Notes on Intermediate Microeconomics

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Spring 2023

1 Consumer choice

In this chapter, we present the basic model of consumer behavior. That is, we discuss how we represent the problem of an individual's choice of what to consume. In our historical context, it seems reasonable to cast this problem as that of a person that has at her disposal a certain amount of dollars (**income**) that she can spend in an array of goods and services, each of them available at a particular **price**. The consumer faces trade-offs, since the more she spends in one good (the more of one good she purchases) the less she can purchase of other goods or services. So, the problem for that consumer is what basket (**bundle**) of goods to purchase with her income given the prices of those goods.

Different consumers, even if endowed with the same income and facing the same prices, would solve this problem differently. Inded, their decisions will follow their possibly different **tastes**, which, as a starting point, we may take as innate. (True: probably only a small part of our tastes is innate, and much is learnt, influenced by advertising, peer pressure, etc., but let us abstract from all those factors for now.) Income may be represented by a number (of dollars) and each price can also be represented by a number (of dollars per unit). How do we prepresent the preferences or tastes of a consumer? Coming up with such representation is our first task. Notice that to do so, we may begin ignoring prices, income, and actually everything that has to do with the economic system. Indeed, all we want to represent is how a particular individual

1.1 Preferences

Our ultimate goal will be to investigate what **bundle** of goods the consumer will purchase, so preferences refer to these (conceivable) bundles of goods: the consumer's (conceivable) choices. It is important that you keep this in mind. In particular, a question like whether a consumer prefers tea to coffee, or pizza to beer, is not a relevant question. If you think of it, such questions don't make too much sense (how much coffee to how much tea, and does it need to be ONLY coffee or tea, not certain amount of coffee AND certain amount of tea?). The questions that the consumer needs to answer is whether she prefers certain bundle of goods (so much coffee, so much tea, so much pizza,...) to another bundle of goods (again, so much coffee, so much tea,...).

Thus, let us begin explaining how we may represent a bundle of goods. That seems quite straightforward: if there are n goods/services out there (n goods/services the consumer may spend some of her money in), then a bundle may be represented as a list of n quantities, each representing the amount of one of the n goods. For simplicity, suppose there were only two goods/services, call them good 1 and good 2. (Although we will restrict our discussion to this case, it should be straightforward how to generalize that discussion.) Then a consumption bundle could be represented by a pair of numbers, (x_1, x_2), where x_1 is how much good 1 there is in the bundle and x_2 is how much good 2 there is in the bundle. Example: $(3, 4)$ represents a bundle with 3 units of good 1 and 4 units of good 2. (E.g., three loaves of bread and 4 pints of juice, if good 1 is bread and good 2 is juice.)

So all conceivable bundles may be represented by all vectors of n (2, if $n = 2$) non-negative real numbers. Graphically, when $n = 2$, this is the positive quadrant of a standard Cartesian axes system (yes, the x, y plane).

With this representation of all conceivable bundles, the tastes of a consumer may be thought of as a ranking of all of them. Simply put, a particular way of ordering all those possibilities. That is, for $n = 2$, a ranking (order) of all points in the positive quadrant in the x, y axes graph.

Remember: two consumers may differ in the way they rank two bundles. E.g., consumer A may prefer $(3, 4)$ to $(4, 3)$, whereas consumer B may prefer the latter to the former. That is what we consider innate for the consumer: how the consumer ranks all possible bundles.

Note: I (and probably you) could rank a bundle with one seat at Musk's rocket next trip and two beers, and another bundle with no trip and five beers, even if I cannot afford the former. (I won't tell you my ranking.) In other words, a consumer may rank (has tastes/preferences) **beyond and independent** of feasibility (income and prices). When we talk about preferences, income and prices are not in the picture.

