level, to say a supply curve is upward sloping? Visually it is quite simple and is shown in Figure 6-13. Basically a supply curve tells us how much of the commodity Q will be supplied to the market at a given price. When the price is P' then Q' is supplied. When the price rises to P'' then the amount of the commodity supplied to the market increases to Q'' . In other words, there is a positive relationship between the price of a commodity and the amount suppliers (often firms) are willing to take to the market. When supply curves are upward sloping the equilibrium price and quantity are still determined by the intersection of supply and demand, just as in Figure 6-8. The only difference is that changes in price now induce a change in the quantity supplied as well as a change in the quantity demanded.

Let's consider the example of rent control again, this time using an upward sloping supply curve. Now when rental rates increase there is an increase in the number of rooms available to rent, and when there is a decrease in rental rates, there is a decrease in the number of rooms to rent. Consider Figure 6-14. Before there was any form of rent control the rental on rooms was P^* and a total number of rooms Q^* was both supplied and demanded. When the rent control is put on the rental rate is legally set to \bar{P} , which means the quantity demanded increases to \bar{Q} . This is the same as before. The difference now is that suppliers of rooms *remove some rooms from the market*. When the market price for a room falls, room owners convert some of the previously rented rooms to other uses. For example, they may just use the room for a guest room, or a shop, or sewing room. There are many uses for rooms, and the landlord will seek the best one. This fall in the quantity supplied of rooms to Q' means the marginal value those rooms actually rented increases to P' . Anyone who actually rents a room at these lower prices is getting a great deal, and those who do not have a room are willing to pay up to P' to get one. If you're a *Seinfeld* fan, you may recall the episode where

George is trying to get a new apartment in his building which is rent controlled. Those in charge of renting the room out are going to give it to an old man because he survived a ship sinking at sea. George gives them a brief outline of his life and easily proves he has a more pathetic life and deserves the apartment. In the end the apartment goes to another person who simply bribed the superindendent of the building. Such is what happens under rent control.

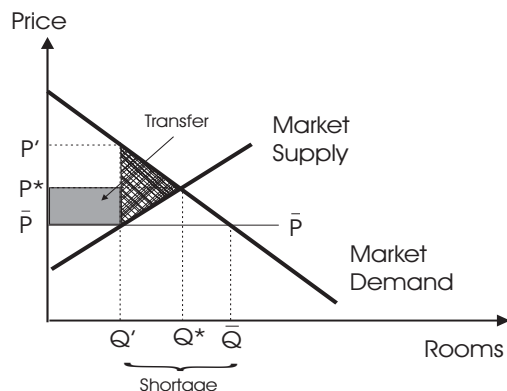


Figure 6-14
Rent Control With Upward Sloping Supply Curves

When the supply curve is upward sloping, the rent control has more significant impacts. Notice with an upward sloping supply curve the shortage of apartments is larger. Notice also there is a reduction in the number of units available to rent because of the rent control. This means there is a loss of consumer and seller surplus from the reduction in trade. This loss is represented as the cross hatched area in the figure. We'll discuss this area more in chapter 9, but it is called a "deadweight loss." A deadweight loss is different from a transfer of wealth. This is a loss of surplus, which no one acquires. Thus from figure 6-14 we would say the rent control made some sellers and buyers worse off by the amount of the deadweight loss.

6.9 Summary

This chapter has examined trade when people are simply endowed with goods and are unable to change the supply of what they have. Using demand curves we again saw that trade takes place when people have different marginal values. We also saw that trade stops when marginal values are equal, and this condition is met when market demand and market supply are equal. When a trading equilibrium is reached, the gains from trade (the sum of consumer and producer surplus) are maximized.

Changes in any of the factors that are normally held constant, like changes in incomes, other prices, tastes, or supplies, will lead to shifts in either the market demand or supply curves. These shifts then lead to changes in the equilibrium prices and quantities. Any increase in demand leads to an increase in price and quantity. Any increase in supply leads to a fall in price, but an increase in the quantity traded.

Although we briefly introduced the notion of an upward sloping supply curve at the end of the chapter, in the next two chapters we will examine issues of production before we return again to markets and supply curves.

REVIEW QUESTIONS

1. Explain how it is exchange can make both parties better off, even when there is no production?
2. How is the Theorem of Exchange just an implication of the principle of maximization?
3. If trade between two people makes them both better off, will trade between three people always make all three better off?
4. What is the difference between the extensive and intensive margins?
5. If there is an excess supply, what forces will cause the price to fall?
6. If there is an excess demand, what forces will cause the price to rise?
7. In real markets we see prices moving up and down all the time, does this mean the market is out of equilibrium?

PROBLEMS

1. What is wrong with the following statement: “If the price of housing goes up to \$500,000 then no one will be able to afford it.”
2. When asked why a hand carved mask was so expensive, the owner of the store said “Because it takes so many hours to make it.” Provide a better answer.
3. When you find someone who eats hot dogs at a ball park, the person invariably says “da dawgs, dey always taste great!”. Assuming that hot dogs don’t really taste better at the ball park (but knowing that they cost twice as much as they normally do) what would explain this observation (that is, why would we observe a large fraction of the hot dog consumers in the park saying that the hot dogs taste great relative to hot dog consumers at home or elsewhere)?
4. “Trade occurs when two people value different goods equally. In this sense, trade is fair because equally valued goods are being traded.” True, False, explain.
5. Person A has demand curve $D_a = 8 - P$, while person B has demand curve $D_b = 13 - P$ for some good. Person A owns 7 units, while person B only owns 4.
 - a. What is the equilibrium price at which trade takes place?
 - b. Who is a net seller, who is a net buyer, and by how much?
6. Analyze the following statement using our economic model: “The threat of sexually transmitted diseases (stds) has increased the demand for prophylactics, but this increase in demand has raised prices of prophylactics. At the higher prices demand falls and in the end fewer prophylactics are used, and stds become more common.”
7. If the gains from trade are exhausted or will be, why do individuals trade at all? Aren’t individuals better off with gains rather than having their gains exhausted? Briefly explain.
8. “The wages in Mexico are significantly less than those paid in Canada. Therefore Canada will gain from trade with Mexico, but not the other way around.” True/False, explain.
- 9.. Mr. A and Mr. B have the following respective demands.

$$P^a = 25 - 5X, \quad P^b = 11 - X$$

- a. Graph them on separate graphs.
 - b. Mr. A has no X’s while Mr. B has 10 X’s. What are their marginal and total values at these quantities? Using either method discussed in the chapter, determine how much each will have after trade? What will be their marginal values at these quantities?
10. Suppose you are in charge of a toll bridge that is essentially cost free. The demand for bridge crossings Q is given by $P = 12 - 2Q$.

- a. Draw the demand curve for bridge crossings.
 - b. How many people would cross the bridge if there were no toll?
 - c. What is the loss of consumer surplus associated with the charge of a bridge toll of \$6.
11. What economic principle is Robert Frost discussing below?

Two roads diverged in a yellow wood,
And sorry I could not travel both
And be one traveler, long I stood
And looked down one as far as I could
To where it bent in the undergrowth;
Then took the other, as just as fair,
And having perhaps the better claim,
Because it was grassy and wanted wear;
Though as for that the passing there
Had worn them really about the same,
And both that morning equally lay
In leaves no step had trodden black.
Oh, I kept the first for another day!
Yet knowing how way leads on to way,
I doubted if I should ever come back.
I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I —
I took the one less traveled by,
And that has made all the difference.

A literary critic, commenting on this poem said “The poet’s ‘difference’ is in him from the beginning, long before he sets out on his career. The road that Robert Frost took was not only the ‘different’ road, the right road for him, but the only road he could have taken.” Who is the better economist, Frost or the Critic? Why?

12. Whistler is an international ski resort with a relatively fixed supply of housing at any time. Recently a home renting 70 beds for \$700 per month for each bed was shut down for violating fire codes. The mayor of the town stated it was morally wrong to charge so much for one bed in a room with nine other beds, and if it were up to the mayor, all such bunk houses would be shut down. Who would be hurt by such a by-law? Who would benefit?
13. “The law of demand says that when the price of something falls, more should be consumed. But when the price of vacations falls, I still just take one vacation per year.” How does the law of demand fit in this circumstance?
14. In the summer of 2003 the interior of the province of British Columbia experienced the worst forest fire season in recorded history. In the city of Kelowna, over 200 homes were destroyed by fire. In a CBC radio interview a Kelowna city councillor made the following statement: “Since the forest fires of the summer there has been an enormous increase in the cost of rental housing in the city. Two hundred and thirty people lost their homes to forest fires, and these people have to live somewhere. It will take a long time before the supply of housing equals demand.” Assuming the councillor meant to say “It will take a long time before the quantity demanded of housing equals the quantity supplied,” what is wrong with his economic logic?
15. One of the common traffic rules car drivers must know is how to proceed at a four-way stop. This happens in intersections where drivers from all directions must stop and then proceed on a “first come, first served” basis; that is, the first person to the intersection goes first, the second person goes second, etc. If there is a tie, the person on the right goes first. Suppose a busy intersection has a four-way stop procedure, is such a rule Pareto optimal? If not, do people proceed along lines which are Pareto optimal?

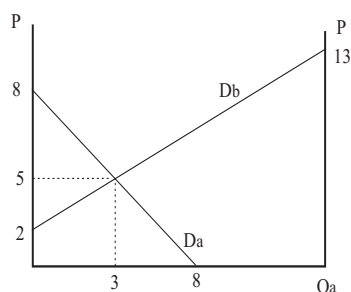
REVIEW QUESTION ANSWERS

1. *When two people exchange goods, the flow is from low valued users to high valued users. Surplus is generated because the two parties value the goods differently at the margin. Hence, production is not necessary for the generation of wealth, a redistribution from low to high valued users also generates wealth. As a corollary, if there is a forced, involuntary redistribution of goods in an economy, this must lower wealth.*
2. *When people are maximizers they trade because it makes them better off. As long as there are gains to be had, they keep trading. This process only stops when all the gains from trade are exhausted at the margin, but this is the Theorem of Exchange.*
3. *No. When a third party enters a trade arrangement, he is likely to displace one of the other traders. If he has a higher or lower marginal value of a good then he will start to receive or trade that good. As a result, even though the total gains from trade will increase with more traders, not everyone will be happy about it. This means having more traders is not usually Pareto Optimal. Can you think of when it would be?*
4. *The extensive margin refers to individuals entering or leaving the market. The intensive margin refers to those already in the market who now buy a little more or less.*
5. *An excess supply means inventories increase. That is, those with the goods have a low marginal value for them, and those without the goods have a high marginal value. Maximization is the force that will drive the price down until the marginal values are equal.*
6. *The answer is essentially the same as in (5).*
7. *Our model is an “equilibrium” model. That is, it assumes the “economy” moves from one equilibrium to another instantaneously. Hence, fluctuating prices are interpreted as movements from one equilibrium to another due to some changes in the demand or supply curves.*

Odd Numbered Problem Answers

1. *Prices are determined by supply and demand. A demand curve is based, in part, on one's ability to pay. Therefore, if the price is \$500,000 then someone is willing and able to afford that price.*
3. *The observations we see are a biased sample. Only those people who value goods greater than the price purchase, and only those firms with costs below the price produce. At the ball park, only people who love hot dogs are willing to pay the high price. They would say any dog tasted great. At a birthday party where the hot dogs are free, everyone consumes them and many people will say they are gross ... even though they may be fresher and better than the hot dogs at the ball park. For the same reason you won't find anyone coming out of a Brittany Spears concert saying it was a bad show. Any fan willing to stand in line for two days and pay several hundred dollars for a ticket would love any Spears performance.*

5.



