In Chapter 4, we were introduced to the law of demand and showed how that demand curves are negatively sloped. In this lecture, we'll develop a model of consumer choice to provide the economic logic behind the negatively sloped demand curve. The theory of consumer choice is based on the principle that consumers maximize their satisfaction given the limits of their incomes and prices. As we'll see, every point along a demand curve represents the best choice for a consumer.

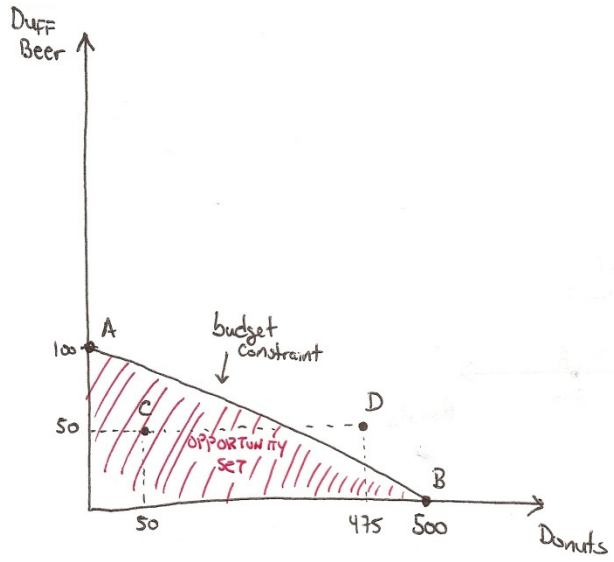
I. Budget Constraint

Consider first the constraints faced by a consumer. What prevents you from purchasing everything you want to consume? One obvious constraint is how much income or wealth you possess. The **budget constraint** identifies the **opportunity set (choice set)** that is the consumption options that are possible. In other words, the budget constraint shows the bundles of good that consumers *can afford* to buy. Within the opportunity set the households are free to choose any combination of goods they wish. We'll look later in this chapter on how consumers make that decision.

Suppose that that Homer has an income of $1000 a month to spend on two goods: donuts and Duff Beer. Further assume that the price of a case of Duff Beer is $10 and the price of a donut is $2. If Homer spent his entire income on Duff Beer, he will purchase 100 cases of beer, but 0 donuts (Point A). Homer could have chosen to spend his entire income on donuts instead. In this case, he would purchased 500 donuts, and 0 cases of beer. (Point B) Connecting these points reveals the budget constraint. At any point along the budget constraint, Homer is spending his entire income on some combination of beer and donuts that will exhaust his budget. All the combinations of beer and donuts that lie on and below the budget constraint represent the opportunity set. These are the combinations of the two goods that Homer can afford. For example Homer can choose a point inside the opportunity set such as Point C which represents a bundle of 50 beers and 50 donuts. Homer can certainly afford this bundle since the total cost will amount to (50 x $10) + (50 x $2) = $600.

Points outside the budget constraint are unattainable. They represent bundles of goods that cannot be purchased. For example Point D represents a bundle of 50 beers and 475 donuts. The total cost for this bundle is (50 x $10) + (475 x $2) = $1450 which exceeds Homer's budget. (We're assuming for now that there is no borrowing).

Figure 1

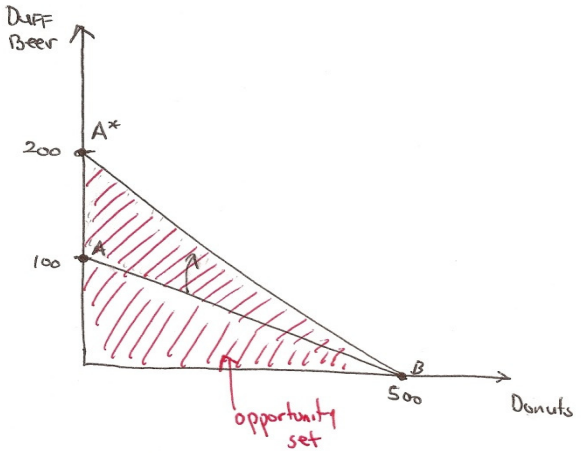


Changes in the prices of the goods and/or income will affect the budget constraint.

A. Change in Price

Suppose that there was a decrease in the price of beer from $10 to $5. How would that affect the budget constraint? Well now Homer knows if he spent his entire income on beer, he can purchase 200 cases instead of 100. (Point A* in Figure 2) Since the price of donuts hasn't changed, if Homer spent his entire income on donuts he'll still be able to only purchase 500. Figure 2 illustrates the new budget constraint. Notice that the budget curve has pivoted upward. The opportunity (choice) set has increased from the original opportunity set. Homer can afford more bundles than he did before. Homer is clearly better off now than before due to the lower beer prices. The opposite will be true if prices increased.

