30 MORE UTILITY MAXIMIZATION

Purpose: To demonstrate the rule for utility maximization when utility is a cardinal measure of satisfaction. To show the effects on consumer choice of changes in prices and incomes.

Computer file: **utilmax298.xls**

Instructions and questions:

In the previous problem set utility was measured ordinally, which is to say that consumers were only expected to rank bundles of goods in order of preference. In an ordinal ranking, bundles may be first, fifth, or eighth, for example.

A stronger assumption about consumers would be to expect them to say things like "I like consuming 6 bicycles four times as much as consuming 2 bicycles,) or "Three tacos gives me 125 utils of satisfaction, and one more taco would add 18 utils to my total satisfaction." In this case utility is a cardinal phenomenon, and can therefore be measured with real numbers, not just a ranking.

If utility is cardinal, we can reformulate the rule for utility maximization into one that is, to some folks at least, more intuitive. The more intuitive version of the rule is that the consumer should adjust consumption to make the marginal utility of an extra dollar spent on each good the same for all goods. In the case of spaghetti and tacos, utility will be maximized if

$$MU(S)/P_S = MU(T)/P_T$$

Just as in the previous problem set, the utility maximizing consumer should spend all income on the goods. The ratio of MU to price, the marginal utility per dollar, is the extra utility a consumer will get from spending one more dollar on the good.

Open the Excel file **utilmax2.xls**. The screen will show a set of indifference curves similar to those in the last problem set. The differences here are that you can see a) the value of the marginal utility for each good (not just the marginal rate of substitution), b) the marginal utility per dollar, and c) the total utility from consuming a bundle of goods.

Some of Sally Jones's indifference curves are shown in blue, and her indifference curve for current consumption of spaghetti and tacos is shown in red. You can change her consumption by choosing different amounts of spaghetti. Taco consumption is automatically computed to exhaust income for each level of spaghetti you choose. You can also change income and the prices of the two goods.

You're asked in the questions to find the utility maximizing amounts of the goods. You can use Goal Seek to do this by asking it to set the *difference* between the marginal utilities per

dollar equal to zero by changing the amount of spaghetti. Notice that the nature of the solution is exactly the same as before -- at the best choice, the slope of an indifference curve is equal to the slope of the budget constraint.

Pay particular attention here to the problem in which Sally has to pay income taxes, and then receives in return an amount of goods exactly equal in value to her tax bill. Her utility goes down as a result, even though she receives the *same dollar value* of goods both before and after the tax. Economists make a big thing out of this result, and it is good if you understand the intuition of the result.

Here are some other things to watch for as you do the problems:

1) Consumers maximize utility by choosing amounts of goods so that the marginal utility per dollar spent on all goods is the same. The marginal utility per dollar is a good's marginal utility divided by its price.

2) Giving a consumer goods is unlikely to raise her utility by as much as giving her an equivalent amount of money. (The exception is the case in which the consumer is given in goods what she would have bought with the money anyway.)

MATH MAVEN'S CORNER: The utility function used to generate the graph in **utilmax298.xls** is given by

$$U = AS^a T^b$$

where S is the amount of spaghetti consumed and T is the amount of tacos consumed, and A, a, and b are randomly chosen. This is the same utility function as in the last problem set. The budget constraint is given by $I = P_S S + P_T T$, where I is income, and P_S and P_T are the prices of S and T, respectively. The marginal utility of S is given by $\partial U/\partial S$, and similarly for T. Therefore there is an easy relationship between the Marginal Rate of Substitution and the marginal utilities. The $MRS_{S \text{ for } T}$ in general is $-dT/dS|_{dU=0} = (\partial U/\partial S)/(\partial U/\partial T)$, which is the ratio of the marginal utilities.

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Questions

Set income and prices to their baseline values, and set spaghetti consumption to 5 plates.

1) How much is taco consumption?
2) How much is total utility?

Following on from the last question:

3) If the consumer spends one more dollar on spaghetti, how much does total utility increase?
4) If the consumer spends one more dollar on tacos, how much does total utility increase?
5) Is total utility maximized when the consumer buys 5 plates" of spaghetti? (yes or no)

6) Following on from the last question, of which good should the consumer buy more? (spaghetti or tacos)
7) What is the utility maximizing amount of spaghetti?
8) What is the utility maximizing amount of tacos?

9) With income and prices to their baseline values, what is total utility when utility is maximized? (Compare to 2)

Disaster strikes the consumer, and she finds she has to pay $51 dollars in income taxes. Her weekly income is now at $99, and prices of spaghetti and tacos are $4 and $1.50, respectively.

10) What's the new utility maximizing amount of spaghetti?
11) What's the new utility maximizing amount of tacos?

12) Continuing on from the last question, what is the consumer's new level of utility? (Compare to 9)

Now suppose the government proposes to give the consumer $51 worth of government benefits in the form of 12 plates of spaghetti and 2 tacos. (The consumer gets the benefits after making the choice in question 12.)

13) What's the consumer's level of utility now (after paying the tax and getting the benefits)?

Set income and prices to their baseline levels, and find the utility maximizing solution. Now set the price of spaghetti to $2 per plate.

14) How much spaghetti is demanded at the lower price? (Compare to question 7.)

15) For spaghetti, does Sally obey the Law of Demand? (yes or no)