8

Figure 6-5

- a. *The easiest way to solve this problem is to make a box 11 units wide, and solve the two equations. From the graph we see the equilibrium price is \$5, and person A demands 3 units, while person B demands 8 units.*
- b. *Person A is a net seller of 4 units, and person B is a net buyer of 4 units.*
7. *The gains are exhausted **at the margin**. When this happens the total gains from trade are maximized.*

9.

a.

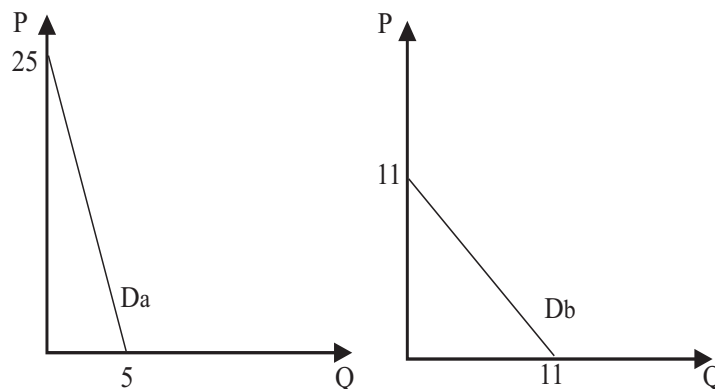


Figure 6-9

- b. When Mr. A has no X's his MV is 25 and his TV is zero. If Mr. B has 10 X's, then his MV is 1, and his TV is 60. After trade Mr. A will have 4 units and Mr. B will have 6. The MV of each will be 5.
11. Frost is pointing out life is full of choices, a very economic notion. The critic seems to be suggesting Frost had no choice. This gets at a deep philosophical issue which is nicely raised at this point. What is the nature of choice? If we have preferences and constraints, and if we are driven by maximization, then in what sense do we choose? Are we a computer program, like Maple, where once the parameters are punched in an optimal "choice" spits out? Maple has no choice but to pick a certain outcome, are we, like Frost's critic, made to make choices like this? I think not. Unlike Maple, we make choices because we want to, not because we must make them. We have the ability not to do the optimal strategy. Frost **could have** taken the other road, he just didn't want to. And that makes all the difference. Frost was the better economist.
13. There's no such good as a "vacation". People take time off, they actually go places, buy trinkets, etc. What good actually fell in price? If the cost of taking time off falls, then people will take more time off. They may take one vacation, but it will be longer. If flights away fall in price, the person might take one vacation, but will fly further away. And so on. Whatever the dimension of price reduction is, there will be increased consumption along that margin.
15. It generally is not Pareto Optimal. If you have four cars at an intersection, the two cars going in opposite directions can go at the same time. This means four cars go through in the time it takes two cars under the legal rule. This happens all the time at four way stops, and no one gets mad because no one is harmed and some benefit.

CHAPTER 7

COST AND COMPARATIVE ADVANTAGE

7.1 What is Cost?

There's a not so famous story of a Nobel prize winning economist who sits down on an airplane seat beside a Nobel winning Doctor. "Tell me" says the Doctor to the economist, "what is one simple and important idea in economics that's not obvious?" The economist thought for a moment, and couldn't come up with anything. Later, after he'd left the plane, the economist realized he should have said "Cost." The concept of cost is one of the most important and valuable ideas in economics, yet the profession has done such a bad job in marketing its true meaning that the general public has no idea what cost means.

Let's pause and consider what cost is. Ask the man on the street, "what is cost?" and the response is almost universal — "what you pay for something". In other words, the layman's notion of cost is "historical cost". This answer is reinforced by the accountant's use of historical cost as their measure of cost. Although it's possible for historical cost to equal the true cost, historical cost is often completely irrelevant in measuring actual costs, and as a result, often bears no relation to current prices or behavior. Your parents may have paid a trivial price for their home thirty years ago, even though it might be worth a small fortune today. Perhaps you've purchased a car for \$10,000, only to find out it is rusted-out, and needs major repairs. The \$10,000 you paid is irrelevant to what the car is worth, and irrelevant for how you will behave with respect to the car. A firm may own an asset that has long been fully depreciated on the accountant's books, but is still a valuable piece of equipment. In all of these examples, the historical cost is irrelevant.

Economists refer to costs as *opportunity cost*. Opportunity cost is the value of the next best alternative, and is often independent of historical cost. When you decide to do something, like ride your bike, you give up the opportunity to do hundreds of other activities. Each one of those activities has a value. The value of the activity with the highest value, is the cost of riding your bike. To be even more concrete, suppose instead of riding your bike you could see a movie worth \$20 or study another course worth \$15. The cost of riding then is \$20.

To help understand this notion of cost, keep in mind opportunity cost always refers to an action. In our casual speech we say things like "how much does the book cost?", but such a statement does not make any sense literally. What we should say is, "how much does it cost to *buy* the book, *read* the book, *write* the book" and so on. Actions imply there is a forgone alternative, and therefore a cost. If there is no action or choice taken, then there can be no cost.

Likewise, if there is no alternative, neither is there a cost. The most common linguistic mistake made in this regard, is with respect to time. We say things like "my time is money", or "my time is valuable", or even "I'm a high time-cost person". As with the case of the book, these are examples of sloppy language — time is not a cost! Time marches on and there is nothing we can do about it. What is costly is what we do with our time. If I sleep in, I forgo having breakfast. The value of the lost breakfast is the cost of using my time between 7:00-8:00 am for sleeping. When we say an individual is a high time-cost person, what we really mean is the value of the alternative uses of this person's time are high. Opportunity cost is our fourth economic principle.

PRINCIPLE #4

Opportunity Cost: *the value of the highest forsaken alternative.*

7.2 Adding Up Costs

Opportunity cost critically hinges on the value of the *next best* alternative, not the value of all the alternatives. At this moment, what is the cost to you of reading this chapter? Perhaps you could be working right now for \$10 per hour? Perhaps you could be at a party, or eating lunch with friends. If you think about it, the set of things you could be doing right now is very large. The cost of reading this chapter is not the sum value of all these activities. Rather it is the value of the single alternative activity you value the most.

This is not to say several values are never added up to arrive at the cost of an activity. Suppose the final exam for this course is only three days away — on a Friday. On Tuesday night there are three mutually exclusive things you can do besides study. Ranking them from most to least preferred you can (i) go to a party, (ii) go to a movie, or (iii) watch an old Star Trek episode. On Wednesday night you could (i) go to a party, (ii) visit your Mom, or (iii) get some sleep. On Thursday night you could (i) go visit your priest, (ii) do the laundry, or (iii) go to yet another party. If you decide to study all three nights, what is the cost? It is the value of two parties and one visit to the priest. It is not the value of every single activity, nor the value of the single highest activity. Cost is the value of the highest forsaken alternative, and the key to understanding it is to determine the true alternative. For example, suppose you buy a hot-dog at a sidewalk vendor for \$1.50. Is the \$1.50 a cost? Absolutely, since the money could have been spent on anything else, including the most valuable alternative. Suppose in addition to the money, you had to wait for 10 minutes, and what you could do with this time was worth \$2. Is this part of the cost of the hot-dog? Absolutely, because in deciding to purchase the hot-dog, you are deciding to forgo the time as well as the money.

As a final example, consider the cost of your education. The tuition is an obvious sacrifice, but so is your forgone income. By being in school you are out of the workforce, and this constitutes a major cost of education. What about your books, are they part of your education cost? If you wouldn't have bought them otherwise (which is probably true for all your books but this one!), then yes they are a cost. What about the rent for your apartment, is it a cost of your education? This is a little trickier. If, by going to school, you had to move and increase your rent, then this *increase* in rent is a cost of education. Presumably, you would have been renting something had you not gone to school, so if your rent does not change, then it is not part of the cost of your education.

7.3 Costs and Bads

It is a common mistake to always think of costs as a bad thing and to confuse costs with bads. In every decision good things and bad things come along with that decision. The bad things, however, are not the costs of the decision. Hence, sweat, toil, and pain, unless they affect the value of alternatives, are not costs. For example, suppose there are two mutually exclusive choices: you can

purchase a swimming pool for your home or purchase a new car. There are good things about the swimming pool — you can exercise, cool off, etc., and these may be worth \$15,000 to you. However, there are also some bad things — the neighbor kids are always over, your heating bill is higher, etc., and perhaps these “bads” are worth \$-2,000 to you. The difference of \$13,000 is the value of the pool, namely the amount you would be willing to pay to have one. Suppose the car also has good and bad features about it, and the difference of \$9,000 is the value of the car. What is the cost of having the pool? It is not the value of the bads (\$2,000), it is the forgone value of the car (\$9,000).

When we think of costs always as bads, we miss the fact that increasing costs can sometimes be a good thing! Suppose an individual is working for Microsoft in Seattle Washington, and has a salary of \$160,000. Then one day Corel offered him a job for \$300,000 in Ottawa. The cost of staying in Seattle has gone up because the worker is giving up a higher salary in Ottawa. However, we wouldn't want to say the worker is worse off because his costs increased. He is clearly better off with the new job offer. Any increase in outside opportunities is an increase in cost, but this type of increased cost is a good thing because it represents an increase in wealth. The employee who has zero opportunity costs of staying at his or her job is not exactly in a strong bargaining position.

When a competitive firm pays workers \$10 per hour it does so because these workers could earn \$10 per hour at some other activity — the firm must pay the workers their opportunity cost. When you read about marginal costs and supply curves, keep in mind the cost of producing an additional unit ultimately reflects the value of the inputs in their next best use. Hence, though the term “opportunity” will usually be dropped in the rest of the text, the costs relevant to a firm are still opportunity costs.

7.4 Sunk, Avoidable, Fixed, and Variable Costs.

For economists there are three critical distinctions among different types of costs. The first is the difference between ordinary costs of production and transaction costs. Transaction costs are costs that arise when individuals try to cheat one another in an exchange. Shoplifting is a transaction cost, but so are the extra wages paid for shirking workers. This distinction is central to Part III of the book, but for Parts I and II we simply ignore these types of costs and assume all transaction costs are zero.

The second distinction is between sunk (unavoidable) costs, and avoidable costs. Sunk costs are costs that have no bearing on economic decisions because nothing can be done about them. When your mother told you not to cry over spilled milk, she was recognizing the lost milk was sunk, gone, ... history. Avoidable costs, on the other hand, are costs that need not occur and can be avoided. If you buy an ugly lamp, and later lament your decision, the cost is not sunk if you can resell the lamp for what you paid for it. People base their decisions on avoidable costs, not sunk costs. Sunk costs are costs that once incurred, cannot be recovered. Avoidable costs are costs that need not be incurred.

The third distinction made among costs is the difference between fixed and variable costs. A fixed cost does not vary with output, while a variable cost changes when the level of output changes. When you turn the light on in your room to do some reading, the cost of the electricity is independent of how much reading you do. In this sense, the electricity would be a fixed cost. In the next chapter we introduce the inputs of labor and capital into our production model. Labor will be allowed to vary and hence labor costs will be variable costs. The capital will be usually assumed fixed, and so

the capital costs will be fixed costs. Fixed costs do not vary with output, variable costs do change with output.

Sunk Costs: costs that cannot be recovered.

Avoidable Costs: opportunity costs that are not sunk, they can be recovered or avoided.

Variable Costs: costs that change when output changes.

Fixed Costs: lump sum costs that do not change with output.

Costs can be sunk and either fixed or variable, or they can be avoidable and either fixed or variable. In other words, any combination is possible. Table 7.1 provides some examples.