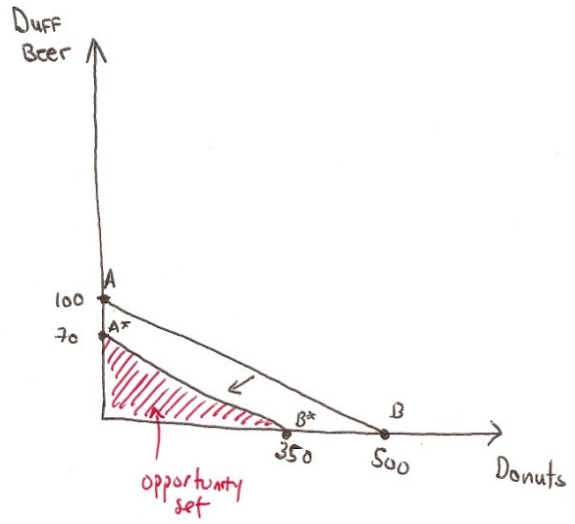
Figure 2



B. Change in Incomes

Let's go back to our original example where the price of beer is $10 and donuts are $2. Suppose that Homer's boss, Mr. Burns decided to cut Homer's salary from $1000 a month to $700 a month. How will this affect the budget constraint? If Homer were to spend his entire new salary on beer, he can only purchase 70 cases of beer. Likewise if he were to spend his entire income on donuts he would only be able to purchase 350 donuts. Figure 3 illustrates this new budget constraint. The reduction in income has shifted Homer's budget constraint inward to the left. Homer's choice set is smaller than before. Homer is worse off after his reduction in income since he can afford less bundles than he used to. The opposite would occur if Homer's income increased.

Figure 3



II. Utility

We have seen that households have limits which constrain their budget choices. We next turn to the question on how consumers choose their basket of goods they want to consume given these constraints.

In our consumer theory, we'll assume that consumers are able to rank the goods they consume and give some indication of their preferences. In order to measure preferences, economists use a measure called **utility.** Utility simply measures the satisfaction consumers gain from consuming a good.

There are two obvious problems with the utility measure.
(1) We can't hook up individuals to "utility meters" to measure the benefit individuals receive when they consume a good. Difficultly in measuring utility is one problem.
(2) Another problem is that we can't compare utility among different individuals. Everyone has different tastes and preferences. One person can place high value on broccoli, while another would gain no satisfaction (and perhaps even negative utility) consuming broccoli. Utility cannot be compared across individuals.

With these caveats in mind, let us proceed in examining utility.

Total utility is the total amount of satisfaction obtained from all units consumed. At the same time, each unit of good that is consumed add some measure of happiness. **Marginal utility** is the extra satisfaction (utility) received from consuming **one more** unit of a good. Table 1 more clearly illustrates this distinction between total utility and marginal utility.

Table 1: Total Utility and Marginal Utility

Quantity of Movies	Total Utility	Marginal Utility
0	0	
1	48	48
2	93	45
3	135	42
4	171	36
5	201	30
6	225	24
7	243	18

Table 1 shows hypothetical utility received by Al when he goes to watch a movie in the theater. When Al watches 1 movie his total utility is 48. His marginal utility is also 48 since he went from 0 utility to 48 units of utility by watching **one more** movie. Suppose that when Al goes and watches 2 movies the total satisfaction he gets is 93 units of utility. What is his marginal utility? His marginal utility is the extra utility received by watching the 2nd movie. We already know that he got 48 units of happiness from the first movie, thus the difference between the total utility of 93 and the utility received from the first movie will give us the additional utility the 2nd movie gave Al. In this case it is 93-48 = 45. Be sure you could complete the marginal utility column in Table 1 given total utility. Figure 4 graphically illustrates total utility, while Figure 5 graphically illustrates marginal utility.

