A Short Introduction to Ecological Economics

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Chapter 1: Analyzing Markets

Introduction: Crisis in a Cup

Mohammed Ali Idris is a coffee grower from Ethiopia. Interviewed in 2002, he had this to say about what was happening to his livelihood and life as a result of changes in the coffee market:

> *Five to seven years ago, I was producing seven sacks of red cherry (unprocessed coffee) and this was enough to buy clothes, medicines, services and to solve so many problems. But now even if I sell four times as much, it is impossible to cover all my expenses. I had to sell my oxen to repay the loan I previously took out to buy fertilizers and improved seed for my corn, or face prison.*
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> *Medical expenses are very high as this is a malaria-affected area. At least one member of my household has to go to hospital each year for treatment. It costs US $6 per treatment. We also need to buy teff, salt, sugar, soap;, kerosene for lighting. We have to pay for schooling. Earlier we could cover expenses, now we can't...Three of the children can't go to school because I can't afford the uniform. We have stopped buying teff and edible oil. We are eating mainly corn. The children's skin is getting gray and they are showing signs of malnutrition.*[1]

Plunging world coffee prices have created an economic and humanitarian crisis in much of the developing world. Coffee is the world's second largest commodity trade behind oil; more than 25 million people are employed growing it, mostly on small farms. Coffee grows only in tropical and near-tropical regions, so the major producers are in Africa, Latin America and Southeast Asia. These countries are not rich to begin with. As the price small coffee growers can get in the market plummets, malnutrition, disease and illiteracy are the results.

Figure 1 shows the long-term trend in prices earned by growers for Arabica, the most commonly traded type of coffee. (The other is Robusta, a lower quality bean that accounts for 20% of the market.) Specifically, it displays the price received by shippers in New York City for Brazilian Arabica, adjusted for inflation. (The prices in each year were converted to an equivalent number of 2003 dollars.) Other coffees might be somewhat higher or lower, but the general trend is virtually the same. The high point was a spike in the mid 1970s, when a drought in Brazil led to a global shortage. Since then the overall movement has been down, and by the end of the period the price was at an all-time low—so low, in fact, that farmers could no longer even recover their cost of production, much less earn an income.

This disaster affects whole countries. Particularly in Africa, it is common for coffee to account for a large share of a country's export earnings. In Burundi, for instance, an astonishing 80% of all foreign sales are for coffee; the number is over 50% in Ethiopia and close to that level in Uganda. When coffee earnings collapse, so does the ability of these countries to earn the precious foreign exchange (dollars and euros) with which they can keep up payments on their foreign debt and

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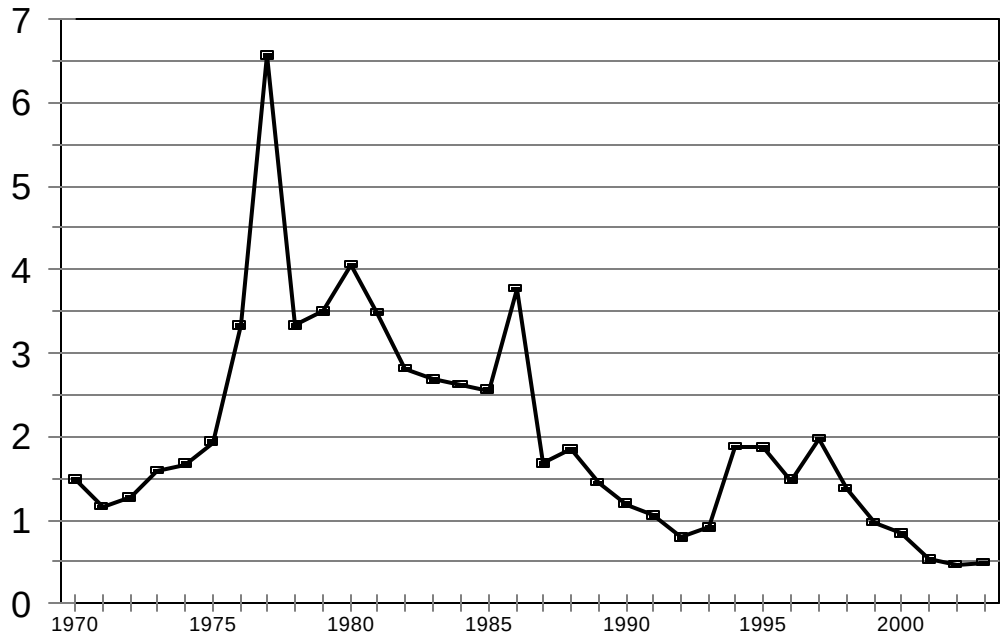
1. Gresser, Charis and Sophia Tickell. 2002. *Mugged: Poverty in Your Coffee Cup*. Oxfam. www.maketradefair.com, p. 10.

perhaps purchase a few imports. So the coffee crisis grips entire populations and pushes countries further back in their pursuit of economic and social development.

Those of us who are fortunate enough to witness this catastrophe from a distance should also be disturbed. We are the ones who drink the brew purchased at the cost of so much hardship. Moreover, we have the resources to make a difference in how the world coffee market operates—if we understand it. But what exactly is the problem? Why have prices dropped to such a low level? Unless we can answer these questions, anything we might try runs the risk of doing more harm than good.

Figure 1: NY Price for Brazilian Arabica, 1970-2003, in 2003 $US



Source: USDA (2003)

There are many *possible* reasons why coffee prices might fall. Perhaps it has become cheaper to produce the bean in some regions, and this puts pressure on everyone else. Or maybe consumers are buying less of it. Or maybe there is too much coffee being produced, or not the right kind. Or maybe the price is being manipulated by powerful special interests. How would we go about trying to figure out what the true story is? What information should we look for, and how can we analyze to separate reality from fantasy?

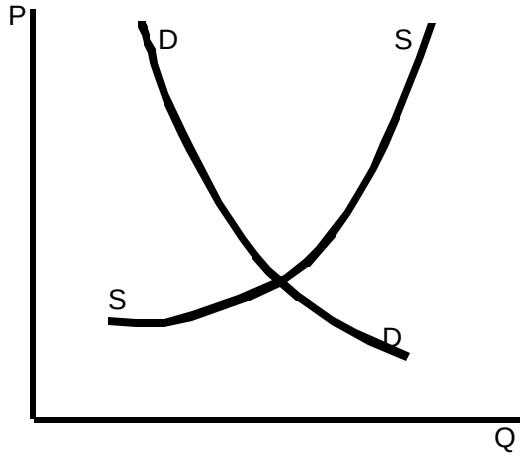
Economics offers a helpful tool, supply and demand analysis. This is a fairly simple but highly flexible way of depicting how a market works, and it guides users toward answers to questions like those we have asked about coffee. It doesn't take long to learn, and it has many "add-ons" that permit it to tackle more complex issues, such as those involving labor, natural resources and technology. This chapter is devoted to presenting this tool and explaining how to use it. The next section introduces the supply and demand model and makes several general comments about

models, in economics and elsewhere. After this, we will look more closely at the three main building blocks, supply, demand and equilibrium. We put this model through some practice exercises, and then conclude by seeing what it has to say about the causes of the coffee crisis.

