I. The Price System

In Lecture 1 we defined economics as the study of how scarce resources are allocated to competing ends. The production possibilities frontier illustrated society’s need to “decide” what to produce, but beyond our simple Moe-economy we did not delve very far into how that decision is made. This lecture, and much of the rest of the course, is concerned with how markets and prices allocate society’s resources, and thus implicitly decide what, and for whom, output is produced.

An economy with freely adjusting prices is said to operate with a price system or market system. A price system performs three main functions in allocating society’s resources.

1. It provides information about values and costs.
2. It provides the incentives for people to act on that information, using society’s resources where they are most valuable.
3. It allocates production of a good among firms, and it allocates available supply of a good among those who want it.

Prices provide the information and incentives that coordinate the decisions of millions of buyers and sellers. Each individual needs only to be motivated by simple self-interest and concerned with only those prices related to the products he produces or wishes to consume. Because of this, we say that decisions in a price system are decentralized: people decide for themselves what they would like to produce or consume, and there is no conscious social “plan” directed toward a particular outcome or goal. Yet despite this seeming lack of coordination the ideal form of the market system, called perfect competition, yields an economically efficient outcome—society’s resources are used in their most valuable possible way. As Adam Smith famously put it in 1776:

“…by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for the society that it was no part of it. By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.”

Smith’s analysis was no idle theoretical exercise. The niceties of perfect competition aside, it is now almost universally accepted that decentralized market economies do a better job of allocating society’s resources than other, more “planned” systems. In virtually every case, economies based on the market system have produced greater prosperity, higher living standards,
better health, and greater growth and welfare than those based on central planning. How can this happen?

**Prices: Information and Incentives**

In a market system, the decisions of buyers and sellers are guided by prices, which perform two functions in allocating society’s resources. First, prices provide buyers and sellers with *information* about values and costs. One might say that prices are the language by which economic actors communicate with one another. Second, prices provide *incentives* for buyers and sellers to act on this information. In a nutshell, it is often said that decision makers in a market system *respond to price signals*. We shall find that the information content of prices is particularly cheap and accurate, while the incentives are appropriate to the task of using resources efficiently. In large part, this “explains” the success of the market system compared to alternatives.

Consider my decision to purchase and consume a gallon of milk. Production and distribution of the gallon requires resources—cattle, feed, land, labor and so on—that could be used for something else. Ideally, the gallon should only be produced if those resources yield greater value when producing milk than in their next most valuable uses. Further, once a gallon is produced efficiency requires that it be consumed by those who value it the most.

With these two goals in mind, think of the information contained in the price of milk. If the market price is $2/gallon, and anyone can buy at that price, then I know that other consumers are willing to pay $2 for a gallon. So I know how much other people *value* that gallon. The price also tells me that sellers’ *costs* of producing and selling a gallon cannot exceed $2 (else they wouldn’t offer it). And, as it turns out, if there are many sellers I can be confident that the cost of producing and selling that gallon is exactly $2. I learned quite a bit from simply observing the price.

The price also provides incentives for me to act on this information. If my value of the gallon is $3, but the price is $2, I will buy it. The gallon is worth more to me ($3) than to others ($2), so my decision to buy places milk in the hands of he who values it most (me). Were my value only $1 I would not buy a gallon, which makes that gallon available for those who value it more. So the price embodies incentives that cause milk to be consumed by those who value it most. Moreover, because cost reflects the next best alternative uses of resources, the value that I put on using those resources to produce milk ($3) exceeds the value of their next best use—they are best used producing milk.

Now suppose you are a seller of milk. The price tells you the same things that consumers learn, and provides an incentive to act on that information. If the price is $2 and your cost of supplying another gallon is $1, then you will produce and sell more because it is profitable to do so. This increase in your production is efficient for two reasons: First, consumers’ value of milk is larger than your costs, so resources are best used producing milk rather than in some other activity. Second, your costs ($1) are lower than others’ ($2), so milk production shifts toward the least cost producer—you. In this way, society’s total cost of producing milk is minimized. More broadly, the information and incentives contained in the price cause society’s resources to be used in their most valuable way. We will develop this theme in some detail later, but this discussion reflects the way that the information content of prices guides decision making.
II. Types of Markets

We’ve already mentioned the idea of a “market” with buyers and sellers, but we haven’t given a precise definition. Here is one:

Definition: Market
A market is a mechanism that brings buyers and sellers together for the exchange of a good or service.

Some markets, such as stock markets (the New York Stock Exchange), commodity and futures markets (the Chicago Board Options Exchange), and art auctions (Christie’s or Sotheby’s) are “formal” in the sense that there is a formal structure, and there is a specified mechanism for setting prices and completing trades. An auctioneer or formal mechanism may change prices continuously in response to the flow of buy and sell orders.

Most other markets—the ones for most of the goods we buy—are “informal” and unstructured. The price is typically pre-set by sellers at a level they think the market will bear, as on the menu at a restaurant, or the posted prices in the grocery store and gas station. There is no auctioneer who continuously adjusts prices. But these are markets nevertheless: prices get determined and trades take place.

We will initially concern ourselves with a particular type of market, called perfectly competitive markets. The key feature of a perfectly competitive market is that both buyers and sellers “take” the market price as given, beyond their control, and they make decisions to buy or sell based upon the given market price. This is worth a definition:

Definition: Price Taking Behavior
A price taker treats the market price as given, and makes decisions based upon that price.

For example, suppose you go to the grocery store to buy oranges. The price of oranges is $1/pound whether you buy one pound or one hundred. In other words, no matter how many or how few you want to buy, the price is always the same. The price is beyond your control—you are a price taker. Similarly, no matter how many oranges an individual orange grower may plausibly sell, he cannot have an appreciable impact on the market price of oranges. If he tried to charge more than the market price, no one would buy from him. The orange grower is a price taker.

Why is price taking plausible for these two examples? Because your purchases of oranges and the growers sales of oranges are negligibly small compared to the total amount transacted in the market for oranges. If I decide to buy more oranges because my doctor recommends them my decision raises the worldwide demand for oranges, but not by enough to noticeably affect the market price. And if an individual grower doubles or triples his crop of oranges, his contribution to overall supply is still vanishingly small. In both cases, a price taker acts as if his actions will not affect the market price, because for practical purposes they won’t. In terms of market structure, the assumption of price taking behavior is most plausible when there are many buyers of a good—so demanders of the good are price takers—and when there are many sellers—so suppliers are plausibly price takers too. Later in the course we examine what happens when the assumption of price taking behavior is inappropriate; for example, when there is one (monopoly) or only a few (oligopoly) sellers.
While price taking behavior is the key feature of perfectly competitive markets, three other conditions are also necessary. The first is that all firms sell identical products, so that it makes sense to talk of the “price” of a well-defined thing and so that one seller’s good is perfectly interchangeable with any other seller’s. The second is that there is complete information about the price charged by each seller, and about the quality of each seller’s good. Then no seller can charge a higher price than any other seller, else no one would buy from him. No buyer ever gets good of lower quality than expected—a “lemon”—because quality is perfectly knowable before a good is purchased. Finally, property rights must be well defined and enforced, so that owners can be properly paid.

These conditions are worth gathering in a definition.

**Definition: Perfectly Competitive Markets**

Four conditions are necessary for a market to be called *perfectly competitive*:

1. All buyers and all sellers are price takers.
2. The good or service offered by all sellers is homogeneous.
3. There is complete information about price and quality.
4. Property rights are well defined.

“This is silly”, you say. “No market is like that.” Well, you’re wrong. The market hard red wheat traded on the Chicago Board of Trade is just like that. “So we’re studying the market for wheat?” No.

Perfectly competitive markets got their name because they yield a “nice” outcome: if markets are perfectly competitive, then (we shall find) the allocation of resources is economically efficient. So if your criterion is efficiency, perfect competition does the trick. On the other hand, if the assumptions of perfect competition fail to hold then resources will not, in general, be allocated efficiently. This means that perfect competition is a sort of “benchmark” against which we can compare real world outcomes. For example, later in the course we will examine the effect on price and quantity sold of having only one seller in a market, which is called *monopoly*. Since perfectly competitive markets are efficient, we can compare the monopoly outcome to what would happen under perfect competition, which allows us to measure the welfare “costs” of monopoly—what society loses from having monopoly instead of competition in the production and sale of a particular good. Similarly, we shall find that incomplete information or incomplete property rights may cause markets to “fail” as a mechanism for efficiently allocating resources.

A second reason for studying the perfectly competitive model is entirely practical, as discussed in Lecture 1. The perfectly competitive model is easy to use, simple, and it does remarkably well in describing and predicting many real-world outcomes. So on the principle of Occam’s Razor, it is a very good model. Indeed, it is the basis for the model of supply and demand, to which we now turn.

**III. Demand**

In economics, **demand** for a good or service refers to the amount people are willing to purchase at various prices during a specified period of time. The actual **quantity demanded** refers to the amount they are willing to purchase at a particular price. Used by itself the word “demand” conveys a set of possibilities—the alternative amounts that consumers are willing to
purchase at various hypothetical prices. When set out in a table, the set of possibilities is called a demand schedule. When displayed in a graph the possibilities are called a demand curve.