	Avoidable Cost	Sunk Cost
Fixed Costs	Heating	Advertising
Variable Costs	Metal	Firm Specific Press

Table 7-1

Suppose you own a factory which makes a special auto part for the engines in General Motors cars. Let us consider some of the costs in your factory. The cost of heating the factory space is a fixed cost, since it does not change with the number of parts produced. The heat bill is also avoidable because you can shut the heat off at any time. Similarly, your parts may require some metal to build them. The metal is a variable cost because the more parts you make, the more metal you use. The metal is also an avoidable cost because if you stop producing parts, you don't have to use any metal. Any advertising done is a sunk fixed cost. You cannot get the investment back and the advertiser doesn't charge based on output. Finally, there may be a special stamp or press used in producing the part, and this stamp may wear out the more you produce. Because it wears out it is a variable cost, and because it is only used by this firm it is a sunk cost — no other firm would pay anything for the special stamp.

Although any combination of the different types of costs is possible, for the remainder of the book, unless otherwise stated, we will make the standard assumption that all fixed costs are sunk, and that all variable costs are avoidable. This is a strong assumption, but one made only to make the presentation simpler and easier to understand.

7.5 Comparative Advantage

We saw in earlier chapters how individuals could be made better off by trade when they valued goods differently. Now we want to ignore differences in values for a moment and focus in on gains from trade that result when individuals have different costs for different activities. When individuals have different *marginal costs*, then they gain from trade.

Individuals with different marginal costs gain from trade, even when marginal values are the same.

Marginal costs are the incremental opportunity costs from increasing output by one unit.¹ Once we start talking about marginal costs, we’re clearly talking about a world where people can make things. Producing things is a complicated process. There is the physical aspect of production; that is, the labor, skills, and resources used in the actual product. There is also the organization of production; that is, the firm, the boss, and the contracts used to combine the various physical inputs. To start with, we’re going to assume most of these complications away and consider the simplest production processes. In the end, we’re going to see that even in the simplest cases, supply curves are going to be upward sloping.

Consider a married couple, Jon and Elaine, who have two household tasks to accomplish: clean the kitchen, and cook the meal. Jon is very fast at both activities, in fact, he’s faster than Elaine in both of them. The times it takes Jon and Elaine to do these two tasks is given in Table 7-2.

	Cleaning	Cooking
Elaine	60 minutes	80 minutes
Jon	40 minutes	20 minutes

Table 7-2

Because Jon is better at both activities, we say Jon has an *absolute advantage*.

An absolute advantage means you are more productive in all activities.

¹ Technically, marginal costs are the change in costs for any given change in output, but for ease of language we’ll think of marginal costs as the costs of one more unit.

Generally speaking people tend to naturally think in terms of absolute advantage. We think the United States shouldn't bother to trade with Niger, Bangladesh, or Haiti because those poor countries couldn't possibly offer the United States anything. Any product produced in those countries could no doubt be better produced in the United States. That's probably true. The United States probably has an absolute advantage over thousands of goods over dozens of countries. But here's the catch: absolute advantage doesn't tell us anything about who will produce what goods.

What we need to know is *comparative advantage*, which is a concept based on opportunity costs. To have a comparative advantage in something means you are the least cost producer, even though you may not have an absolute advantage.

Consider Jon and Elaine above. Jon is twice as good at cooking as he is at cleaning. When he does one cleaning of the kitchen he could have cooked two meals. On the other hand, when Elaine does the cleaning, during that time she could only have cooked $3/4$ of a meal. Jon sacrifices more meals when he cleans, therefore, Jon is a high cost cleaner. To turn it around, if Elaine were to cook, she would sacrifice 1.33 cleanings, while Jon only sacrifices $1/2$ of a clean kitchen for every meal he cooks. So, although Jon is the high cost cleaner, he's the low cost cook. Thus Jon has a comparative advantage in cooking, and Elaine has a comparative advantage in cleaning.

Everyone has a comparative advantage in something.

Notice Elaine doesn't have an absolute advantage, but she does have a comparative advantage. This is the reason why small poor countries are able to trade with large rich ones. There are some activities at which they are the low cost producers.

A comparative advantage exists, even though an absolute advantage may not exist.

Suppose Jon and Elaine start off thinking they should take turns cleaning and cooking. Over two days, Jon will spend 60 minutes doing housework (40 minutes cleaning, 20 minutes cooking), while Elaine will spend 140 minutes doing her work. The total time spent doing chores in the household is 200 minutes. Now suppose the two decide to specialize according to their comparative advantage and trade jobs one for one. So Jon does all the cooking and Elaine does all the cleaning. Now Elaine, over a two day period, spends 120 minutes on housework, and Jon spends only 40, for a grand total of 160 minutes. By specializing they both are made better off, and they saved 40 minutes of time.

Your own experience no doubt confirms this simple reasoning. Consider households made up of some combination of men and women. Most of these households divide their labor up according to comparative advantage. Men often do outside work, automotive repairs, and the more physical jobs in the household, women tend to do the cleaning, cooking, and laundry. Even after 50 years of

feminist sensitivity training, one's hard pressed not to find this. But even if you find a household where the woman changes the oil in the car, you can bet the male of the household is not changing it as well — he'll be doing some other activity he's specialized in. By specializing according to comparative advantage, both parties to the exchange are made better off. To do otherwise would simply raise costs. Consider how long it would take Jon and Elaine to do their chores over a two day period if they specialized according to their comparative *disadvantage* — 240 minutes.

7.6 The Gains from Specialization

It is hard to underestimate the gains from specialization according to comparative advantage. Consider the famous section in Adam Smith's *Wealth of Nations*

To take an example, ... the trade of the pin maker; a worker not educated to this business, ... could scarce, perhaps with his utmost industry, make one pin in a day, and certainly could not make twenty. But in the way in which this business is now carried on, not only the whole work is a peculiar trade, but it is divided into a number of branches, of which the greater part are likewise peculiar trades. One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business, to whiten the pins is another; it is even a trade by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about eighteen distinct operations. ... I have seen a small manufactory of this kind where ten men only were employed, and where some of them consequently performed two or three distinct operations. But though they were very poor, and therefore but indifferently accommodated with the necessary machinery, they could, when they exerted themselves, make among them ... upward of forty-eight thousand pins in a day.

To go from making 20 pins in a day to making 48,000 is simply amazing. In fact, none of the pleasures we enjoy in life could be achieved without everyone being highly specialized. Take any product, no matter how primitive, and odds are you have no idea how to make it. Forget your computer, what about the little yellow pencil you have in your pencil case? Any idea how to make that? How would you know what wood to use? What would you use to cut the tree down, how would you take the tree and turn it into a small piece of wood? What about the paint and little gold letters, how would you make those? And the graphite shaft, who even knows what graphite actually is, let alone where it comes from and how you make it so skinny. And let's not even get started on the metal ring and little rubber eraser. When it comes right down to it, we have no clue how to make a pencil. And yet, we can go to our local book store and buy one for under a dollar. The more you think about it, the more remarkable it is. Probably thousands of people were able to combine their specialized skill to come up with a pencil that costs almost nothing.

Specialization doesn't just mean goods become cheaper. The forces of specialization can be strong enough to influence culture as well. Perhaps this effect has been no greater than in the Prairies of Canada and the Great Plains of the U.S. where specialization in agricultural communities

is changing the rural landscape. In 1920 approximately 30% of people in North America lived on farms, while today less than 2% do. What allowed for this dramatic shift was the tremendous changes in technology in planting and harvesting grain. These changes were possible due to the introduction of tractors, combines, and paved roads in rural communities. Whereas one farmer, in the 1920s could barely manage to farm 300 acres on his own, today a farmer can easily manage 10,000 acres. A farmer in the 1920s would have raised mixed livestock as well as grain, but today livestock are raised on specialized farms and feed lots, and farmers specialize in certain types of grains. As farmers specialized and lowered the costs of farming, they became bigger and the local communities began to get smaller and smaller. The result has been a steady decline in rural populations, and in some provinces like Saskatchewan, a fall in total provincial population. Any individual who tries to farm the old fashioned way, is simply driven out of business by the larger more efficient and specialized farmers.

You've probably noticed other effects of specialization around you. Consider your college instructor. If someone is a professor of engineering, they probably know very little about economics. If you have a professor of micro economics, that person probably knows little about macro economics. Professors specialize in specific types of knowledge because it is the only way to push the frontiers of knowledge. The person who knows a little of everything is a lot of fun at a cocktail party, but they'll never win the Nobel prize. Jack-of-all-trades in academics never get tenure because they can't compete against the low cost specialist.

If you're from a smaller community, you've probably noticed there is much less specialization than in large urban centers. This is because the amount of specialization is limited by the size of the market. If a barber lives in a town of 65 people, he'd probably starve to death if he only cuts hair for seniors. In fact, he'd probably starve to death if he was just a barber. The size of the market is just too small to support someone so specialized. I have a cousin, who lives in a very small community in rural Saskatchewan, she not only runs the local store, but she's also the postmaster and owns an antique business. On the other hand, I have a friend in New York City who's full time, and well paying job, is to assess the risk of a particular type of insurance transaction. Incomes in large cities are greater than those in rural communities, in part because the larger markets allow for so much greater gains from specialization.

7.7 Comparative Advantage and Marginal Cost Curves

Comparative advantage means production takes place at least cost. Those people producing one good, who sacrifice the least in terms of other goods, are the ones who produce the good first. To see how this leads to a supply curve, let's consider another example, this time with three people. Sue, Charles, and Daphne are all capable of producing two goods: machine guns and spinach. The amounts of each good they can produce in a given day are given in Table 7-3. Sue, for example, can produce at most 8 machine guns *or* 4 units of spinach. She cannot produce both 8 guns and 4

spinach because she is constrained by how much time and other inputs she has.

	Machine Guns	Spinach
Sue	8	4
Charles	3	3
Daphne	1	2

Table 7-3

As in the example of Jon and Elaine, we see Sue has an absolute advantage over the other two. She can produce more of either good in one day than the other two can. In calculating who has the comparative advantage though, we must recognize this is a two-by-two concept. Thus it should be clear that Sue is the low cost gun maker, sacrificing only 1/2 of a unit of spinach for every gun she makes. Daphne is the high cost gun maker, losing 2 units of spinach for every gun made. Charles, on the other hand, who has costs of 1 unit of spinach for every gun made, lies in between the other two. Compared to Sue, he is the low cost spinach producer. Compared to Daphne he's the low cost gun maker. This is no problem. The key is we can rank the individuals from low cost to high cost producers. Efficient production requires the low cost producers produce the good first, followed by the next lowest cost person, etc.

Figure 7-1 shows how many machine guns and spinach could be produced by these three, assuming they always specialize according to their comparative advantage.

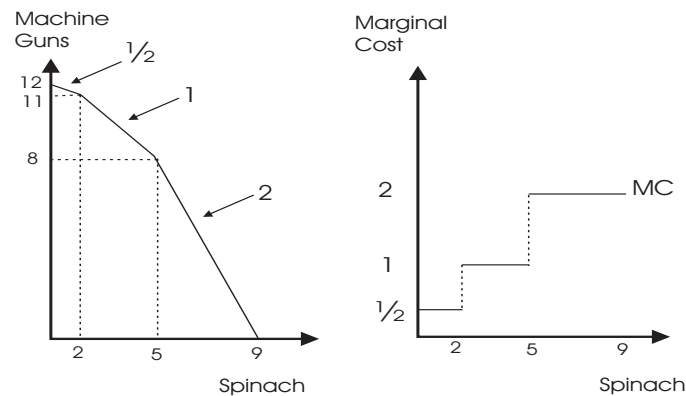


Figure 7-1
The Marginal Cost Curve

The graph on the left is called a *Production Possibility Curve* and it tells us the maximum amount of both goods this little economy can produce. If everyone works building guns, then at most 12

guns per day can be made $(8+3+1)$. If everyone works in the field producing spinach, then at most 9 units of spinach can be made $(2+3+4)$. The curve that lies in between these points contains the combinations of goods the economy is capable of producing if everyone specializes at what they are least cost at. Hence, if the combination 11.5 guns and 1 unit of spinach are to be produced, Daphne, the low cost spinach producer makes the spinach. If Sue were to make the spinach there would be a reduction of 2 guns, rather than just $1/2$ of one gun. If more than 2 units of spinach are wanted, then Charles is the second person into the field. It is only if more than 5 units of spinach are wanted that Sue reduces the number of guns she makes and starts to produce spinach.