A First Look

Here is a "naked" supply and demand diagram. It is stripped to its bare essentials. What is being depicted is a market, which, in non-technical terms, consists of all the buying and selling of some particular good or service. Individuals do not appear in this diagram; rather, it represents everyone involved in this market collectively. At this extremely general level, only two kinds of information are recorded, the possible prices people may buy or sell at, and the possible amounts they may buy or sell. All other aspects of the situation—the thoughts or feelings of these people, their relationships to one another, the qualities of the goods being considered—are ignored. In fact, just by creating categories like "buyers", "sellers" and a "particular good", we are making a set of gigantic simplifications, since human beings and even mass-produced commodities have individual differences as well as similarities. (Economists might talk about the market for "oranges", but there are a great many varieties of oranges, and even within a single variety one orange may be juicier or more attractive than another and therefore more likely to sell at a higher price.) All these real-world complications are suppressed in Figure 2, and what remains is an imaginary world with a few features of the real one, a simplification that may nevertheless tell us something important about the logical structure of the world we actually inhabit. Note, incidentally, that there are few labels and no numbers in this diagram. We don't know what goods are being traded, how much or at what price. All we see are two curved lines intersecting in two-dimensional space, bounded on the left and below by measurement axes.

Figure 2: A Basic Supply and Demand Diagram



So this is it: the basis for nearly all ground-level economic reasoning. In a nutshell, you would read it in this way: The straight lines represent two axes; the vertical axis is price and the horizontal axis is quantity. Thus, the further "north" we go in this diagram, the higher the prices, and the further "east" we go the higher the quantities of goods being offered for sale or purchase. The S curve represents the amount individuals wish to sell at various prices. (One assumption behind this curve, and the demand curve as well, is that there will be only one price for all the transactions taking place in this market at any moment in time. The price may change, but only over time, not

between individual goods or people.) It is upward-sloping, which is to say that it travels from the southwest to the northeast. At lower prices there are fewer goods offered for sale, and as the price rises more goods are placed on the market. The D curve represents the amount individuals wish to buy at different prices. It is downward-sloping, which means that at high prices there is less desire to buy, but more at lower prices. Here in a nutshell is the framework for thinking about markets (including coffee markets). Don't worry if Figure 2 is still mysterious at this point: we are just making an initial acquaintance. After some general comments about the role of models in economics, we will return to this diagram and examine its elements in much greater detail.

This supply and demand diagram is an example of a model, a simplifying device that makes it possible to draw logical deductions about events taking place in the world. The real world, of course, is far too complicated to be fully portrayed in any diagram or even any set of mathematical equations. Perfect prediction is impossible—fortunately, I think. Models are like maps: they eliminate large numbers of factors so that the remaining ones can be understood more precisely. In this case we are eliminating everything except the intentions of buyers and sellers, and we are eliminating any influence on them except the prices they pay or receive. This will make it possible to look at the logical possibilities that could explain why markets work the way they do, without getting confused by too many simultaneous influences and counter-influences. As we will see, it is a very powerful approach, in the sense that it can make strong (sweeping or very assertive) inferences from a small amount of information. Where does this power come from?

The short answer is that it comes from the number and sweeping character of the assumptions we made in order to create the model in the first place. The more factors you either eliminate from a model or reduce to the narrow form of x-causes-y (mathematical functions), the more power you provide to the factors that remain. This comes at a cost, however. Every assumption (or mathematical simplification) you make takes your model further away from reality. You have to say things like, "If we assume this and this and this, then we can conclude that." Then it is up to the listener or reader to judge for herself whether the assumptions constitute so large a departure from reality that the conclusions are worthless, or whether the assumptions are fairly plausible and the conclusions probably hold. There is no formula for making such a judgment; each of us has the responsibility of making it for ourself. As we continue looking at the supply and demand model, and other models later on in these chapters, keep this question in the back of your mind: how much sense do these assumptions make? How likely is it that the results that flow so forcefully from the model also describe what is likely to happen in the real world?

A second general issue to be aware of when examining models is what we expect them to do for us. There are two possible benefits from using models, generally referred to as **positive** and **normative**. A positive benefit would be one that helps you either explain or predict reality. For instance, think of the old saying, "Red sky at night, sailor's delight; red sky at morning, sailors take warning." Behind it is a model. It says that there are only two skies of interest, red skies and non-red skies. It says there are only two time periods of interest, night and morning. Already it has ruled out almost all other forms of meteorological information. Finally, it offers a general rule: if the night sky is red, the weather the following day will be calm, whereas if the sky in the morning is red it will be stormy. The purpose of such a model is primarily predictive. We want to know whether to go out on the water tomorrow, and this model purports to help us predict what the weather is going to be. In other words, it is helping us perform a positive analysis, one that can provide benefits in the form of prediction. We would continue to call it "positive" even if the advice is wrong. Perhaps the sunset is brilliantly red and then a hurricane arrives the following day. Nevertheless, we would still

say that the model was used for positive purposes, just that it failed at the task rather miserably. Similarly, we might be trying to "predict" the past; that is, we are trying to explain why things turned out the way they did. A classic example is Charles Darwin's theory of natural selection. According to this theory, there is endless competition in nature between different members of a species for limited food and reproductive opportunities. Over time, characteristics that promote adaptation to environmental conditions will become more widespread, as individuals with those characteristics disproportionately survive and reproduce. Thus, the characteristics of species today can be explained by the pressure of natural selection operating in previous environments. This is a positive theory; it simply tries to explain why species are as they are without passing judgment on them. The evidence for it is massive, although there are disputes over whether it provides a complete model of evolution (whether there are other factors that need to be taken into account) and how exactly it should be applied. But none of the controversy has to do with the positive (explanatory) intentions of the model.

The other purpose of a model is normative. This refers to an analysis which tries to determine whether something is good or bad, to be sought or avoided. Whereas positive analysis is about prediction and explanation, normative analysis is about evaluation. An example would be Aldo Leopold's famous Land Ethic: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise." ("The Land Ethic", from *A Sand County Almanac*) This is as clear a statement of values as one could want, and it uses judgmental words like "right", "wrong", "integrity" and "beauty". Even the concept of stability, which is positive in most respects (it is something we could explain or predict), carries a normative load: in the context of Leopold's dictum, it is understood to be desirable, an end that justifies actions undertaken to achieve it. It is obvious that instability would not be looked on very favorably by Leopold; it is not emotionally neutral.