Table 1 records the Smith household’s monthly demand schedule for milk. These data are graphed as the demand curve $D_s$ in Figure 1. Their desire to purchase milk can be affected by a number of factors: obvious candidates are the income they have available to spend, the number of kids in the household, the weather, the prices of other beverages, and the price of milk itself. Table 1 varies only one of those factors, the price of milk. So we should interpret the data in Table 1 and Figure 1 as representing the quantity of milk that the Smiths would purchase at various hypothetical prices, *holding constant all other factors that affect their decisions to buy.*

<table>
<thead>
<tr>
<th>Price ($/gallon)</th>
<th>Quantity (gallons/month)</th>
<th>Point in Figure 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4.50</td>
<td>0</td>
<td>$a</td>
</tr>
<tr>
<td>$4</td>
<td>1</td>
<td>$b</td>
</tr>
<tr>
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<td>2</td>
<td>$c</td>
</tr>
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<td>$3</td>
<td>4</td>
<td>$d</td>
</tr>
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<td>6</td>
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</tr>
<tr>
<td>$2</td>
<td>9</td>
<td>$f</td>
</tr>
<tr>
<td>$1.50</td>
<td>12</td>
<td>$g</td>
</tr>
<tr>
<td>$1</td>
<td>16</td>
<td>$h</td>
</tr>
</tbody>
</table>

Figure 1
The Smith Household’s Monthly Demand Curve for Milk

At each hypothetical price of milk, the table records how many gallons the Smiths would purchase. At a price of $2 per gallon the Smiths would buy 9 gallons of milk each month. At a price of $1 per gallon they would buy 16 gallons, and so on. Notice that the demand schedule and demand curve carefully specify the units for both price (dollars per gallon) and quantity...
(gallons) as well as the period of time during which milk purchases take place (one month). To be precise, the horizontal axis of Figure 1 measures *quantity of milk per unit time* (a flow); here gallons per month. That’s why the label for the horizontal axis is “Q/t” (quantity per unit time). The vertical axis measures dollars per unit, for example $2/gallon.

**Question 2.1:** The demand curve in Figure 1 intersects the vertical axis at a price of $4.50: At a price of $4.50 or higher the Smiths buy no milk. Must the demand curve intersect the vertical axis? Why? What about the demand for insulin by diabetics? Does the demand for insulin slope down—i.e. is less demanded at a higher price?

Figure 1 is our first encounter with a **demand curve**. We can summarize the discussion in a definition:

**Definition: Demand Curve**

The **demand curve** for a good or service graphs the relationship between the quantity of good demanded and its price, holding constant all other factors that affect demand.

*An aside on money:* The vertical axis in Figure 1 and all demand graphs measures $/unit. So now money is in the picture, though we previously concluded that “demand” involves willingness to substitute among different goods, like fish and coconuts in Lecture 1. But *money* is simply a legally recognized claim on “other” goods and services, so a demand curve reflects willingness to substitute other goods for (in this case) gallons of milk per month. In other words, the price of a good measures the value of other stuff that must be sacrificed in order to obtain one more unit of the good.

**The Law of Demand**

The demand curve for milk in Figure 1 slopes down, indicating that the Smiths are willing to purchase more milk at a lower price. This feature of their demand curve is called the law of demand:

**The Law of Demand:**

For any good or service, the **law of demand** states that more is demanded at a lower price, holding constant all other things that affect demand.

The phrase “holding constant all other things that affect demand” is sometimes expressed as the Latin “ceteris paribus” because it sounds esoteric.

The intuition of the law of demand is pretty obvious. People would like to have more of the goods and services they consume, but the price system erects a barrier (price) that keeps them from having all they would like. With a limited budget, when the price of milk rises the Smiths must buy less of *something* (why?), and the most likely candidate for reduced consumption is the good whose price has risen, milk. But the law of demand goes farther than mere intuition, and states that more (or no less) *will* be demanded at a lower price. There are some commonly alleged exceptions to the law of demand. They are wrong, but discussing them can deepen our understanding of what the law really says.

Consider a “prestige good” such as an expensive Swiss watch or an Italian sports car. In addition to their qualities, one reason people buy these things is to show other people that they can afford them. (It’s gauche to just tell people how much money you make, or to wear a button
with your wealth printed on it). If the price of a Rolex were reduced to that of a Timex, some people who wish to demonstrate their wealth would stop wearing Rolexes. Thus a reduction in price could conceivably reduce the demand for Rolex watches, which appears to violate the law of demand. This is where the condition “holding constant all other things that affect demand” (ceteris paribus) comes in. To satisfy the conditions for the law of demand, the value of the watch as a signal of wealth must be held constant when the price changes. So, for example, if Rolex would only sell to persons with incomes above $500,000 per year, the law of demand predicts that more rich people would want one at a price of $500 than at a price of $5000. Here the value of a Rolex as a signal of wealth is held constant, and only the price is allowed to change.

Another alleged example of demand rising with price can occur when buyers use price as a signal of quality. For example, good wines generally cost more than bad wines, because they are good. Occasional buyers of wine who are uninformed about quality can use this market fact to infer which wines are “good.” When I bring a bottle of wine to a friend’s dinner party, I may pass up the $30 bottle and choose the $40 one, reasoning that the more expensive wine is likely to be better. Then a winery that cuts its price by half might lose sales—some buyers would reason that an inexpensive wine must be bad. Again, the culprit is “other things” that are not held constant. In this example, buyers’ estimation of the quality of the product falls with price, and the reduction in estimated quality reduces demand. To satisfy the conditions for the law of demand, the quality of the wine expected by buyers must be held constant when the price falls. The law of demand says that more wine of the same expected quality will be purchased at a lower price. Why pay more for the same thing?

Topic 3 provides a more formal treatment of the law of demand based on individual optimizing (goal oriented) behavior. But for now we can regard it as a description of what is generally true in the real world.

Two Views of What the Demand Curve Represents

Some of you have already taken an economics course, and have encountered demand curves, like the one illustrated in Figure 1. Demand curves have two alternative interpretations, depending on which axis of the graph we think of “first.”

**Interpretation 1: You tell me price, I’ll tell you quantity demanded**
The usual way to think of a household’s demand curve views things from the perspective of the vertical axis: For any given price along the vertical axis, such as P_0, the horizontal distance out to the demand curve tells us the quantity demanded, in this case Q_0 gallons of milk per month. If we choose another hypothetical price that is lower than P_0, say P_1, the corresponding quantity demanded (Q_1) will be larger. This interpretation treats quantity demanded as a function of price. Demand slopes down means that more is demanded at a lower price.

**Interpretation 2: You tell me quantity, I’ll tell you the marginal value of another unit**
An alternative interpretation of the demand curve in Figure 1 views things from the perspective of the horizontal axis. For any given hypothetical quantity of milk per month measured along the horizontal axis, say 6 gallons, the height of the demand curve tells me the household’s marginal value (MV) of the last gallon consumed. So if the Smiths are consuming Q_0 gallons per month, their marginal value of the last gallon is $2.50. If the Smiths are consuming a larger quantity, say 12 gallons, their marginal value falls to $1.50.
To see why the second interpretation makes sense, suppose that the price of milk is $P_0 = 2.50$. Will the Smith’s buy 1 gallon of milk? They will only buy the first gallon if their marginal value of a first gallon—they amount they are willing to pay for it—is larger than the price. As the height of the demand curve at $Q = 1$ reflects willingness to pay for a first gallon, we can conclude from Figure 1 that the Smiths will purchase a gallon because $MV(1) = 4 > 2.50$. Continuing in this way, it is worthwhile to purchase an additional gallon so long as marginal value (the height of the demand curve) exceeds price. This leads the Smiths to purchase 6 gallons per month. If they purchased more than 6 at a price of $P_0 = 2.50$ the marginal value of those gallons would be less than what the Smith’s had to pay for them. On this interpretation of the demand curve, “demand slopes down” means that the Smith’s marginal value (willingness to pay) of milk declines with the quantity of milk consumed. The more milk they consume, the less they are willing to pay for an additional gallon. “Diminishing marginal value” and “downward sloping demand” are the same thing.

In various contexts, one or the other of our two interpretations of the demand curve will be the more useful. The first interpretation is the one usually encountered in introductory economics courses, but the second is actually a powerful tool that is based on a deeper understanding of demand and individual decision making. Soon we will give a similar interpretation to the height of the supply curve (it is marginal cost). Using this understanding of what supply and demand “mean” will lead us to some powerful results in welfare economics.

**From Individual to Market Demand**

Individual or household demand curves for a particular good are useful constructs for some problems, but more often we will be concerned with market demand curves that represent the quantities demanded by all households participating in the market at various hypothetical prices.

**Definition: Market Demand Curve**

A market demand curve shows the total quantity demanded, at all hypothetical prices, by all households in a particular market.

So we might speak of the monthly demand curve for oranges in Canada, or the weekly demand for milk in the United States, or the monthly demand for chicken in Hyde Park. How do we get the market demand for a product from the demand curves of the individuals that participate in the market? By adding them up.