Example: Suppose that we thought that the largest number that exists is 4. Also, suppose that we could not think of fractions: you may have one unit, two units,... of one good, but there is no such thing as 1.65 units of that good, for example. (During this course, we will sometimes make this latter assumption, and some other times we will assume that goods are infinitely divisible, so that talking of 1.659823 units makes sense, and even talking of $\sqrt{2}$ units makes sense.) Then the points in Figure 1 represent all the possible bundles.

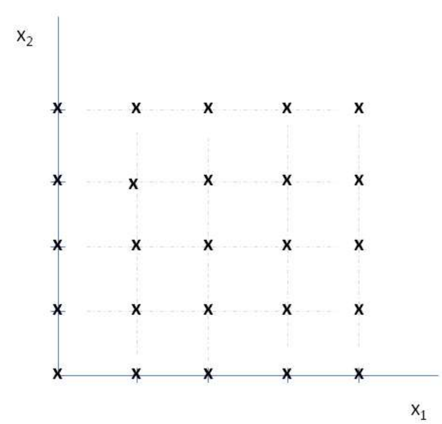

Figure 1

Make sure to understand what this graph represents: it is not a function but just a representation of a set of points, each defined by two components, the values of x_1 and x_2. Each point represents a bundle, respectively with x_1 units of good 1 and x_2 units of good 2. Thus, a consumer's preferences is simply an ordering of these (25, in this case) points (bundles). **For instance**, the following ordering is a possible preference profile:

Ranking						
1	(4,4)					
2	(3,4)	(4,3)				
3	(1,4)	(2,4)	(3,3)	(4,2)		
4	(0,4)	(0,3)	(1,3)	(2,3)	(3,2)	(4,1)
5	(1,2)	(2,2)	(3,1)	(4,0)	(2,1)	
6	(0,2)	(1,1)	(3,0)			
7	(0,1)	(1,0)	(2,0)			
8	(0,0)					

Table 1

Note that some bundles are ranked at the same level. That means that the consumer is **indifferent** between them. For instance, the consumer in the example is indifferent between a bundle with 3 units of good 1 and 4 units of good 2, and a bundle with 3 units of good 1 and 4 units of good 2.

1.1.1 Properties of preferences

Do you think that this ordering (ranking) makes sense? It does not matter: it only needs to make sense to the consumer. Those are her tastes!

In any case, we may **expect** (and then assume) that most consumers' preferences would satisfy certain properties, that we may postulate as **axioms**:

1) **Completeness**: the consumer can compare (rank) any two bundles. The preferences above satisfy this axiom: taking any two of the 25 bundles, we can ascertain whether the first is preferred to the second or the second is preferred to the first, or the consumer is indiferent between the two. That is, whether one has a higher rank than the other, or the latter has a higher rank than the former, or both have the same rank.

2) **Transitivity**:If the consumer prefers (ranks weakly higher) a certain bundle (x_1, x_2) to some other bundle (y_1, y_2) and then prefers (ranks weakly higher) the latter to a third bundle (z_1, z_2) then it must be the case that the consumer prefers (ranks weakly higher) bundle (x_1, x_2) to bundle (z_1, z_2). (Check that the consumer in our example satisfies this axiom.)

3) We may add (for convenience and since we talk about "goods", not bads) that preferences are **monotone**: more is better than less. Note that the consumer in our example satisfies this axioms in a weak sense, but not

in a strong sense: she is indifferent between some bundles even though one of them has more of one of the goods (but not more of both) than another.

In economics, it is customary to use the symbol $\succsim$ to indicate (weak) preference. Thus, we may write that, for the consumer in our example above, $(1,4) \succsim (0,3)$ and also $(1,4) \succsim (2,4)$. That is, for the consumer the bundle $(1,4)$ is "at least as good" as the bundle $(0,3)$ or the bundle $(2,4)$. Or the consumer weakly prefers the bundle $(1,4)$ to the bundle $(0,3)$ or the bundle $(2,4)$. We reserve the symbol $\succ$ for strict preference (i.e., for the consumer in our example $(1,4) \succ (0,3)$ but $(1,4) \nsucc (2,4)$). Also, the symbol $\sim$ is used for "indifference." For instance, again for our consumer, $(1,4) \sim (2,4)$ (and so, not only $(1,4) \succsim (2,4)$ but also $(2,4) \succsim (1,4)$). You can consider this simply as notation: part of our jargon.

