

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

by

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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 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. This difference is yet to come.

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.

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.

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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*. 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

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 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 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 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

would we devote our lives to it?

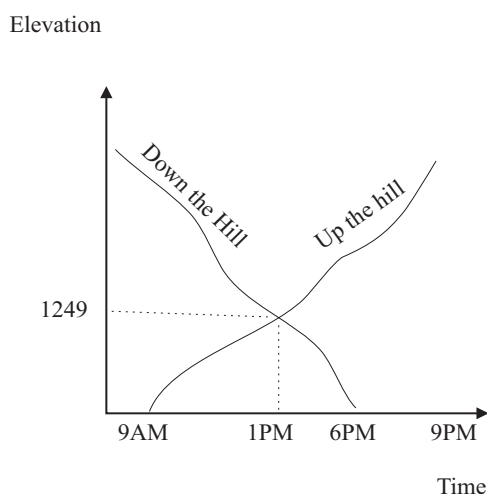


Figure 1-1
A Model of A Cow Going Up a Mountain

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.

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.

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.

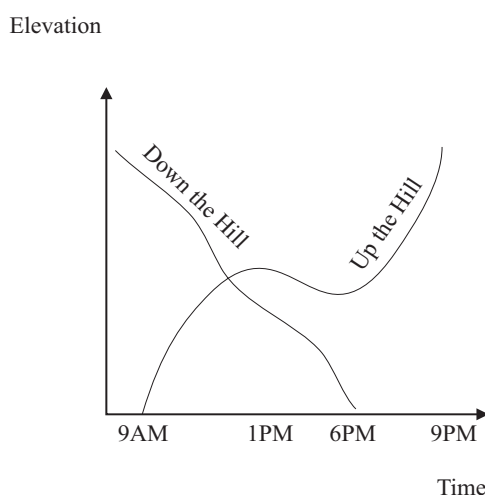


Figure 1-2
A Model of A Cow Going Up and Down and Up a Mountain

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 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

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

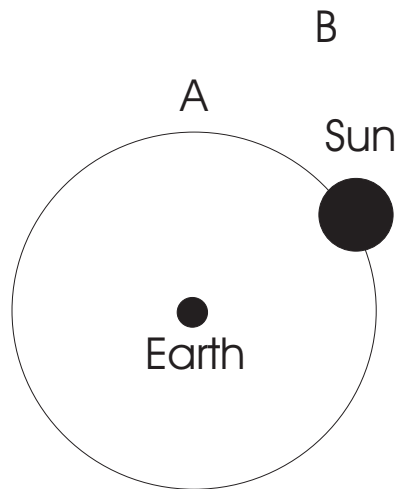


Figure 1-3
Aristotle's Model of Heavenly Bodies

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:

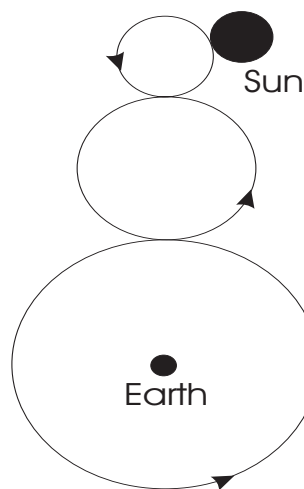


Figure 1-4
Aristotle's Untestable Model of Heavenly Bodies

known as the "problem of induction".

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 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

From the time of Adam Smith's *The Wealth of Nations*, published in 1776, 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. 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 puts economists at odds with certain groups of people, and in bed with others. Feminists are often have a hard time with economic principles because of the reluctance of

economists to assume men and women are fundamentally different in terms of their preferences and what motivates them. On the other hand, at times Evangelical Christians have formed coalition with economists because they also believe all individuals are similar in nature. This latter partnership, in fact, gave economics the name of the *dismal science*.⁴

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.

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 Ur-Text of Racial Politics*, University of Michigan Press, Fall 2001.

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	\implies	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.

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.

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 soooooo 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 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, hottubs 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 tbou 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.”

