A Theory of Consumer Behavior

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Preliminaries

- The fundamental question in economics is
  Given limited resources, how are goods and service allocated?
- Last class we argued this allocation comes from the interaction of supply and demand. Today we want to develop the theory of demand.
- Given limited income, how do consumer allocate their income across different goods and services?
- We focus on three main criteria
  1. Consumer Preferences
  2. Consumer Income
  3. Available choices

Consumer Preferences

- The number of different goods and services one can purchase is simply too large to comprehend. So we begin by considering a market basket or bundle of goods.
- Usually we just work with two goods.
  - apples and oranges
  - beans and cornbread
  - food and clothing
- It is a more general set up than you might think. Consider one good to represent everything else.
  - oranges and everything else

- Consumer theory is essentially a model of you. It is hard to study consumer theory without become introspective.
- I know what you will be thinking: “Oh I never go into a store and think about my purchases this way ...”
- But keep with me. Economics is like playing pool.
  - but you don’t get to drink beer in class
- Consumers are not explicitly solving complicated mathematical problems, but the solution to the model can accurately describe their behavior.
• We begin by considering a market basket or bundle. It is a collection of goods and services a particular individual might consume. For example, one basket might be
  – two Super Bowl tickets, a hotel room in Detroit, and a six-pack
or a basket might be
  – two tickets to Met, a dinner at a nice restaurant in NYC, and room
at the Yale Club
• We are going to follow the books example and only think about baskets or bundles of food and clothing
  – six units of food and seven units of clothing
and/or
  – seven units of food and six units of clothing

The Three Big Assumptions About Consumer Preferences

1. Preferences are complete.
   • That is, the consumer is able to rank any two baskets. For baskets A and B, for example, the consumer can state her preferences according to one of the following possibilities
     – She prefers basket A to basket B (written \( A \succ B \)).
     – She prefers basket B to basket A (written \( A \prec B \)).
     – She is indifferent between, or equally happy with, baskets A and B (written \( A \approx B \)).

2. Preferences are transitive
   • By this we mean that the consumer makes choices that are consistent with each other.
   • Suppose that a consumer tells us that she prefers basket A to basket B, and basket B to basket E. We can then expect her to prefer basket A to basket E.
   • We can represent transitivity as follows: If \( A \succ B \) and if \( B \succ E \), then \( A \succ E \).

3. More is better than less.
   • In other words, having more of a good is better for the consumer. Goods are assumed to be desirable. You never get satiated. This assumption is made make our life easy for now.
   • Flip ‘bads’ into ‘goods’
   • Free disposal
Indifference Curves

- Let’s consider the book’s food and clothing example.
- Look at table 3.1 and figure 3.1
- Using the assumption that more is always preferred to less we state the following:
  1. $B \succ H \succ G$
  2. $E \succ A \succ G$
  3. $E \succ H$
  4. $D \succ G$
- Not much more we can say at this point.

Now suppose I state the individual is equally happy consuming either bundle $B$ or $A$ or $D$.
- I can draw an indifference curve through these points.
- An indifference curve represents all combinations of market baskets that provide a consumer with the same level of satisfaction.
- Indifference curves that are high and to the right represent higher levels of utility, because more consumption is preferred to less.
- In general, indifference curves are bowed toward the origin. You prefer a little bit of everything to a lot of just one thing.

The Four Important Properties of Indifference Curves

1. When consumers like both goods, indifference curves slope downward from left to right: less consumption of one good requires more consumption in the other good to keep the consumer equally happy.
2. Indifference curves cannot intersect.
3. Every consumption basket lies on one and only one indifference curve.
4. Indifference curves are not “thick.”

1. Indifference curves slope downward from left to right
   - This follows from our assumption that more is preferred to less.
   - If an indifference curve was upward sloping the individual would have to be indifferent between two market baskets even though one would have more of both goods.
2. Indifference curve cannot intersect.
   - Consider the case of two indifference curve which cross. See figure 3.4.
   - The basket represented by point $B$ on $U_1$ is preferred to the basket represented by point $D$ on $U_2$. Thus $U_1 > U_2$.
   - Similarly the basket represented by point $R$ on $U_2$ is preferred to the basket represented by point $Q$ on $U_1$. Thus $U_2 > U_1$. But wait – this can’t be. There is a logical inconsistency here.
3. **Every consumption basket lies on one and only one indifference curve.**
   - This follows from the property that indifference curve cannot intersect.
   - The basket represented by point $A$ lies on the two intersecting indifference curves ($U_1$ and $U_2$); a point can lie on two curves only at a place where the two curves intersect.
   - Since indifference curves cannot intersect, every consumption basket must lie on a single indifference curve.

4. **Indifference curves are not “thick.”**
   - To see why, consider the figure with the think indifference curve passing through distinct baskets $A$ and $B$.
   - If $B$ lies northeast of $A$, the utility of $B$ must be higher than the utility of $A$. Therefore $A$ and $B$ cannot be on the same indifference curve.