1.1.2 Indifference curves and willingness to trade

A useful **concept** that we will be using once and again is that of **indifference curve**. What we mean by that is a set of bundles over which the consumer is indifferent. For example, for our consumer in Table 1, the **set of bundles** $\{(3,4),(4,3)\}$ is an indifference curve: all the bundles in that set –the two of them– are at the same position in the ranking, and all the bundles in that position are in the set. Also, the set of bundles $\{(0,4,(0,3),(1,3),(2,3),(3,2),(4,1)\}$ is another indifference curve. Note that the consumer ranks all bundles in the former equally, and ranks each of them higher than any bundle in the latter.

Note: Do not be misled. We use the word "curve" (we will see why later), but we are referring to a **set** of bundles. It is important that you do not forget this.

Let's consider what we can learn from looking at one indifference curve. One thing that we can see is that **if** this consumer *owned* the bundle $(2,3)$ and we approached her offering to trade good 1 for good 2, she would be willing to give us **up to** one unit of good 2 in exchange for one extra unit of good 1. (It is **extremely** important that you understand this.) So this rate –one to one– measures her **willingness to trade** (good 1 for good 2) ... **when she sits** at bundle $(2,3)$.

Note, however, that this willingness to trade may be different if she sat at some other bundle. Indeed, if she owned the bundle $(1,4)$ instead, we would have to offer her 2 units of good 1 for her to be willing to give up one unit of good 2.

This rate at which a consumer is willing to trade one good for another, which as you can see is simply a reflection of her preferences, is what we will call **marginal rate of substitution** later on.

1.1.3 The continuous case

The discussion so far was (hopefully) simple enough. We have used an example where the goods were not "divisible", but nothing that we said was really specially tailored to that case. If the goods were perfectly divisible (i.e., we could talk about an amount 3.1256 of good 1, for instance), we could still talk about bundles of goods, rankings of them, indifference curves, willingness to trade, etc. The only difference is that now the components in a bundle (the amount of each good) could be any real number instead of being limited to integers. Also, graphically, the conceivable bundles over which the consumer would have preferences would not be a grid of points as in Figure 1, but the whole positive quadrant of the graph. That is, each point in that quadrant (which, remember, represents two components: the amounts of each good) would represent a possible bundle.

It so happens that the continuous case is easier to handle, as we may then use the (basic) instruments of algebra and calculus. All the discussions are simpler and more concise, and so we typically assume that, indeed, goods/services are perfectly divisible (even though we do not really know what $\sqrt{3}$ loaves of bread or $\frac{1}{2}$ haircuts are!).

Yet, I advise you never to lose sight of the discrete case, which is easier to relate to experience, and resort to it when you feel that you are losing track of what is going on.

For the continuous case, we may write a ranking like the one we wrote before ... except that we cannot write it, of course: there is a continuum (a very large class of infinity) of possible ranking positions (not just first, second, third,...) and possibly a continuum of bundles in each of these positions. Nevertheless, we can still think in these terms. And more importantly, we can still understand what an indifference curve is: one set of (all) bundles over which the consumer is indifferent, that is, occupy the same position in the ranking. Figure 2 shows one possible such indifference curve (now you see why the name "curve").