The slope of the production possibility curve at any point tells us the marginal cost of producing one more unit of spinach. This cost moves from $1/2$ to 1, from 1 to 2. If we graph this slope against the amount of spinach produced we get the graph on the right which is the marginal cost curve for producing spinach. The *height* of this curve is the marginal cost of producing a given quantity. Notice this curve is upward sloping. Why? Because the low cost individual produced first, and the highest cost person produced last.

Can you see what will happen to the marginal cost curve if the number of people in the economy starts to get larger? Figure 7-2 shows what happens. As the number of producers increases, each individual has a smaller and smaller impact on the total amount produced. This means the production possibility curve becomes smooth, and the marginal cost curve loses its “step” shape. As a result the marginal cost curve is continuously upward sloping.

Marginal cost curves can slope upwards because different individuals have different costs of production.

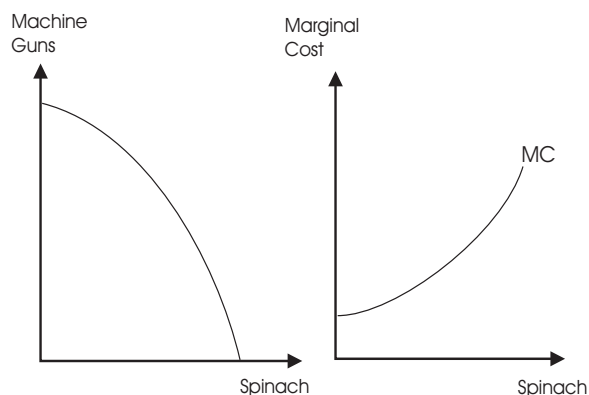


Figure 7-2
The Marginal Cost Curve with Lots of People

7.8 Marginal Costs and the Supply Curve.

The height of the marginal cost curve is the incremental cost from increasing output by an infinitesimal amount. If we think about marginal cost in a discrete sense, the marginal cost would be the area under the marginal cost curve between two different levels of output. If the difference in the levels of output was one unit, then the marginal cost would be the cost of producing one more unit.

$$\text{Marginal cost} = \frac{\Delta TC}{\Delta Q}$$

Given this definition of marginal costs, the area under the marginal cost curve must be the total costs (ignoring any sunk costs). This is shown in Figure 7-3.

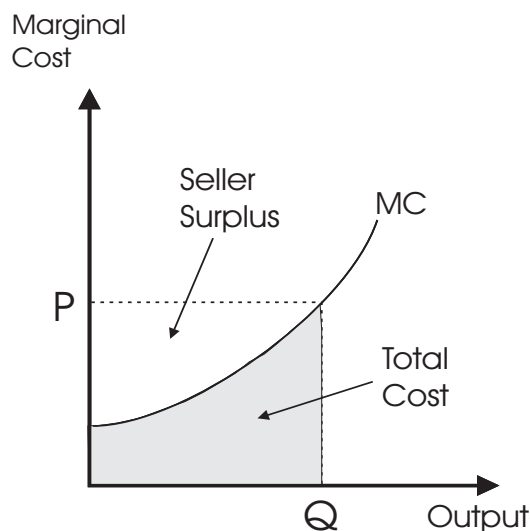


Figure 7-3
Marginal Costs, Total Costs, and Surplus

Since the total revenue is price times quantity, and since the area under the marginal cost curve is the total cost, then the difference between these two (revenue – cost) is the seller’s surplus. This surplus is often called a rent. A rent is an amount that could be taken away from the producer and the same output would still be produced.

In Figure 7-3 there is a price listed on the vertical axis. At this price, the amount Q will be supplied because those producing this good are made better off in doing so. In other words, they achieve some surplus or rent. The rent on the marginal unit produced is zero, and this is where production stops. To produce any more would make the producers worse off because the marginal

costs would be more than the price. In other words, when the price is equal to the marginal cost, there is an equilibrium for the producers. At this point the producers have maximized their surplus. When the price increases, more is produced because this again sets price equal to marginal costs. Hence, the marginal cost curve is the supply curve of these producers.

7.9 Summary

Unlike earlier chapters, in chapter 7 we started to talk about production. We began with a discussion of opportunity cost — the value of the highest forsaken alternative. Opportunity is not easy to think about because we are so used to thinking about cost as “what we paid for something.” What we pay is often the relevant cost, but many times it isn’t. To understand behavior, we need to understand opportunity cost.

In addition to opportunity cost we discussed the related concept of comparative advantage. Comparative advantage is what comes out of combining maximization with opportunity cost — everyone is better off when they specialize in production according to their least cost activity. When individuals produce this way, marginal cost curves are upward sloping because the low cost individuals produce first. The more output produced, the higher the costs are. Since we assumed that any individual has constant costs, movements along the marginal cost curve are *extensive* changes — costs change because different individuals are producing the good. In the next chapter we’ll consider intensive changes that lead to increasing marginal costs.

REVIEW QUESTIONS

1. Why do you think accountants mostly use historical cost in keeping books?
2. If opportunity cost is the value of the next best alternative, why would you ever add up costs? That is, wouldn't there just be one next best alternative?
3. Why is a "bad" not the same thing as a "cost?"
4. In what way is comparative advantage a combination of the principle of maximization and the definition of cost?
5. What might be some reasons for why there are gains to specialization?

PROBLEMS

1. Zane hates doing his income tax, but his wife Isabella loves doing it for him. Is it more costly for Zane to do his income tax, than for his wife?
2. Suppose a fishing equipment retailer buys 30 new lobster traps that have the special feature that they collapse and are therefore easy to store on dock. Suppose he pays \$2 000 for the traps, but after one month he has sold no traps, and suspects it is because of a news release that the traps are also collapsing under water and releasing the lobsters! The only good news is that a local school has offered to buy the lot for \$2100 for holding class supplies. The retailer has checked out the scrap yard and discovered that the traps are worth \$560 as junk metal. In order to make his decision the retailer calculates his costs.

Wholesale costs	\$2 000
Interest charges	20
Handling and Advertising	230
Display Space	110
Total Cost	\$2 360

Since it is bad business to sell below cost, our retailer decides to turn down the offer from the school. Did he make the right decision?

3. In 1950 those living in the Republic of Ireland were a demographic outlier. Compared to other western countries, the family sizes were much larger, wives stayed home more, contraception was not used, age at first marriage was higher, and divorce was unheard of. Incomes were also very low. No doubt most of this was due to the strong presence of the Catholic Church in Ireland. The Catholic Church is just as strong in Ireland today, but with rising incomes, what do you think has happened to family sizes, contraception use, divorce, etc in Ireland now compared to other western countries?
4. Given the answer to (3) what types of pressures do you think the Catholic church is under regarding the use of contraceptives, divorce, etc? At one time (prior to 1930) the Anglican church did not allow the use of contraception. In many churches today there is a debate over the legitimacy of homosexual unions. Do you think religions have an impact on the costs and benefits people face in day to day living, or do you think the costs and benefits of daily life have a bigger impact on religion?
5. Consider a society whose only worker is Helen, who allocates her production time between cutting hair and baking bread. Each hour per day she devotes to cutting hair yields 4 haircuts, and each hour she devotes to baking bread yields 8 loaves of bread. If Helen works a total of 8 hours per day, graph her production possibilities curve.
6. A bumper sticker reads “Eliminate Government Waste — At Any Cost”. Does this make sense economically?
7. The Professor (on Gilligan’s island) was better at everything than Gilligan, and yet Gilligan still performed a lot of tasks on the island. This demonstrates the difference between what two economic ideas?

8. In one hour Elmer Fudd can make 120 hot-dogs and 40 hamburgers. Porky Pig can make only 100 hot-dogs and 20 hamburgers in the same time. Which one has a comparative advantage in the production of hot-dogs, and why?
9. By taking an airplane one can go from Toronto to Montreal in one hour. The same trip takes five hours by bus. If the air fare is \$500 and the bus fare is \$50, which would be the cheaper mode of transportation?
10. The city of Vancouver has about 2 million people in it, and is located next to the mouth of the Fraser River. The delta of the Fraser river has some of the best soil in the world for growing crops and yet most of it is not used for farming; it is used for warehouses, airports, and housing. Explain why the best soil in the province of British Columbia is not used for farming.
11. Suppose you live in Chicago and the Black Hawks finally make it to the Stanley Cup finals. If people are willing to pay \$1000 for a ticket with a face value of \$100 to see one of the games, and someone gives you a ticket, what does it cost you to attend the game?
12. Complete the following table (note the marginal cost of \$1.10 lies in between the quantity 1 and 2). Average cost is defined as Total Cost, divided by Quantity.

Quantity	Total Cost	Marginal Cost	Average Cost
1	1.00		
2		1.10	
3	3.36		
4			1.20
5			1.25

13. Biologists tell us that females of every species are more selective of mates than males. If sex and reproduction cannot be separated, why would this be so? For humans would you think that women would be more selective of mates before or after the invention of the birth control pill?
14. Why are waiting lines longer in poorer neighborhoods?
15. "In Japan a great deal of agriculture is done on carefully terraced hill sides, while on the Canadian prairie there is a far more wasteful use of land."
 - a. Is it true the Japanese use their land more efficiently?
 - b. How would you explain this different pattern of farming?
16. Suppose you work in a firm that provides you with free parking, along with the condition that you can sublet the space if you want to. What is the cost of parking?
17. Recent changes have made it harder to get a drivers license in BC. Although you can still apply at 16, there are more restrictions and the tests are harder. For the sake of argument, suppose

this delays the acquisition of a license for 1 year. What effect will this have on the high school completion rate for students in BC?

18. There is an old cliché that states “you can’t have your cake, and eat it too”. Is this consistent with the principles of economics we’ve looked at so far? Explain your answer.
19. How long will you search for a \$50 bill that you lost in your bedroom, if the value of your time is \$5 per hour? Suppose that you know with certainty that it is lost in your bedroom, that the value of your time remains at \$5 per hour no matter how long you look, and that you must look for the money in order to find it.
20. One day my kids wanted to go to Kid’s city (essentially a private indoor playground that you pay to use). I told them, of course, they would like to go, because I was paying for it. I then told them that they could have a choice: they could go, or they could stay at home and have the money for admission. In this case, what economic concept am I exploiting to guarantee an efficient decision?
21. Should the casualties already incurred in a war be taken into account by a government in deciding whether it is in the national interest to continue the war? Explain.
22. Women participate in religious activities (as measured by the amount of hours per week) more than men do. Why would this be? [Hint: don’t say “women are more religious!”]
23. The following statement made by a rather fashionable young woman was over-heard (paraphrased): “Honestly, I’ve never met a good looking punker. I don’t mean their style of dress, make-up, and jewelery [which she obviously found distasteful], but basically I think their looks are below average.” Granted beauty is in the eye of the beholder, but there are conventions for good looks ... there seems to be something of a common denominator in the women of Playboy, fashion magazines, TV shows, and movies. Anyway, for the sake of argument, let’s take the young woman’s observation as fact. Would it make economic sense? That is, would “ugly” people become punks before the women on Bay Watch?
24. Suppose you recently made a confection which called for one cup of buttermilk. The smallest container of buttermilk you could find was one pint (two cups). Having made it, you have one cup of buttermilk left. You do not like to drink buttermilk, but there is another dessert you could make which would use up your remaining cup. Suppose the pint of buttermilk originally cost 50 cents and the other ingredients for the dessert cost \$2.50. The value you place on the dessert is \$2.70. Should you make the dessert? Why?
25. Suppose there are two identical gold bars that you own. The only difference between them is how you acquired them. One bar was won as a prize the other you purchased.
 - a. What is the difference in the cost of retaining ownership in the two bars?
 - b. Will there be any predicted difference in the use of the bars?
26. The following table shows the amount of corn and wheat that two countries could produce if they devoted all of their resources to that good. That is, England for example, could produce at most 200 units of Wheat or 400 units of Corn. Assume that there is a linear transformation

from one crop to another, meaning the cost of producing more corn is always a constant amount of wheat sacrificed.