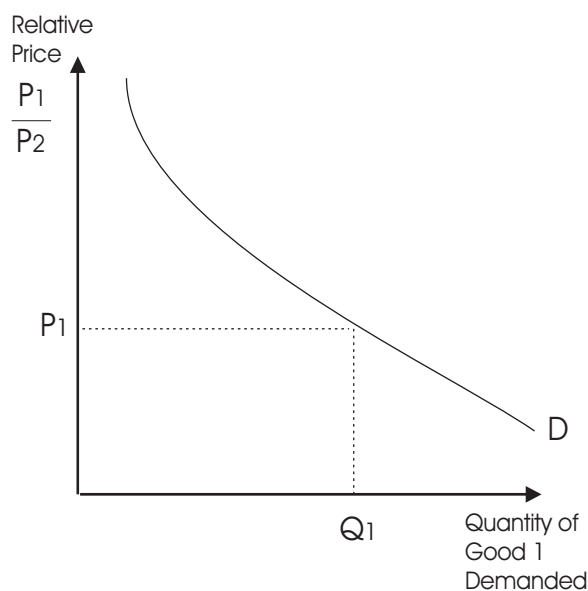


Figure 4-1
A Demand Curve

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.

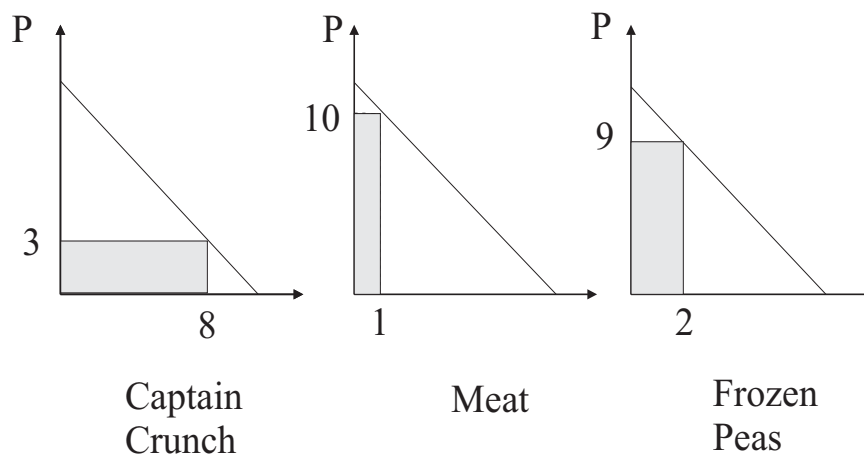


Figure 4-2
Prices at Tradewell

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 \$67 in Safeway and \$75 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.

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 be 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.

