

Instructions: This problem set is due in class on Wednesday, September 21. Each student is to hand in his or her own independent solutions to the problem set. You may work together on the problem sets as long as “working together” means learning together or learning from each other and not simply sharing final answers.

If you get stuck, you are encouraged to ask questions of the instructor or the tutors. Tutors will be available at work sessions in the Dorothy Johansen House according to the posted schedule. Individual tutoring (at no cost for up to one hour per week) can be arranged through the Office of Student Services.

1. Present vs. future consumption. Consider a consumer Felicia’s choice between “goods this year” (C_1) on the horizontal axis and “goods next year” (C_2) on the vertical axis. Goods cost \$1 in each period, so the number of goods equals the number of dollars spent. (We explicitly assume no inflation so that we don’t need to worry about the distinction between “real” and “nominal interest rates,” which we will discuss later.) We also assume that Felicia has no previous savings and does not want to have any savings at the end of next year, so this year’s goods and next year’s goods are the only two goods relevant to her consumption behavior. Both current and future consumption are normal goods. Felicia’s preferences are such that she tends to like reasonably smooth consumption (close to equal in the two periods) rather than a very uneven consumption path.

Felicia earns \$20,000 this year and \$30,000 next year. She has the option of borrowing or lending at a 10% interest rate. She can borrow or lend as much as she wants at 10%, as long as she repays any borrowing next year. One consumption option is to consume the same amount as she earns in each period, so this “endowment point” ($C_1 = 20,000$, $C_2 = 30,000$) must lie on her budget constraint.

- a. What is the “relative price” of goods this year in terms of goods next year: the amount of next year’s goods that must be given up to consume an additional unit of goods this year? How is this related to Felicia’s budget constraint? Graph the budget constraint, showing the values at which it intersects each axis. Is it a straight line?
- b. Suppose that Felicia’s current-year income increases by \$1,000 (from \$20,000 to \$21,000) with no change in future income. How will her budget constraint and her consumption in the current year and the future year be affected?
- c. Now show the effects on her budget constraint and consumption in the two periods of a \$1,000 increase in next-year’s income (from \$30,000 to \$31,000 with no change in current income). How (if at all) are they different from those in part (b)? Explain.

- d. Show the effects on her budget constraint and her consumption in the two periods of a \$1,000 annual increase in income in both years (\$2,000 of total increase, to \$21,000 this year and \$31,000 next year).
- e. Based on your analysis above, does an increase in someone's income have a larger effect on current-year consumption if it is believed to be permanent or if it is believed to be temporary? Why?
- f. We have assumed so far that Felicia is able to borrow or lend at the same interest rate. Now suppose, more realistically, that Felicia has to pay a higher interest rate (15%) on her borrowing than the rate that she receives if she lends (10%). What does the budget constraint look like in this case (at the original levels of income: \$20,000 and \$30,000)? Does this imperfection in the credit market make it more likely that Felicia would choose to consume at exactly the endowment point? Why?
- g. Finally, suppose that Felicia cannot borrow at all, but is able to lend at 10%. What does her budget constraint look like in this case? Assuming that she starts at a point of no lending, revisit the relative effects of a permanent vs. temporary income change on her budget constraint and her consumption.

2. Consumer Equilibrium. George has a given amount of income and can afford at most 9 units of Y if he spends his entire income on Y. Alternatively, if he spends all his income on X, he can afford at most 6 units of X.

- a. What is the relative price of X in terms of Y? (How much Y must George give up to get a unit of X?)
- b. Draw George's budget constraint and an indifference curve such that George chooses to buy 4 units of X. (Put X on the horizontal axis.)
- c. In equilibrium, what is George's marginal rate of substitution between Y and X?
- d. Martha faces the same prices as George, yet she chooses to buy 2 units of X. Is Martha's income higher, lower, or the same as George's, or can we tell for sure?
- e. In equilibrium, is Martha's marginal rate of substitution between Y and X higher, lower, or the same as George's, or can we tell for sure?

3. Choosing between leisure and consumption. The consumer-equilibrium model can be used to examine the tradeoff between leisure and labor (or, more precisely, leisure and the goods that can be bought with one's labor earnings). To do this, we put weekly hours of leisure (non-work time) on the horizontal axis and the generic commodity "goods" on the vertical axis (measured in dollars). There are 168 hours in a week, so the number of leisure hours equals 168 minus the number of hours worked.

- a. Suppose that a consumer, John, can work as many hours as he wishes during the week for a wage of \$20/hour, but that he needs to sleep at least 42 hours per week (which counts as leisure). Show the graph of his budget constraint.
- b. John and his friend Nigel face the same budget constraint, but they have very different preferences: John chooses to work 40 hours per week, but Nigel chooses zero. Show (on

separate graphs) indifference maps for John and Nigel and their respective points of utility-maximizing equilibrium.

c. Suppose that overtime work (all hours above 40 per week) earns a doubled wage (\$40/hour). Show how the budget constraint changes. Given his indifference map, can you be sure that John will work overtime? Might Nigel choose to work now, and if so, will he work overtime? Explain your answers.

d. Now suppose that (with no overtime wage), anyone who doesn't work at all gets \$200 per week in welfare payments, but that these payments are reduced by \$0.50 for each dollar of income earned, so that workers earning \$400 or more per week get none. Show the budget constraint for this situation. Might Nigel work? Might John quit working altogether? Might John choose to work fewer (but still positive) hours? Explain your answers.