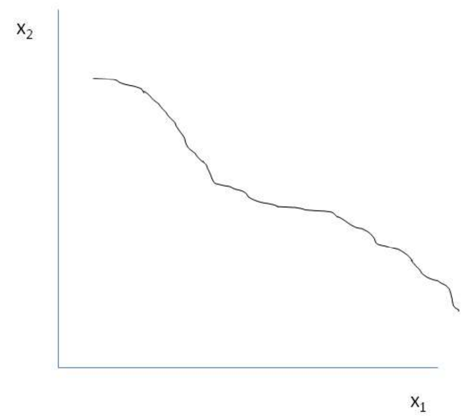

Figure 2

Remember: that curve is nothing but a set of bundles, a bunch of points. The curve may have any shape, but if the consumer is willing to give up some of one good only in exchange for some amount of another good (if such are her preferences), then the indifference curves have to be downward slopping. Make sure that you understand why. Also, try to understand why, if the preferences satisfy transitivity and strict monotonicity (i.e., as opposed to the consumer in our example, the consumer always prefers strictly a bundle with some more of one good and no less of any other good), then two different indifference curves:

1) cannot cross;
2) are lines (i.e., are not "thick");
3) and are indeed, downward slopping.

An example of a **few** indifference curves for the preferences of a consumer that satisfy these conditions is shown in Figure 3. (You should realized that the whole quadrant is "filled" with indifference curves.)

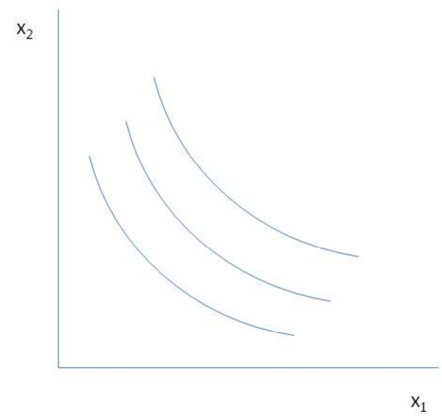

Figure 3

Again, if preferences are monotone as we are assuming, curves further from the origin contain bundles that the consumer (considers just as good as any other in the curve and) prefers to any bundle in a curve closer to the origin. Indeed, for any bundle in the latter, there is one in the former that has more of each of the goods.

Let us now get back to how the indifference curves can give us information about the rate at which the consumer is willing to trade one good for another. That is, what we call the marginal rate of substitution. As we know from the discrete case, in general, this depends on what bundle the consumer is sitting at (what position she is trading from). Suppose the consumer is sitting at bundle $(2, 4)$. In Figure 4 we are representing this bundle and the indifference curve to which this bundle belongs. That is, all the bundles that the consumer finds just as attractive as bundle $(2, 4)$. How much good 2 is the consumer willing to give per unit of good 1 that we offer her, when she starts from bundle $(2, 4)$?

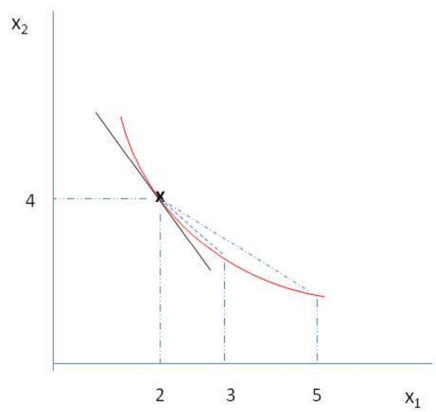

Figure 4

In Figure 4 we have represented two of these trades that would leave the consumer indifferent: one that takes her to end up with one more unit of good 1 (3 units, at the end), and one that takes her to end up with 3 more units of good 1 (5 units, at the end). The negative of the slopes of the two dashed lines in the graph measure the rate at which the consumer gives up good 2 for good 1 in those two different trades. That is, the rate at which the consumer is willing to trade may be different depending on how large a trade we are talking about, even starting from the same position.

In order to clear this ambiguity, when we speak of the consumer's willingness to trade, i.e., her **marginal rate of substitution**, we refer to the rate at which she is willing to trade in an **arbitrarily small trade**. That is, the slope of the corresponding line when, in this case, we move from 2 units of good 1 to $2 + \varepsilon$ units, for very small ε. Or, in other words, the slope of the solid line in the graph, the straight line that is tangent to the curve at that bundle, $(2, 4)$ in this case.