Ec 1530, Spring 2012
Problem Set III

Setup:

Let the health production function be:

$$h_{ij} = \ln(w_{ij} + (1 - w_{ij})s_{ij} + \bar{s}_j) + c_{ij}$$

Where the each term is defined as follows:

h_{ij} denotes health in household *i* and in neighborhood *j*

w_{ij} is the fraction of time that piped water works for household i in neighborhood j

(Think of this as the number of hours the water works per day divided by 24, so $0 < w_{ij} < 1$)

s_{ij} is the time household i spends cleaning around its household

$\bar{s}_j$ is the average time other households in neighborhood j spend cleaning

c_{ij} denotes consumption.

Households maximize health subject to a money budget constraint:

$$c_{ij} = y_{ij} + v l_{ij}$$

where l_{ij} denotes time devoted to work and *v* denotes the wage, and a time budget constraint:

$$l_{ij} + s_{ij} = l$$

where *l* is the total time endowment.

You may assume throughout the problem that $l = 1$ and $v = 1$.

Exercises:

A) Use the time and money budget constraint to construct a full income budget constraint

B) Solve the full income budget constraint for consumption and substitute into the health function. You should have an expression relating health to s_{ij} and $\bar{s}_{ij}$ as well as w_{ij} and y_{ij}. Explain in words what the health production function says about the relationship between piped water and health. In what sense does piped water appear to be a health improving technology?

C) Maximize the function in (B) with respect to s_{ij} taking neighbors' behavior as fixed. Find expressions for the optimal value of s_{ij} and optimal health h_{ij} as a function of $\bar{s}_{ij}$, w_{ij}, and y_{ij}.

D) Show that optimal health is increasing in w_{ij} given $\bar{s}_{ij}$. If you have trouble doing this analytically make a table showing optimal health for various values of w_{ij} and $\bar{s}_{ij}$. Explain why you would expect this to be the case.

E) Just like in our model of other health technologies the behavior of one household depends on what other households do. In this case in equilibrium average sanitary behavior is determined by the cleaning behavior and thus the availability of piped water of all the neighbors. Assume all neighbors are the same so that in equilibrium $s_{ij} = \overline{s}_j$ and $w_{ij} = \overline{w}_j$ for all *i* in *j*. Substitute $s_{ij} = \overline{s}_j$ and $w_{ij} = \overline{w}_J$ into your expression for s_{ij} in C and solve for $\overline{s}_j$ as a function of $\overline{w}_j$. Substitute back into your expression for optimal health from C to get optimal health in equilibrium as a function of $\overline{w}_j$ and y.

F) Show that optimal health is decreasing in $\overline{w}_j$. If you have trouble with this it is okay to calculate optimal health at various values of $\overline{w}_j$ Explain why an otherwise beneficial technology leads to lower health in this model.

G) Bennett.dta is a data set simulated to look like the one that he used. Variables are barangay (neighborhood), hhid (household id), water (house has piped water), education (years of schooling of head), sanitation (whether household yard is clean of feces), dist (distance of barangay from underground reservoir and diarrhea (whether child has had diarrhea in the last week).

1. Create mean education, mean water, mean sanitation within barangay using the "egen" command: e.g. egen Xmean=mean(X), by(barangay).
2. Use the reg command to regress sanitation on water, mean water, education and mean education. Regress diarrhea on the same variables. Use "cluster(barangay)" in your regressions to account for the fact that household behavior may be correlated within the barangay.
3. A possible concern with (2) is that water is endogenously chosen by the household and that wealthier households may choose to have piped water and a cleaner compound. Unfortunately the data set does not have measures of wealth. How might this bias your results in (2)?
4. Distance to the reservoir may predict access to water. It cannot separately predict water usage of households within the barangay. Repeat your regressions from (2) with individual water omitted. Then do instrumental variables using distance as an instrument for watermean. Interpret your results.