	England	Germany
Wheat	200	300
Corn	400	900

Suppose both countries are currently devoting half of their resources to the production of corn and half of their resources to the production of wheat. What would be the total amount of wheat and corn produced? If they now specialize to their comparative advantage, and if wheat production is to be held at 250, what would be the total increase in corn production?

27. When Tom takes a nap, he always gets a cramp. Does the cramp make it more costly for him to take a nap than if he didn't get a cramp?
28. Why are there so few gas stations in the center of large cities? With such heavy traffic one ought to be able to do an excellent business.
29. The acres of grass surrounding the Taj Mahal in Agra, India, are often cut by young women who slice off handfuls with short kitchen blades. Is this a low or high cost way to keep the lawn mowed?
30. You have the following three options for your building:
 - a. rent as restaurant for \$1200/mo.
 - b. sell as warehouse for \$1400/mo.
 - c. rent as bookstore for \$700/mo.

What is the cost of each action?

31. Airlines always try to over book their flights. If a situation arises where not enough seats are available, then the airline bids for passengers to be bumped to another flight. As compensation to bumped passengers, the airline supplies an additional ticket for any flight over the next year. Suppose an average airfare is worth \$300. It seems likely that many passengers would be willing to wait for \$100 (quite often the wait is only 1 or 2 hours, and many times there is a fight to get bumped). Why would the airline pay so much when it could pay less with cash?
32. Professor Sneed got to be the Marshall at the Hogsworth graduation ceremony. On his way back to his office (dressed in a spectacular regalia) a student approached him, and they had the following conversation:

Student: "You just love strutting around in that hat."

Sneed: "Absolutely!"

Student: "How much did that outfit cost, anyway?"

Sneed: "\$600, but I used my professional development money to pay for it."

Student: “So, it didn’t cost you anything.”

At this point Sneed walked away. Professional development money is a budget of about \$1000/year, that each Hogsworth faculty gets to pay for journals, travel, computers, paper, books, and regalia. Do you think this student needs to learn some economic principles?

33. At one point during an economics principles course, in which I was using this on-line book, I asked a student what they thought of the book. “Great” was the reply, “I really like the price, and I appreciate not having to line up at the bookstore to buy the book.” Why would “not having to line up at the bookstore” probably not be a benefit of purchasing an on-line book? Under what circumstances would it be?

Review Question Answers

1. *Opportunity costs are not always observable to third parties. For accountants it is critical to be consistent and accurate ... even if incorrect. Thus historical cost is often a more appropriate measure of cost for them. Accountants do a number of things to try to correct for this. The concept of “goodwill” is an attempt to cost out the value of an entrepreneur; the use of the term “net income” rather than “profit” to reflect the fact that true costs are not considered; and special formulas for adjusting depreciation of capital (e.g., sum of years digits) to reflect the true value, are just three examples of accounting corrections to historical cost figures.*
2. *There is only one next best alternative, however, that alternative may involve a collection of sacrifices. Hence these sacrifices must be added up to put a value on the forgone alternative.*
3. *A “bad” is something that generates a negative level of satisfaction or utility. When you step in dog crap, that’s a bad thing, but it isn’t a cost until it effects your alternatives. “Bads” influence the value you place on something, like walks in the park where there are lots of dogs, but they don’t change costs unless they also change the value of alternatives.*
4. *When people maximize they go about their activities in a cost minimizing way. For example, when you go to school, you generally take the route that minimizes your travel time. So maximization implies cost minimization. Comparative advantage basically says that in order to maximize output you should produce according to the minimum opportunity cost. Hence it is a combination of the two ideas.*
5. *Perhaps the most important is learning. Consider most jobs around the household. If you’ve ever had to hang a door, repair a wall, or do some plumbing or electrical work, you’ll know the first time doesn’t always work out too well and takes forever. And why wouldn’t it, you don’t have a clue what you’re doing. If you do any of these tasks a second time, however, it generally goes better, and by the third time you’re an expert. You learn over time. However, there are other gains as well. Every task has set up and take down costs. By specializing you can minimize the number of times these non-productive activities have to take place. Also, specialization often results in different types of capital being used. If you paint one door you use a brush. If you paint 1000 doors, you get a compressor and a spray gun.*

Odd Numbered Problem Answers

- 1 *Cost is about alternative, not hating or liking. The cost for Zane and Isabella depends on their alternatives. Zane might be an aging academic, with nothing better to do, while Isabella might be an international fashion designer with extreme demands on her time. Under these conditions Zane would be the low cost income tax doer.*
3. *With rising incomes, especially for women, the cost of having a large family has increased a great deal. Thus family sizes are smaller, more contraception is used, and children are born closer together. Divorce is now common in Ireland.*
- 5.

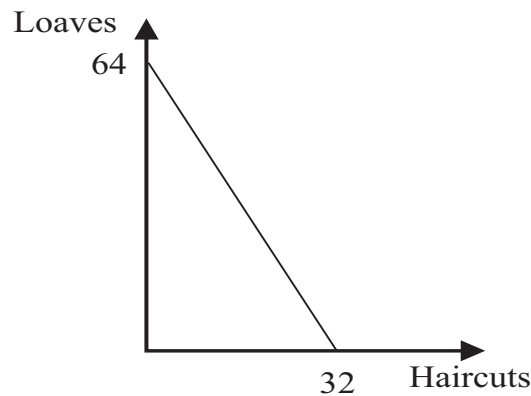


Figure 7-5

7. *The Professor had an absolute advantage in everything, but Gilligan still had a comparative advantage in many tasks.*
9. *It depends completely on the cost of time. A high time cost individual would find the bus trip very expensive.*
11. *\$1000.*
13. *Sex for a female is much more costly when it leads to reproduction. Not only must a female carry the offspring and care for it after birth, but females have few eggs relative to male sperm. Reproduction with one male precludes mating with other males, while this is not true for males. Many studies have been done regarding the selection of mates after the introduction of the pill, and it appears that women do select differently.*
15.
 - a. *No, they use their land more intensively.*
 - b. *The price of land is much different. In the Fraser Valley of British Columbia, for example, the value of land is very high and we see very intensive use of the land (greenhouses, high*

valued crops, etc). On the prairies, where land is very cheap, we see much less intensive agriculture.

17. *Having a driver's license increases one's opportunities for employment. Better employment opportunities lead to higher costs of staying in school. Thus the delays in getting a license lower the costs of staying in school and should lead to higher completion rates.*
19. *You'll look until you find it (assuming it is worth looking for) because the time spent looking will be sunk. I know you want to say 10 hours, but this is wrong.*
21. *No. These costs are sunk. The real issue is how many more casualties will occur in order to meet the objective of the war.*
23. *It is lower cost for an ugly person to damage the market value of their body than for a person with a valuable body. Yes it does make economic sense.*
25.
 - a. *Nothing.*
 - b. *No.*
27. *No, not unless the cramp prevents him from doing things. Cost depends on alternative values, not on pleasure.*
29. *It must be a low cost method, or else it wouldn't be used. In India wages are low and labor intensive methods of production are used. In North America where wages are high, more capital intensive methods are used.*
31. *It is paying its customers a ticket that has no cost to them. When a plane takes off with an empty seat it is simply lost revenue. Adding a passenger does not alter the cost of the flight. Hence giving a ticket away for a flight that is not full has no cost. Whereas, to give away \$100 costs the airline \$100.*
33. *If the student had to go to the bookstore to purchase books for other classes anyway, then not having to go there to purchase this particular book is not a benefit of an on-line book. It would be a benefit if this course was the only course the student was taking, or the only course which required a textbook, or the student made a unique trip to the bookstore for every book she needed.*

CHAPTER 8

PRODUCTION WITH DIMINISHING MARGINAL PRODUCTS

In the last chapter we saw when individuals had different abilities the supply curve at the market level was upward sloping. By specializing in activities in which they had a comparative advantage, low levels of output are produced by the low cost individuals. As more and more output is produced, the cost of producing this output increases as different individuals with higher costs join production. If you recall, however, each individual was always equally productive, no matter how much of any particular good they produced. In other words, the cost of production for an individual was always constant. This was apparent in the flat individual marginal cost curves in Figure 7-1.

In this chapter we're going to reverse the assumptions on the homogeneity of productive inputs. That is, rather than assuming different people have different productivities, every individual will be assumed to be equally productive. However, unlike the last chapter where a given individual was always equally productive, now each person's productivity will change depending on how much they produce. Once again, we will show that under this set of assumptions, the supply curve is again upward sloping. Essentially the last chapter was looking at changes in cost along the *extensive margin*, while this chapter will consider changes in costs along the *intensive margin*. At the end of the chapter we will bring both of these movements together and discuss the general supply curve of a firm where productivity varies across inputs and with intensity of use the inputs.

8.1 The Production Function

Let's start by considering the process of production a little more carefully. Producing an output requires some inputs: land, workers, machines, other raw material, and most importantly, some type of organization. In a small, single person firm, the individual coordinates production by himself. In large firms, the organizational structure is extremely complicated. Until we reach Part III of this book we're going to assume away all such organizational issues, and claim output is produced by simply combining various inputs. In other words, output is simply given by a *production function*. A production function tells us the maximum amount of an output for a given amount of inputs. As unrealistic as it seems, this production function will describe the economic "firm."

A production function tells us the maximum amount of an output for a given amount of inputs.

To keep things even simpler, we'll assume there are only two inputs: labor (L) and capital (K). Labor is an input that hardly needs introduction. When you apply your physical effort to a task, you're providing labor to some type of production. By capital, economists refer to long lived assets that generate income. A tractor is capital, and when used provides services that generate

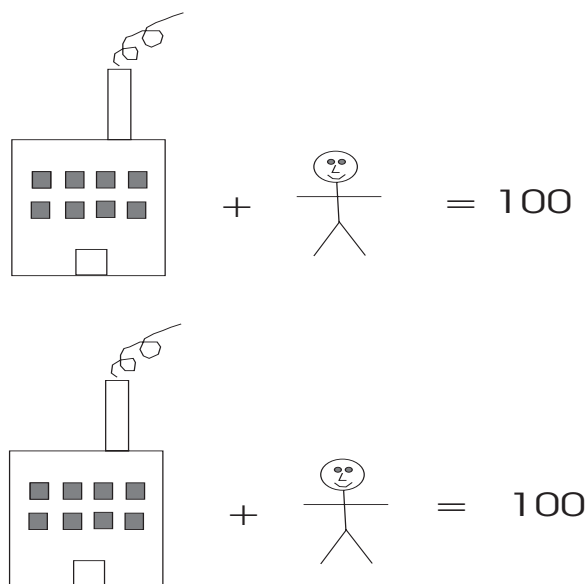


Figure 8-1
Replication and Constant Returns to Scale

income. Land is a form of capital, and generates rents over time for its owner. Ironically, people can also be capital. When a person invests in education, for example, they increase the productivity of their labor services, and therefore increase their income. Hence, economists often speak of *human capital*. Since we're generally only going to look at one input at a time, it is enough for us to think of labor as being the human input and capital as being the non-human one. If we consider Q as the quantity of output produced, then our production function is given by:

$$Q = f(L, K)$$

This is a very “engineer” like relationship. Simply combine a certain quantity of labor and capital and presto, output appears. It reminds one of the story of the Russian immigrant who comes to America and enters a grocery store. He's reading the labels of the products: “Instant Potato Powder ... just add water. Powder eggs ... just add water. Chocolate cake powder ... just add water.” Then he comes across another product: “Baby powder”. The man looks up and exclaims “what a country!” We shouldn't worry too much about this presto technology, or “black box” production function as some call it. The model we're developing is intended to explain movements in the volume of trade and the price of trade, and for this purpose the simple production function is entirely adequate. When it comes to issues of explaining why firms are organized differently, we'll see this procedure is not adequate and we'll have to complicate the model.

