Due Date: Friday, October 10, 2003

1. You are invited to visit a small island nation and to help in analyzing a proposed tax reform. The economy consists of two types of individuals, with each type accounting for half of the population. Jello is the numeraire consumption good in the economy. The first type of individual has a wage of 1 jello packet per unit of labor supplied, and the second has a wage of 2 jello packets per unit of labor. Individuals of each type have an endowment of one unit of labor. Each individual also has a lump sum income of one packet of jello.

Individuals of both types have preferences over three goods: leisure (1-L), jello (J), and coconuts (C). These preferences are described by a utility function:

$$U = \log J + \log C + \log (1-L).$$

There is a domestic production technology that turns one package of jello into one coconut. The process can be reversed.

The current tax system is as follows. Taxable income, which is measured in units of jello, is defined as labor earnings plus lump sum income. The marginal tax rate on the first 1.5 jellos of income is 25 percent, while the marginal tax rate is 50 percent on all income above this level.

(a) You begin your analysis of the tax system by trying to determine the optimal labor supply behavior of the two types of individuals in this economy. Find the labor supply, consumption of jello, and consumption of coconuts for individuals with a wage of 1, and for those with a wage of 2.

(b) What is per capita tax revenue from the current tax code?

(c) The domestic coconut lobby has proposed a tax deduction for coconut purchases. If all expenditures on coconuts were excluded from taxable income, describe the new tax schedule. How would per capita revenue change if this policy were adopted? Explain the factors that contribute to any revenue change that you identify.

(d) The coconut lobby has evaluated the potential revenue cost of the proposal in (c) by multiplying outlays on coconuts under the current (no coconut deduction) tax system by estimates of marginal tax rates for consumers of types 1 and 2. (This is known as "static revenue estimation.") Do your calculations offer any insights on the validity or limitations of this approach?

2. As news of your success in solving the previous problem spreads, you are invited to a small tropical island nation to become a tax policy consultant, with particular responsibility for analyzing tax-induced distortions in labor supply. Sensing the opportunity for an interesting vacation, you accept. The republic's finance minister faxes you a copy of the current tax schedule, defined over total daily (labor plus non-labor) income, which is:

$$T(y) = \begin{cases} 0 & \text{if } y < 60 \\ .5*(y - 60) & \text{if } y > 60. \end{cases}$$

After arriving in the republic, you discover it is smaller than you thought. The Complete Population Survey contains only four observations. Undaunted, you proceed with your proposal to estimate a linear hours-of-work model for the republic's population:

$$h = \alpha + \beta y_v + \gamma w$$

where h denotes daily hours, y_v is virtual income, and w is the household's after-tax wage rate. The data you receive are shown below:

Household	Non-labor Income	Hours Worked	Total Pretax Income
1	0	15.15	45.45
2	0	10.00	60.00
3	10	8.25	92.50
4	20	7.25	92.50.

(a) Use these data to estimate (α, β, γ). You should be able to solve for the parameters exactly (i.e., with no error terms in the hours equation) using three data points. (Hint: Remember to check whether each household is on a linear segment of the budget set, or at a "kink point.")

(b) Compute the total amount of revenue currently collected by the tax system, and find the lump sum tax (equal across all households) that would be needed to raise the same amount of revenue. For household 1, find the equivalent variation of shifting to this tax.

3. An economy is made up of individuals who have identical preferences, but different wage rates. Everyone has preferences given by the indirect utility function:

$$v(w,y) = e^{-.04*w}\{y - 12.5*w - 412.50\}$$

where w denotes the per-hour after-tax wage rate, and y denotes nonlabor income. No one in the economy has any non-labor income. Half of the population has an hourly wage rate of 10, while the other half has an hourly wage of 20.

The economy has the following income tax schedule:

$$T(Y) = \begin{cases} .10*Y & Y < 90 \\ 9 + .5(Y-90) & Y >= 90. \end{cases}$$

(a) Use the indirect utility function to find the labor supply function for everyone in this economy. (Note that this is a function of each person's wage rate and nonlabor income. You should find a positive number of hours of work.)

(b) Find the number of hours of labor supply for individual's with a wage of 10, and for those with a wage of 20.

(c) How much revenue does the government collect from the existing income tax system?

(d) Now imagine that in the name of fiscal stimulus, policymakers in this economy propose eliminating the lower bracket of the income tax, so that $T(Y) = 0$ if $Y < 90$. Describe the budget set for individuals with wages of 10, and with wages of 20, after this change.

(e) Does elimination of the lower bracket in part (d) change the virtual income of individuals who were previously earning more than 90? Explain why or why not.

(f) Fiscal conservatives worry that the stimulus package has too large an effect on the government deficit. They propose raising the revenue that was previously collected by the lower bracket of the income tax with a lump sum tax. How large would the lump sum tax need to be to return the government's revenue to the level collected with the initial income tax system?

4. OPTIONAL EMPIRICAL EXERCISE

The dataset mrozpsid.dta is a STATA dataset which contains a sample of married women from the Panel Survey of Income Dynamics for 1975. It is the data set used by Thomas Mroz in "The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions," Econometrica July 1987. The data set includes both working and non-working women for 1975.

Using this dataset:

(a) Calculate non-wife-income (YNW) as FAMINC - WHRS*WW. Estimate a simple linear probability model of the form $LFP_i = X_i\beta + \varepsilon_i$, where X should include the wife's age, number of children under 6, educational experience, mother's educational achievement, local unemployment rate, and non-wife-income. Use your resulting coefficients to perform two calculations. First, what would you predict a $1000 per family lump sum grant to do to the average probability that married women are in the labor force? Second, evaluate the linear probability model as a specification. How many wives have predicted probabilities of labor force participation greater than one, or less than zero?

(b) Estimate a probit model for the labor force participation decision, using the same variables as in (a). Repeat your calculation of d(participation rate)/d($1000 lump sum grant) for the married woman with sample average characteristics.

(c) Estimate a wage equation on the subsample of women who work, using the specification

$$\ln (w_i) = Z_i\gamma + u_i$$

where Z_i includes age, educational attainment, previous labor market experience, and whether you live in a city. Re-estimate the specification including the inverse Mill's ratio term from your probit equation in (b). Make a table of the estimated coefficients from the two models (are they very different?). Using the coefficients from the equation with the Mill's ratio, compute a predicted log wage for every woman in the sample.

(d) Re-estimate the probit equation from (b), now including the predicted log wage from part (c) as one of the explanatory variables in X. Do the coefficients on the other variables change significantly? What is your estimate of the change in labor force participation from a one percent increase in the wage of the married woman with sample average characteristics? What is your estimate from this model of the effect of a $1000 lump sum grant?