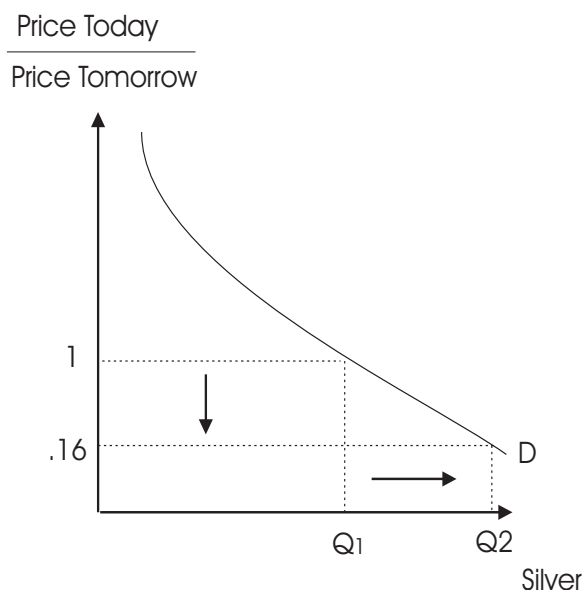


Figure 4-3
Changes in the Relative Price of Silver

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.³

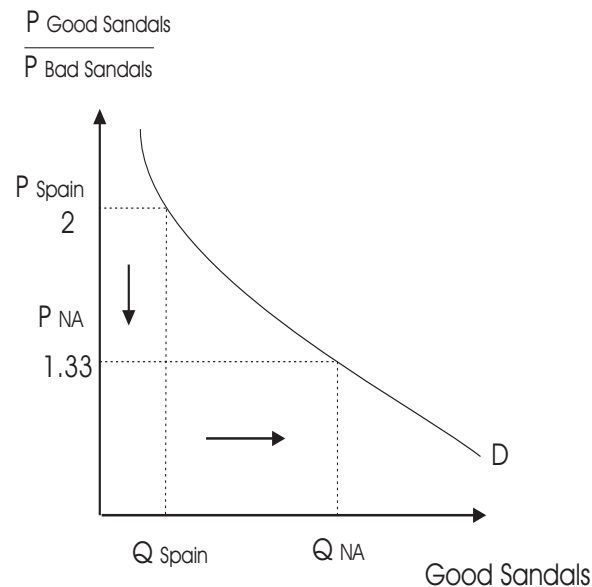


Figure 4-4
Transportation Charges and the Demand for Good Sandals

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

³ 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.

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.

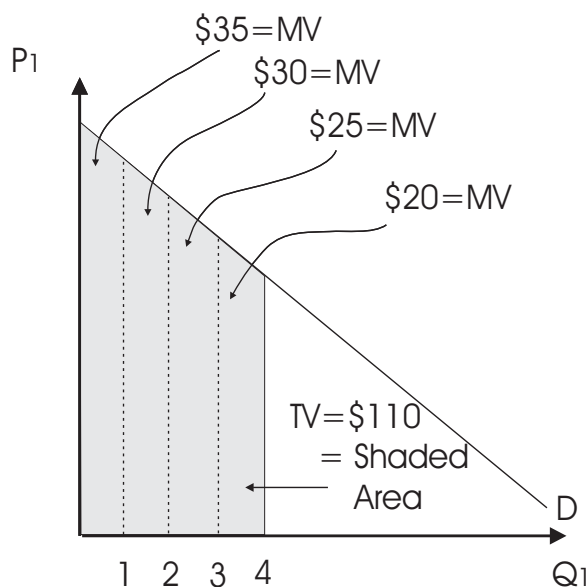


Figure 4-5
Marginal Values and Total Values

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.

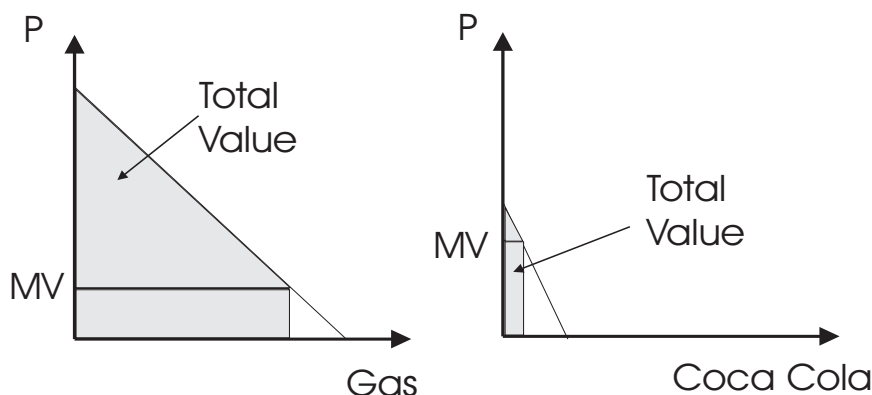


Figure 4-6
The Gasoline / Coca Cola Paradox

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?

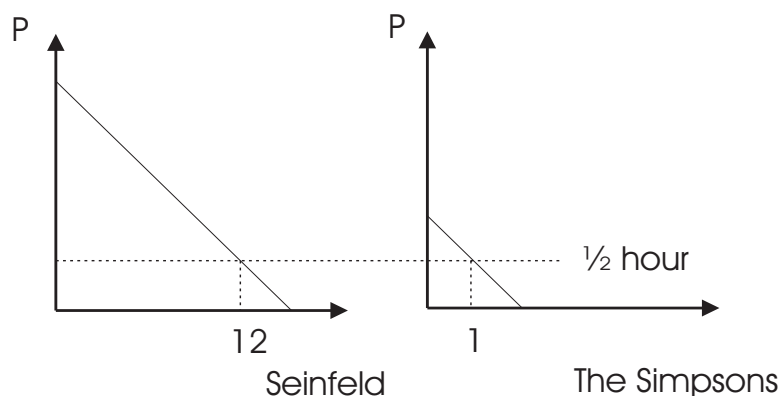


Figure 4-7
Equal Marginal Values When Costs are the Same

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.