Constant Returns To Scale

The production function has certain properties. First of all, when all of the inputs are increased, the amount of output increases. Generally speaking we have little to say about *how much* output will change when all inputs change. It would make some philosophical sense if doubling all inputs doubled the output. After all, if you do something once, you should be able to repeat the procedure and get the same outcome. Consider the situation in Figure 8-1.

In Figure 8-1 we have a factory as one input, and a person as the other input. When these two inputs are combined in a production function they yield 100 units of output. If we could double both of these inputs exactly, and combine them once more, then we should also get another 100 units. Hence, there is something appealing to the idea that doubling all inputs always leads to a doubling of output. When this happens it is said the production function is characterized by *constant returns to scale*.

Constant Returns to Scale: *a doubling of all inputs leads to a doubling of output.*

The debate over the returns to scale in production is a very old one. There is a famous dialogue between the 19th century economists Pareto and Walras. Walras, who was theoretically opposed to the notion of constant returns existing everywhere, apparently stated to Pareto, “if you doubled all of the subways in Paris I doubt you would double the volume of rides.” To which Pareto is claimed to have said “yes, but you didn’t double the Paris.” The problem with directly testing for constant returns to scale is we can never be sure we’ve literally doubled everything exactly. Inputs are hard to measure, and we’re never sure two inputs are always identical. Constant returns to scale is an assumption we’ll make for convenience, but not one we’ll use too much. Much more important is the second characteristic of production functions.

Diminishing Marginal Products

When the amount of only *one* input increases, and all other inputs are held constant, then output also increases, but at a decreasing rate. These increases in output are called *marginal products*, and so this property is called diminishing marginal products, and it is our fifth principle of economics.

PRINCIPLE #5

Diminishing Marginal Products: *increases in one input, other inputs held constant, lead to increases in output at a diminishing rate.*

The principle of diminishing marginal products is another idea, like the law of demand that has been noticed for centuries. For example, in agriculture, when labor is added to a fixed amount of land, crop output increases, but very quickly the effects of diminishing returns are felt. Output increases, but at a slower rate. Figure 8-2 shows both a graph of the production function in the top graph, and the resulting marginal product curve in the lower graph.

In the top graph the production function drawn is often called a “three stage production function.” The first stage is where output is increasing at an increasing rate. The second stage is where output is increasing at a decreasing rate. Finally the third stage is where output is actually decreasing. The

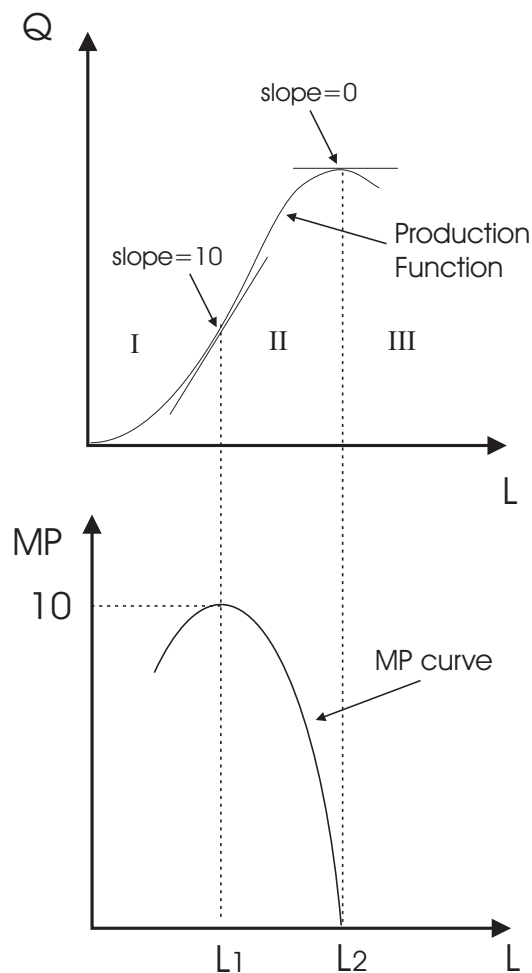


Figure 8-2
Total Output and Marginal Products

first and third stages seem consistent with common sense, but the principle of diminishing marginal product states that stage II must exist. As we'll see shortly, the firm will always operate in stage II, and never in stage I or III.

The production function in the top graph of figure 8-2 takes this shape because the ratio of labor to capital is changing as we move from left to right. Output depends on the labor to capital ratio. Since capital is held fixed, low levels of labor mean there is "too much" capital for the small units of labor. Imagine a situation where there is a large machine, perhaps a steam engine tractor. When there is only one unit of labor applied to the tractor some output is produced, but not very much. When a second labor is added to the tractor output increases a great deal because one can keep the fire going while the other drives and makes sure enough water is in the boiler. When a third person is added to the tractor output might increase even more. As the amount of labor increases relative to the fixed amount of capital this effect goes away. Eventually, as you add more and more labor units to the tractor, output increases, but at a decreasing rate — stage II. If we keep adding units of labor output eventually falls as workers simply get in each other's way. If it makes sense

there could be too much capital or too much labor, then in between the two extremes the capital labor ratio must be about right. Hence, the principle of diminishing marginal products essentially says region II must exist. Output never continues to increase at an increasing rate.

The bottom graph in figure 8-2 plots the *slope* of the top graph. The slope of the production function is the marginal product. The production function is steepest as it moves from stage I to II. At this level of labor L_1 , the slope of the production function is 10 units of output. This is the marginal product of L_1 units of labor. The production function is flat when it reaches a maximum between stages II and III, which means the marginal product is zero. Notice when output is increasing at an increasing rate in stage I, the marginal product is increasing. When production is increasing at a decreasing rate in stage II, the marginal product is positive but decreasing. In stage III the marginal product is actually negative. The marginal product curve tells us how much each unit of labor contributes to output. For example, when there are L_1 units of labor being used, the last unit of labor contributed 10 units to output. When L_2 units of labor are used, then the marginal product is zero — the last worker contributes nothing.

8.2 Marginal Products and the Demand for Labor

The notion of marginal products is valuable in part because it tells us what the demand for labor is when other inputs are held fixed. Suppose our output is eggs. The production function tells us how changes in the amount of labor applied to a farm determines the number of eggs produced. Suppose the local wage rate for egg collectors is 4 eggs per hour. How many hours of egg collecting time should a farmer hire? Consider Figure 8-3, which shows the marginal product of an egg collector. For simplicity the marginal product curve is drawn as a straight line.

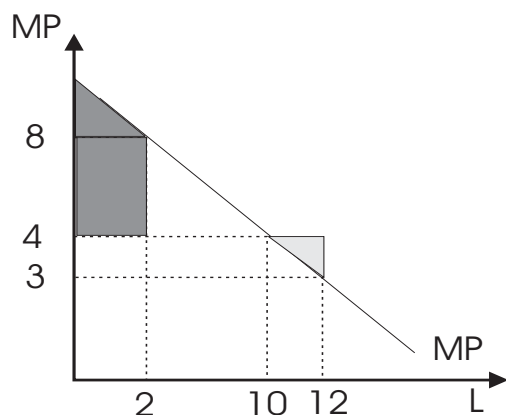


Figure 8-3
The Demand for Egg Collection

When the farmer hires two units of labor he only pays 4 eggs for each unit. However, the marginal product of the second unit of labor is 8 eggs. Hence the farmer receives more eggs than he pays out and is better off. In fact, the farmer receives a surplus of eggs equal to the dark shaded

region above 4 eggs and below the marginal product curve. Since the farmer is demanding labor, this is his consumer's surplus for labor. We've seen this logic before. The farmer certainly isn't going to stop hiring units of egg collecting labor at 2. If the farmer hires labor up to 10 units he will maximize his surplus of eggs. At a "wage" rate of 4 eggs per unit, the farmer will then demand 10 units of labor. If the farmer stops short of this amount then he fails to maximize his surplus, and if the farmer hires more than this amount, say 12 units of labor, then the farmer's surplus would be lower by the lightly shaded triangle. The marginal product schedule in figure 8-3 is the demand for labor in terms of real goods (eggs in this case). Notice the upward sloping segment of the marginal product curve is irrelevant. If each additional hour hired led to more and more eggs, the farmer would continue to hire, until eventually he reached the downward sloping part. Likewise, the negative section of the marginal product curve is irrelevant as well. Why would a farmer hire workers who made a negative contribution? Thus the positive downward sloping portion of the marginal product curve is the only relevant section for a profit maximizing firm. This section corresponds to stage II of the production function.

Rather than think of the demand for labor in terms of the real goods provided by labor, we could convert the entire exercise in terms of dollars. The wage to the labor would not be in eggs, but would be some number of dollars per hour. We'll call this wage rate w . In terms of output, rather than the amount of eggs that get produced, we measure the *value of the marginal product*. The value of the marginal product is the price of the output (the price of eggs in this case) multiplied by the marginal product. It tells us the how much the change in output is worth.

The value of the marginal product is: Price \times the Marginal Product.

Hence the demand for labor is generally shown in Figure 8-4. For a given wage rate, the quantity demanded of labor is where that wage intersects the demand curve. Notice if workers become more productive, (that is, if their marginal product increases) the demand curve for labor will increase. Notice also if the price of the output increases, then the demand for labor will increase as well. If the supply curve of labor is fixed, or generally upward sloping, then this means the wage will increase in both of these cases. People who earn high wages earn them because they are either good at what they do, or what they produce is very valuable, or both. On the other hand, if someone is very productive, perhaps the best rock picker in the whole world, but people don't value rock picking, then that person will earn a low wage.

The Demand for Capital and Variable Inputs

If we had held the amount of labor constant and varied the amount of capital instead, all of what we have said about labor would have followed for capital. There is a marginal product for capital, just as there is for labor. Under these conditions the demand for capital would also be the marginal product curve for capital, and it would be true that in equilibrium the rental price for the capital would have to equal the value of the marginal product of capital. Everything follows through.

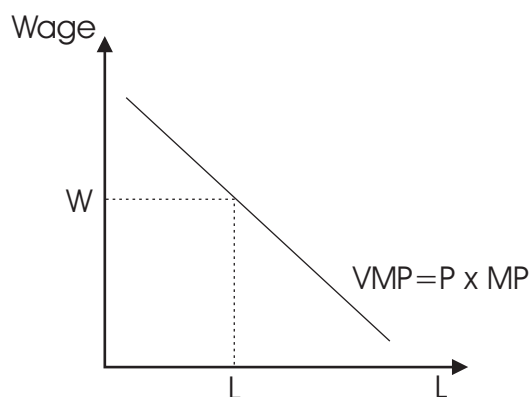


Figure 8-4
The Demand for Labor

Things do get a little tricky, however, when both labor and capital are allowed to vary. Fortunately for us, since we're not concerned with technical details in this book, we can focus in on a few simple outcomes. First, it is still true the demand curves for inputs are always downward sloping, even when both inputs are allowed to change. Second, it is still true in equilibrium, the firm hires labor and capital until the value of the inputs marginal products is equal to its price.

