

HOMEWORK 3: Consumer Theory

30 Points

Due: Wednesday, February 25th, 2015

LEARNING OBJECTIVES

- Consumers will choose the “best” (preferences) with “what they can afford” (budget constraint).
- Demand curves are derived through the intersection of preferences and budget constraints.
- Demand curve shifts due to changes in income.
- Income and substitution effects explain why quantity demanded changes when price adjusts.

INSTRUCTIONS

Carefully read the question before answering. Make sure your pages are in order and stapled together. Your work should be **clear** and **easy to follow**. When prompted, make sure that you explain your answer completely.

QUESTION

1. (3 points) Provide a definition (1 sentence) and a violating example (1 sentence) for each of the three assumptions over consumer preferences.

Transitive: Definition: $A > B, B > C$, therefore $A > C$. Example: David likes playing piano over the guitar; the guitar over the harp; and the harp over the piano.

Complete: Definition: An individual should be able to state how they feel about all goods, even if they are indifferent to it. Example: David likes chicken and beef but cannot say how he feels about pork.

More is better: Definition: More is better than less. Example: David likes playing video games but prefers 3 games to 5 games.

2. (3 points) What information is contained in the slope of an indifference curve? Why are these curves typically convex to the origin? (minimum of 4 sentences)

The indifference curve shows the combination of 2 goods that can keep an individual equally happy or satisfied. The slope then illustrates how an individual is willing to trade off between the 2 goods to remain at a constant level of happiness. IC's are often convex to the origin because of diminishing MRS (slope of IC). There is diminishing MRS because the more an individual has of something, the more they are willing to give up to get more of another good. However, the less they have, the less they are willing to trade.

Homework 3 Continued

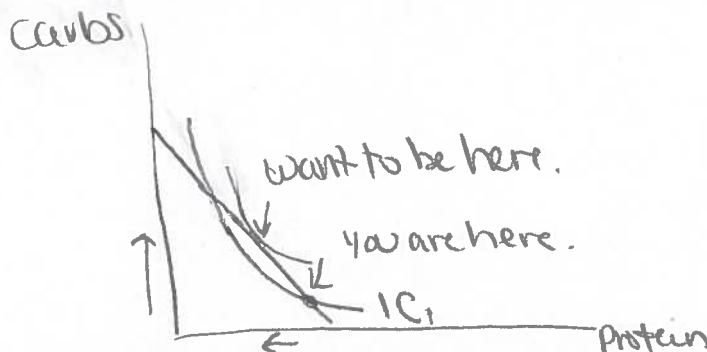
3. Carbohydrates and protein are integral for a healthy diet and could be considered imperfect substitutes. Carbohydrates sell for \$5. Protein sells for \$10. At your current level of consumption, your marginal rate of substitution between carbohydrates and protein is $-1/2$. Assume carbohydrates are on the y-axis and protein is on the x-axis.
- a. (2 points) Are you maximizing your utility?

$$MRS = -\frac{MU_{protein}}{MU_{carb}} = -1/2$$
$$MRT = -\frac{p_{protein}}{p_{carb}} = -\frac{10}{5} = -2$$
$$|MRS| < |MRT|$$

No, you are not maximizing your utility. If you were, then $MRS = MRT$.

- b. (3 points) If not, are you consuming too many carbohydrates or too little protein? Explain with 2 sentences and a simple figure.

For you to maximize your utility you would increase your carbohydrate consumption and reduce your protein consumption. As a result, $MU_{protein}$ increases and MU_{carb} decreases, which results in an increase in the MRS until the point where $MRS = MRT$. See graph below.



4. It is common in environmental policy to quantify the value of an ecological resource by the cost it would take to replace it, e.g. the value of clean water from a watershed can be valued by the cost of building a water treatment plant. As a result, watersheds and water treatment plants can be viewed as perfect substitutes. Assume society's utility from clean water is given by $U(W, T) = 6W + 3T$, where W is a clean water from a watershed and T is clean water from a water treatment plant. Assume T is on the y-axis and W is on the x-axis.
- a. (3 points) Suppose that at the following prices, P_W , price of water from a watershed, and P_T , price of water from the water treatment plant, society is consuming a positive amount of water from both sources. What is the price of water from the watershed relative to the price of water from the water treatment plant?

