

**Nanyang Technological University**  
**HE2001 Microeconomics II**

**Tutorial 4**

1. Peregrine Pickle consumes  $(c_1, c_2)$  and earns  $(m_1, m_2)$  in periods 1 and 2 respectively. Suppose the interest rate is  $r$ .
  - (a) Write down Peregrine's intertemporal budget constraint in present value terms.
  - (b) If Peregrine does not consume anything in period 1, what is the most he can consume in period 2? Is this the future or present value?
  - (c) If Peregrine does not consume anything in period 2, what is the most he can consume in period 1? Is this the future or present value? What is the slope of Peregrine's budget line?
2. Nickleby has an income of \$2,000 this year, and he expects an income of \$1,100 next year. He can borrow and lend money at an interest rate of 10%. Consumption goods cost \$1 per unit this year and there is no inflation.
  - (a) What is the present value of Nickleby's endowment? What is the future value of his endowment? Show in a graph the combinations of consumption this year and consumption next year that he can afford. Label Nickleby's endowment with the letter  $E$ .
  - (b) Suppose that Nickleby has the utility function  $U(C_1, C_2) = C_1 C_2$ . Write an expression for Nickleby's marginal rate of substitution between consumption this year and consumption next year. (Your answer will be a function of the variables  $C_1, C_2$ .)
  - (c) What is the slope of Nickleby's budget line? Write an equation that states that the slope of Nickleby's indifference curve is equal to the slope of his budget line when the interest rate is 10%. Also write down Nickleby's budget equation.
  - (d) Solve these two equations. How many units will Nickleby consume in period 1 and period 2 respectively? Label this point  $A$  on your diagram.
  - (e) Will he borrow or save in the first period? How much?
  - (f) On your graph, show what Nickleby's budget line would be if the interest rate rose to 20%. Knowing that Nickleby chose the point  $A$  at a 10% interest rate, even without knowing his utility function, you can determine that his new choice cannot be on certain parts of his new budget line. Draw a squiggly mark over the part of his new budget line where that choice can not be. (Hint: Close your eyes and think of WARP.)
  - (g) Solve for Nickleby's optimal choice when the interest rate is 20%. How many units will he consume in period 1 and period 2 respectively?
  - (h) Will he borrow or save in the first period? How much?
3. Laertes has an endowment of \$20 each period. He can borrow money at an interest rate of 200%, and he can lend money at a rate of 0%. (Note: If the interest rate is 0%, for every dollar that you save, you get back \$1 in the next period. If the interest rate is 200%, then for every dollar you borrow, you have to pay back \$3 in the next period.)
  - (a) Illustrate his budget set in a graph. (Hint: The boundary of the budget set is not a single straight line.)

- (b) Laertes could invest in a project that would leave him with  $m_1 = 30$  and  $m_2 = 15$ . Besides investing in the project, he can still borrow at 200% interest or lend at 0% interest. Draw the new budget set in the graph above. Would Laertes be better off or worse off by investing in this project given his possibilities for borrowing or lending? Or can't one tell without knowing something about his preferences? Explain.
- (c) Consider an alternative project that would leave Laertes with the endowment  $m_1 = 15$ ,  $m_2 = 30$ . Again suppose he can borrow and lend as above. But if he chooses this project, he can't do the first project. Draw the budget set available to Laertes if he chooses this project. Is Laertes better off or worse off by choosing this project than if he didn't choose either project? Or can't one tell without knowing more about his preferences? Explain.
4. In an isolated mountain village, the only crop is corn. Good harvests alternate with bad harvests. This year the harvest will be 1,000 bushels. Next year it will be 150 bushels. There is no trade with the outside world. Corn can be stored from one year to the next, but rats will eat 25% of what is stored in a year. The villagers have Cobb-Douglas utility functions,  $U(c_1, c_2) = c_1 c_2$  where  $c_1$  is consumption this year, and  $c_2$  is consumption next year.
- (a) Draw a "budget line," showing consumption possibilities for the village, with this year's consumption on the horizontal axis and next year's consumption on the vertical axis. Put numbers on your graph to show where the budget line hits the axes.
- (b) How much corn will the villagers consume this year? How much will the rats eat? How much corn will the villagers consume next year?
- (c) Suppose that a road is built to the village so that now the village is able to trade with the rest of the world. Now the villagers are able to buy and sell corn at the world price, which is \$1 per bushel. They are also able to borrow and lend money at an interest rate of 10%. On your graph, draw the new budget line for the villagers. Solve for the amount they would now consume in the first period and second period.
- (d) Suppose that all is as in the last part of the question except that there is a transportation cost of \$.10 per bushel for every bushel of grain hauled into or out of the village. On your graph, draw the budget line for the village under these circumstances.
5. Marsha Mellow doesn't care whether she consumes in period 1 or in period 2. Her utility function is simply  $U(c_1, c_2) = c_1 + c_2$ . Her initial endowment is \$20 in period 1 and \$40 in period 2. In an antique shop, she discovers a cookie jar that is for sale for \$12 in period 1 and that she is certain she can sell for \$20 in period 2. She derives no consumption benefits from the cookie jar, and it costs her nothing to store it for one period.
- (a) In a graph, label her initial endowment,  $E$ , and draw the budget line showing combinations of period-1 and period-2 consumption that she can afford if she doesn't buy the cookie jar. On the same graph, label the consumption bundle,  $A$ , that she would have if she did not borrow or lend any money but bought the cookie jar in period 1, sold it in period 2, and used the proceeds to buy period-2 consumption. If she cannot borrow or lend, should Marsha invest in the cookie jar?
- (b) Suppose that Marsha can borrow and lend at an interest rate of 50%. On the graph where you labelled her initial endowment, draw the budget line showing all of the bundles she can afford if she invests in the cookie jar and borrows or lends at the interest rate of 50%. On the same graph, draw one or two of Marsha's indifference curves.

- (c) Suppose that instead of consumption in the two periods being perfect substitutes, they are perfect complements, so that Marsha's utility function is  $\min\{c_1, c_2\}$ . If she cannot borrow or lend, should she buy the cookie jar? If she can borrow and lend at an interest rate of 50%, should she invest in the cookie jar? If she can borrow or lend as much at an interest rate of 100%, should she invest in the cookie jar?