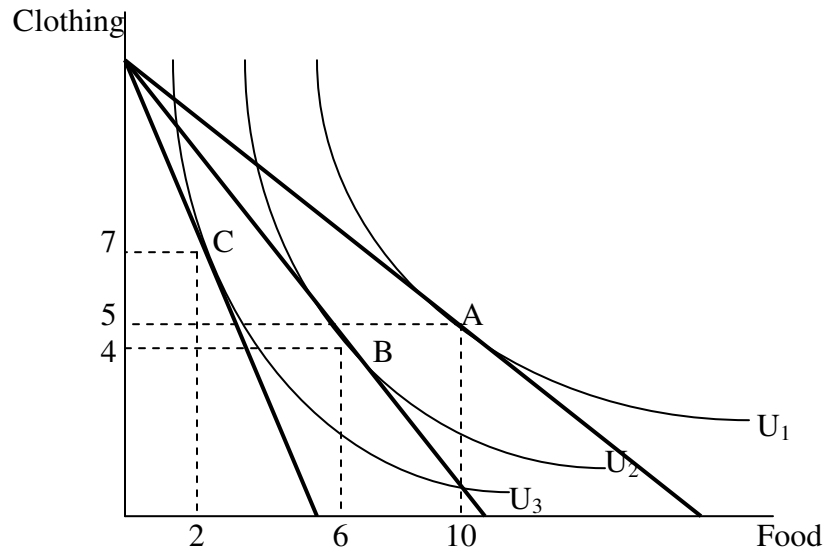


Chapter 4: Individual and Market Demand

In this chapter, we will use what we learned about indifference curves and budget constraints to study demand in more detail. We will see how utility maximization results in a demand curve for individual consumers, and then see how these individual demand curves can be aggregated into a market demand curve. We will also study a basic measure of consumer welfare (consumer surplus).

Individual Demand

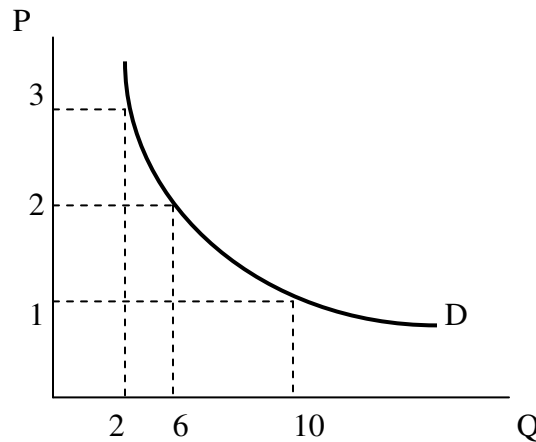
Our first goal is to see how indifference curves and budget constraints can be used to derive a demand curve for an individual consumer. Sticking with our example from the last chapter, suppose that our hypothetical consumer buys food and clothing. Suppose also that the consumer has an income of \$20 and $P_F = 1$ and $P_C = 2$.



At these prices and income, the consumer starts off at point A. When the price of food rises to \$2, the budget constraint gets steeper, moving the consumer to a lower level of utility, to point B. When P_F rises yet again to \$3, the consumer chooses basket C off the new budget constraint.

By the way, notice that the consumer's clothing purchases could either fall (A to B) or rise (B to C) as the price of food rises. From A to B, food and clothing behave like complements ($\uparrow P_F \Rightarrow \downarrow$ demand for clothing), while from B to C food and clothing behave like substitutes ($\uparrow P_F \Rightarrow \uparrow$ demand for clothing). Sometimes this relationship is extremely important if we are analyzing particular markets.