Homework 3 Continued

As W and T are perfect substitutes, it must be the case that $MRS = MRT$ for society to consume BOTH watershed water and water treatment plant water. This means that the indifference curve falls directly on top of the budget constraint. As a result,

$$MRS = -\frac{MU_W}{MU_T} = -\frac{6}{3} = -2$$

So the price of the watershed water is twice that of the water from a water treatment plant.

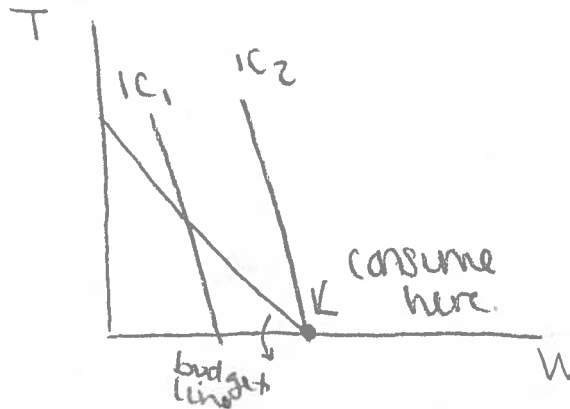
- b. (3 points) How will societies consumption change if P_T doubles, while P_W remains the same?

$$MRT = -1$$

Since

$$|MRS| > |MRT|$$

Society will consume all water from the watershed and no water from the treatment plant. See graph below.



- c. (2 point) What are some environmental implications resulting from a change in price in part b?

Environmental implications from increasing the consumption of water could be great, both good and bad. Good, the watershed may experience more conservation and biological diversity. Bad, we could reduce the water to unsustainable level, which would impact biological diversity. Also, possible unemployment from closing the water treatment plant. Answers will vary.

5. You can use economics to help find your soul mate:
<http://www.telegraph.co.uk/women/sex/relationship-advice-and-romance/10706844/Three-key-questions-that-can-predict-whether-a-relationship-will-last.html>. Given the questions in the article above, assume that you enjoy horror movies, h (measured by the number of movies seen annually) and traveling alone, a (measured by the number of trips travelled alone). Your utility can be measured by the function

Homework 3 Continued

$U(h, a) = h^{0.3}a^{0.7}$. The cost of watching a horror movie and traveling alone is given by p_h and p_a , respectively. Assume h is on the y-axis and a is on the x-axis.

- a. (2 points) Let $p_h = \$12$ per movie and $p_a = \$100, \$500, \$800$ per trip. Calculate and graph the demand curve for trips travelled alone if your total budget for horror movies and travel is \$1000.