To keep things simple, think first of a “market” with only two demanders: the Smith and Garcia households. Table 2 records their monthly demand schedules for milk. The market demand for milk, shown in the last column, is simply the sum of the quantities demanded by the Smiths and Garcias at each possible price. Notice that the Garcias do not buy milk at prices above $2.50, so the market demand in that price range is simply the Smith’s demand. When price reaches $2.50 the Garcias would buy 1 gallon/month, so the market demand at price $2.50 is 6 gallons + 1 gallon = 7 gallons/month. If price were to fall to $1 the market demand is 16 gallons + 4 gallons = 20 gallons/month, and so on.

This solution is shown graphically in Figure 2: at each price, the “market” demand curve shows the sum of the horizontal distances from the vertical axis to the Smiths’ and Garcias’ demand curves. We say that the market demand curve is the horizontal sum of the demand curves of the individual market participants. Nothing important changes when there are 2
million participants instead of just two: at each price, the market demand curve shows the total quantity demanded at that price, which is the horizontal sum of the demand curves of all the participants in the market.
Figure 2

Summing Household Demands

\[ D_M = D_S + D_G \]

Market = Smith + Garcia
Table 2
Summing Demand Schedules to Obtain Market Demand

<table>
<thead>
<tr>
<th>Price ($/Q)</th>
<th>Smith’s Quantity Demanded (Q/month)</th>
<th>Garcia’s Quantity Demanded (Q/month)</th>
<th>Market Quantity Demanded (Q/month) =Smith + Garcia</th>
</tr>
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<tr>
<td>$4</td>
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<tr>
<td>$1</td>
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<td>20</td>
</tr>
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</table>

Changes in Demand

When we drew the Smiths’ demand curve for milk in Figure 1, we noted that the demand curve shows the quantity demanded at various hypothetical prices, holding constant all other things that affect demand, such as the number of kids in the household, the prices of other beverages, or the household’s income. Similarly, at the level of market demand, the market demand curve shows the relation between price and quantity demanded, holding constant all other things that could affect market demand, such as average household income, the number of households in market, or the prices of other goods and services. Obviously, changes in these “other things” can affect the amount that people wish to buy, but how do we represent such changes graphically?

There are only two axes in the graph of a demand curve—price and quantity. If some factor other than the price of the good itself changes, the demand curve must change its position in the graph. This is true in general: a curve shifts its position when there is a change in some relevant factor that is not already accounted for on the axes of the graph. Understanding how the demand curve changes its position requires some intuition about what factors are important and how they affect the demand for a particular good or service.

Consider again the Smith household’s demand for milk. Suppose that the Smith’s household income rises from $3000 to $5000 per month, so they can afford to buy more stuff than before. Suppose that the Smith’s would spend some of their increased income on greater milk consumption, because they can afford more for their existing kids and because their higher income allows them to adopt a new one. (All kinds of decisions change). Specifically, at any possible price of milk, their higher income causes the Smiths to demand more milk than before. How can we represent this “increase in demand” graphically? In Figure 3 the original demand curve is $D_S$, representing the Smiths’ choices before the increase in household income. With higher income demand “shifts” to demand curve $D'_S$—more is demanded at each possible price. For example, before the increase in income the Smiths would purchase 6 gallons per month at a price of $2.50, but after the increase in income they would purchase gallons each month.
Some useful terminology

Income, in this discussion, is a factor that (a) affects the Smiths’ demand for milk and (b) is not measured along the axes of a graph showing the demand for milk. So when income changes, the demand curve must change its position, as when the demand curve shifts from $D_s$ to $D_s'$ in Figure 3. In contrast, when the price of milk changes (holding income and other factors constant) the change in the Smiths’ behavior is represented by a movement along a single demand curve: when price falls from $2.50$ to $1$, quantity demand rises from 9 gallons to 16 along $D_s$. To distinguish these events, economists have adopted some language. The movement along a single demand curve caused when the price of the good in question rises or falls is called a change in the quantity demanded. The shift in the demand curve cause a change in some factor other than price is called a change in demand. There is nothing particularly scientific about this, it is just terminology. So in this example, the increase in the Smiths’ income caused a change in demand, specifically it caused an increase in demand at each possible price.

Returning to Figure 3, notice that the increase in the Smiths’ household income increased the demand for milk at all prices: the demand curve shifted to the right at each possible price. This is the usual way of thinking about shifts in demand; more (in this case) is demanded at each price. But we could just as well have said that the demand curve shifted up; at each possible quantity of milk, the Smiths’ demand curve for milk is higher than it was before—saying that demand shifted to the right is the same thing as saying it shifted up.
At 2 gallons/month the height of demand curve $D_s$ is $MV(2)=3.50$, but the height of
demand curve $D'_s$ is $MV'(2)=4.50$. Drawing on our previous discussion, this means that the
Smith household’s marginal value of milk increased when its income rose. This allows us to
understand the marginal decisions made by the Smiths. At price $P_0 = 2.50$ the Smiths chose to
purchase $Q_0 = 6$ gallons per month. With an increase in income the Smiths were willing to pay
more for a gallon—milk became more valuable to them. The marginal value of the 6th gallon
increased to $MV'(6)=3.50$. As marginal value of an additional unit (what the good is worth to
the Smiths) exceeds the cost of obtaining it, the Smiths buy more milk. They continue to buy
more so long as $MV'(Q)>2.50$, which leads them to consume 9 gallons per month. So the
following statements are equivalent:

1. “The increase in the Smiths’ family income increased their demand for milk at each
   possible price. So they bought more”
2. “The increase in the Smiths’ family income increased their marginal value of milk at
each possible quantity. So they bought more”

**Factors that Cause the Demand Curve to Change Its Position**

There is no scientifically correct list of stuff that causes shifts in the demand curve for an
arbitrary good or service. But some factors have proven empirically important. Here is a list of
the things that prove most useful in applied economic analysis, so they belong in your tool kit.

**Income or wealth**: Intuitively, you might think that an increase in a household’s wealth might
always shift the demand curve rightwards (or up). After all, with greater income the household
is able to buy more of everything than before, so maybe it does. Then just as in our milk
example above, higher income means more demand for a particular good—say dinners at
Japanese restaurants—so the household’s demand for Japanese restaurant dinners shifts to the
right (or up). But demand doesn’t have to increase with income. The demand for some goods—
say macaroni and cheese dinners eaten at home—may fall as income rises and consumption
shifts toward other things. Then a particular household’s demand curve for macaroni and cheese
dinners shifts to the left (or down) when the household’s income rises.

Economists give names to these two situations. When an increase in household income
leads to an increase in demand (the demand curve shifts to the right, or up) we say that the good
in question is a *normal good*, because that is the “normal” situation: when we get more income
we usually buy more stuff. But not all goods are normal. For some goods—like macaroni and
cheese in our example—higher income causes demand to fall (the demand curve shifts left, or
down). We call these goods “inferior” for no apparent reason.

**Definition: Normal and Inferior Goods**

When an increase in income leads to an increase in demand for good X, we say that X is a *normal good*. When an increase in income leads to a reduction in demand for good X, we say that X is an *inferior good*.

It is important to note that the terms “normal” and “inferior” are just names for which
way a demand curve shifts when income rises; they do not categorize goods in any meaningful
way. For instance, even for a single household a particular good may be “normal” at some levels
of income and “inferior” at others. Consider a household’s demand for bus rides. At very low
levels of income, members of the household walk most places and treat rides on the bus as a luxury. As income rises they take more rides on the bus, so bus rides are a normal good. As income rises still more the family can afford a car, and their demand for bus rides falls—bus rides are inferior at higher levels of income, though they were normal at lower levels of income.

**Prices of other goods:** Changes in the prices of other goods may also shift the demand for a particular good. For example, our intuition tells us that an increase in the price of grapefruit juice will increase the demand for orange juice—households shift toward consumption of orange juice when it becomes more expensive to drink grapefruit juice. So, when the price of grapefruit juice rises, the demand curve for orange juice shifts up (to the right)—at each quantity of orange juice, the marginal value of orange juice is higher. To describe this situation, we say that grapefruit juice and orange juice are *substitutes* because an increase in the price of one raises the demand for the other. In contrast, suppose that the price of tennis rackets rises. Now our intuition suggest that this will reduce the demand for tennis balls because tennis rackets and tennis balls are used together, and it is now more expensive to play tennis. When the price of tennis rackets rises, the demand for tennis balls shifts down (to the left). To describe this situation, where an increase in the price of one good reduces the demand for another good, we say that the goods in question are *complements*.

**Definition: Complements and Substitutes**

If an increase in the price of X raises the marginal value of Y (the demand for Y shifts up, or to the right), we say that X and Y are *substitutes*. If an increase in the price of X reduces marginal value of Y (the demand for Y shifts down, or to the left), we say that X and Y are *complements*.

Again, “complements” and “substitutes” are just names that we attach to the direction that the demand curve shifts—there is nothing intrinsic to orange juice and grapefruit juice that requires them to be substitutes, but our common experience says that they usually are. Some people may only drink orange juice and grapefruit juice when they are mixed together, so for these people OJ and GJ would be complements (Why?).

