BOSTON UNIVERSITY
Global Development Policy Center
Economics in Context Initiative

Chapter 4: Consumption and Decision Making

Appendix

Appendix to Chapter 4 of *Essentials of Economics in Context*

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APPENDIX: A FORMAL THEORY OF CONSUMER BEHAVIOR

A1. THE ASSUMPTIONS

This appendix presents in more detail the standard economic model of consumer behavior. In this model, the consumer is seeking to maximize his or her utility. Note that this model, by its very nature, cannot include much of the contextual variables discussed in the chapter, including factors that our preferences.

The consumer is assumed to be well informed and rational and to consider only his or her own preferences, budget, and prices in making a consumption decision. For simplicity, we assume there are only two goods, good *X* and good *Y*.

A2. THE BUDGET LINE AND ITS SLOPE

The combinations of *X* and *Y* that are available to the household are shown by a budget line, like that in Figure 4.6. The budget line arises because the sum of the consumer's expenditures must add up to—not exceed—the consumer's income. Mathematically:

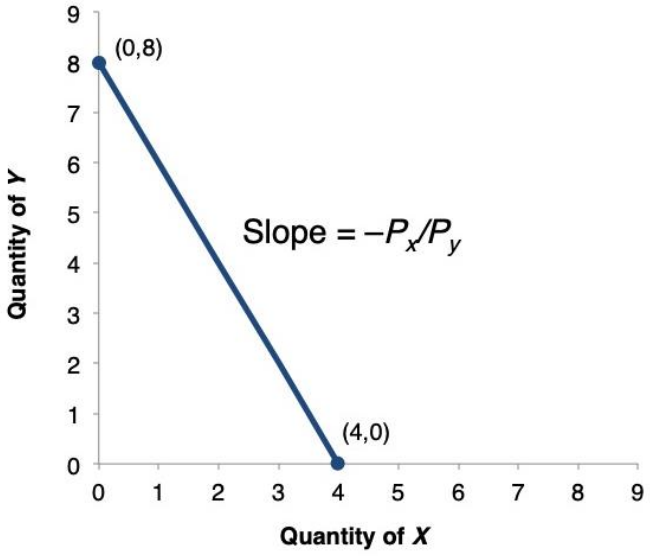
$$P_x x + P_y y = \text{Income}$$

where *x* and *y* denote the quantities purchased of each good, and P_x and P_y are their respective prices. This equation can be rearranged, algebraically, into slope-intercept form (i.e., $y = a + bx$, where the intercept *a* gives the value of *y* when *x* equals 0, and *b* is the slope of the line). This yields:

$$y = \frac{\text{Income}}{P_y} - \frac{P_x}{P_y} x$$

For example, in Figure 4.6, income could be \$40, the price of *X* could be \$10, and the price of *Y* could be \$5. The budget line crosses the *y*-axis at 40/5 = 8 units of *Y* and has a slope of −10/5 = −2. In general, we note that the budget line has a slope equal to $-P_x/P_y$.

Figure 4.6 The Budget Line and Its Slope

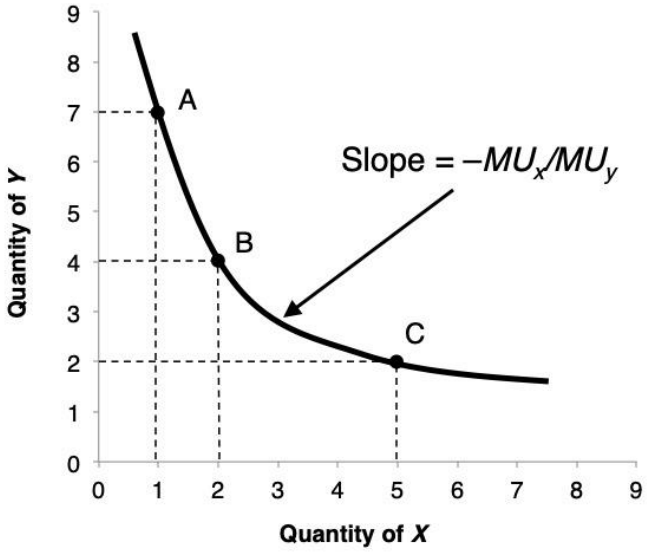


A3. INDIFFERENCE CURVES

The consumer's preferences concerning the two goods can be illustrated on the same graph by using the concept of **indifference curves** pioneered by the economist Paul Samuelson. Indifference curves show combinations of the two goods with which the consumer would be equally satisfied (i.e., has the same utility). Indifference curves are generally thought to have the bowed-in-toward-the-origin shape shown in Figure 4.7. This shape arises because we assume that the consumer experiences diminishing marginal utility for both *X* and *Y*.

indifference curve: a curve consisting of points representing combinations of various quantities of two goods, such that every such combination gives the consumer the same level of utility