$$MRS = -\frac{7h}{3a}$$

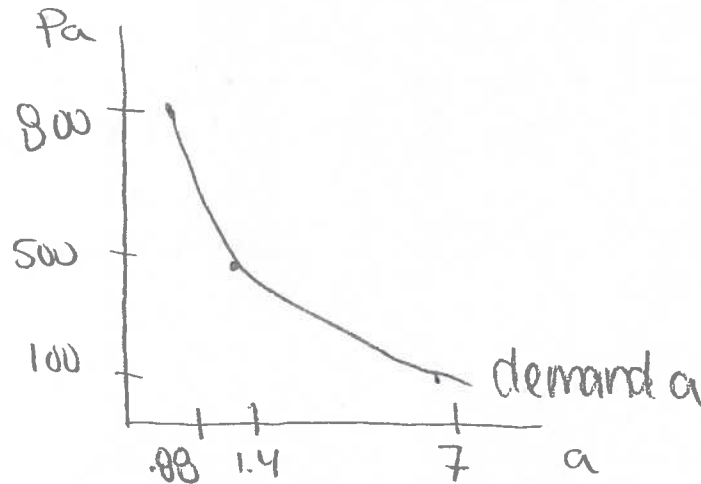
$$MRT = -\frac{p_a}{12}$$

$$Income = p_a a + 12h$$

$$a = \frac{7Income}{10p_a}$$

$$h = \frac{7Income}{280}$$

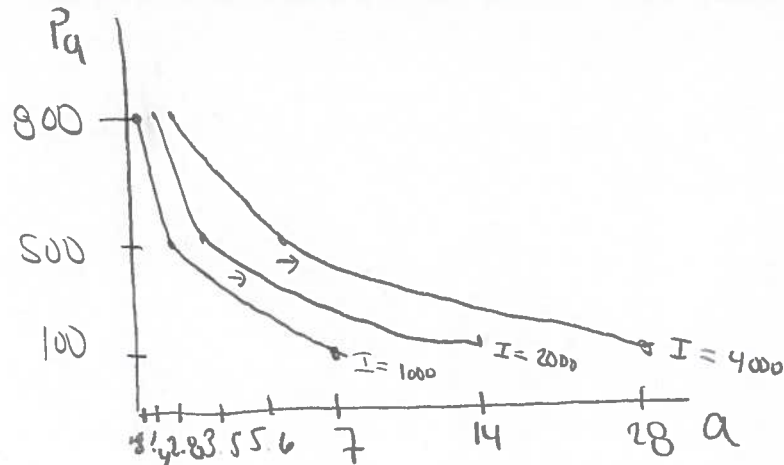
Table 1: Demand for trips traveled alone, a and horror movies, h			
	$p_a = 100$	$p_a = 500$	$p_a = 800$
$Income = 1000$	$a = 7; h = 25$	$a = 1.4; h = 25$	$a = 0.875; h = 25$



- b. (4 points) Using the prices in part a., mathematically derive and graph what happens to demand for traveling alone as your budget increases to \$2000 and \$4000.

Table 2 Demand for trips traveled alone, a and horror movies, h			
	$p_a = 100$	$p_a = 500$	$p_a = 800$
$Income = 1000$	$a = 7; h = 25$	$a = 1.4; h = 25$	$a = 0.875; h = 25$
$Income = 2000$	$a = 14; h = 50$	$a = 2.8; h = 50$	$a = 1.75; h = 50$
$Income = 4000$	$a = 28; h = 100$	$a = 5.6; h = 100$	$a = 3.5; h = 100$

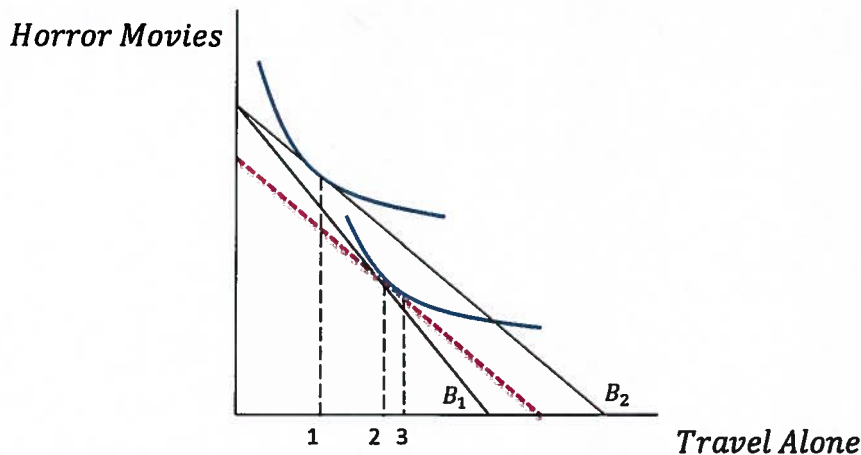
Homework 3 Continued



- c. (1 point) How can you use part a and b to find your soul mate? Obviously, this question is just for amusement, so try to apply your intuition as best as you can.

Given the article above and my preferences above, I will want to spend time with someone who also likes to travel alone and someone who likes horror movies. As a result, at lower prices to travel alone, I will try to meet someone on the road. However, as the price of traveling along increases, I will likely try to find someone at the theater. Answers will vary here

6. The figure below represents Jill's indifference map for horror movies and trips alone. B_1 represents her original budget line. B_2 indicates her budget line from a decrease in the price of traveling alone. Before the price change Jill wants to travel alone twice annually and after the price change she wants to travel alone once.



- a. (2 points) What change in quantity best represents her substitution effect?

+1 (3-2) = substitution effect. With a decrease in the price of traveling alone, Jill will substitute more travel by 1 trip.

- b. (2 points) What change in quantity best represents her income effect? Is traveling alone a normal or inferior good?

Homework 3 Continued

- 2 (3-1) = income effect. With an increase in Jill's purchasing power from a decrease in the price of traveling alone, Jill begins to watch more horror movies. As a result, as income increases, traveling alone decreases. So traveling alone is an inferior good and horror movies is a normal good.