Most economists draw a solid line between these two types of analysis. In particular, they argue that if your goal is to explain or predict you should stick as closely as possible to positive analysis and not get sidetracked into making value judgments. It is easy to see why they would say this. Why something happened or whether it will happen in the future should not depend on what your feelings are about it, and vice versa. Whether you approve or disapprove of the course evolution has taken over the eons should not influence your analysis of *why* it has taken this course, nor should it lead you to over- or underestimate the likelihood of future evolutionary trends. This is a reasonable perspective. On the other hand, it is not so easy to disentangle positive and normative analyses. One obvious example would be the Land Ethic from the previous paragraph. As mentioned above, stability is used in a normative fashion, yet it also has a positive dimension. Much positive analysis can go into determining which actions promote stability and which don't, and even integrity and beauty can be analyzed. (Integrity can be identified with the preservation of ecological processes like nutrient cycles, and perceptions of beauty can be verified through opinion surveys and studies of sight-seers.) At the same time, positive criteria can easily acquire normative connotations. Shortly after Darwin had published his major theoretical treatises, a doctrine we now call Social Darwinism made its appearance. According to this viewpoint, differences in wealth and power among human individuals are traceable to the same process of natural selection that Darwin applied to worms and finches. The Social Darwinists concluded that egalitarian social reforms were misguided because the sorting of human beings into rich and poor is natural and inevitable. Their position remained positive in some respects (it can be assessed through the accuracy of its explanations and predictions), but it was also explicitly normative in its role as a political ideology. Indeed, it is difficult to pinpoint exactly where Social Darwinism crosses over from positive to

normative in its own argumentation. We will see a similar type of slipperiness in economics, where the focus of positive analysis is on income or economic growth, and the value judgment that these things are *good* comes in more or less unconsciously.

A second reason for the interconnection has to do with the process of constructing models themselves. Models depend on assumptions, and there is generally a choice about which assumptions to make. It all depends on what we *want* to find out. Note the italics for the word "want". What we want to find out depends on what we value. Suppose, for example, that a research team conducts a study to determine whether, and if so why, a small, little-known fish is in danger of extinction. This is a clear case of positive analysis: it will result in an explanation for why the fish is or isn't endangered, and it seems to have nothing at all to do with value judgments. Nevertheless, it is reasonable to ask why such a study is being done. In particular, if there is no burning social interest in this fish, there must be some other justification for doing all the work it will take to find the answers. Perhaps the researchers believe that the extinction of any species is a bad thing, something to be avoided if at all possible. Or perhaps they view the fate of the fish as indicative of the more general health (integrity, stability and beauty in Leopold's words) of the ecosystem of which it is a part. In either case they will be acting on their values, or, to use our terminology, undertaking a positive inquiry for normative ends. In a world in which there is almost an unlimited number of mysteries to investigate, and only limited time and resources to put to their exploration, there is no escaping judgments over what is worth doing. It will turn out that this issue of choosing what to analyze (and therefore what to assume away when building a model) will be deeply consequential for economics.

The Elements of Market Analysis

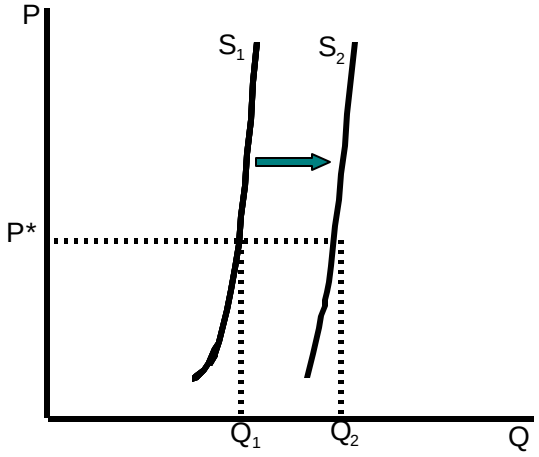
Now that we have ruminated on the general characteristics of models, let's look at this one in particular. Where do these curves come from, and what shapes can they reasonably take?

A. The supply curve. The amount of something that people are willing to sell depends on many things. The cost of acquiring this good is an obvious consideration. Perhaps the sellers are making this item, in which case their supply will depend on the cost of materials, the cost and characteristics of labor, the technology, etc. Or they may be middlemen, like wholesalers or retailers, in which case they have to pay attention to the price they have to pay as buyers in some other market. The capacity of the sellers may also be a factor: how many of them are there, and how much do they have in the way of investments, like buildings, land, materials, equipment, etc.? Another influence might be the expectations that sellers have of the future—whether they expect prices to go up or down, for instance, which will persuade them to sell now or wait until later. And of course sellers will be interested in the price they can get if they sell today. For any given situation, the possibilities are almost endless. But the trick employed in economics is to suppose that all of these factors are assumed to be constant, fixed and unchanging, except just one: the current price buyers are willing to pay. This is the meaning of the supply curve. It says that, with all other factors held constant, there is a one-to-one relationship between the going price and the amount sellers wish to sell. (Remember that in a supply and demand diagram there are no individuals, just sellers as a group and buyers as a group.) Each point on the supply curve represents one such combination, and movement along the curve means seeing how a change in the price affects the amount offered for sale. If you go up (northeast) along the curve, the price is rising along with the quantity; the opposite holds for movement down (southwest) along the curve. The story is Pavlovian: flash a price and the sellers will respond with a perfectly predictable amount they want to sell.

There is one critical point to bear in mind: this supposedly predictable relationship between price and quantity depends entirely on the initial assumption that every other factor is being held constant. This assumption is important enough to merit its own name, *ceteris paribus*. The words are Latin, for "things [being] equal". In econospeak, people will say things like, "This relationship holds ceteris paribus." They are simply invoking the common, but sweeping, assumption that nothing else will change that might interfere with the one relationship being examined. In the case of the supply curve, each point along the curve, and the curve as a whole, depends on everything else in the whole world being exactly what it is and staying that way. If anything of significance change, the whole curve moves. Read that sentence again: if anything of significance changes, the whole curve moves. Understanding why and how this happens is fundamental to understanding the use (and possible misuse) of the supply and demand apparatus.

Let's consider our original example, the global market for coffee. The supply side of this market consists of producers and processors who make coffee beans available to the ultimate consumers, such as most of us. One well-publicized event that occurred was that, during the decade of the 1990s, Vietnam became a major producer. Let us suppose (falsely of course) that this is the only thing that happened on the supply side of the market during the 1990s. We might represent this in the following diagram:

Figure 3: Vietnam Expands its Coffee Production; the Supply Curve Shifts



Before Vietnam entered the market the curve might be drawn as S_1, after as S_2. The whole curve has shifted to the right. For any given price, say P*, the world's suppliers, including Vietnam, will produce more: Q_2 instead of Q_1. This is true for any possible price: the new supply curve is completely to the right of the old one. This shift in the supply curve underlines the original point: it was the assumption of ceteris paribus that enabled you to draw the curve in the first place. If this assumption is broken—if some factor of significance other than the market price changes—the whole curve must be redrawn. In this case, the change is rather obvious; the addition of Vietnam to the ranks of major producers leads to a rightward shift in the curve as a whole.