Figure 4.7 An Indifference Curve



Suppose the consumer starts out at point A, with a large amount of *Y* (7 units) but relatively little of *X* (only 1 unit). At point A, the consumer has a fairly low marginal utility of *Y*, because she is already consuming a lot of it, and a fairly high marginal utility of *X*, because she has only a little of it. (Refer to the shape of Figure 4.4 if necessary. Utility flattens out if you have a lot of a good and rises steeply if you have little.) She will be willing to give up some of *Y*—marginal units from which she is getting relatively little utility, anyway—to get more of *X*, a good that still has fairly high marginal utility. If she is just willing to give up 3 units of good *Y* to get 1 additional unit of good *X*, then she is indifferent between point A and point B. The slope of the indifference curve can be mathematically shown to be equal to $-MU_x/MU_y$, where MU_x is the marginal utility of *X* and MU_y is the marginal utility of *Y*. As we see on the graph, the slope of the indifference curve between point A and point B is approximately −3 (rise/run on a straight line between the points = −3/1). The ratio of marginal utilities, MU_x/MU_y is called the **marginal rate of substitution**, which tells how much of one good the consumer is willing to give up to get more of the other.

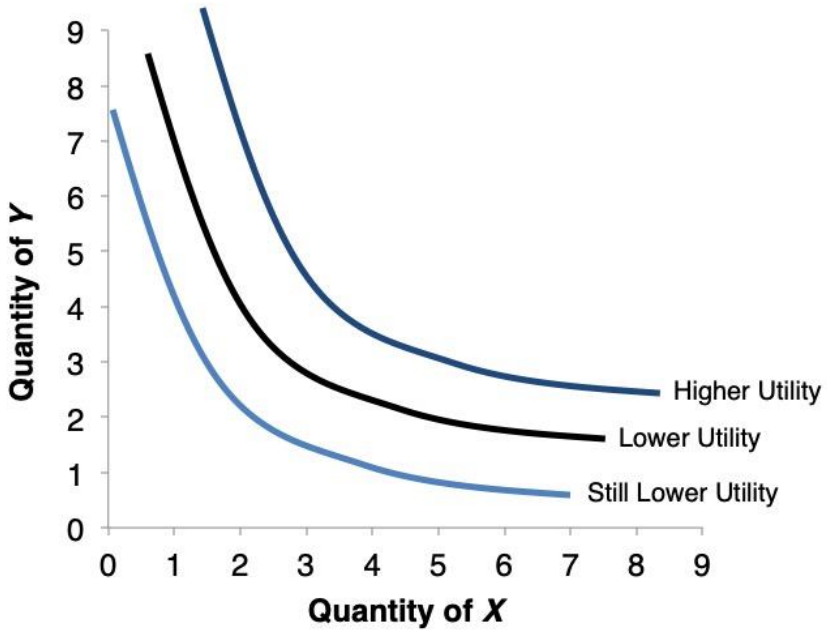
marginal rate of substitution: how much of one good the consumer is willing to give up to get more of another

However, at point B, the consumer's marginal utility from good *Y* will have risen from what it was at point A, because she is consuming less of it. Meanwhile, her marginal utility from *X* will have fallen, because she is consuming more of it. She will be more reluctant to give up more units of *Y* in exchange for further units of *X*. Likewise, because she is now consuming more *X*, she is less eager to get more of it than she was before. This means that if she is presented with further opportunities to trade, she will demand *more X* to compensate her for giving up any more *Y*. If forced to give up 2 more units of *Y*, Figure 4.7 shows that she will now require 3 more units of *X* to keep her utility at the same level. The approximate slope of the indifference curve between point B and point C is –2/3, and the marginal rate of substitution is now approximately 2/3. Indifference curves tend to be steep at low levels of consumption of *X* (or whatever good or service is on the *x*-axis) and then flatten out as you move to the right, as a consequence of diminishing marginal utility. Thus we have a falling marginal rate of substitution.

A4. UTILITY MAXIMIZATION

Different levels of utility are represented by different indifference curves. Because the standard economic model assumes that consumers always want more of at least one good (and usually of both goods), this "more is better" assumption means that utility rises as you move upward and to the right on the graph. Figure 4.8 shows three examples of indifference curves, corresponding to three different levels of utility.

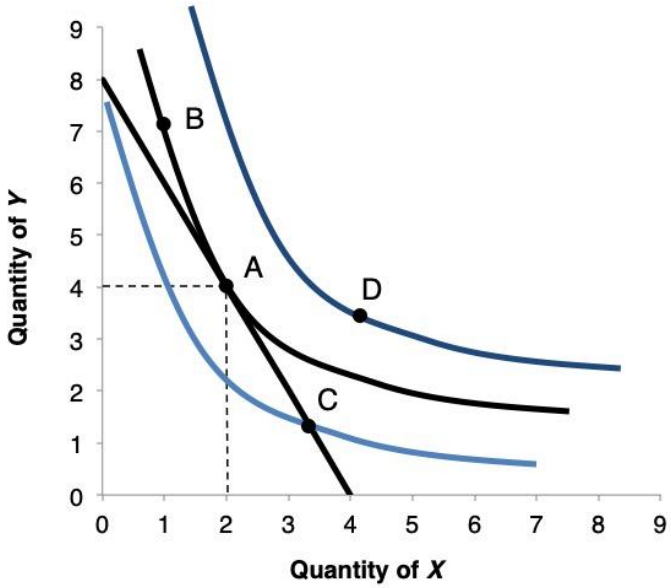
Figure 4.8 Different Levels of Utility



The consumer's problem, then, is to get to the highest level of utility possible, given her budget. This problem and its solution are illustrated in Figure 4.9. The consumer can afford many points on the lowest indifference curve—much of the curve lies below and to the left of the budget line. If she chose to consume