Suppose we stick with our simple case of two inputs (L) and (K), suppose the per unit price of these are w and v , and suppose the price of the output produced is P , then profit maximizing conditions are:

$$w = P \times MP_L$$

and

$$v = P \times MP_K.$$

Namely, the input price equals the value of the marginal product for each input. These equilibrium conditions are graphically shown in Figure 8-5. The height of the demand curve for each input is equal to the value of the marginal product of that input. It should be obvious by now that when the equilibrium conditions are met the firm's surplus is maximized.

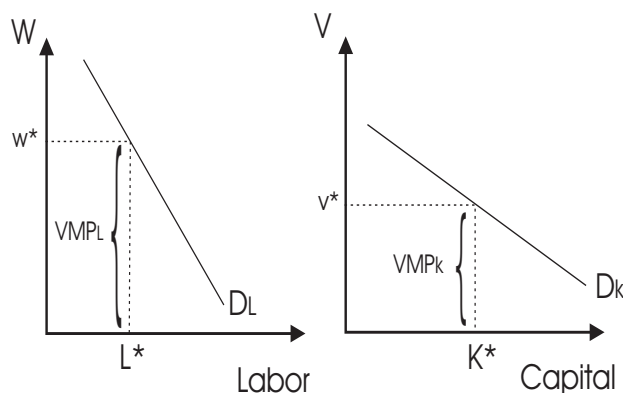


Figure 8-5
The Demand for Labor and Capital

If we take the equilibrium conditions and divide one by the other and then manipulate the terms a little bit, we get the following:

$$\frac{MP_L}{w} = \frac{MP_K}{v}$$

This is a very interesting and powerful expression. It says the marginal product per dollar the firm spends must be equal across the two inputs used to produce output if the firm is to use inputs efficiently. Now think about this for just a moment, because it makes perfect sense. If a firm has an input that gives a big boost to output and doesn't cost very much, and it has another input that makes a marginal contribution to output and yet is relatively expensive, then the firm will make more money if it hires more of the first input and less of the second. As the firm hires more of the first input, its marginal product starts to get smaller according to principle #5. For the same reason, as the firm hires less of the second input, its marginal product starts to get bigger. Eventually the marginal product per dollar will equalize, and the firm can hire no better combination of inputs.

When firms maximize profits they equalize the marginal product per dollar across all inputs.

We've seen this result before when we talked about the marginal value consumers have across goods. Whenever a person (whether a consumer or producer) makes a decision involving several margins (how many apples and oranges to buy, how much labor and capital to use) the net benefits across these margins must be equalized in order to maximize — whether we're maximizing profits or utility. Most notably, maximizing the net benefits under these conditions does not mean the *average* products per dollar are equalized. However, when people talk about productivity, they often refer to average productivity, and as a result mistakes in logic often follow. Consider the following applications.

In the early 1990s the Toronto Blue Jays baseball team achieved a remarkable thing by winning back-to-back World Series. They were unable, however, to win three times in a row. In virtually all cases of professional sports teams, dynasties are rare and short lived. What prevents a wealthy team owner from accumulating all of the stars on one team and winning year-in, year-out? Before we answer that question, consider an analogous one. In World War II, submarines sank almost 90% of the boats sunk in the war. They were by far the most important weapon in a Navy's arsenal. Given this, why would Navies invest in other types of vessels? Why not just have submarines?

To answer both questions, consider the relevant production functions and marginal products. The marginal product of a single hockey star to a given club is quite large. When Wayne Gretzky was traded to the Los Angeles Kings, he almost single handedly turned the team around, and within a couple of years they made it to the Stanley Cup finals. However, given diminishing marginal products, the marginal product of a second star player is lower than the first — even though he may be the same quality. Likewise for the third, fourth, and fifth star. The more stars on a team, the lower is their marginal contribution. For teams without a star, the marginal product is very high. As a result, poor teams without stars are able (and willing) to pay more for the marginal star player on the good team, and this draws some star players to the poor team. In the process the

marginal products of the various quality sports stars get equalized across teams, and no single team systematically tends to dominate.

The same answer applies to the submarines. Submarines were very effective on average, but at the margin their contribution could be quite low. If the Navy must make a decision between the 1000th submarine and the 1st battleship, it is quite possible the marginal product of the latter is higher than the former. When the marginal products of the different weapons are equalized, there are necessarily larger numbers of those weapons with the higher total product — in this case, more submarines.

The great power of economics is that you don't have to learn a new theory every time a different situation arises. Can you use the notion of diminishing marginal products to explain the practice of triage by medical doctors in war time? Under triage patients are divided into three categories: those who will get better without attention; those who will get better with attention; and those who will die no matter what is done. Although it is a crude system, triage is an attempt to equalize marginal products across patients. The marginal product of the first and third categories is close to zero, and as a result the Doctors concentrate on the second group of patients. By working on patients who have a chance of winning they are applying their services where their marginal products are highest.

8.3 Marginal Costs Again

We will return to our study of marginal product curves when we analyze input markets more closely. In the meantime, our concern is to explain why supply curves are upward sloping. In the last chapter we saw there was an extensive margin explanation for this. When individual inputs are different, maximization implies the low cost inputs are used in production first. The more produced, the more costs increase because those inputs not well suited for production start to be used.

In this chapter we've been assuming all labor inputs are identical, and all capital inputs are also identical. Hence we do not have the above extensive margin reason for increasing marginal costs. However, we do have the principle of diminishing marginal products, which states that as more labor is used in production for a given amount of capital, the labor is less productive at the margin. This *intensive margin* also implies marginal costs are upward sloping. Consider Figure 8-6.

The marginal cost curve is *inversely* related to the marginal product curve. They are not exact mirror images of each other, but when one is rising the other must be falling, and vice versa. The intuition is rather straight forward. Keeping in mind labor is paid a fixed amount, consider what happens to marginal cost when the *marginal product* is increasing in stage I. An increasing marginal product means that for every unit of labor added to production, output increases by more than it did for the unit before. If the first unit of labor contributed 10 units to output, the second unit might add 20 units to output, and the third unit might add 30 units to output. If each unit of labor costs \$25, and if there were no other inputs, then the total cost of 10 units is \$25, or \$2.50 per unit, the total cost of 30 units is \$50, or \$1.67 per unit, and the total cost of 60 units is \$75 or \$1.25 per unit. These costs per unit are the average costs, which are clearly falling, but what is happening to marginal costs? Marginal costs are the change in costs divided by the change in output. Hence the marginal cost of going from 10 to 30 units is $25/20 = \$1.25$. The marginal cost of going from 30 to 60 units is $25/30 = 83\text{¢}$. Clearly the marginal cost is falling.

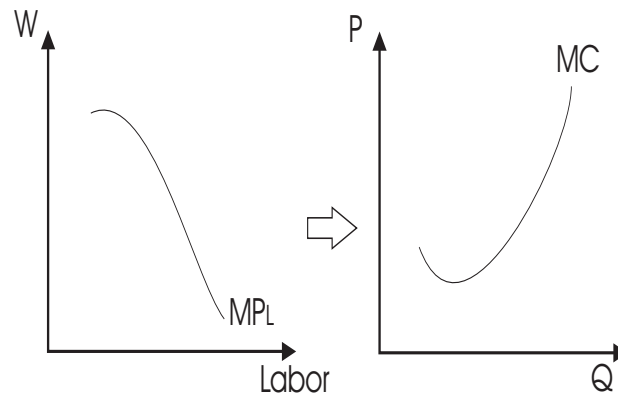


Figure 8-6
The Marginal Product and Marginal Cost Curves

The opposite is the case for when the marginal product is diminishing in stage II. When the marginal product is diminishing, the output each individual unit of labor contributes is falling. However, the firm continues to pay each worker the same wage, even though the marginal product is falling. Therefore, the cost per unit of output must increase when the marginal product is falling. Table 8-1 contains a more specific example of what we've been considering. In this trivial example it is clear that when the marginal product is falling, the marginal cost is increasing. As labor is added to a fixed level of capital, output increases at a decreasing rate. We see this in the steadily declining marginal product numbers. The cost of labor is \$10, so as labor increases, costs increase as well. But look what is happening to marginal costs. They increase. Marginal costs are increasing because each additional unit of labor contributes less and less. The marginal cost curves can be upward sloping when all units of labor are the same, just as long as production experiences diminishing marginal products.

Differences in Inputs and DMP

Thus we've shown the principle of diminishing marginal products implies marginal cost curves are upward sloping, even when the quality of inputs is held constant. What happens though, when we combine the assumptions of last chapter with the principle of diminishing marginal products? When both inputs vary in terms of quality and when diminishing marginal products are present, then marginal cost curves slope upwards for both reasons. Thus the marginal cost curve slopes upwards for both extensive and intensive reasons, just like the market demand curve. As the amount of output produced by a firm increases, costs increase at the margin both because higher cost inputs are eventually used, and because increased use of an input when other inputs are held fixed lead to falls in the marginal products of those inputs.

Consider figure 8-7. As we move from points A to B to C, the costs at the margin are increasing. They increase for two reasons. First because not all inputs are the identical and the inputs used to produce at point A are "better" (lower cost) than those used at point C. Second, the costs also increase because at point C, more of every type of input is also used, and thus their marginal products are lower.

L	TP	MP	TC	MC
1	10		10	
		8		1.25
2	18		20	
		7		1.42
3	25		30	
		6		1.67
4	31		40	
		4		2.50
5	35		50	
		3		3.33
6	38		60	
		2		5.00
7	40		70	
		1		10
8+	41		80	

Table 8-1
The Inverse Relationship Between MP and MC

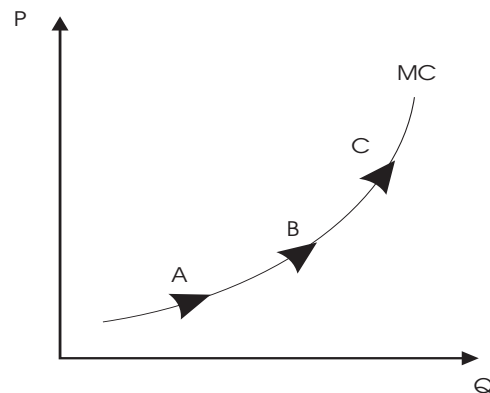


Figure 8-7
Marginal Costs with Extensive and Intensive Margins

8.4 Average Cost Curves

The most important idea of this chapter is what lies behind the marginal cost curve, and what explains its positive slope. In the next chapter, however, it will be necessary for you to understand one other type of cost curve: the average cost curves. Whereas the marginal cost curve tells us the change in total costs for a change in output, the average cost curves tell us the cost per unit. In this sense, they are an easier type of cost to think about.

There are three types of average costs we will worry about. First there is the average total

cost, or simply the average cost. This is the total cost of a given level of output, divided by the level of output. Second, there is the average variable cost, which is the total average variable cost divided by the level of output. Finally there is the average fixed costs, which is the total fixed costs divided by the level of output.

$$\text{Average Total Cost} = AC = TC/Q.$$

$$\text{Average Variable Cost} = AVC = TVC/Q.$$

$$\text{Average Fixed Cost} = AFC = FC/Q.$$

Average Fixed costs is very straight forward. Since a fixed cost is just a lump sum of money, as output increases, the average fixed cost continuously falls. Suppose you built a rail line for 10 million dollars of fixed costs. If you only ran one train on the line, the average fixed cost would be 10 million dollars per trip. If you ran two trains, the AFC would be 5 million per trip, and four trains would bring the AFC down to 2.5 million, and on and on. The AFC is graphed in Figure 8-8.