To summarize, we have seen two potential ways prices or quantities can change. Either can change as a result of a change in the other, as we saw represented by movement *along* a supply curve. But either can also change despite *no* change in the other, as represented in movement *of*

a supply curve. Knowing the difference between these two possibilities is 90% of what you need to know about this topic.

Take a moment to consider some other examples. (1) Because of a drought during a crucial phase of the growing season, there is a change in the amount supplied. This will look like a mirror-image of Figure 3. Now the supply curve will shift to the left. Once again there has been a change in one of the factors normally held constant under the ceteris paribus assumption, in this case the productivity of coffee growers. At any potential price they will bring less to the market. (2) Caffeine is found to be a major cause of brain damage. This will *not* cause any shift in the supply curve, because none of the ceteris paribus factors have changed. From the supplier's perspective, the only thing that's changed is the amount consumers are willing to buy, which is to say the amount they will be able to charge if they want to sell their harvest. The supply curve stays put, but there is movement along it—in this case down and to the left. (3) Fair Trade importers offer growers a higher price than the going market rate. Once again the supply remains fixed, since it is the price sellers can get which is changing. The movement is up and to the right along the supply curve, at least for the fortunate growers who are able to qualify under Fair Trade rules. (We will return to the economics of Fair Trade later in the chapter.)

If this makes sense to you, you are ready for the other 10%. Take another look at Figure 3. Notice how vertical the supply curve looks in this diagram, compared to the one in Figure 2. Why did I draw it this way? The assumption behind the artwork (I'm being charitable) is that agricultural commodities like coffee have more vertical supply curves than average. The reason for this is that, in the relatively short run (within the growing and harvesting period of a year), the amount that will be produced is more or less what it is, no matter what the going price. Coffee plants don't yield more beans just because the price goes up. The decision to plant, combined with the weather and a few other factors, predetermines the harvest. On the other hand, the curve is not completely vertical, because there is still some discretion on the part of growers. They can harvest more or less intensively, put more or fewer resources into storage and processing in order to cut down on waste, etc. When prices are high, they will squeeze a few more beans out of their operation somehow; the reverse when prices are low. So the supply curve still slants, but only a little.

We have a name for highly vertical supply curves: they are called **inelastic**. There is a formula for calculating the elasticity of a supply curve:

$$\text{elasticity of supply} = \frac{\%\ \text{change in quantity supplied}}{\%\ \text{change in price}}$$

We speak of a supply curve as being elastic if the formula has a value greater than one—if the percentage change in quantity is greater than the percentage change in price. It is inelastic if it is less than one. The nearly vertical curves in Figure 3 are highly inelastic. Imagine going from a low price to a high one on either curve. There would be a very large percentage change in the price, perhaps more than 100% (double), but only a very small percentage change in the quantity, say 5 or 10%. So the value of the fraction, with quantity on top and price on the bottom, would be close to zero. A very horizontal curve would have an extremely high elasticity; it could easily be 10 or 20 or 100 (if it were very flat). Here is a tip for making sense of the word "elasticity": think of something elastic like a rubber band. It is highly stretchable; you pull on it and it gets longer. This is the same as the quantity supplied in an elastic supply curve. If the price goes up, the quantity stretches in response. The opposite is true for an inelastic supply curve. Price changes can pull and pull on it,

but quantity stretches hardly at all. This may not be the most scientific approach to understanding elasticity, but you might find it useful all the same.

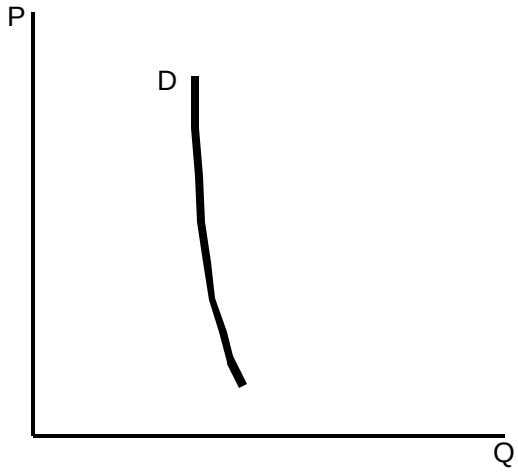
Visually, a supply curve is inelastic if it points downward toward the horizontal axis, which is the case in Figure 3. If it points toward the vertical axis, it is elastic. Of course, unless the supply curve is a straight line, it will point in different directions depending on what part of the curve you look at. Recall from geometry that the slope of a curve at any point is determined by the straight line tangent to it at that point. We could then say that the supply curve is elastic at one point but inelastic at another, depending on the slope of the corresponding tangents.

Why bother with this terminology of elasticity? One reason is that it gives us a language to talk about the geometry of curves without actually having to draw them. Simply by saying that the supply of coffee is inelastic, I am alluding to a curve such as the one(s) drawn in Figure 3. Moreover, if the supply of coffee really is inelastic, this tells us something about the nature of the coffee industry. In the time frame represented by the diagram, the amount of coffee producers put on the market is not very responsive to the price: the amounts produced at a high price will be very similar to the amounts produced at a low price. This piece of information will prove useful later on when we attempt to unravel the mystery of the coffee crisis.

B. The same sort of analysis can be applied to the demand side of the market. Many factors affect the amount that consumers want to buy----their desire for the product, the amount of income available to them, the prices of other goods they might buy instead, their expectations about future prices and availability, and certainly the price currently being charged for the good in question. In order to produce a demand curve, we make the assumption that all these factors, except the current price, are held constant, and then we can consider the relationship between price and quantity purchased. This relationship depends on the *ceteris paribus* assumption, just as the supply relationship did; change one of the factors being held constant and the whole relationship changes.

Let's imagine how this would work for the world coffee market. Suppose the buyers we are interested in are the volume coffee purchasers, the "middlemen" who buy from the actual growers and then resell to the companies that sell coffee to people like you and me. These buyers must keep in mind the amount of coffee consumers may be willing to drink, costs of marketing and distribution, and the need to stockpile supplies in times of low prices or draw down stockpiles if prices are expected to rise. But we can also assume that they will buy in larger quantities when current prices are low, and in smaller quantities when they are high. This gives rise to a demand curve such as we see in Figure 4.