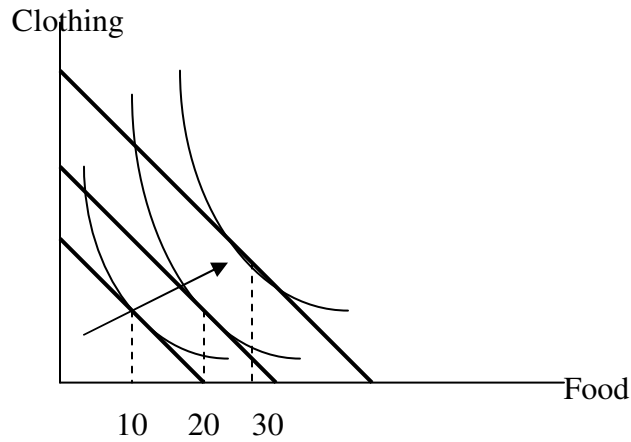
Notice that as the price of food rises, the consumer buys less of it. If we know the different prices and quantities from the graph, we can now graph this consumer's demand for food.



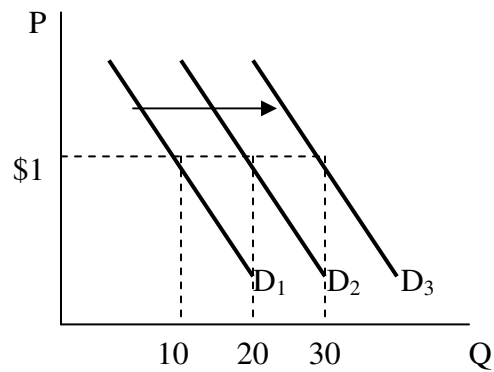
A couple of things to note about this demand curve:

- 1) *It slopes down.* We got a downward sloping demand curve because of the way we drew the consumer's preferences. More on this point later.
- 2) *As we move along the demand curve, the level of utility changes.* Specifically, utility rises as P falls. This isn't exactly shocking, since this result just means that the consumer is happier if his purchasing power increases.
- 3) *At each point on the demand curve, $MRS = P_F/P_C$ (utility maximization condition).* Therefore, as P_F falls while P_C is held constant, MRS must be falling. Indeed, this makes sense, because as the consumer acquires more food, he is less willing to give up clothing to get more food (the amount of clothing he is willing to give up to get more food is decreasing).

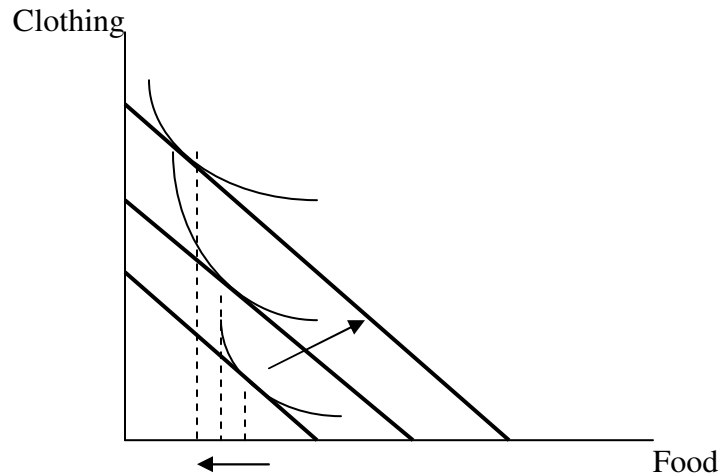
We can also use indifference curves and budget constraints to investigate a consumer's demand for a good when his income changes. Again, suppose $P_F = \$1$, $P_C = \$2$ and $I = \$20$. Now suppose that the consumer's income doubles to $I = \$40$, and then rises to $I = \$60$. In this case, the budget constraint will shift out, as follows:



As the consumer's income rises, he buys more food (and more clothing; more on this in a second). However, the price of food has not changed. Therefore, since the price of food is the same but the consumer is buying more, it must be the case that demand is shifting to the right.



