New Economic School

Development Economics

Problem Set #1 Due Week 4

1. Endogenous growth in Ramsey model.

   Consider a Ramsey model of a decentralized economy with endogeneous technological progress. Population growth rate is $n > 0$, depreciation rate is $\delta = 0$, time preference rate is $\rho > 0$, utility function is $u = \ln c$. Each firm has a production function $Y_i = L_i A(k) f(K_i/L_i)$ where $f(\cdot)$ is a conventional neoclassical production function and satisfies Inada conditions; $k = \sum_i K_i / \sum_i L_i$ is average capital per capita in the economy. $A(k) = 1$ if $k \leq k^*$ and $A(k) = 2$ otherwise.

   Consumers maximize intertemporal utility $\int e^{-\rho t} e^{nt} u(c(t)) dt$ and firms maximize profits. The utility function u also satisfies Inada conditions. The labor and capital markets are competitive and each firm takes $A(k)$ as given. The initial capital stock is k_0 per capita. For all combinations of parameters, describe the equilibrium path of the economy.

2. Human capital accummulation.

   Consider an overlapping generations model with human capital accumulation (Azariadis and Drazen). Assume $A_t = 1$, $F(K, N) = \sqrt{KN}$. Here N is the effective (i.e. skill-adjusted) labor available in the economy. There is no depreciation. The consumer's utility function is $u(c_t, c_{t+1}) = \ln c_t + \ln c_{t+1}$. The human capital is accumulated according to $x^i_{t+1} = x_t h(\tau^i_t, x_t)$. The initial capital stock is k_0, initial human capital is x_0. Find the steady state(s) in the following cases.

   (a) $h(\tau, x) = \sqrt{\tau}$

   (b) $h(\tau, x) = 1 + \tau\gamma \min\{x, 1\}$

   Hints: (a) the steady state is a path with constant k and τ; (b) $\tau \in [0, 1]$.

3. School Inputs: The Case of Flip Charts in Kenya.

   (Please attach the code you have written to generate the results in whatever software you have used)

   There are two related data sets for this problem: retro.dta and prosp.dta. These data come from Paul Gewwe, Michael Kremer et al. (2004),

"Retrospective vs. Prospective Analyses of School Inputs: The Case of Flip Charts in Kenya," Journal of Development Economics, 74, 251-268. The data and the paper are downloadable from the course web page. The aim of this problem is to compare different methods of estimating the effect of wall charts on test scores.

The main variables measuring wall charts are: *wallchar* (in retro.dta) that measures the number of wall charts in the school, which the student attends and *wc* (in prosp.dta) which is a dummy indicating whether the school received wall charts from the Dutch NGO, and 0 otherwise.

Note that the NGO gave 4 wall charts to the recipient schools; thus, in the prospective data, $wc = 1$ represents a package of 4 wall charts. In order to make your results from the retrospective and prospective studies comparable, you would want the wall charts measure in the retrospective data set also to be in units of 4 wall charts. Thus, in the retrospective data, generate a new variable wc_r which is equal to wallchar divided by 4. Now, in the retrospective data, $wc\_r = 1$ also represents a set of 4 wall charts.

(a) OLS

In this part, examine the effect of wall charts on test scores using the retrospective data.

i. In an attempt to estimate the effect of wall charts on test scores, regress normalized test score on wc_r. Report and interpret the coefficient on wc_r.

ii. Now regress the normalized test score on wc_r, controlling for whether the classroom is indoors, whether the roof leaks, blackboard condition, textbooks per pupil (use bkpup), desks per pupil, teacher training level, and class size (see variable labels in the dataset to determine the definitions of the variables). Why might you want to use each of these controls? How does the coefficient on wc_r in this regression compare with the coefficient on wc_r in (i)? What do you conclude from this comparison?

iii. What could be problematic with using OLS regression like (i) or (ii) to estimate the effect of wall charts on test scores?

Which way would you expect the coefficient on wc_r to be biased? Why?

(b) Differences-in-differences

Continue using the retrospective data. Flip charts are subject-specific, and hence are relevant for some subjects but not for others. In particular, there are flip charts for teaching math, science, and home science (i.e., *sub* = "mat" or "sca" or "hsb"), but not for English, Swahili, geography, or arts (i.e., *sub* ="eng" or "kis" or "ghc" or "acm").

i. Based on the above information, propose and calculate a DD estimator for the effect of wall charts that compares the impact of wall charts on test score of students in the three wall chart and the four non-wall-chart subjects. Interpret.

ii. Compare this with the OLS result. What is the difference? Why are they different?

iii. What might be some problems with the DD estimate of the effect of wall charts on test scores?

(c) Randomized evaluation

For this part, use the prospective data set, prosp.dta. Note that in this data set, *wc* measures whether or not the student is in a school that received a package of four wall charts (including a wall map), so that wc is a dummy variable.

i. Calculate the mean test score for tests taken by students in schools which received wall charts, and the mean test score for tests taken by students in schools which did not receive wall charts. Take the difference of these conditional means. How do you interpret the difference? Note that you can also calculate the difference of these conditional means by regressing test score on wc; do this, and verify that the coefficient on wc equals the difference of conditional means.

ii. Note that in this sample, geography (sub = "ghc") is a wall-chart-related subject since the wall chart packet includes a wall map. Calculate the difference in mean test score, for tests in wall-chart-related subjects, between students in schools that received wall charts and students in schools that did not. In trying to estimate the effect of wall charts on test

scores, why might you prefer this to the calculation in part (i)? Interpret the result.

iii. Calculate the difference in mean test score, for tests in non-wall-chart-related subjects, between students in schools that received wall charts and students in schools that did not. Why would you want to do this?

(d) Comparison

What is the most preferable estimation method. Why?