**Expectations about the future:** Suppose that airlines announce a 25% increase in fares, commencing six months from now. Some people who had planned future trips are likely to change their travel plans, traveling this month instead of later. The demand for airline travel this month shifts to the right (up), because we reason that current and future travel are substitutes in the eyes of many consumers. This is just one example of a general principle: expectations of future prices, incomes, and events affect current decisions. So, as we shall see later, an increase in a household’s expected future income, holding current income constant, will raise the current demand for normal goods and reduce the current demand for inferior goods. (How?)

**Size of the market:** We said that the market (or total) demand curve is the sum of individual demand curves. So, as more individuals or households enter a market, the total demand curve shifts to the right. The market demand for a good at a given price, $P_0$, is the sum of the quantity each individual in the market demands at $P_0$. As more individuals enter a market, this sum can only increase, so the market demand curve shifts to the right.

**Question 2.2:** If the market demand curve for good X shifts to the right as more households enter the market, it must also shift up. So, at any quantity, the marginal value of X is higher than before. Explain how this can be. [Hint: It is easy to understand why the height of an individual household’s demand curve measures marginal value at each quantity. What does it mean for the
height of the market demand curve to measure marginal value at a particular quantity? When there are 10,000 households in the market, whose marginal value are we talking about?]

**Tastes**: The key goal of economic analysis is to understand and explain real-world events in terms of observable things. So when an economist is asked why people are eating more chicken and less beef than in the past, he (most economists are hes) will “round up the usual suspects.” As incomes rose, did demands change because chicken is a normal good and beef is inferior? (No, both are normal). Did information about the health consequences of eating beef affect the demand? (Maybe). Or did the price of chicken compared to beef decline, so people substituted toward chicken and away from beef? (Evidence suggests that this is a large part of the answer). But the economist could have “explained” the increase in the relative consumption of chicken by resorting to “tastes”:

**NEWS REPORTER**: Between 1970 and 2000, the average American’s yearly consumption of chicken increased by 30 percent, while consumption of beef fell by 20 percent. Why did that happen?

**ECONOMIST**: People decided that they liked chicken more than before, and beef less.

**NEWS REPORTER**: But from 2000 to 2010, beef consumption increased and chicken consumption fell. Why?

**ECONOMIST**: People decided that they like beef again.

**NEWS REPORTER**: Oh.

As you can see, “changes in tastes” are a very powerful tool: they can explain everything. Why do people eat strawberries in the summer? Cuz that’s when they like ‘em. Why did the average horsepower of automobile engines fall from 1972 to 1982? Because people didn’t like fast cars anymore. Why did horsepower rise after 1982? We liked fast cars again. You get the idea: changes in tastes can “explain” virtually anything, so they can really explain nothing. Tastes are intrinsically unobservable, so the statement that “X happened because people’s tastes changed” is neither empirically refutable nor verifiable. The economist might as well have said “God did it.”

This is not to deny that changes in tastes are important determinants of observable events. Consider fashion. In different periods men have worn very narrow ties (the 1960s) and very wide ones (the 1970s). Women have worn short skirts (the ‘60s) and long ones (the ‘80s). An earnest PhD student in economics might try to explain these changes in fashion by changes in prices: maybe the price of silk was high in the ‘60s and low in the 70s. Maybe women wore miniskirts because the price of wool was very high, so less fabric saved money. Not likely. Sometimes we have to admit that we cannot explain everything with prices, incomes, and other observable things. As a last resort we then acknowledge that “tastes changed.” How else to explain fads like hula hoops, pet rocks (rocks didn’t get cheaper), and goatees?

**IV. Supply**

Just as demand represents the willingness of people to buy a good at various possible prices, supply represents the willingness of people to sell goods at various possible prices. But while price is an obstacle to buyers, price is a reward to sellers. So while a higher price reduces
quantity demanded (the law of demand), an analogous “law of supply” says that supply slopes up: more will be supplied at a higher price. A supply curve with this quality is shown in Figure 4. It shows the supply curve $S_B$ of milk for Farmer Bob, a dairy farmer. As with demand, we continue to assume that Bob is a \textit{price taker}—he behaves as if can sell as much or as little as he likes without having a material effect on price.

![Figure 4](Farmer Bob’s Supply Curve of Milk)

As with demand curves, we may think of the supply curve in two different ways. Viewed from the perspective of the vertical axis, the supply curve tells us how much milk the farmer will supply at any possible price: “You tell me price, I’ll tell you quantity supplied.” So at price $P_0 = $2/gallon Bob will supply $Q_0$ gallons per year. Viewed from the perspective of the horizontal axis, the \textit{height} of the supply curve tells us something else, but what is it? Consider Bob’s decision making. The price that Bob can get for his milk is $P_0 = $2 per gallon. Should he produce a first gallon of milk? He will if the price the milk will fetch ($2) is higher than his cost of producing and selling the first gallon—his \textit{marginal cost} of producing milk at zero gallons. Notice in the graph that $P_0$ exceeds the height of the supply curve at zero gallons, which is $0.50.

Let’s suppose for the moment that the height of the supply curve at any quantity is \textit{marginal cost}, and see where it takes us.

At zero quantity price ($P_0 = $2) exceeds marginal cost, $MC(0) = $0.50. Should the farmer produce and sell the first gallon? Yes, because his revenues rise by $2 but his costs only rise by $0.50 so his profit (the difference between revenue and cost) rises by $1.50. The farmer continues in this way, making marginal decisions that move him up his supply curve so long as the price of milk, $P_0$, exceeds marginal cost, the height of the supply curve. For example, having increased quantity to the positive amount $Q_b$ corresponding to point $b$ on the supply curve, it is still the case that $P_0 > MC$, so it is profitable to produce more. These decisions lead the farmer to point $c$, corresponding to quantity $Q_0$, where price is equal to the height of the supply curve—that is, where price equals marginal cost. Having increased his production to $Q_0$ it does not pay the farmer to produce more—if he did his additional costs (the height of supply) would exceed
his additional revenues ($P_0$), so his profits would fall. And if Bob produced less than $Q_0$ his profits would fall because revenues lost would exceed costs saved. It follows that the farmer’s profits are maximized at $Q_0$, where $P=MC$.

We conclude that our assumption that the height of the supply curve represents marginal costs is valid, representing profit maximizing supply behavior by a seller. So an individual price-taking seller’s supply curve is also his marginal cost curve. Let’s state this as a result.

**The Supply Curve of a Seller and Profit Maximizing Behavior:**
The height of the supply curve of a price-taking individual seller is marginal cost. A price-taker maximizes profits by selling the quantity where price equals marginal cost: $P=MC$

Notice the similarity of this conclusion to our conclusions about the demand curve. The height of an individual’s demand curve for a good is marginal value. Demand curves slope down because of diminishing marginal value—the more people have of something, the less they are willing to pay to get more of it. The height of an individual seller’s supply curve is marginal cost. Supply curves slope up because of increasing marginal cost—the more the seller is producing, the greater the cost of producing more. As mentioned in Lecture 1, underlying rising marginal cost is the famous (but poorly understood) law of diminishing returns, which we will discuss in more detail in Lecture 4.

So remember this: *Demand is value and supply is cost.*

**Aggregating Supply Curves to Find Market Supply**

The market demand curve is the horizontal sum of the demand curves of individuals that participate in the market. The same is true of market supply. To find the market supply curve, we sum the quantities supplied by all sellers at each hypothetical price.

![Figure 5](image)

**Figure 5**
**Adding Supply Curves to Obtain Market Supply**

Figure 5 provides an example of summing supply curves to obtain market supply. Suppose there are only 2 sellers in the market, farmers Bob and John. Notice that John’s supply curve is “higher” at every quantity than Bob’s, indicating that John’s marginal cost is higher than Bob’s at every rate of production. For example, at price $P_1$=$1$, Bob would choose to supply $Q_1^B$ gallons per year. Farmer John’s costs are higher—his cost of producing the first gallon is $1 (How do we know that?)—so at prices of $1 or less he would not participate in the market. This
means that the market supply curve at prices below $1 is the same as Bob’s supply curve, so total market quantity supplied at $P_1 = $1 is just $Q^B_0$, Bob’s quantity supplied. At prices above $1 John chooses to participate, and the market supply curve shows the sum of the quantities supplied by Brown and John at each price. So at price $P_0 = $2 the total quantity supplied is $Q^M_0 = Q^B_0 + Q^J_0$.

**Question 2.2:** Notice that the market supply curve is flatter than each of the individual supply curves that go into it. Similarly, the market demand curve is flatter than the demand curves of the individuals who participate in the market. Why is this?

**Question 2.3:** It is easy to understand why the height of an individual seller’s supply curve is marginal cost. The same is true of the market supply curve: the height of the market supply curve is the marginal cost to society of producing another unit. (Why?) So think of a market supply curve when there are just two sellers in the market, like in Figure 5. Now suppose a third seller enters. With entry, the market supply curve shifts to the right, which means it also shifts down. More is supplied at each price, and marginal cost of producing milk is lower at each quantity. Why does the market marginal cost of producing milk shift down when a new seller enters the market?