Figure 4: World Demand for Coffee



As you can see from this diagram, at high prices buyers purchase somewhat less; as the price falls, the amount they purchase goes up. Nevertheless, the quantity varies just a little, even if price changes are substantial. That suggests that demand is **inelastic**, just as supply was. The formula for the price elasticity of demand is virtually the same as that for supply:

$$\text{price elasticity of demand} = \frac{\%\ \text{change in quantity demanded}}{\%\ \text{change in price}}$$

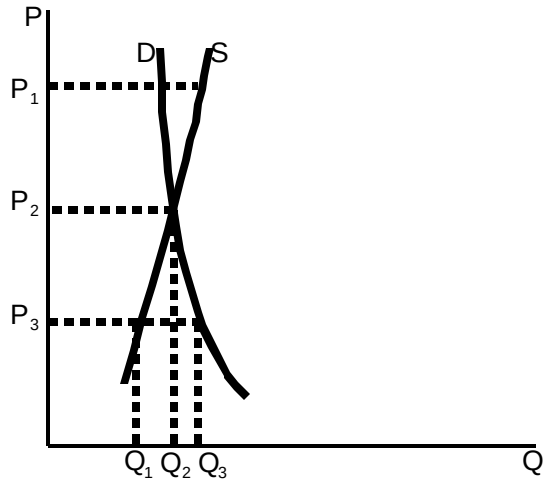
In this case, very large percentage changes in price have very little effect on the percentage change in the quantity demanded; hence the choice of an inelastic demand curve. Is this realistic? Both logic and experience suggest it is. The price of coffee beans is a relatively small part of the total cost of a cup of coffee, so coffee drinkers will tend to buy about the same amount whatever the price of beans. The number of coffee drinkers is generally independent of prices anyway, and wholesalers have little difficulty passing along increased costs.

Note that no change is assumed to take place on the demand side of the market. No events have transpired in the world to change the relationship between the price charged for coffee and the quantity purchased. The demand curve doesn't tell us what the price or the quantity demanded will be, just that, if we know one we can deduce the other by finding the corresponding point on the curve.

C. Equilibrium. So here we have two pieces of information, the supply curve and the demand curve. What do they tell us about events in the coffee market, or any other market? To answer this question, we need to add more assumptions about how buyers and sellers respond to one another.

Let us assume that buyers always prefer to be at some point on their demand curve rather than off the curve, and that sellers always prefer to be at some point on their supply curve. If this is true, then both can do this simultaneously if and only if their curves cross. The reason is that there can be only one set of prices and quantities for both groups: whatever price buyers are paying is also the price sellers are receiving, and the amount buyers are buying is also the amount sellers are selling. We can see this graphically in Figure 5.

Figure 5: Equilibrium in the Coffee Market



At any point along the D curve buyers would be acting in accordance with their intentions. At any point along the S curve sellers would be acting in accordance with their intentions. They are both able to do this simultaneously at price P_2 and quantity Q_2. At any other price this would not be possible. Consider price P_3, for instance. At this price, buyers want to purchase and amount of coffee equal to Q_3, while sellers would prefer to sell Q_1. Both cannot be satisfied. The most likely outcome is that sellers will make Q_1 available, and that is all buyers will be able to acquire. The difference between what they want to buy and what they are able to buy, Q_3 minus Q_1, represents **excess demand**. Those who place their orders first may be able to make their purchases, but there will be other buyers who will be told that all the supplies are gone. An opposite situation would occur at P_1. In this case the amount that buyers wish to buy is less than the amount sellers wish to sell. Some suppliers would manage to make sales at this higher price, but others would be left with unsold stock. This would be a condition of **excess supply**.

Economists generally assume that both excess demand and excess supply are unstable. If either buyers or sellers are not able to make the transactions they wish (as represented by their demand and supply curves), they will have an incentive to change their response to the market. In the case of excess demand, suppliers who find themselves quickly selling out will be tempted to raise price prices, and they may find buyers among shoppers who are trying to avoid being frozen out by a shortage. In the case of excess supply, suppliers who find their inventories piling up may try lowering their prices, and clever consumers will bargain aggressively to take advantage of the situation. Thus excess demand will tend to lead to an increase in prices, and excess supply to a decrease. As long as the price is below P_2 there will be pressure for the price to go up, and vice versa. Only at P_2 is the price at least temporarily stable.

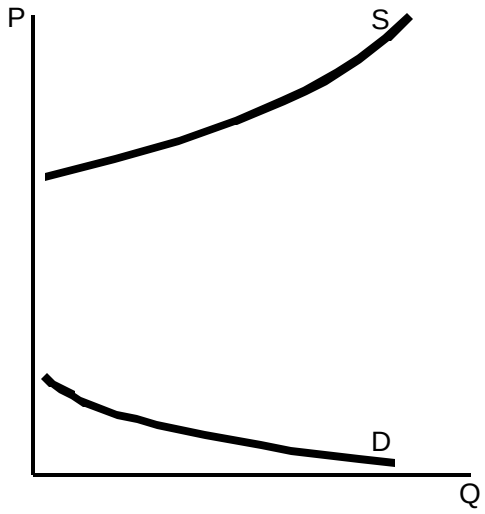
This analysis explains why the term **equilibrium** is used to describe prices and quantities like P_2 and Q_2. A situation is in equilibrium if there are no forces internal to it that would lead to a change; change can come only from the outside. If the situation is in **disequilibrium**, however, change is likely to occur even if no outside factors play a role. In our analysis of demand and supply, the line that separates inside and outside is the ceteris paribus assumption. If this assumption holds—if all the factors that enter into the demand and supply relationships remain constant—then nothing

is transpiring on the outside to alter the market. It will remain as it is if it is in equilibrium, which is to say if the market price is P_2. If this is not the price there will be pressure for readjustment, pushing the price toward P_2. The pressure will end only when equilibrium is restored.

It should be apparent that equilibrium is a powerful concept for explaining and predicting how markets will function—the purpose of positive theorizing in economics. Once we have the information that enables us to draw supply and demand curves, we can say with some confidence what prices we expect to see, and how much will be produced and sold. This is true even if the initial situation is not in equilibrium, since the pressures exerted by excess demand and supply will tend to move the market in the direction of equilibrium.

To see the power of this concept, consider a good that is *not* currently bought or sold on the market, such as individual solar-powered helicopters. The technology probably exists to produce this gizmo, and no doubt there are some people who would like to have one. Nevertheless, we don't see them for sale at the mall. Why not?
The market in all likelihood looks like that depicted in Figure 6.

Figure 6: Demand and Supply for Individual Solar-Powered Helicopters



There are prices at which consumers would buy and prices at which producers would produce and sell, but there is no overlap between them: the cheapest price at which such a device can be made is still too expensive for the most rabid consumer. There is no equilibrium price in this market, and the only equilibrium quantity is zero. If the supply-and-demand model of the market, with its predictive notion of equilibrium, is correct, then *every* non-produced good must look something like this. Thus, equilibrium analysis can not only explain the prices we expect to find in the market, but also why there are no markets at all for many potential goods.