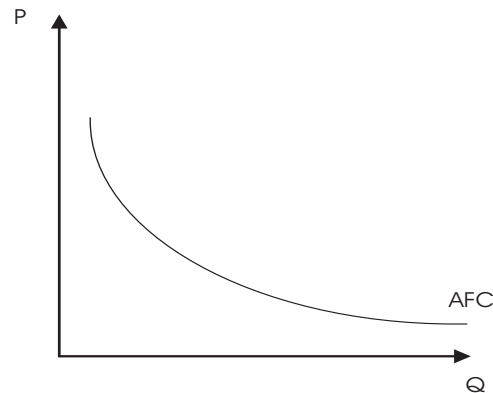


Figure 8-8
Average Fixed Costs

Average Variable and Average Total costs are not quite as simple as the AFC. In order to understand them, it is best to return to our three stage production function found in Figure 8-2. Recall in stage I output is increasing at an increasing rate as the labor input increases at a constant rate. This must mean the average cost per unit of output is falling. As production moves through the second stage, output is increasing, but at a decreasing rate. Eventually, the average cost per unit begins to rise. This means, as output increases the average variable and average total cost curves will be U-shaped, and will have a minimum. These average cost curves are shown in Figure 8-9.

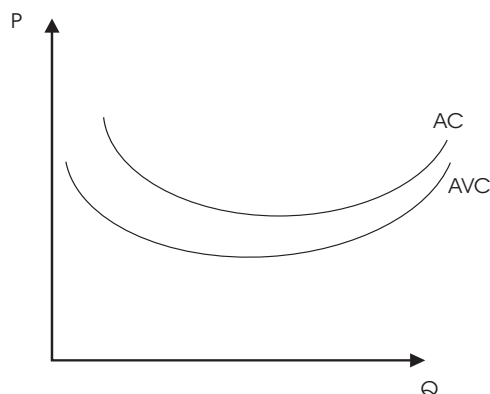


Figure 8-9
Average Total and Variable Costs

Notice the AVC and AC curves have a shorter vertical distance the larger the output. Can you tell why? Recall total costs is just the sum of the variable costs and the fixed costs. This means the $AC = AVC + AFC$. In other words, the vertical distance between the two curves is just the AFC. Since this is always falling with output, the vertical distance is getting smaller.

Tin Cans and Card Board boxes.

In the next chapter we'll see that an individual firm will always want to minimize their average costs. That is, a firm wants to produce a product for the lowest possible cost per unit. This is part of the firm's profit maximizing strategy. If a firm is making a given product, it will make more money if it produces this product at the lowest possible cost.

There is a wonderful application of this in storage containers. The next time you visit your local grocery store, take a walk down the canned goods section. You'll notice, that most of the cans have a particular shape — the relationship between the height and diameter of the can is relatively constant. This turns out to be an implication of cost minimization, and a little thought to the matter might help your intuition of production.

Let's suppose a tin can has the general shape of panel (a) in Figure 8-10, where D is the diameter of the can and H is its height. Let's also suppose there is no wastage in making the side piece of tin, but the top and bottom must be cut from a square piece of tin and this leaves some waste, shown as the shaded area in panel (b) of Figure 8-10. It is a simple mechanical problem (which we will ignore) to show that the cost minimizing amount of tin for a given volume is $H = 1.27D$. That is, in order to use the minimum amount of tin for a given volume requires the height of the tin to be about 25% bigger than the diameter.

A walk down the canned goods aisle shows about 90% of the cans satisfy this relationship. Soup, beans, vegetables, fruit, and spaghetti, all seem to satisfy this rule. There are two big exceptions, however. Pop cans, are too tall, and tuna cans are too short. This means there must be some other aspect to these cans, other than size, which matter to consumers in order for producers to produce a more expensive can. For pop cans the answer is quite obvious. Many times people drink straight

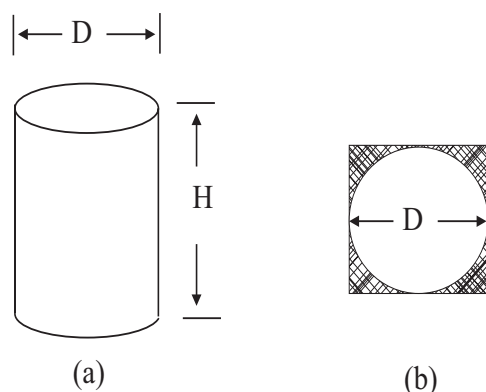


Figure 8-10
The Cost Minimizing Can

from the can. A can with the relative dimensions of a soup can is too thick to comfortably hold in your hand. So the can is made thinner and taller to accommodate this.

Why would tuna cans, though, be so short? To think about this, consider the types of contents in these short tins: tuna, salmon, cat food, and other meat products. The problem with putting meat in a can is the bacterium is not killed by simple canning procedures. To can meat it is necessary to can it under 10-15 pounds per square inch pressure. When the meat cools down inside the can there is pressure placed on the walls of the can. A can shaped like a soup can would likely collapse under this pressure, and so the can is made shorter and stronger. Often these cans have “ribs” in the tin which increase their strength. Interestingly, cat food comes in short cans, while dog food generally comes in tall cans. It turns out cat food is mostly made of meat, but dog food is mostly cereal based.

If you walk down the cereal aisle in any grocery store, you’ll notice cereal is never sold in cans, nor is it sold in cylindrical containers. The shape of the container often depends on the method used to pack the contents. Contents under pressure or packed under heat often require a cylindrical container for strength. For a given volume of content, a cylindrical container also minimizes the cost of container material. However, a cylindrical container wastes shelf space, while rectangular boxes can utilize shelf space more effectively. Here again we see predictable tradeoffs by firms trying to minimize costs. When the value of the contents and the cost of the container material fall relative to the value of shelf space, the goods are more likely to be sold in boxed form. Cereals, like Corn Flakes and Cheerios, dish soap, and items sold close to the check out stand seem to conform to this pattern. Exceptions abound at every turn in a grocery store, of course, because of the huge variety of items being sold, but our simple understanding of cost minimization and trade-offs between different inputs seems to explain a great deal of packaging at the local store.

8.5 Summary

This chapter has been one of the more technical ones, and one where many issues have been left unsaid. What is important is your understanding of why a marginal cost curve is upward sloping. At the beginning of the chapter the concept of a production function, along with a marginal product

curve was developed. The shape of this curve came from our fifth economic principle, namely that marginal products were diminishing. It was briefly discussed how these marginal product curves related to the demand for inputs into production, but their main purpose was to generate a marginal cost curve. Although not proven, the marginal cost curve is inversely related to the marginal product curve. Marginal costs, when all inputs are homogeneous, increase because the more of an input is used, the less productive it becomes at the margin. At the end of the chapter we showed how allowing for different quality of inputs does not reverse the slope of the marginal cost curves. Whether for extensive or intensive reasons, the marginal cost curve is upward sloping. We also provided a brief definition of the average cost curves. In the next chapter we move on to an analysis of the output decision of the firm, and the determination of the market supply curve.

REVIEW QUESTIONS

1. In Chapter 7 it was shown that marginal cost curves were upward sloping. In this chapter it was also shown that marginal costs curves are upward sloping. What is the relationship between the two explanations?
2. Does a production function have anything to do with the price of inputs?
3. Suppose you have a square piece of property measuring 100 feet by 100 feet (or 100 meters by 100 meters if you like), and you decide to fence it in. You've got 10,000 square feet of property. Now double the sides of the property so it is 200 feet by 200 feet. Now you're going to use twice as much fencing, but you've got 40,000 square feet fenced in. Is this an example of constant returns to scale?
4. Why is it that only stage II of the production function is really relevant to study? That is, why would firms not operate in stage I or III?
5. What does the demand for an input depend on?
6. Why would a firm have to choose the least cost method of producing a good. Do you think this argument applies to firms like churches or universities?

PROBLEMS

1. Every book publisher sells far more principles books than advanced books because the principles class sizes are so large. Why would publishers even bother publishing books for classes that have only 10 students?
2. Is it more efficient to build dams with lots of labor or lots of machines?
3. If you've ever used a drive up window for banking, you've probably noticed that the buttons have Braille dots on them. This is puzzling because blind people don't drive cars and don't use drive through banking. Why is it that keypad buttons on drive up automatic teller machines have Braille dots?
4. "We want the best person for the job" Does that mean we want the person who can perform the job best?
5. You own a hardware store, and your accountant tells you that based on profit per square foot, home appliances are much better than tools. Does this mean you should expand the home appliances section at the expense of the tool section?
6. In your computer lab what can explain why the productivity of the network laser printer falls as more computers are connected to the print queue?
7. Does an owner of a firm hire additional workers if the cost of the worker is greater than the average product of the worker?
8. If the total cost of producing 8 units is \$53, and the marginal cost of producing the 9th unit is \$10, what are the total costs of producing the 9 units?
9. If $w/MP_L > v/MP_K$ then what will a profit maximizing firm do in terms of the amount of labor and capital it uses?
10. Consider the following production function: $Q = 2K + L$ where Q is output, K is capital and L is labor. For positive amounts of labor and capital, what are the marginal products of capital and labor?

Review Question Answers

1. *In chapter 7 every individual was assumed to be different in terms of their costs of producing goods, but for a given individual the cost of producing each unit was the same. Thus, marginal cost curves were upward sloping because the low cost individuals produced first. In chapter 8 we are assuming every person is the same in terms of their productivity, but when they produce more goods they become subject to diminishing marginal products. Thus there are two reasons for why marginal cost curves are upward sloping.*
2. *No. A production function is a technical relationship between the amounts of inputs and the amount of output. There are no prices involved.*
3. *This is not a case of constant returns to scale, and in fact, it is really the most important type of exception. Here when you double the input (fencing) you square the output (area). Hence we have what is called increasing returns to scale.*
4. *In stage I there is really too much capital for the amount of labor being used. Every time the firm adds more labor, output increases at an increasing rate, so it always makes more money by increasing output. Thus the firm ends up in stage II. In stage III there is too much labor. The firm is paying for workers who are making a negative contribution. Clearly the firm would be better off reducing the number of workers at the firm, and ending up in stage II.*
5. *It depends on the price of the output and the inputs marginal product.*
6. *If they didn't they would soon find they could not compete with other firms that were. This must hold for all firms in a competitive environment, even if they are technically nonprofit. A church that does not minimize costs will not be able to provide the same services as a similar church that is not wasting money. Parishioners will see their contributions are more productive at the other church and will leave. At a public university, if the state is constantly willing to subsidize the extra costs, then non cost minimizing behavior is possible.*

Odd Numbered Problem Answers

1. *Even though the average product of a principles book is higher, at the margin an advanced book with limited sales might contribute more than a principles book. The publishing company is equating the value of the marginal products of all its books (assuming they cost the same), even though this implies drastically different sales for the different types of books.*
3. *There are fixed costs in producing the banking machines. To create a different banking machine without the Braille dots would increase these costs, but would produce no benefit. Sighted people don't care if Braille dots are present. This sort of thing is found all over. Cars, for example, come with thousands of "standard features" like wheels, locks, heaters, and seats because to customize each car over issues that almost everyone wants is costly without producing a benefit. At one time heaters in cars were an option, but since most people ordered them, it was cheaper to simply make all cars with heaters.*
5. *No. This only tells you what the average product is for each department. What you want to know is the marginal product.*
7. *No. Under such circumstances the firm would be better off to shut down.*
9. *This says the cost per marginal product of labor is greater than the cost per marginal product of capital. A firm would want to hire less labor and more capital under such circumstances.*