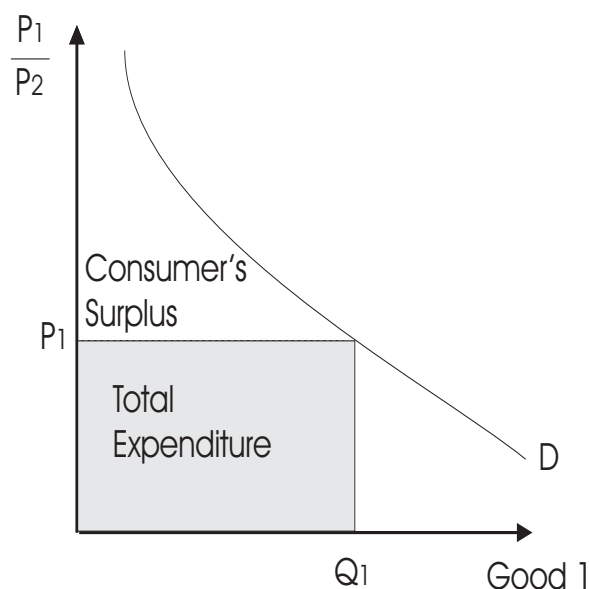


Figure 4-8
Consumer's Surplus and Total Expenditure

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.⁴ 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.

⁴ 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 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.

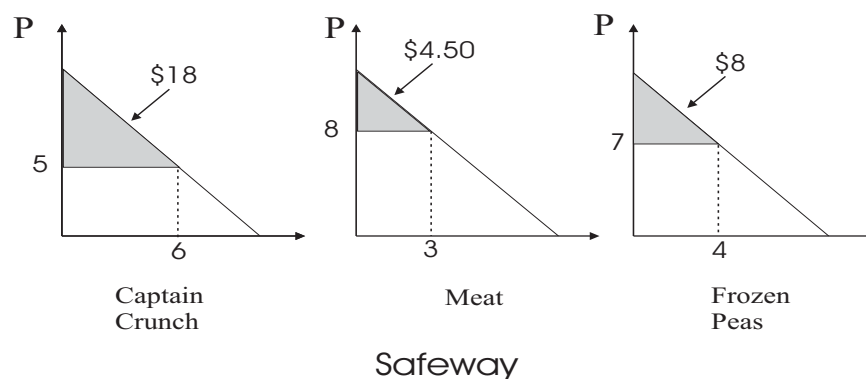
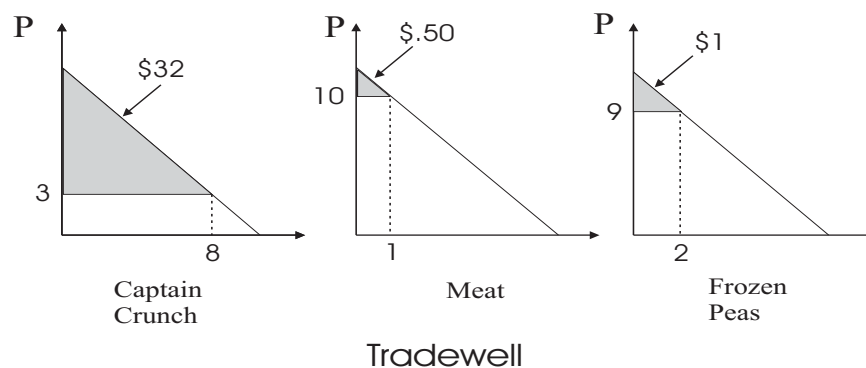


Figure 4-9
Consumer's Surplus at Tradewell and Safeway

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.

QUESTIONS

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 demand for meat is

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

The price of meat is \$8, and the demand for meat does not depend on the level of income. Meat stamps are available. People can purchase \$1 of meat stamps for \$.50. Joe can buy, at most, \$80 worth of meat stamps (for \$40).

- a. Assuming Joe cannot trade meat and meat stamps, 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?
 - c. If Joe can resell the meat stamps and the meat, how much meat will Joe buy?
 - d. Which case would Joe prefer? 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?)