**Factors that Shift the Supply Curve**

As with demand, there are a number of factors that affect sellers’ supply decisions. If the price of the good in question changes, holding constant all other factors that affect supply decisions, then the effect is represented by a movement along a given supply curve—a change in the quantity supplied. So the “law of supply” says that supply slopes up, holding all those other factors fixed. If something other than price changes—for example the cost of feed for the cows or the wages of farm workers—then the supply curve changes its position. That’s a change in supply. What factors shift supply, and how?

This is where “supply is (marginal) cost” comes in handy. If we want to know how some factor affects the position of the supply curve, we simply ask how it affects the marginal cost of producing and selling the good. For example, suppose the wages of farm workers go up, because the demand for their services in some other activity (growing wheat) has risen. How does this affect marginal cost? So long as it takes labor to produce additional gallons of milk (workers milk the cows), higher wages increase marginal cost. The marginal cost curve of each individual seller shifts up (to the left), so each is willing to supply less milk at each possible price because each seller’s marginal cost is higher. Since the market supply curve is simply the horizontal sum of the supply curves of all sellers, it too shifts up (to the left), reflecting higher marginal cost at each possible quantity produced.

Here is a list the most important factors that shift supply:

**Input Prices:** Higher costs of inputs raise marginal cost, so long as the input must be used to produce additional units. So higher input prices shift supply to the left (up)—a reduction in supply.

This is a good place to re-emphasize our previous point that costs and prices reflect alternative uses of resources. That is, all costs are opportunity costs. For example, suppose Farmer Brown can either sell the milk he makes, or use it to produce ice cream. The (opportunity) cost of selling milk is the foregone profit he would have received had
he made ice cream. So, if the price of ice cream increases, then the marginal cost of milk increases.

**Expectations about the Future:** For many goods, the idea that alternative uses affect supply can be used to understand the impact of expectations on supply decisions. Consider a storable good, like oil. Prospects of a future war in the Middle East raise expectations of future oil prices. How does this affect the current market supply of oil? Since oil can be sold either today or in the future, a higher expected future price raises the opportunity cost of selling a barrel of oil today. Marginal costs shift up, so the current market supply of oil is reduced. As we will see later in the course, this is not the only way that current supply can be affected by future expectations. For example, an increase in the future demand for housing, say because a baby boom generation will reach adulthood, can increase the current supply of housing. (Think about it).

**Technology:** Technological improvement is the foundation of economic growth and prosperity. It simply means that more can be produced with the same resources—technological improvement reduces marginal cost. So advances in technology cause supply to shift to the right (down); an increase in supply. Later in the course we will take a closer look at the pace of technical progress and its relation to economic growth and prosperity.

**Number of Sellers:** We have already discussed the impact of new entry on the position of the market supply curve: entry by new sellers causes the supply curve to shift to the right. Notice that when a new seller enters a market the supply curve shifts down, which means that marginal cost falls (Again, why?). When a new buyer enters a market the demand curve shifts up, which means that marginal value increases at each quantity (Why?).

**V. Market Equilibrium: How Price and Quantity are Determined in a Market**

To this point our discussions of demand and supply have been hypothetical: at various hypothetical prices, how much would consumers of a good like to buy? How much would suppliers of the good like to sell? We had nothing to say about how prices are determined. Now we have all the tools to figure that out.

Figure 6 shows demand and supply curves for milk in a particular market, say the U.S. market for milk. The vertical axes measure the price of milk in dollars/gallon, and the horizontal measures the annual production and consumption of milk, say in millions of gallons per year. To see how price is determined, choose an arbitrary price like $P_1$ in Figure 6a. At price $P_1$ the supply curve tells us that suppliers of milk would produce and offer for sale $Q_1^S$ units. But at that price demanders would only wish to buy $Q_1^D < Q_1^S$ units. Since quantity supplied is greater than quantity demanded at price $P_1$ we shall say that there is excess supply of milk at that price.

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1 You might well ask: “What type of milk.” Non-fat milk, two-percent, or whole? Organic? this is a good question. Since the product in question has to be homogeneous, there can be a market demand curve for (say) organic whole milk, which will be affected by the prices of other types of milk, which are substitutes.
Think about the market forces at work when there is excess supply. At price $P_1$ more units are offered for sale than consumers want to buy. There is pressure in the market for price to fall because quantity supplied exceeds quantity demanded at that price. As price falls, quantity supplied falls as well, moving to the southwest along the stable supply curve, $S$. Further, with price falling the quantity demanded rises, moving southeast along stable demand curve, $D$. So excess supply causes price to fall, which reduces the condition of excess supply. But so long as quantity supplied exceeds quantity demanded, price is pushed down. The
condition is eliminated when price falls to $P^E$, where $Q^s = Q^d = Q^e$ —quantity demanded equals quantity supplied and the condition of excess supply has been eliminated. At price $P^E$ and quantity $Q^e$ there is no excess supply, so there is no longer any pressure causing price to fall.

Of course we could have started with a price $P_2 < P^E$, also shown in Figure 6. At that price more units of the good are demanded by buyers than suppliers are willing to sell, so $Q^D > Q^S$. We say that there is excess demand at price $P_2$. When more units are demanded than are available, there is pressure in the market for price to rise. As price rises, suppliers are willing to offer greater quantities of the good—we move to the northeast along the stable supply curve—and demanders wish to purchased smaller quantities of the good—we move northwest along a stable demand curve. So rising price reduces the condition of excess demand. Excess demand is eliminated when price rises to $P^E$, where (again) $Q^s = Q^d = Q^e$. There is no further pressure on price to rise.

So when price is above $P^E$, the condition of excess supply pushes price down. When price is below $P^E$, the condition of excess demand pulls price up. At price $P^E$ and quantity $Q^e$ there is neither excess supply nor excess demand, so there is no pressure for price to change. We will refer to the combination $(P^E, Q^e)$ as the market equilibrium price and quantity. At the market equilibrium price, quantity supplied equals quantity demanded—the amount that demanders wish to buy at price $P^E$ is just equal to what suppliers wish to sell. No supplier’s good goes unsold, and no demanders offer to buy goes unmet. All is good.

**Definition: Market Equilibrium**

A market equilibrium is a situation in which there is no pressure for price or quantity to change. The market equilibrium price, $P^E$, equates quantity supplied and quantity demanded, so there is zero excess demand and zero excess supply.

With upward sloping supply and downward sloping demand, the market equilibrium depicted in Figure 6 is also “stable.” That is, suppose that for some reason price were pushed above $P^E$. This would cause excess supply, and price would fall back toward $P^E$. Similarly, if price were pushed down below $P^E$ there would be excess demand and price would rise back toward $P^E$. So pushing price away from $P^E$ creates market forces that tend to bring it back—$(P^E, Q^e)$ is the stable equilibrium of the market. This is similar to the behavior of a marble placed in the bottom of a bowl. Absent some outside force, there is nothing in the system (the bowl and Earth’s gravity) that would cause the marble to move, so the bottom of the bowl is the marble’s equilibrium position. If some outside force (a finger) were to push the marble away from its equilibrium, gravity and the shape of the bowl would force it to eventually return. The bottom of the bowl is the stable equilibrium position of the marble.

Of course we could also think of an unstable equilibrium for the marble. Imagine the bowl turned upside down, with the marble precariously balanced on the bowl’s highest point. The top of the bowl is the marble’s equilibrium—absent an outside force it will not leave its position. But if some outside force perturbs the marble it will role off the bowl and across the room. There is nothing in the system that will bring it back, so the equilibrium in this case was “unstable.” It is possible to draw a market equilibrium that is unstable too (but we would need a forward falling supply curve, and we don’t have one), but the possibility is not very interesting.
Empirically: we don’t see the prices of goods going all over the place after the slightest disturbance. Real world markets are pretty stable.

**Market Equilibrium and Efficiency**

Loosely speaking, markets are efficient when resources are put to their most valuable uses. With this in mind, consider the market equilibrium portrayed in Figure 7, and recall the dictum “Demand is value, supply is cost.” That is, the height of the demand curve measures the marginal value of the last unit consumed, and the height of the supply curve measures the marginal cost producing it. So at the market equilibrium quantity $Q^E$ we conclude that $MV = MC$; marginal value and marginal cost are the same, and both are equal to the market price, $P^E$. Notice that there is no other quantity greater or smaller than $Q^E$ where $MV$ and $MC$ are the same.

![Figure 7: Market Equilibrium and Efficiency](image)

If $MV(Q) > MC(Q)$ efficient to produce and consume more
If $MV(Q) < MC(Q)$ efficient to produce and consume less
Condition for Efficiency: $MV(Q) = MC(Q)$

To be specific, suppose there was an infinitely knowledgeable and benevolent dictator (Joe Stalin, only nice) whose only goal was to allocate resources to their most valuable uses. Observing the milk market in Figure 7, he might consider ordering his minions to produce and consume a quantity of milk like $Q_1 < Q^E$, reasoning that the cows, workers, land and so on could be use for something else, and maybe the minions don’t like milk so much anyway. But at this quantity the marginal value of a gallon of milk is bigger than its marginal cost: $MV(Q_1) > MC(Q_1)$. Ponder what that means. It means that the resources required to produce additional milk (cows and stuff) yield a value of $MV(Q_1)$, say $3$, when they are used to make milk. Those same resources can produce something worth $MC(Q_1)$, say $1$, when they are used in their next most valuable activities. (Remember, cost is always opportunity cost). They yield greater value when used to produce more milk than when they are used anywhere else, so it follows that their most valuable use is in producing more milk. This reasoning applies at any
quantity smaller than $Q^E$, so if Uncle Joe cares about efficiency he would always increase milk production and consumption if $Q < Q^E$.