At this point it is only fair to mention three important limitations of equilibrium reasoning in economics. First, in the real world few markets are actually in equilibrium at any moment in time. If there are strong pressures pushing markets toward equilibrium, it is also true that the flow of outside events never stops, and this leads to changes in the equilibrium even before the market can get there. At best, equilibrium analysis is approximate; it is not a precise reflection of how markets

function. Second, the assumptions we made about excess demand and supply do not always hold. Buyers and sellers may respond as we suggested, but they may not. There are many markets in which excess supply or demand can persist for months or years, with no apparent effect on prices. In those cases the notion of equilibrium as an intersection of demand and supply curves (no excess demand or supply) may be too simplistic. There are more intricate analytical devices (such as those offered by game theory) that can be used to represent more complex forms of equilibrium. Finally, equilibrium is a positive concept—it helps us explain or predict—but it has no necessary normative significance. This is such an important point that it deserves a paragraph all to itself.

Language can play tricks on us. Words often mean different things in different contexts, and we can go wrong by failing to recognize the distinctions. Equilibrium can give rise to exactly this type of confusion. In normal speech, equilibrium is a desirable state of affairs. The word has connotations of balance and harmony. On a personal level, to be in equilibrium is to have resolved troublesome psychological conflicts and found inner peace. It is only reasonable to extend the same type of judgment to economic equilibrium—reasonable but wrong. In fact, there is no presumption in economics that a market equilibrium is better than a disequilibrium. It all depends on the market. Here is an extreme example: the market in nuclear weapons. It is altogether possible that there are private individuals who have access to nuclear weapons at the present time. Some may have escaped military control during the collapse of the Soviet Union; it may also be the case that countries with secret programs have permitted a few of the weapons to enter the black market. No doubt there are other individuals, many of them terrorists or criminals, who would like to purchase such weapons. Insofar as sellers are motivated by the money they can make selling weapons and buyers are constrained by how much they can afford to pay, there are supply and demand curves, and therefore also a market equilibrium. At some price, the number of nuclear warheads underground arms dealers want to sell is equal to the number potential mass murderers want to buy. With luck, however, the market will *not* reach an equilibrium, and these transactions will never take place.

This is clearly an extreme example, and yet it is not so different in principle from more commonplace economic threats. Many of the goods produced in modern economies are harmful to the environment and to human health. Much of the work performed to manufacture and distribute these goods is hazardous, degrading or oppressive. We can explain why these problems exist using the apparatus of market equilibrium, but we should be clear at all times that explanation is not justification. Equilibrium is a positive, not normative, concept. In the next chapter we shall consider the conditions under which there may (repeat: may) be a connection between equilibrium and human betterment, but for now we should view them as entirely separate and distinct phenomena.

Before leaving the topic of equilibrium, we should consider what the concept means in a world of many markets, all of them interlinked. There are markets for shoes and markets for socks, markets for cars and buses, markets for the goods farmers buy and the goods they sell. What happens in one of these affects the others. When the pressure to get to equilibrium leads to adjustment in one part of the economy, this is experienced as an “outside” force in other markets. A chain reaction is set off, and the effects may ultimately rebound on the market that set the process in motion in the first place. We can make economic analysis much simpler by focusing on just one market at a time, but to do so is to overlook the interconnectedness of real-world economies.

To address this problem, economists have developed the concept of **general equilibrium**. This is a situation in which all markets are in equilibrium simultaneously, each taking the others into

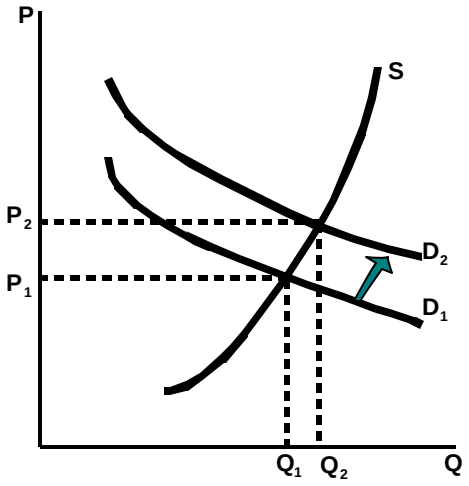
account. Economists spent decades investigating the mathematical basis for the hypothesis that economies might have such a general equilibrium. By 1960 it had been proven that this was a logical possibility, although more recently theorists have found new grounds for skepticism. They have shown that economies typically have many potential general equilibria, a problem from the perspective of explanation and prediction. (If an analysis shows that, say, twelve combinations of prices and quantities could all be in equilibrium, how do we know which one is likely to occur?) They have also shown that the adjustment process sparked by excess demand and supply can shift the equilibrium itself, making it more difficult to use the supply-and-demand model to make predictions. We will have more to say about general equilibrium in the next chapter; for now, the main point is that, in using demand and supply curves, it is important to keep in the back of one's mind the possibility that there may be important effects that extend beyond the confines of a single diagram.

Using Supply and Demand

The best way to get a feel for the supply and demand apparatus is to use it. Let's imagine various situations that might arise in an economy and see how they could be approached with the three building blocks of supply, demand and equilibrium.

A. Ice cream. Suppose you open a home-made ice cream stand specializing in vegetable flavors—spinach, zucchini, turnip, etc. After the initial burst of demand (because people have been waiting all their lives to try these new taste sensations), you settle into a predictable level of sales. We might ask how various events would affect the amount of ice cream you sell per week and the amount you are able to charge for it. For instance, suppose that global warming produces a month-long heat wave during the late spring. People are looking for cooling, refreshing snacks, like cucumber-cilantro swirl. The result may be depicted as in Figure 7.

Figure 7: The Effect of a Heat Wave on Ice Cream Sales



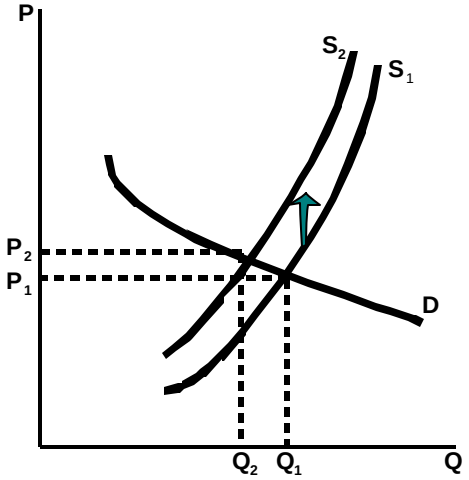
By shifting the demand curve from D_1 to D_2, we are reflecting the increased desire of consumers to buy ice cream at any price. Even after demand shifts, it is still the case that more ice cream will be bought as the price falls (the curve is downward-sloping), but the quantity is greater. If you pick one price in particular (identified as a vertical distance up the P axis), you can find out what the sales

will be by tracing a horizontal line over to the demand curve. First you will reach D_1, which tells you how much will be bought if this is the demand curve, and then you will reach D_2. Since D_2 is to the right of D_1, more ice cream will be bought during the heat wave than before it. Alternatively, you could think of D_2 as being *above* D_1: for any potential quantity of sales, a higher price can be charged during the heat wave. Note the thought process that led us to shift the demand curve. Because of the higher temperatures, consumer preferences, which are one of the factors normally held constant in conjunction with the *ceteris paribus* assumption, have changed, and this shifts the entire curve. On the other hand, nothing has transpired to change the *ceteris paribus* factors on the supply side; this curve remains where it was.