In this case, I have drawn each good as a normal good. That is, the consumer buys more food when his income rises, and he also buys more clothing as his income rises. Remember, though, that it is perfectly possible for one of these goods to be inferior, in which the consumer's demand decreases as his income rises. For example, suppose that food were an inferior good. In that case, our indifference diagram would look like this:



In this case, the quantity of food demanded by the consumer falls as his income rises, while his quantity of clothing increases. Notice also that it is impossible for both goods to be inferior. That would imply that as the budget constraint shifted out, that the consumer bought less of both goods, putting him at a point inside the budget constraint and violating nonsatiation.

Income and Substitution Effects

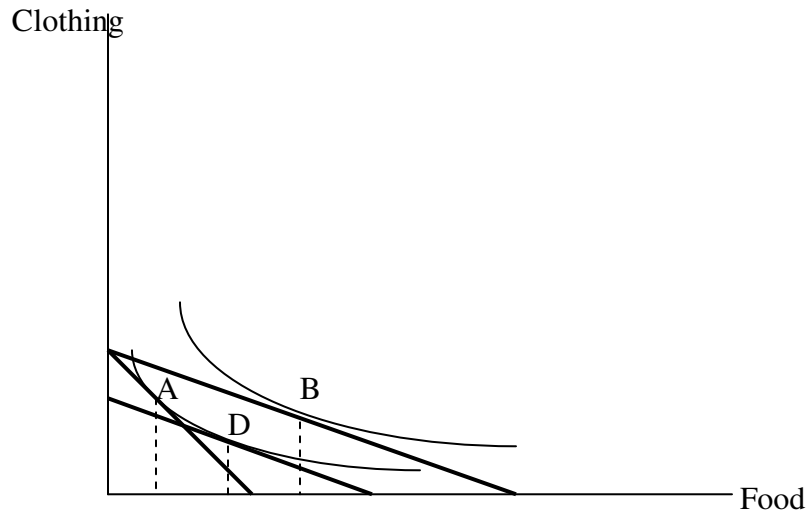
It turns out that the changes in income and prices we have considered are related. Specifically, think about what happens when the price of a good changes. Suppose the price of food falls. Two things occur:

- 1) Food is now cheaper relative to clothing. This change in relative prices tends to cause consumers to buy more of the cheaper good. Hence, the quantity of food demanded rises. This is called the substitution effect.
- 2) Because food is cheaper, the consumer experiences an increase in real purchasing power. Even if his nominal income stays the same, a decrease in the price of a good allows the consumer to buy more with that income. In other words, it is as if the consumer is earning more income than before. This increase in the consumer's income could cause food consumption to rise or fall, depending on whether it is a normal or inferior good. This effect is called the income effect.

For normal goods, the income and substitution effects work in the same direction.

$$\begin{aligned}
 \downarrow P_F &\Rightarrow \uparrow \text{ food demanded due to substitution effect and} \\
 &\quad \uparrow \text{ food demanded due to income effect} \\
 &\Rightarrow \uparrow \text{ food demanded}
 \end{aligned}$$

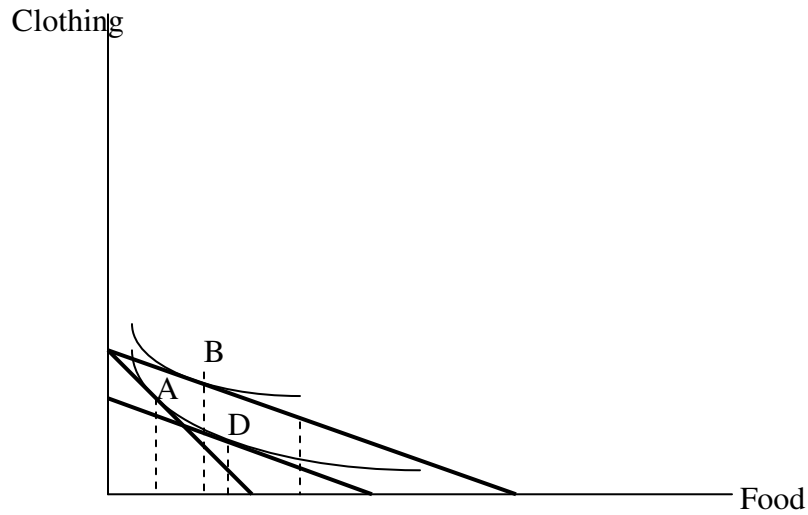
We can show this on an indifference diagram. When the price of food falls, we can show the substitution effect by rotating the budget constraint to its new slope (reflecting the new price ratio) but holding utility constant. This shows the consumer's new consumption bundle if real income (utility) were held constant. The income effect is then shown by shifting this budget constraint to its actual new position.