What of quantities like $Q > Q^E$. At $Q_2$ the heights of demand and supply indicate $MV(Q_2) < MC(Q_2)$: the resources used to produce the last gallon would have generated more value to members of society had they been used for something else. A wise and benevolent Joe would have used them elsewhere, so he would have reduced milk production and consumption, while increasing the production and consumption of other things. This reasoning applies for any $Q > Q^E$. Joe is led inexorably to $Q^E$, where $MV = MC$, because then there is no way to find a more valuable use for society’s resources. It follows that $Q^E$ is the efficient quantity of milk for society to produce and consume—if $MV > MC$ it is efficient to produce more, and if $MV < MC$ it is efficient to produce less. That is worth repeating:

**The Condition for Efficiency:**

Society’s resources are used efficiently when the marginal value of a unit is equal to its marginal cost: $MV(Q) = MC(Q)$.

Of course there is no infinitely knowledgeable and benevolent dictator guiding the allocation of society’s resources. Benevolence aside, think of the vast amount of information necessary to “solve” an allocation problem like this one. The central planner would have to know the valuations of all consumers (and potential consumers) and the costs of all producers (and potential producers) for all possible goods. It isn’t possible. Our remarkable finding, however, is that under certain conditions (perfect competition) private markets do solve the problem of efficiently allocating society’s resources. The ‘E’ on $Q^E$ stands for both *Equilibrium* and *Efficient*. This was Adam Smith’s remarkable insight: armed only with knowledge of the market price of the good they are interested in, plus knowledge of their own values and costs, the decisions of self-interested people yield an efficient outcome.

Of course market outcomes are not always efficient. But the conclusion that perfectly competitive markets are efficient tells us where to look if we want to find market “failure.” At least one of the assumptions of the perfectly competitive model must be invalid. So either

1. Buyers and/or sellers are not price takers.
2. There is imperfect information about prices and qualities of goods.
3. Property rights are not well defined.

If one of these conditions occurs, there is at least the prospect that intervention in markets might improve things. Whether intervention actually does improve efficiency is another matter: even when markets fail to be fully efficient, intervention in the market process may still make things worse. We will consider these possibilities as the course unfolds.

**Comparative Statics: What Happens When Something Changes?**

“Comparative statics” is a fancy way of saying that we would like to know how markets adjust to changes in circumstances. If household incomes rise, what happens to price and quantity in the market for caviar? If there is a drought that damages the hops crop, how does that impact the market for beer? We have all the tools we need to analyze issues like these.
Consider an event that would cause the demand curve for Russian caviar to shift to the right (an increase in demand) such as an increase in household incomes (caviar is a normal good). The situation is shown in Figure 8. The original demand and supply curves for caviar are $D_1$ and $S_1$, so the market equilibrium is $(P^E_1, Q^E_1)$. Higher incomes shift demand to $D_2$, so at the old price $P^E_1$ there is excess demand. With excess demand, price rises. The higher price causes quantity demanded to fall along the new demand curve, $D_2$, while quantity supplied increases along the unchanged supply curve $S_1$. The new equilibrium is $(P^E_2, Q^E_2)$, so price and quantity both increase when demand rises.

![Figure 8](image)

**The Effects of a Change in Demand on Price and Quantity:**

$P^E$ and $Q^E$ move in the same direction

Question 2.4: Suppose that the demand for caviar shifts up by $1 at all quantities—people are willing to pay $1 more for any amount. Does the price rise by $1, or by less than $1? Why?

If demand had fallen, say because caviar was found to cause hypertension in laboratory mice, then a similar analysis (do it) would show that the equilibrium price and quantity would both fall. We conclude that changes in factors that cause the demand curve to shift also cause price and quantity to move in the same direction. An increase in demand raises price and quantity, a decrease in demand reduces price and quantity.

Now consider events that cause the supply curve to shift. If an outbreak of fish infertility reduces the number of egg-bearing Russian sturgeon (you have to know a lot about technology to be an economist), the supply curve of caviar will shift to the left (up), from $S_1$ to $S_2$ in Figure 9. At the old equilibrium price, $P^E_1$, there is excess demand, so price will rise. With rising price, caviar producers increase quantity supplied along the new supply curve, $S_2$, while consumers reduce their quantity demanded along the unchanged demand curve, $D_1$. The new equilibrium pair $(P^E_2, Q^E_2)$ involves a higher price of caviar and a lower quantity. Similarly, if the supply of caviar had increased, say because technical advances made it easier to catch fish, then price...
would fall and quantity would rise. (Do the analysis.) The upshot is that factors that cause the supply curve to shift also cause price and quantity to change, but in opposite directions. An increase in supply reduces equilibrium price and raises equilibrium quantity, a reduction in supply raises price and reduces quantity.

![Diagram](image)

**Figure 9**
The Effects of a Change in Supply on Equilibrium Price and Quantity: 
$P^E$ and $Q^E$ move in opposite directions

### VI. Intervening in the Market Process: Some Applications of the Basic Market Model

Many public policies are meant to “improve”—by someone’s definition—on market outcomes. Examples include price ceilings (the market price is “too high,” some authority is convinced it should be lower), price floors (the market price is “too low,” some authority thinks it should be higher), import quotas and tariffs (there are too many imports, so price is “too low”), and sales taxes (the government needs money, and consumption of some products—cigarettes?—is “too high” anyway). We consider several examples.

#### Price Controls

Price controls take two forms, price ceilings and price floors. A **price ceiling** is a legally determined maximum on the price of a particular good—it is not legal to sell or buy the good for a price above the ceiling. A **price floor** is legally determined minimum on the price of a good—it is not legal to sell or buy the good at a price below the price floor.

#### Price Ceilings

An example of a price ceiling is a rent control, as practiced in New York City or in Berkeley and Santa Monica, California. Under rent control, a local government passes a law that places a legal maximum on apartment rents. It is illegal to charge or pay more than the control price for a rental apartment. Another recent example occurred in Zimbabwe, where Robert
Mugabe’s government placed a ceiling on the price of agricultural products used for food. The effects of a price ceiling are shown in Figure 10.

![Figure 10](image)

**The Effects of a Price Ceiling: Excess Demand and Rationing**

In the Figure, the market equilibrium price is $P^E$ and the equilibrium quantity is $Q^E$. It should be obvious that the ceiling price, $P^C$, must be below $P^E$ to have any effect. At price $P^C$, demanders wish to obtain $Q^D$ units of the good, but sellers are only willing to offer $Q^S < Q^D$ units—there is excess demand in the amount $Q^D - Q^S$. In popular jargon, this is a “shortage”: at the ceiling price there is not enough of the good to go around. So the first implication of a price ceiling is that it always creates a shortage of the good in question. Further, less of the good is available than would be at the market price.

The shortage will often increase over time. For example, apartments do not have to be rented—they can be converted to condominiums and sold. So when rent controls were imposed in the Peoples’ Republic of Santa Monica, many apartment owners converted their units to condos. This means that supply of the good (rental apartments) declines by even more in the “long run,” when sellers have time to adjust. To offset this, the local government passed new legislation limiting owners’ rights to convert. Similarly, investors are less likely to build new apartment buildings when rents are artificially low, so fewer new buildings will be built. So the city council added an exemption for new apartment buildings. Of course, then it became profitable to tear down perfectly-good old buildings and replace them with new ones. Things get complicated. In Zimbabwe, food price controls forced more farmers to abandon their farms as time went on, so the shortage worsened. Why didn’t they just export their crops and get world prices? The government imposed big export tariffs to prevent that.

**Question 2.5:** You will often encounter the term “shortage” in news reports about particular markets. “There may be a shortage of natural gas this winter,” or “Bad weather in Brazil has
damaged the coffee bean crop. There is a shortage of coffee.” What do these statements mean? Under what circumstances can a shortage occur?

But the good must be allocated to buyers in some way, and this is the second implication of a price ceiling—the $Q^d$ units that are available at the ceiling price must be allocated by some non-price mechanism. The mechanism may be a lottery, so you get the good if your name is drawn or you are a member of some favored (by whom?) group. The mechanism may be a queue. So apartment hunters put their name on a list and wait for an apartment to come available. Then the true cost of the good is $P^c$ plus the value of time spent waiting. (Then the good goes to those with the lowest value of time). The mechanism may be side-payments and bribes to owners of the good. So apartment hunters in New York pay “key money”: the rent for the apartment is $1000/month, but the key will cost another $500. Or Zimbabweans who wish to eat must bribe government officials who control the supply of food. Then the true cost of the good is $P^c$ plus the side-payment necessary to procure it. In most cases, the true cost of obtaining the good exceeds the control price, which is the third implication of a price ceiling.