Applying the concept of equilibrium permits us to make a prediction. We expect that, in the absence of any outside change (like the weather), the market would settle at a price of P_1 and a sales level of Q_1. Due to the heat wave, these will change to P_2 and Q_2. In other words, the price will go up *and* so will the sales. The process has been instigated by a change in the demand curve. Although there has also been a change in the amount of ice cream sold, there has been no change in the supply curve. *We see movement **of** the demand curve and movement **along** the supply curve.* Knowing which curve to move and which to keep in place is 90% of the art of applying the supply-and-demand framework.

Now suppose that, rather than a change in the weather, we see a change in the tax laws. What happens if the city decides to raise money by placing a tax on ice cream vendors for each scoop they sell? We can picture the result in Figure 8.

Figure 8: The Effect of a Tax Increase on the Ice Cream Market



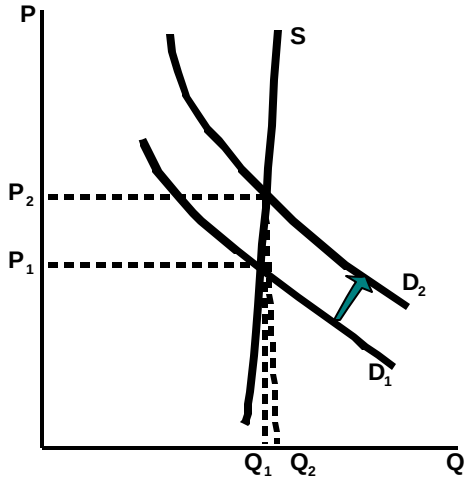
If ice cream sellers such as yourself have to pay a tax, this increases your costs and means that you now need to charge a higher price than before. In other words, your supply curve will shift upward (or to the left). On the other hand, nothing has changed to alter the relationship between the price and the quantity consumers want to buy, so the demand curve stays put. The equilibrium quantity sold will fall from Q_1 to Q_2, while the equilibrium price will rise from P_1 to P_2. Note that increase in price per scoop is substantially less than the amount of the tax per scoop. (You can read the size of the tax increase from the vertical distance between S_2 and S_1.) This means that sellers are able to pass along some of the tax increase, but not all of it. By looking closely at this diagram, you can see that the portion that can be passed on to consumers depends on the slope

of the demand curve, loosely related to the price elasticity of demand. As drawn, the demand curve is rather elastic: relatively small changes in price induce consumers to make relatively large changes in their ice-cream eating habits. What if the D curve were inelastic—more nearly straight up and down? If you try this out on a piece of scratch paper, you should find that the price increase becomes larger and the quantity decrease smaller. At the limit, with a perfectly inelastic (vertical) demand curve, all of the tax increase could be passed along to the consumer. At the other limit, with a perfectly elastic (horizontal) demand curve, none of the tax could be passed along, and all would be absorbed by the seller.

This gives us one clue toward why economists think about the elasticity of demand and supply. As demand becomes more inelastic, suppliers gain more power over buyers; they can increase prices with relatively little concern about lower sales. But what determines the elasticity of demand? Many factors are relevant, but the most important ones are tied to a single word: substitutes. If consumers have ample opportunity to substitute other goods for the one being considered, their demand will be elastic. This was the assumption that led to the fairly elastic demand curve in Figures 7 and 8; presumably most consumers of ice cream have alternative ways to spend their money that are almost as satisfying, and so they will be sensitive to relatively small price changes. An opposite case would be cigarette smokers, whose tobacco consumption is probably insensitive to price shifts. (This is not to say that prices have no effect at all, just less than for ice cream, because of the addictive quality of nicotine.)

B. Housing in Olympia. Here our example will be the market for apartment rentals in Olympia. To simplify matters, we will overlook all the differences in size, quality and location that affect prices and assume that there is a single “standard” apartment available at the same rent everywhere. (This is only for the purpose of keeping the analysis within a single diagram; in principle we could incorporate all these differences if we were willing to draw a separate diagram for each type and location.) What does the demand curve look like? It is probably moderately inelastic. There are substitutes for renting an apartment—doubling up in existing units, living with parents or other relatives, or finding some other town to live in—but these are not always convenient. (The reality of homelessness in our community demonstrates that many of our neighbors can find neither an affordable apartment nor a satisfactory alternative.) As for the supply curve, it is almost completely inelastic in the short run. In other words, within the next few months the supply of housing is nearly fixed; it can only be augmented or diminished slightly by decisions involving repairs to marginal units or potential subdivision. Only in the long run, over a horizon of several years, is it possible to greatly increase the amount of housing available through new building or remove a large number of units through demolition or conversion to new uses. So let us stick with the short run for now. As a first exercise, imagine how the market will change if Evergreen College manages to expand from 3800 to 5000, as the state has mandated. This is shown in Figure 9.

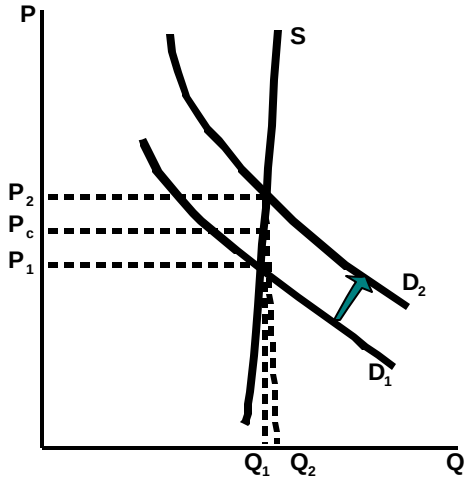
Figure 9: The Effect of Evergreen Expansion on the Olympia Apartment Market



As more students move to Olympia to attend Evergreen, the housing market becomes saturated. If no measures are taken to anticipate this, the supply will increase only marginally, from Q_1 to Q_2; meanwhile, the equilibrium rent will shoot up from P_1 to P_2. Only in the long run, as more apartments are built and the supply curve shifts to the right, will rents moderate.

We could well imagine that, if rents skyrocket as in Figure 9, there will be pressure to hold them back politically. One way to do this is rent control. Rent control laws can take many forms, but they all have in common a legislative prohibition of rent increases above a certain percentage or in the absence of certain types of investment. If rent control is adopted in Olympia, the immediate result might be a situation like that in Figure 10.