The consumer starts at point A. Then the price of food falls. If we changed relative prices but kept the consumer just as well off (same utility) as he was before, the consumer would buy more food and move to point D. (Note that since $\downarrow P_F \Rightarrow \downarrow$ slope of budget constraint, and since we are holding the utility level constant so that slope of budget constraint = slope of indifference curve and since the indifference curve gets flatter as we buy more food, the substitution effect of a price decrease must always result in more of that good being consumed.

Of course, that is not the actual new budget constraint. We can shift this hypothetical constraint out to its actual position, and the move from D to B is the income effect, in this case positive because we've assumed that food is a normal good.

If food were an inferior good, the effect of the shift from D to B would be negative.



Here, food consumption has still risen because the substitution effect overwhelms the income effect. Note, though, that this result is somewhat ambiguous, since for an inferior good,

$$\begin{aligned} \downarrow P_F &\Rightarrow \uparrow \text{ food demanded due to substitution effect and} \\ &\quad \downarrow \text{ food demanded due to income effect} \\ &\Rightarrow ? \end{aligned}$$

It is possible, in theory, for the income effect to be so strong as to overwhelm the substitution effect. In that case, $\downarrow P_F \Rightarrow \downarrow$ food demanded. In this case, the demand curve will be upward-sloping. Such a good is called a Giffen good, named after the economist who first noticed this perverse possibility. This possibility has little practical significance, though, since it requires a huge income effect. There are no goods that are commonly recognized as Giffen goods.

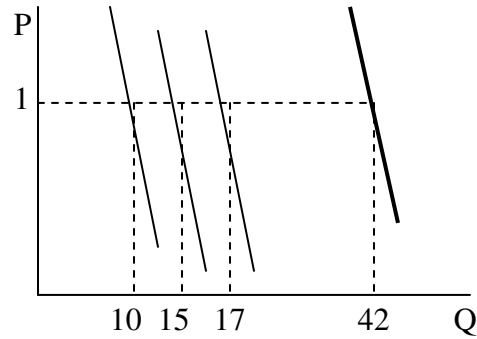
Market Demand

Once you get an individual's demand for a good, getting market demand is easy. You simply add up quantity demanded for each consumer at each price, and there's your market demand. This process is sometimes called horizontal summation.

Suppose we know some points on the demand curve for the following three people:

<u>Price</u>	<u>Mr. X</u>	<u>Mr. Y</u>	<u>Mr. Z</u>	<u>Mkt. Demand</u>
\$1	10	15	17	42
\$2	8	12	12	32
\$3	6	9	8	23

We can also see this process graphically



A couple of points about this:

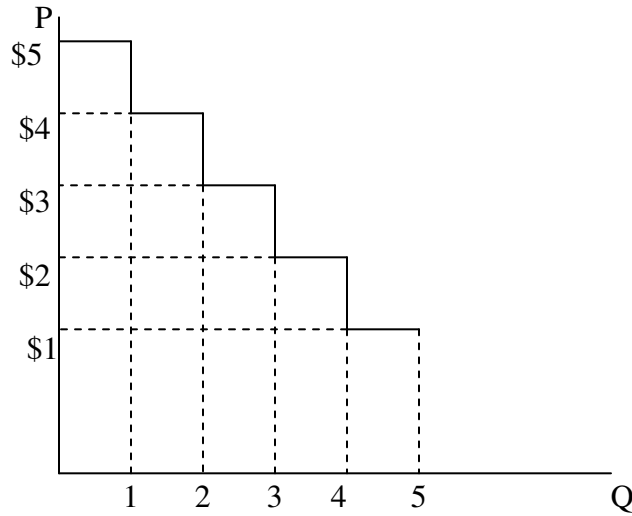
- 1) *As more consumers enter the market, the market demand curve will shift to the right.* This must be true because there will be more demand curves to add together as more consumers are present.