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**Perfect Substitutes and Perfect Complements**

- Let’s look at two extreme cases
- Perfect substitutes are two goods for which the marginal rate of substitution is a constant.
- Hence the indifference curves has a constant slope. Does not have to be one-for-one.
- These are goods that the consumer doesn’t care how she has has of one or the other, but only about the total amount of the two goods. Examples, red pencils and blue pencils.
- Perfect complements are two goods for which the MRS is infinite; the indifference curves are shaped as right angles.
- These are goods that are always consumed in fixed proportions. Right shoes and left shoes are the classic example. Doesn’t have to be one-for-one.

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**Utility**

- The book defines utility as the numerical score representing the satisfaction that a consumer receives from a market basket.
- This will allows us to represent consumer preferences with a utility function. We can then illustrate
- Consider a single customer who consumes a single good: cola. Let the consumer’s utility function be $U(y) = \sqrt{y}$.
- More must be preferred to less, and preferences must be transitive.
- The rate at which total utility changes as the level of consumption rises is call the *marginal utility* or in short $MU$.

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**The Marginal Rate of Substitution**

- A consumer’s willingness to substitute one good for another while maintaining the same level of satisfaction is called the *marginal rate of substitution*.
- For example, a consumer’s marginal rate of substitution of hamburgers for lemonade is the rate at which the consumer would be willing to give up glasses of lemonade to get more hamburgers, with the same overall satisfaction.
- See figure 3.5
- The MRS can be written mathematically as $\frac{\Delta C}{\Delta F}$.
- When the indifference curves are bowed to the origin, the MRS is diminishing.
Utility and Happiness

- In standard economics we use utility to represent a measure of satisfaction or happiness that people receive from consuming a good or service.
- But do more goods and service really make people happier?
- So one area of research these days is happiness economics.
- Two examples of trying to directly measuring happiness
  - the book
  - the reading packet
- Price of everything, value of nothing?

Utility with more than one good

- Now let’s consider the case when there are two goods, which we call food and clothing.
- Suppose the utility function for these two goods is $U(F, C) = \sqrt{F \times C}$.
- So just to get idea of units, if the consumer consumes 2 units of clothing and 8 units of food his utility is $U(C, F) = \sqrt{2 \times 8} = 4$.
Back to Indifference Curves

- Recall that all points on an indifference curve generate the same level of utility.
- So on an indifference curve it must be the case that
  \[ MU_F \times \Delta F = -MU_C \times \Delta C \]
- That is gain in utility from an increase in food consumption must exactly equal to the loss in utility from a decrease in consumption of clothing.
- Rewriting this expression
  \[ -\frac{\Delta C}{\Delta F} = \frac{MU_F}{MU_C} \]
- Note that \(-\frac{\Delta C}{\Delta F}\) is the marginal rate of substitution. So we get
  \[ MRS = \frac{MU_F}{MU_C} \]
  So the marginal rate of substitution is the ratio of the marginal utilities.

Budget Constraint

- The budget constraint defines the set of baskets that a consumer can purchase with a limited amount of income. Suppose a consumer purchases only two types of goods, food and clothing. Let \( F \) denote the amount of food purchased and \( C \) denote the amount of clothing. We denote the prices of the two good \( P_F \) and \( P_C \). Note the units ($ per unit of food and $ per unit of clothing)
- The budget line indicates all the combinations of \( F \) and \( C \) for which total amount of money spend
  \[ P_FF + P_CC = I \]
- Consider what happens if the consumer spend all his/her money on clothing (e.g. \( F = 0 \)).
  \[ C = \frac{I}{P_C} \]
  Now consider the case if the consumer spends all his/her money on food (e.g. \( C = 0 \)).
  \[ F = \frac{I}{P_F} \]

Changes in Income

- We can rewrite the budget constraint as:
  \[ C = \frac{I}{P_C} - (P_F/P_C)F \]
  Positive intercept and a negative slope.
- The slope of the budget constraint \(-(P_F/P_C)\) is the negative of the ratio of the two prices. Slope of the budget constraint is the opportunity cost.
- Bundles to southwest of the budget constraint are in the feasible set. Bundles to the northeast of the budget constraint are not feasible.
- A change in the income does not change the slope of the budget constraint, since the slope is the ratio of the two prices, and prices remain unchanged.
- A change in income causes a parallel shift in the budget constraint (in or out).
Changes in Relative Prices

- Consider a decrease in the price of food.
- If the person consumes no food, nothing changes for him/her.
- The budget constraint rotates in.