Question 2.6: The third implication of a price ceiling is that the true cost of obtaining the good exceeds the price ceiling, as other resources must be devoted to getting it. Is it ever the case that the true cost of obtaining the good exceeds $P^E$? That is, can the good be more expensive with a price ceiling than without one? Explain.

Question 2.7: Some goods, like apartments, require maintenance. For others, sellers’ costs will be lower if a lower quality good is produced. If enforcement agencies cannot precisely define or monitor the characteristics of the good, how will the price ceiling affect the quality of goods sold? Might the shortage disappear? If so, does that mean that the price ceiling had no effect?

The fourth implication of a price ceiling is that there are winners and losers. If the local government imposes a rent ceiling, people who already have an apartment benefit—they pay less than they otherwise would. Some people who don’t yet have one may also benefit—say because they ended up at the head of the queue, or had their name drawn in a lottery. The losers are owners/producers of the good, those who would have been willing to pay $P^E$ but now get none, and those who end up paying more under the price ceiling than without it. In other words, the price control transfers wealth from some groups (e.g. owners/producers) to others (e.g. current occupants or favored buyers).

The last implication of a price ceiling has to do with efficiency. Recall that efficiency requires that MV=MC: what people are willing to pay for an additional unit is equal to the additional cost of providing it, which occurs at the combination $(P^E, Q^E)$ in Figure 10. If sellers receive only $P^c$ for the good, then the actual quantity provided is $Q^S < Q^E$, so too little of the good is provided compared to the efficient outcome. And this isn’t all when it comes to efficiency. Depending on how the good is allocated, the “wrong” (by an efficiency standard) people will typically get it. A market mechanism would provide the good to only those people whose value of it is at least $P^E$. Suppose the good is allocated by lottery. Then anyone with a marginal value of $P^c$ or larger will try to obtain it. Some people with low values will get the good, and some with high values will do without. The allocation of the good among users is also inefficient.
**Question 2.8:** Suppose that rent controlled apartments are allocated by lottery to those who want one. Suppose also that those who “win” the lottery and get an apartment can sublet it. Using Figure 10, identify the equilibrium sublet price. Which individuals end up living in rent controlled apartments. What is their total cost of getting an apartment? Is this cost higher or lower than in an uncontrolled market? Who gains and who loses from the price control?

**Summary: Implications of a Price Ceiling**

There are five implications of a price ceiling set below the equilibrium price:

1. There is excess demand at the ceiling price: a “shortage” is created. The shortage is likely to worsen with time.
2. With excess demand, the good must be allocated by some non-price mechanism such as a lottery or a queue.
3. The true cost of obtaining the good exceeds the ceiling price.
4. The price ceiling transfers wealth from some individuals (e.g. owners) to others (e.g. current tenants).
5. The allocation of resources is inefficient. Too little of the good is provided, and it is allocated to the “wrong” users.

**Price Floors**

A price floor is a legal minimum on the price of a good or service. It is illegal to sell or buy for a price below the floor. Examples are minimum wages in the labor market, “living wages” in certain municipalities (Santa Monica again), or agricultural price supports that are common in many countries, including the U.S., Japan, and much of Europe. Indeed agricultural price supports and subsidies were the major source of conflict between rich and poor countries in the most recent (2003) round of trade negotiations.

The effects of a price floor are illustrated in Figure 11. In order to have an impact, the floor price $P^k$ must be above the market equilibrium price $P^E$. At this price, more is offered for sale $(Q^s)$ than demanders wish to buy $(Q^D)$, so there is excess supply (a surplus) in the amount $Q^s - Q^D$. This is the first implication of a price floor.
The consequences of this surplus depend on the particular features of the price floor. If the floor is a minimum wage then employers wish to hire fewer (say) teenagers than in an unconstrained labor market, while more teenagers would like to work at the minimum wage than at the lower market wage. Then the surplus is unemployment: some people who want to work at the minimum wage cannot find a job. Things are a bit different if the floor is an agricultural price support. Here the purpose of the price floor is to raise the incomes of farmers without leaving any of their product unsold. One way of doing this is to pay farmers not to grow so much stuff. (I’m not making this up). So some farmers get government subsidies for not farming.

More typically, governments stand ready to buy any unsold quantities produced by farmers at the price floor. So the government buys $Q^s - Q^d$ units of, say, milk for price $P^f$. Total government spending on the program is price times the amount of corn the government buys, or $G_t = P^f (Q^s - Q^d)$ per year if the time unit ($t$) is a year.

Aside on areas in Supply/Demand Graphs: The government’s spending is the product of price/unit ($P^f$, a height measured on the vertical axis) and units purchased ($Q^s - Q^d$ units per year, a base measured on the horizontal). So $G_t = P^f (Q^s - Q^d)$ is the area of the rectangle with base $Q^s - Q^d$ per year and height $P^f$. More generally, the unit of measure for areas in supply-demand figures is simply dollars per year (or per month, per day or whatever the time unit is).

Now the government must figure out what to do with its milk (or wheat, or rice…). One option is to throw it away, which often happens because it avoids the costs of the next option. Another is to store it (for example, as cheese). So government warehouses and storage silos are filled with “excess” cheese, grain, wine (in France) or whatever.

A last option is to sell the product for what the world market will bear. In Figure 11, this means that the price of corn must fall to $\hat{P}$, where quantity demanded equals $Q^s$. Then the
government’s policy is equivalent to a per-unit subsidy of \( s = P^e - \hat{P} \) paid to farmers for each bushel of corn they grow. (Why?) With the subsidy, they choose to grow \( Q^S \) bushels which they sell on the market for \( \hat{P} \). The government gives them \( s = P^e - \hat{P} \) for each bushel, so the net price they “see” is \( P^e \) per bushel. Total government expenditure is \( G_2 = (P^e - \hat{P})Q^S \).

**Question 2.9:** In Figure 11, show the rectangle \( G_1 = P^e (Q^S - Q^D) \) and the rectangle \( G_2 = (P^e - \hat{P})Q^S \), representing total government spending under alternative agricultural support policies. Is one larger than the other? On what does your answer depend? As a policy advisor to the government, if you had to choose one of these policies which one would you recommend?

In a nutshell, the reduction in the price of corn to \( \hat{P} < P^e \) is the central issue in the conflict between poor and rich countries over trade policy. Rich countries (the U.S., Western Europe, Japan) advocate free trade policies and the elimination of subsidies, except for their own protection of agriculture. Their agricultural price supports and subsidies have the effect of reducing world food prices, which harms farmers in less developed countries, such as the Philippines, Mexico and much of Africa.

As with a price ceiling, there are winners and losers with a price floor. If the floor is minimum wage, for example, the winners are those workers who are fortunate enough to get a job at the minimum. The losers are demanders of their services—consumers of the products they produce—who pay higher prices, and those workers who don’t get a job but would work at a market wage. So the minimum wage transfers wealth from (e.g.) people who eat fast-food hamburgers to those who work for a minimum wage in fast-food restaurants. With agricultural price supports, the winners and losers depend on the form of the policy for dealing with the surplus. If the government buys the surplus and disposes of it, then food prices are higher and consumption lower than in an unconstrained market. Wealth is transferred from consumers and taxpayers to farmers. If the surplus is sold, driving down prices to consumers, then there is a gain to consumers (domestic and foreign) but a loss to taxpayers. Of course, farmers gain.

The final implication of a price floor is that the allocation of resources is inefficient. Suppose the government buys an agricultural surplus and throws it away. Then consumption is too low compared to the efficient outcome—\( Q^D < Q^E \) in the figure above—while production is too high: \( Q^S > Q^E \). Society wastes resources producing stuff that we don’t even use. If the government sells the surplus, then both consumption and production are too high compared to the efficient outcome: when \( Q^S \) units are produced and consumed we know \( MV(Q^S) < MC(Q^S) \), so the resources used to produce corn would have been more valuable in some other use.

**Summary: Implications of a Price Floor**

There are 4 implications of a price floor set above the equilibrium price.

1. There is excess supply at the price floor: a “surplus” is created.
2. With excess supply, something must be done with the surplus.
3. The price floor transfers wealth from some individuals (e.g. consumers and taxpayers) to others (e.g. farmers).
4. The allocation of resources is inefficient. Too much of the good is produced, while either too little or too much may be consumed, depending on the form of the policy.
**Import Quotas and Tariffs**

Import quotas and tariffs are also used by governments to enrich domestic producers. For example, quotas on sugar imports to the US are designed to raise prices received by domestic producers, in order to aid the sugar industry. (The quotas are so successful that they created another domestic industry—high fructose corn syrup—as a substitute for cane sugar. Your Coke or Pepsi would have real sugar if purchased outside the US, but in the US almost all soft drinks are sweetened with HFCS.) In 2001 President Bush acquiesced to the entreaties of American steel producers, imposing quotas and tariffs on imports of foreign-made steel. In the 1980s, pressure from the US led the Japanese Ministry of Trade to impose “voluntary” quotas on the export of cars to the US, in order to aid Ford, GM and Chrysler. And President Obama has acquiesced to the goals of organized labor in the US by expressing his opposition to NAFTA (the North American Free Trade Agreement) and other reductions in trade barriers. These policies were designed to increase the prices that domestic (US) producers could get for their products—to protect them from competition. Here is how they work, and who they affect.

