32 MARGINAL UTILITY AND OPTIMIZATION

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: **utilmax498.xls**

Instructions and questions:

This problem set is the same as the one preceding it, except in one respect. It is that the accompanying graphical display doesn't use indifference curves, but relies instead on straightforward measures of marginal utility per dollar of the two goods. A simple bar chart shows the values of marginal utility per dollar for each of the goods for any values of income, prices, and consumption. Compared to the use of indifference curves, many people find the approach taken here to be more intuitive in explaining the nature of the optimization problem. The approach taken here is also good for people who like to avoid the discussion of indifference curves entirely in a presentation of consumer choice.

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

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

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. In addition to following the marginal rule, the consumer should spend all income on the goods.

Open the Excel file **utilmax4.xls**. The screen will show a bar chart that shows the marginal utilities per dollar for the two goods. You can change Sally Jones's 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 -- the heights of the bars measuring marginal utility per dollar are the same for the two goods.

MATH MAVEN'S CORNER: The utility function used to generate the graph in **utilmax498.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-to-understand 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 Sally's taco consumption?
2) How much is her total utility?

Following on from the last question:

3) If Sally spends one more dollar on spaghetti, how much does total utility increase?
4) If she spent another dollar on tacos, how much would total utility increase?
5) Is total utility maximized when she buys 5 plates of spaghetti? (yes or no)

6) Following on from the last question, of which good should Sally 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)

Now increase the Sally's income to $220.

10) What is her new demand for spaghetti?
11) What is her new demand for tacos?

12) Following on from the last question, is spaghetti normal or inferior?
13) Are tacos normal or inferior?

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)