Putting Preferences and Constraints Together: Consumer Choice

- We want to find the bundle of goods such that
  1. maximize his satisfaction
  2. allows him to live within his budget constraint.
- The maximizing bundle must satisfy two conditions
  1. It must be on the budget constraint
  2. It must give the consumer the most preferred combination.
- Note that the optimal bundle must be located on the budget line.
  - Assuming the consumer likes both goods (food and clothing), a basket on the interior of the budget set cannot be optimal because it does not require the consumer to spend all his income.
  - The unspent income could be used to increase satisfaction with the purchase of additional food or clothing.

- So let’s start at point A and consider moving along the budget constraint. Utility must fall even if we move a little bit because indifference curve are bowed to the origin.
- Note an important feature of the optimal bundle: at this choice, the indifference curve is tangent to the budget line.
  - Do you remember from high school math what tangent means?
  - If the indifference curve were not tangent it would cross the budget line, and if it cross the budget line, there would be some nearby point on the budget line that lies above the indifference curve – which means that we couldn’t have started at an optimal bundle.
Some Applications

- When driving, most people like to
  - get to their destination quickly
  - get to their destination safely
- There is a tradeoff between these two objectives.
- Now let’s do some thought experiments
  - the introduction of seat belts
  - buy a really safe car (a SUV?)
  - we remove all seat belts and place a huge spike on every steering wheel

Revealed Preference

- We are never going to directly observe someone’s indifference curves ...
- But we do often get observations about consumer choices with two difference budget lines. We can use these observation to infer
- In other words, we can reverse the process and see what the consumer’s behavior reveals about his preferences.
- If a consumer chooses one market basket over another, and if the chosen market basket is more expensive than the alternative, then the consumer must prefer the chosen market basket.
- Figure 3.17.
  - We know the consumer prefers A to B.
  - Can we say anything about A and D?
  - Now suppose prices change so the budget constraint moven from $I_1$ to $I_2$.
  - If the consumer now choose B we know the consumer prefers B to D. We know previously that the consumer chose A to B, so we now know the consumer prefers A to D.

Marginal Utility and Consumer Optimization

- Recall
  \[ MRS = \frac{MU_F}{MU_C} \]
  - the key equation:
    \[ MU_F \times P_F = MU_C \times P_C \]
    \[
    \text{or} \quad \frac{MU_F}{MU_C} = \frac{P_F}{P_C}
    \]
  That is the ratio of the marginal utilities is equal to the ratio of prices.
- Since we know
  \[ MRS = \frac{MU_F}{MU_C} \]
  this means
  \[ MRS = \frac{MU_F}{MU_C} = \frac{P_F}{P_C} \]
- THIS IS BIG!!!!!
Marginal Utility and Consumer Optimization

• In well-organized markets, it is typical that everyone faces roughly the same prices for goods. Take, for example, two goods like butter and milk.

• If everyone faces the same prices for butter and milk, and everyone is optimizing ... then everyone must have the same marginal rate of substitution for butter and milk.

• This follows directly from the analysis above. The market is offering everyone the same rate of exchange for butter and milk, and everyone is adjusting consumption of the goods until their “internal” marginal valuation of the two goods equals the market’s “external” valuation of the two goods.

• This statement is independent of income and tastes.

• People may value their total consumption of the two goods very differently. Some people may be consuming a lot of butter and little milk, and some may be doing the reverse. Some wealthy people may be consuming a lot of milk and a lot of butter while other people may be consuming just a little of each good.

• But everyone who is consuming the goods must agree on how much one is worth in terms of the other; how much of one they would be willing to sacrifice to get some more of the other.

• The fact that

\[
MRS = \frac{MU_F}{MU_C} = \frac{P_F}{P_C}
\]

means that we can value possible changes in consumption bundles.

• Suppose, for example, that the price of milk is $1 a quart and the price of butter is $2 per pound. The marginal rate of substitution for all people who consume both butter and milk must be 2: they have to have 2 quarts of milk to compensate them for giving up 1 pound of butter. Or conversely, they have to have 1 pound of butter to make it worth their while to give up 2 quarts of milk.

• Suppose an inventor discover a new way of turning milk into butter. For every 3 quarts of milk poured into this machine, you get 1 pound of butter and no other useful by-products.

• OK venture capitalists – how much should we invest in this new technology? The answer is nothing.

• Everyone is operating at a point where they are willing to trade off 2 quarts of milk for 1 pound of butter. They are not going to be willing to tradeoff 3 quarts of milk for 1 pound of butter.

• That is, we know from the relative prices of butter and milk that people value the inputs more than the outputs.

• Suppose the inventor said “But I can run this machine in reverse and transform 1 pound of butter into 3 quarts of milk”

• Then the venture capitalist inside of us should state “Sign me up”

• People are just willing to trade one pound of butter for two quarts of milk. So getting three quarts of milk for one pound of butter is a better deal than is being offered in the marketplace.

• Market prices tell us the first machine is unprofitable, but the second machine is more profitable because people values the output more than the input.

• Prices are not arbitrary numbers but reflect how people value things on the margin. This is one of the most fundamental and important ideas in economics.