Department of Applied Economics Johns Hopkins University

Economics 602
**Macroeconomic Theory and Policy**
**Problem Set 6**
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1. **Lags in Labor Hiring.** Rather than supposing that the representative firm at the beginning of period t can decide how much labor it would like to hire for use in period t, suppose that labor used in period t must be chosen in period t-1. (That is, suppose n is a stock (aka state) variable.) As usual, capital for use in production in period t must be purchased in period t-1 because of the "time to build" surrounding capital goods. With this lag in labor hiring, construct the lifetime (in the two-period model) profit function of the firm, and show that the real interest rate now is a relevant price for labor as well as capital goods. Provide brief economic intuition. (**Hint:** Make as close an analogy with our model of firm ownership of capital as you can – in particular, think of workers in this model as being "owned" (contractually obligated to) firms.)

2. **Preference Shocks in the Consumption-Savings Model.** In the two-period consumption-savings model (in which the representative consumer has no control over his real labor income $y_1$ and $y_2$), suppose the representative consumer's utility function is $u(c_1, Bc_2)$, where, as usual, $c_1$ denotes consumption in period 1, $c_2$ denotes consumption in period 2, and $B$ is a preference parameter.

    a. Use an indifference-curve/budget-constraint diagram to illustrate the effect of an increase in $B$ on the consumer's optimal choice of period-1 consumption.
    b. Illustrate the effect of an increase in $B$ on the private savings function. Provide economic interpretation for the result you find.
    c. In the months preceding the U.S. invasion of Iraq, data shows that consumers decreased their consumption and increased their savings. Is an increase in $B$ and the effects you analyzed in parts a and b above consistent with the idea that consumption fell and savings increased because of a looming war? If so, explain why; if not, explain why not.
    d. Using a Lagrangian and assuming the utility function is $u(c_1, B \cdot c_2) = \ln(c_1) + \ln(B \cdot c_2)$, show how the representative consumer's MRS depends on B.
    e. How would your analysis in parts a and b change if the consumer's utility function were $u(Dc_1, c_2)$ (instead of $u(c_1, Bc_2)$) and you were told that the value $D$ decreased? ($D$ is simply some other measure of preference shocks.)

3. **Intertemporal Consumption-Leisure Model – A Numerical Look.** Consider the intertemporal consumption-savings model. Suppose the lifetime utility function is given by $v(B_1c_1, l_1, B_2c_2, l_2) = u(B_1c_1, l_1) + u(B_2c_2, l_2)$, which is a slight modification of the utility function presented in Chapter 5. The modification is that preference shifters $B_1$ and $B_2$ enter the lifetime utility function, with $B_1$ the preference shifter in period one and $B_2$ is the preference shifter in period two. In each of the two periods the function $u$ takes the form

$$u(B_tc_t, l_t) = 2\sqrt{B_tc_t} + 2\sqrt{l_t}\ .$$

Note the $t$ subscripts -- $t = 1, 2$ depending on which period we are considering. Labor tax rates, real wages, the real interest rate between period one and period two, and the preference realizations are given by: $t_1 = 0.15$, $t_2 = 0.2$, $w_1 = 0.2$, $w_2 = 0.25$, $r = 0.15$, $B_1 = 1$, $B_2 = 1.2$. Finally, the initial assets of the consumer are zero.

a. Construct the marginal rate of substitution functions between consumption and leisure in each of period one and period two (**Hint:** these expressions will be functions of consumption and leisure – you are not being asked to solve for any numerical values yet). How does the preference shifter affect this intratemporal margin?
b. Construct the marginal rate of substitution function between period-one consumption and period-two consumption. (**Hint:** Again, you are not being asked to solve for any numerical values yet.) How do the preference shifters affect this intertemporal margin?
c. Using the expressions you developed in parts a and b along with the lifetime budget constraint (expressed in **real** terms…) and the given numerical values, solve numerically for the optimal choices of consumption in each of the two periods and of leisure in the two periods. (**Hint:** You need to set up and solve the appropriate Lagrangian.) (**Note:** the computations here are messy and the final answers do not necessarily work out "nicely." **To preserve some numerical accuracy, carry out your computations to at least four decimal places.**)
d. Based on your answer in part c, how much (in real terms) does the consumer save in period one? What is the asset position that the consumer begins period two with?
e. Suppose $B_2$ were instead higher, at 1.6. How are your solutions in parts c and d affected? Provide brief interpretation in terms of "consumer confidence."