Figure 4

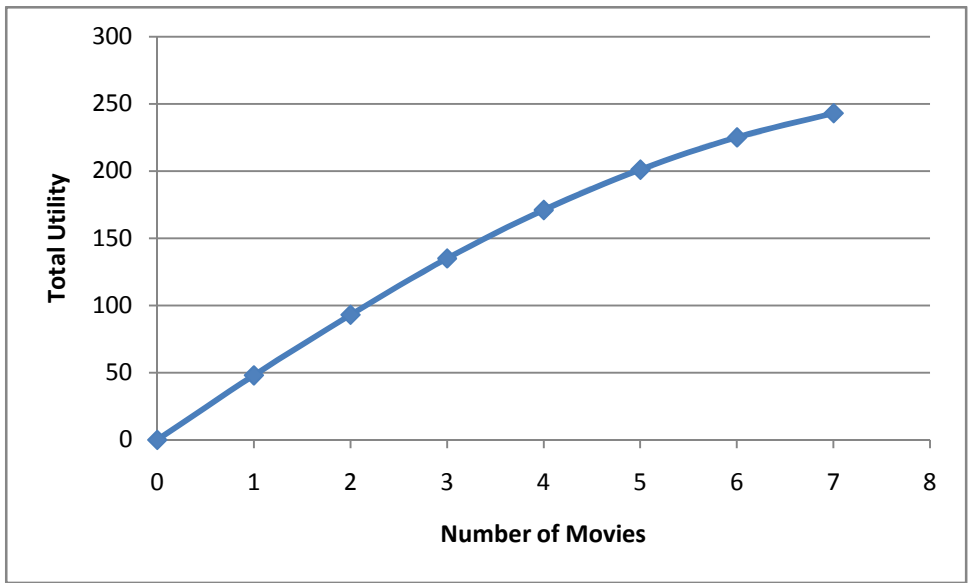
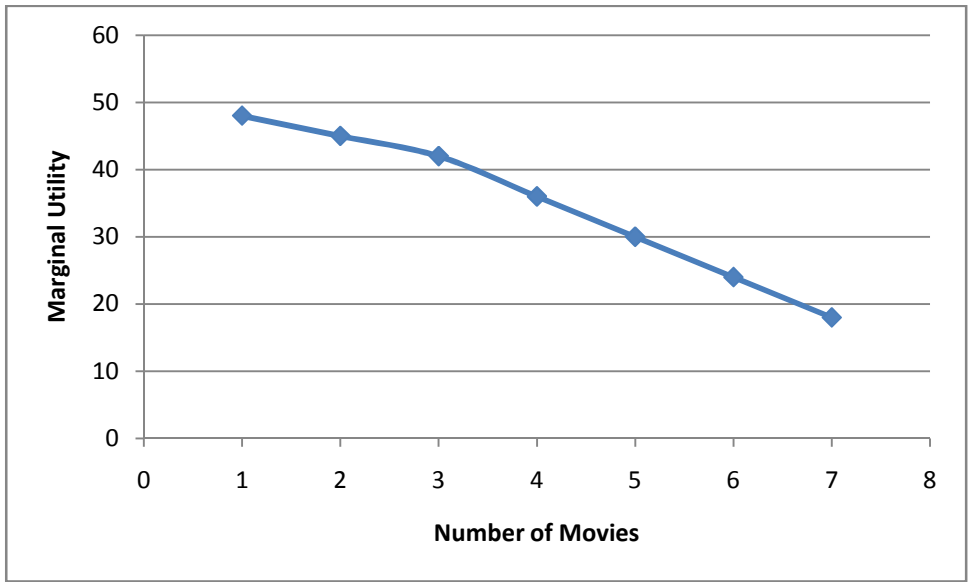


Figure 5



Key Point: Note that marginal utility decreases as the number of movies increases. The fact that marginal utility has a negative slope is due to the **law of diminishing marginal utility.** In words, the more a person consumes of any one good (in a given period), the less satisfaction is generated by each additional unit of the same good. In our example, suppose the given period is 1 day. When Al watches his first movie, he'll be very happy. When he watches his 2nd movie of the day, Al would also be happy but not as much as he was with the first movie. By the time he gets to the 7th movie, Al will start getting sick of watching movies. He might still get some satisfaction out of it, but not as much as he did at first.

A more intuitive example is suppose that you just came back from crossing the Mohave Desert and someone offered you a cold can of Coca-Cola. You'll be extremely satisfied with that first can and thus your marginal utility is very high. By the time you drink you're 15th can of Coke,

you might get to the point where you drinking another can of Coke might make you sick. In this case your marginal utility might be 0 (or be negative).

Assume that Joe has $80 to spend on books and movies each week and that both goods must be purchased whole. Movies cost $8 each, and books cost $20 each. Joe's preferences for movies and books are summarized by the following information.

Number of Movies per Week	Total Utility	Marginal Utility
1	50	50
2	80	30
3	100	20
4	110	10
5	116	6
6	121	5
7	123	2

Number of Books per Week	Total Utility	Marginal Utility
1	22	22
2	42	20
3	52	10
4	57	5
5	60	3
6	62	2
7	63	1

How does Joe determine how many movies and books to consume given his budget and given the prices of books and movies?

Joe would want to consume the bundle that would maximize his utility. If Joe consumed 7 movies and 7 books in a week his utility would be (123+63 = 186). No other combination of books and movies would allow Joe to gain as much happiness. The problem for Joe is that this bundle is unaffordable. The cost of 7 movies is $56 (7 x $8) and the cost of 7 books is $140 (7 x $20). The total cost of $196 far exceeds Joe's budget of $80. The rule of thumb is that Joe should maximize his utility **given his budget constraint.** We could do some guess and check to figure out how to determine this bundle, but fortunately there is a straightforward way to find the optimal bundle.