Figure 12 shows supply and demand in the US market for steel. The supply curve of steel produced by American firms is $S^{US}$, and the demand by domestic users of steel is $D$. To keep things simple, assume that the foreign supply of steel is flat at price $P^F$: foreign steel producers are willing offer as much or as little as the US may want at that price. (Why might that be a reasonable assumption?)

![Figure 12: The Effects of an Import Quota on Price, Domestic Production and Domestic Consumption](image)

Absent intervention, the supply curve of steel to the American market is found by summing the supply curves of foreign and US producers. How is this done? Think of some price below $P^F$. At such a price foreign supply is zero—the price is not high enough to attract foreign producers—so the market supply curve corresponds to the domestic supply curve, $S^{US}$,
for all prices below \( P^F \). Then at \( P^F \) foreign producers will provide as many units as the market can absorb, so the market supply curve is the bold curve in the figure. It is the US supply curve out to quantity \( Q^0 \) and then it is flat: price can’t go above \( P^F \). The market equilibrium occurs where demand and supply intersect. So total consumption is \( Q^1 \) tons of steel per year at price \( P^F \). Domestic (US) suppliers produce \( Q^0 \) tons per year, and imports (the difference between consumption and domestic production) are \( M = Q^1 - Q^0 \). The market is efficient: the marginal cost of producing steel is \( P^F \) (why?) and the marginal value of steel consumed is \( P^F \) (why?).

Now, suppose that the US government imposes an import quota. It does this by issuing import licenses, and requiring that a foreign steel producer have a license for each ton of steel it brings to the US. To have an impact, the quota must restrict imports to be smaller than \( Q^1 - Q^0 \), the amount that would occur in the absence of intervention, so suppose the government issues \( \bar{M} = 1/2(Q^1 - Q^0) \) licenses; the government cuts steel imports by half.\(^2\) What are the effects of the quota?

The first step is to find the new supply curve of steel, which is the horizontal sum of the domestic and foreign supplies. To do this, let’s start again at a prices below \( P^F \) and work our way up. At these prices there is no foreign supply, so the market supply at prices below \( P^F \) is still \( S^{US} \), as shown in Figure 12. Once price reaches \( P^F \) foreign producers are willing to provide any amount, but the quota restricts them to selling \( \bar{M} \) tons, no more. So the market supply at price \( P^F \) is \( Q^0 + \bar{M} \): domestic production plus allowable imports. At prices above \( P^F \) US producers are willing to offer more along their supply, \( S^{US} \), but foreign suppliers are restricted to the quota \( \bar{M} \). This means that the supply curve of steel to the US market is the kinked curve \( S^M \). At prices below \( P^F \) it the same as \( S^{US} \). At prices equal to or greater than \( P^F \) it is \( S^{US} \) plus \( \bar{M} \), the import quota.

The post-quota market equilibrium occurs at the intersection of demand and \( S^M \). Price rises to \( P^M > P^F \), while quantity consumed falls to \( Q^M < Q^1 \). Consumers are clearly worse off. What about domestic producers? Before the quota they sold \( Q^0 \) tons/year at price \( P^F \). After the quota they sell \( Q^2 \) tons/year at price \( P^M \). Domestic producers sell more at a higher price, and are better off. Indeed, the point of the quota was to benefit domestic producers of steel. Foreign producers sell fewer units in the US, but each ton of steel gets a higher price. So foreign producers who obtain import licenses also gain from the quota. The quota transfers wealth from consumers to domestic and foreign producers.

Finally, notice that the post-quota outcome is inefficient. Prior to imposition of the quota, consumers’ marginal value of a ton of steel was equal to the marginal cost of obtaining steel, \( P^F \). With the quota, a “wedge” is driven between value and cost, so too little is consumed compared to the efficient outcome: \( MV > MC \). An additional source of waste occurs because US steel firms produce too much. The true resource cost of obtaining steel for the US is \( P^F \); that is the value of other goods and services that we (the US) would have to give up to get a ton of steel.

\(^2\) Assume for the moment that the licenses are free or are granted to producers in proportion to previous imports. For example, Japanese quotas for auto exports to the US were allocated based on pre-quota market shares. So if Toyota’s share of Japanese exports to the US was 40%, Toyota got 40% of the licenses.
steel on the world market. The quota causes domestic producers to increase their production by 
\( Q^2 - Q^0 \) tons per year, and the marginal cost of each of those tons exceeds \( P^F \). We could have bought those tons on the world market for \( P^F (Q^2 - Q^1) \); instead we produced them in the US for a higher cost. That is waste.

**Summary: Effects of an Import Quota**

An import quota on good \( X \):
1. Increases the domestic price of \( X \).
2. Reduces domestic consumption of \( X \).
3. Increases domestic production of \( X \).
4. Transfers wealth from consumers to domestic and foreign producers.
5. Results in an inefficient allocation of resources: domestic consumption is too low, and domestic production is too high.

**Question 2.10**: Suppose that instead of an import quota the government had imposed a *tariff* (tax) on steel imports. Let the tax be equal to \( T = P^H - P^F \) on each ton of imported steel. Draw the new supply curve of foreign steel to the US. What is the US-market price and quantity of steel? How much is produced by US steel firms? How much is imported? What price, net of the tariff, do foreign producers get for steel they sell in the US? As a policy advisor to the president, would you recommend quotas or tariffs as a method of benefiting US steel producers?

**Lecture 2**

**Points to Remember**

1. Prices convey information about values and costs to buyers and sellers, and they provide the incentive to act on that information.
2. In a perfectly competitive market:
   a. All buyers and sellers are price takers
   b. The good is homogeneous
   c. There is perfect information
   d. All property rights are well defined
3. Demand is determined by buyers’ willingness to pay (marginal value) for a good or service. The height of the demand curve at any quantity measures marginal value.
4. Supply is determined by the marginal cost of providing a good or service. The height of the supply curve at any quantity measures marginal cost.
5. The market equilibrium price equates quantity demanded to quantity supplied—the market “clears.”
6. The condition for economic efficiency is that marginal value equals marginal cost.
7. The equilibrium of a perfectly competitive market is economically efficient.
Problems

Lecture 2

1. You are in charge of analyzing energy markets for a major brokerage house. To analyze the market for crude oil, you must have knowledge of demand and supply conditions in the oil market. Suppose that you want to estimate the demand and supply curves for oil in the U.S. Carefully explain what types of data you would need in order to determine the shapes of the supply and demand curves. In particular, would information on prices and quantities alone be sufficient? Why? Under what conditions would they be sufficient? When would you need additional data, and what would it be? (Hint: If you want to “see” the demand curve, what types of events must occur? If you want to “see” the supply curve, what types of events must occur?).

2. Suppose the outcome of your empirical work in question (1) above is a (daily) market demand curve for oil given by \( D(p) = 35,000,000 - 900,000p \). The (daily) supply of oil by domestic producers is given by \( S(p) = 5,000,000 + 100,000p \).
   a. Suppose the Organization of Petroleum Exporting Countries (OPEC) is the only foreign supplier of crude, offering to sell any amount of oil for $25 per barrel. Given these conditions of market demand and supply, what is the equilibrium price of a barrel of oil in the U.S.? What is domestic production? Domestic consumption? How much oil is imported?
   b. In the interests of achieving energy independence, legislation is being considered that would limit oil imports to 4 million barrels per day. Your clients are intensely interested in knowing the impact of this legislation (it affects the value of oil producing firms, among other things). How would this legislation affect the domestic price of oil? What is the new price of oil, the new level of domestic production, and the new quantities of oil consumed and imported?
   c. Another proposal is to tax imports of oil at a rate of $6 per barrel. What are the effects of this proposal? Who gains and who loses?

3. Let \( Q^e \) be the market equilibrium quantity of an efficient market. Suppose that an omniscient dictator could command that producers offer a total of \( Q^e \) units, which are distributed equally among those expressing a desire to have the good. Is this outcome economically efficient? Why or why not?

4. A Wall Street Journal editorial in 2002 discussed the effects of import tariffs on the steel wire rod market. As the WSJ put it, “producers of this ubiquitous commodity have found that they like what high tariffs do for their bottom line.” The tariffs come from protection put in place by the Clinton administration in 2000 (similar protection for steel was enacted by the Bush administration in March, 2002). According to the Journal, “higher US prices followed and …the average price of high quality steel wire is now $30 to $60 more per metric ton in the US than on the world market.” The Journal also states that companies that make wire out of raw steel wire rod are finding that they can’t pass along their higher costs to their customers, which make consumer products. Some of these businesses are moving overseas, where costs are cheaper.
   a. Evaluate the economics of this tariff. Why is the price higher than on the world market?
   b. Under what conditions would US producers be unable to pass along their higher steel rod costs? When could they pass them all through to consumers?
   c. What impact does this have on US steel rod production? What of the profits of US producers?

5. In “India’s Poor Starve While as Wheat Rotts” (in your packet), the author laments the effects of agricultural price supports in India. Carefully analyze the impact of India’s agricultural program,
using the tools in this Lecture. As a policy advisor to the Indian government, what would you recommend?