at point C, she would use up all her budget. But this is not the best that she can do. Points A and B would both give her more utility than point C, and point D would give her even more. Points B and D are unobtainable, however, because they are above the budget line.

Figure 4.9 Utility Maximization



The best the consumer can do is get onto the indifference curve that just touches his budget line, at point A, purchasing 4 units of *Y* and 2 units of *X*. At point A, the two curves just touch and have the same slope. That is:

$$-\frac{MU_x}{MU_y} = -\frac{P_x}{P_y}$$

which can be algebraically rearranged into:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y}$$

This equation states that the consumer will maximize her utility when the marginal utility per dollar spent on *X* is equal to the marginal utility per dollar spent on *Y*. If this were not true, and the last dollar spent on good *X* produced more utility than the last dollar spent on good *Y*, the consumer could increase her utility by switching a dollar from *Y* to *X*. She can continue to increase her utility in this manner until the last dollar spent on each good provides similar marginal utility.

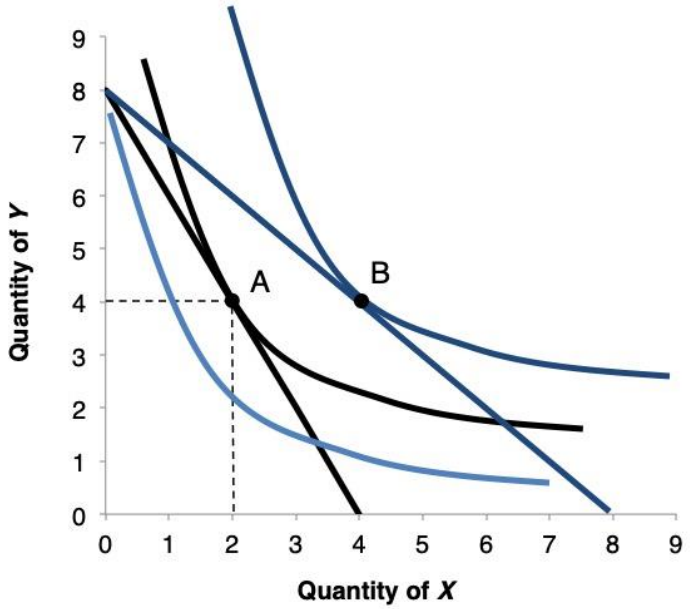
If we add a third good, *Z*, or as many as we want, the rule remains the same. To maximize utility, a consumer should equate the marginal utility per dollar spent for all goods, or:

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \frac{MU_z}{P_z} = \cdots$$

A5. RESPONSE TO VARIATIONS IN PRICE

We can also use a utility maximization graph to theorize about consumer response to a price change. For example, Figure 4.10 shows what might happen if the price of *X* drops from $10 to $5 (with income held constant at $40). Now the budget line is higher at all points, except where it meets the *y*-axis. The consumer is thus able to afford more of the goods than before and to reach a higher indifference curve. The consumer portrayed in Figure 4.10 will now choose to consume at point B, which maximizes her utility based on her new budget line.

Figure 4.10 Response to a Change in Price



Given the assumptions of this model, it is clear that the consumer has higher utility after the fall in price. Generally, it will be true that consumers will buy more of a good when its price falls. In Figure 4.10, we see that point B is farther to the right than point A, indicating that the consumer purchases more of good *X*, which has become cheaper.

This model further demonstrates why demand curves slope downward. Realize that it would be difficult (but not impossible) to draw indifference curves in Figure 4.10 so that the price decline for good *X* results in less of good *X* being purchased.

What happens to the level of purchases of good *Y* when the price of good *X* falls? This is hard to predict without knowing more about the particular goods. The way Figure 4.10 is drawn, it looks like the quantity of good *Y* purchased stays about the same. But this need not be the case—the quantity of good *Y* purchased could also increase or decrease. You can try drawing different indifference curves to obtain each result. What ultimately happens to the quantity of good *Y* purchased depends on the magnitude of the changes in the consumer's income versus the magnitude of changes in relative prices. Why is this? On one hand, a fall in the price of Good X effectively gives the consumer more income to purchase more of Good Y. This increases the incentive to consume more of Good Y. However, the fall in price of Good X also makes

Good Y relatively more expensive (when compared to the price of Good X). This creates a disincentive for the consumption of Good Y.