- 2) *Anything that affects individual demand will affect market demand the same way.* Suppose that this is a normal good. Since an increase in income shifts individual demand curves to the right, then market demand must shift to the right.

Consumer Surplus

From time to time, we will want to be able to talk about how “well off” consumers are as a group. The usual way to quantify such a statement is through the use of consumer surplus. For an individual, consumer surplus is the difference between what a consumer is willing to pay for a good and the amount actually paid (the price). Notice that CS is a lot like profit for the consumer.

Notice also that we can measure consumer surplus using the demand curve. Suppose the consumer has the following demand curve:



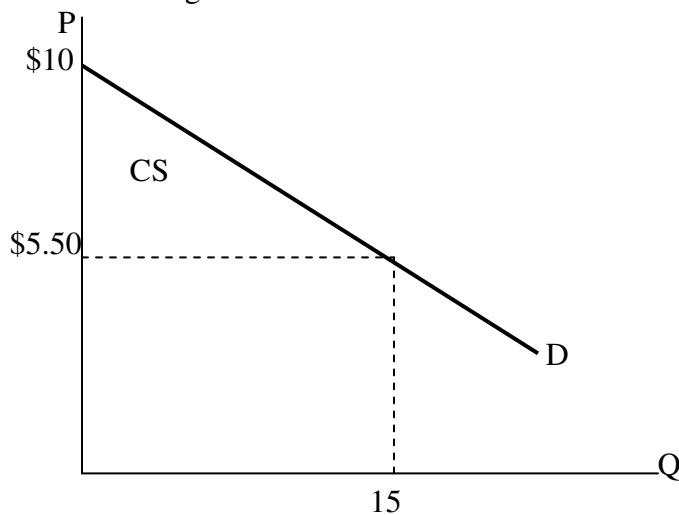
Suppose this diagram shows a person's demand for soda pop. The consumer is willing to pay \$5 for the first can, \$4 for the second, \$3 for the third and so on. Suppose that the market price is \$2. Then the consumer will buy 4 pops (as we see from the graph) and earn the following:

$$CS = \$3 + \$2 + \$1 + \$0 = \$6$$

If the price were \$3.50, the consumer would buy two and earn

$$CS = \$1.50 + \$0.50 = \$2.$$

If we make the good evenly divisible so that the demand curve is smooth, then CS is simply the area under the demand curve and above the market price, a triangle if the demand curve is a straight line.



In this diagram, \$10 is referred to a “choke price,” because that is the price that chokes off demand; nobody wants to buy the good at that high a price. If the current market price is \$5.50, then CS is the sum of the distances between D and P for each unit of output, or the area of the triangle formed by the choke price, P, and Q_D , in this case

$$CS = (1/2)(4.50)*15 = \$33.75$$

If D is an individual’s demand for this product, then this gives us the individual’s consumer surplus. However, if D is the market demand curve, then this measure gives us the total CS earned by consumers as a group.

Note that as P falls, CS rises. That is, consumers as a group are made better off by lower prices since they get to buy more for less. This isn’t surprising, but does show that CS seems to correlate with utility (which also increases as we move down the demand curve), and it seems to make CS at least a decent measure of consumers’ well-being.

We will use CS quite a bit in upcoming chapters when we study social welfare. However, we can already see some of the uses for such a measure:

Example: Clean Air (from book but with different numbers).