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14.74 Foundations of Development Policy
Spring 2009

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14.74 Problem Set #4

Due Friday, April 24, 1pm

No late problem sets will be accepted

1. **Sharecropping (Explanations of results should not exceed one or two sentences. When asked to solve, please write the steps and the equations clearly and explain what they mean).** Consider the following setting
 - Tenant farms the land and applies effort, e
 - Tenant's outside option is 0, and tenant has wealth w
 - The landlord cannot observe e
 - Both the tenant and the landlord are risk-neutral
 - Effort is costly, the cost of effort is $.5ce^2$
 - Two things can happen:
 - With probability e : Output is H
 - With probability $1-e$: Output is 0 (zero)
 - The tenant and the landlord write a contract which specifies a payment from the landlord to the tenant
 - Payment of h if output is H
 - Payment of l if output is 0
 - Tenant and landlord maximize their expected utility, which is equal to expected income for the landlord, and expected income minus cost of effort for the tenant.
 - 1) What do l and h look like in a sharecropping contract? In a rental contract? (Give the general form of l and h).
 - 2) **Optimal effort (first best):**
 - a) What problem do you need to solve to determine the optimal level of effort (the one that would be chosen if there were no contractual difficulties)?
 - b) Solve the problem: what is e^{FB} , the first best level of effort?
 - 3) **Tenant's choice of effort**
 - a) Given a contract that specifies h and l , what is the tenant's effort? (Set up the tenant's utility maximization problem and solve the first order conditions).
 - b) What class of contract will lead the tenant to choose the FB level of effort, e^{FB} ?
 - 4) **Optimal Contract without limited liability**
 - a) Assume there is no limited liability. The landlord maximizes his income. What contract will the landlord propose to the tenant? Calculate the rent that the landlord charges
 - b) What is the tenant's utility under this contract?
 - 5) **Optimal contract with limited liability** – the landlord cannot take more than the tenant's wealth ($l \geq -w$)
 - a) Is the tenant's problem and effort choice given h and l changed?
 - b) What is l chosen by the landlord?
 - c) How does the landlord choose h ? What condition on H , C , w is needed such that the tenant is willing to participate in this contract (remember that we assume in (b) the limited liability constraint binds, solve and plug the solution into the other constraint to find the condition for this constraint to be satisfied).
 - d) What is the tenant's effort under this contract? (e^{LL} : effort under limited liability)? How does it compare to e^{FB} and why?

- e) What is the tenant's utility under this contract? How does it compare to the utility under a rental contract?
- f) Now think of a market with many tenants and landlords. Suppose different plots of land have different fertility levels and therefore H varies (and has a distribution $G(H)$). Each landlord has 1 plot of land and all plots of land are the same size. Let there be a large number of potential tenants whose w varies (distribution $F(w)$) and there be more potential tenants than there are plots of land, so that some tenants will earn their outside option of 0. The allocation of tenants to landlords is generated by a competitive market where landlords compete for the tenants they like the best. What would the matching look like in equilibrium, i.e. landlords with low (high) H are matched with which kind of tenants? No need for closed form solutions here, but justify your arguments.

2. Land Size and Distribution of Labor

This is from Debraj Ray, *Development Economics*, p. 478, Question 1.

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3. Savings: Evidence from Thailand

Paxson (1992), in her article entitled "Using Weather Variability to Estimate the Response of Savings to Transitory Income in Thailand" (which is in the course reader), attempts to estimate the marginal propensity to save out of transitory income. She states that "a finding that these marginal propensities are high would indicate that farmers do use savings to smooth consumption" (p. 15).

Read the article, since you will need to refer to specific tables in the article to complete the following empirical exercise. This exercise uses the data set `paxson.dta`. At the beginning of

your Stata session, type “`set memory 20m`” and also “`set matsize 200`” because you will be using more memory and variables than the default setting.

- a. What is the problem with measuring the marginal propensity to save out of total income by regressing savings on total income?
- b. Paxson only has data on total income (`inc`). She wants to decompose it into a permanent income component (call it `incperm`) and a transitory income component (call it `inctrans`). In this part, you will replicate the results in Table 3 and obtain estimates of `incperm` and `inctemp`.
 - i. Run the regression that Paxson ran in Table 3, Column 1 (the income equation). Include all the variables you see in the table, as well as the region dummies mentioned in the footnote. (When I do this, I get numerically identical estimates as Paxson.) This part is not hard, but it gets tedious because of all the variables that must be included. Note you will have to form dummy variables for year and region.)
 - ii. Using the coefficients estimated in (i), Paxson constructs a predicted value for permanent income as follows. She multiplies the permanent characteristics by their respective coefficients from (i), and adds it all up to form `incperm` (see equation 2). [Stata hint: Suppose in (i), I just ran “`reg inc x z`” where `x` is a permanent characteristic and `z` is a transitory characteristic. Then I would form `incperm` by typing: “`gen incperm = _b[x]*x`”. So note the syntax: the “`_b[x]`” refers to the coefficient estimated for the independent variable, and you ask Stata to multiply it by `x` in order to form the predicted value of permanent income.] Generate the variable `incperm`. What is the mean of `incperm`?
 - iii. Paxson obtains a predicted value for transitory income in a similar way. She multiplies the transitory characteristics by their respective coefficients from (i), and adds it all up to form `inctrans` (see equation 3). Which variables from (i) are considered to be transitory characteristics? Generate the variable `inctrans`. What is the mean of `inctrans`?
 - iv. Paxson also has a category called unexplained income, defined as: $inc - incperm - inctrans$. Form this variable, and call it `incunexp`. What is the mean of `incunexp`?
 - v. Now you are ready to estimate the effect of income on savings. Run the regression that Paxson ran in Table 4, Column 2 (using `save2` as the savings measure). Include all the variables you see in the table, as well as the year dummies mentioned in the footnote. (When I do this, I get very close to Paxson’s results, but not exactly the same. So don’t worry if you don’t exactly replicate her results.) Paxson interprets the coefficient for `inctrans` as the marginal propensity to save out of transitory income. Based on your regression results, what is the marginal propensity to save out of each dollar of transitory income? Test the null hypothesis that this marginal propensity equals one. [Stata hint: Suppose you just ran “`reg save2 inctemp x1 x2`” and you wanted to test whether the coefficient for `inctemp` equals zero. You can just look at the Stata regression table and see whether the t-statistic is above the critical value, or see whether zero is in the confidence interval, or see whether the p-value is \leq the significance level. Or, you can type “`test inctemp=0`” and the p-value will be given. Now, for a test of the coefficient for `inctemp` equal to one, you can either look at the confidence interval or type “`test inctemp=1`”.]