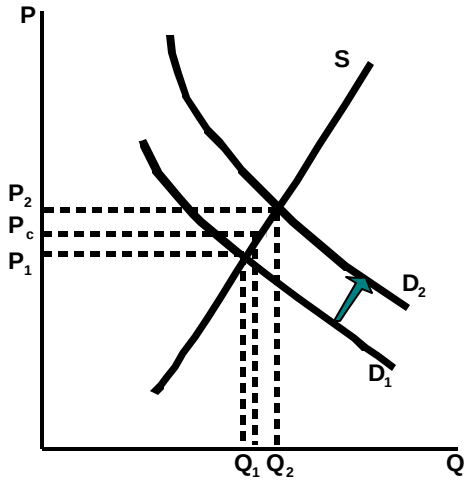
Figure 10: The Short Run Effect of Rent Control on the Olympia Apartment Market



A new controlled rent, P_c, might be established, higher than the original level (P_1) but below the level that would otherwise result in the market after the influx of students (P_2). Fortunately, in the short

run, there would be almost no visible effect on the number of apartment units available for rental. (There isn't room in the diagram to depict a Q_c between Q_1 and Q_2.) The danger, however, is that a poorly drafted rent control law could have damaging effects in the long run. This can be seen in Figure 11.

Figure 11: The Long Run Effect of Rent Control on the Olympia Apartment Market



Once again, rent control reduces the rent students and others have to pay, but now there is a bigger difference in the number of apartments available. The more the demand curve shifts to the right, the greater the gap, over time, between the apartment supply at market rents and at controlled rents. Meanwhile, with a shortage of apartments, opportunities open up for black market-type activities. Renters can sublet their apartments for a considerable profit, and landlords can charge "finder's fees" and other dubious charges to take advantage of the scarcity. These and other stratagems are commonplace in cities with rent control laws. On the other hand, a well designed law can mitigate most of these effects if it incorporates incentives for new building. It is scarcity, not intervention in the market per se, that leads to the worst aspects of rent control.

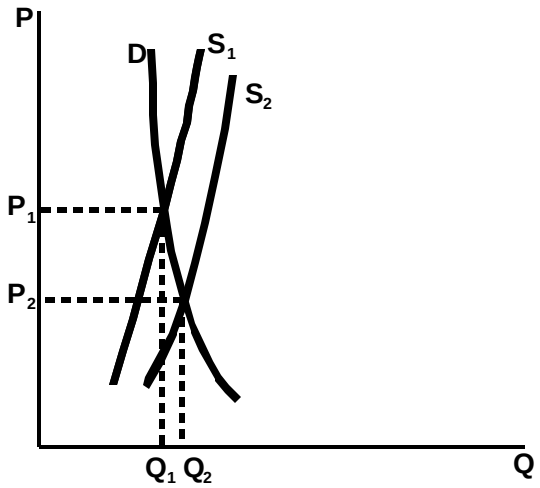
Another Cup of Coffee

Keeping the supply and demand apparatus in mind helps us decipher the changes that have roiled the world coffee market. We have already considered the reasons why both the supply and demand curves for coffee are likely to be highly inelastic. (The shapes of these curves could be measured using real-world data, but the technical aspects of that procedure would take us away from the subject matter of this chapter.) How about the fluctuations of price and quantity?

The most important single fact to know about coffee is that, until 1989, the major producing countries collaborated on an International Coffee Agreement. This arrangement established export quotas, limiting supply in order to bolster prices. The agreement fell apart in that year, and each country was then free to produce as much as it wanted. It takes about five years from the time of initial planting to the first harvest, so it was not until the mid 1990's that the full effect of this change was felt. In 1994/95 world production was about 90 million bags; this total rose to about 115 million bags in 2001/02. The biggest increase came from a new kid on the block, Vietnam. Partly in

response to World Bank advice (backed up by loans), Vietnam increased its production from 1.5 million bags in 1990 (when export quotas were lifted) to 15 million in 2000. Brazil was another source of added supply, due to large investments in acreage and new technology. Meanwhile prices for the highest quality coffee, arabica, fell from a high of $2.00 a pound in 1980 to $1.30 in 1995 and just over $.50 in 2002 (all in 1990 dollars). The combination of modest production increases and drastic price decreases tells us what we most need to know about the causes of the coffee crisis. Figure 12, which is only slightly different from Figure 4, captures these numbers vividly.

Figure 12: Contours of the Coffee Crisis



With demand so inelastic, it takes only small increases in supply to result in large drops in the market price. Each producing country, by trying to increase its exports so as to make up in quantity what it is losing in value, makes the problem that much worse for all of them. The International Coffee Agreement, which kept the supply curve modestly to the left, is sorely missed.

What can we learn about the uses of supply and demand from this example? The most important lesson is that the supply and demand model of markets does not provide any answers in itself; it is a convenient framework for sorting out information and organizing our thinking. In this respect it is like a language: it provides a syntax that makes it easier to produce certain complex ideas—at the cost (which is also true of language) of making it harder to produce other types of ideas. In this case, we saw that we were able to disentangle information about production and demand. Asking about elasticity drew our attention to certain features of the coffee market that are highly relevant to understanding the crisis, but which might have been overlooked otherwise. Above all, it gave us a simple way to imagine the relationship between relatively small quantity effects—a seven year rise of 28%—and very large price effects—a corresponding decline of 62%.

This illustrates the general point about models. If we are willing to make a number of simplifying assumptions, we can construct potential scenarios for real-world events. The power of models lies in their ability to highlight logical interconnections that might be difficult to see without them. The weakness stems from all those assumptions, some of which might blind us to important aspects

of the problems we care about. What were some of those assumptions in our coffee analysis? We assumed that nothing important happens between the sale of coffee by growers and its ultimate purchase by consumers; all the complications of middlemen, marketing arrangements and brand identify are simply ignored. Also, the international character of this market—its production and distribution across national boundaries, requiring the conversion of different national currencies—is put to the side. (The market is treated as if it all took place at a single location.) Finally, specific sub-markets, such as those for organic, fair-traded and "gourmet", are not taken into consideration. Some of these complexities could be reintroduced through more detailed use of supply and demand analysis, but some are hard to squeeze into this model. What lesson can we draw from this?

Finally, we should be clear about the benefits of using economic models. These devices do not "prove" anything; they assist and illustrate. Morever, useful models are flexible. They don't give predetermined answers to questions, but help us gather and organize information. It wasn't the supply and demand model that told us about the importance of the International Coffee Agreement, but instead the information we employed, prompted by the needs of the model. In another market we might well come to a completely different understanding of the key forces at work.

Models, because they purchase their insights at the price of their assumptions, should be used with care. This warning applies with special force to economic models, because the problems they are directed at are extremely complex, and because economics is just one of many perspectives that people have found to be helpful.