Utility Maximizing Rule: In choosing the optimal bundle of goods to consume it must be the case that the extra benefit (utility) received per dollar spent in good X has to be equal to the marginal benefit (utility) received per dollar spent in good Y.

$$\frac{MU_X}{P_X} = \frac{MU_Y}{P_Y}$$

Where
MU_X = marginal utility from the last unit of good X consumed
MU_Y = marginal utility from the last unit of good Y consumed
P_X = price per unit of X
P_Y = price per unit of Y

The marginal utility per dollar spent on good X has to equal the marginal utility per dollar spent on good Y. To see why this must hold, consider what would happen if $MU_X/P_X > MU_Y/P_Y$. This would imply that if you spent an extra dollar on Good X instead of Good Y you would get more happiness. Thus households will consume more of good X (which decreases MU_X) and will consume less of good Y (which increases MU_Y) this will continue until $MU_X/P_X = MU_Y/P_Y$. Similar logic could be used if $MU_X/P_X < MU_Y/P_Y$. Thus when deciding between adding one more unit of Good X or Good Y to your basket you need to compare the marginal utility per dollar spent on both goods. This idea will hopefully be made clear by the following example.

Let's add a column to our table looking at Marginal Utility per dollar spent for both movies and books.

Number of Movies per Week	Total Utility	Marginal Utility	Marginal Utility per Dollar (Movie Price = $8)
1	50	50	50/8 = 6.25
2	80	30	30/8 = 3.75
3	100	20	20/8 = 2.50
4	110	10	10/8 = 1.25
5	116	6	6/8 = 0.75
6	121	5	5/8 = 0.625
7	123	2	2/8 = 0.25

Number of Books per Week	Total Utility	Marginal Utility	Marginal Utility per Dollar (Book Price = $20)
1	22	22	22/20 = 1.1
2	42	20	20/20 = 1.0
3	52	10	10/20 = 0.50
4	57	5	5/20 = 0.25
5	60	3	3/20 = 0.15
6	62	2	2/20 = 0.10
7	63	1	1/20 = 0.05

Let's see how Joe will determine what his optimal bundle will be given his budget constraint of $80. Joe first decides whether he should consume 1 book or 1 movie. The movie gives a

marginal utility per dollar of 6.25 which is greater than the marginal utility per dollar of the first book. Thus Joe will add 1 movie to his bundle and the total amount spent is $8. Next Joe will decide whether he will want to consume a 2nd movie or his first book. The 2nd movie will have a marginal utility per dollar of 3.75 which is still greater than the marginal utility per dollar of the 1st book. Thus Joe will consume his 2nd movie (total spent is $16 now). In fact the marginal utility per dollar is greater for both movies 3 and 4 than for the first book. Thus Joe will consume at least 4 movies (total cost of $32). Now when Joe has to decide between the 5th movie and the 1st book does the marginal utility per dollar of the book is greater than the marginal utility of the movie. Thus Joe should buy the first book. Likewise the 2nd book has a marginal utility per dollar that is greater than the marginal utility of the 5th movie. Finally when comparing between the 5th movie and the 3rd book, Joe will find that the marginal utility per dollar spent on the 5th movie is greater than the marginal utility per dollar of the 3rd book. Thus Joe should spend his money on the 5th movie. Joe's basket is 5 movies and 2 books. Note that at this point Joe's budget is exhausted as the total cost of the basket is (5 x $8) + (2 x $20) = $80. No other affordable combination of movies and books could have made Joe as happy as this combination.

Now that we understand marginal utility per dollar spent, you can easily see why an increase in price would decrease the quantity demanded of a good. For example suppose that the price of the movie jumps from $8 to $16, while the price of books remained the same. What will happen?

Number of Movies per Week	Total Utility	Marginal Utility	Marginal Utility per Dollar (Movie Price = $8)	Marginal Utility per Dollar (Movie Price = $16)
1	50	50	50/8 = 6.25	50/16 = 3.13
2	80	30	30/8 = 3.75	30/16 = 1.88
3	100	20	20/8 = 2.50	20/16 = 1.25
4	110	10	10/8 = 1.25	10/16 = 0.625
5	116	6	6/8 = 0.75	6/16 = 0.375
6	121	5	5/8 = 0.625	5/16 = 0.313
7	123	2	2/8 = 0.25	2/16 = 0.125

If we do the same type of analysis as before we find that the Joe would prefer to watch movies 1, 2 and 3 over purchasing the 1st book. When he compares whether he wants to purchase a 4th movie or his 1st book he'll choose a book (since the marginal utility per dollar is 1.1 for a book vs. 0.63 for the 4th movie). At this point he'll have to stop. He can't purchase any more movies or books as that would put him above his budget. His bundle will be 3 movies and 1 book. Note that the price increase in movies has resulted in fewer movies than Joe is willing to purchase. **The relationship between price and quantity demanded is negative.**