Description of Environmental Variables Accompanying the G-Econ Dataset

Kyle K. Hood*

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The environmental data for this project are derived from several sources. All the data are defined geographically at the level of a one-degree latitude by one-degree longitude cell (hereafter, cell). The following land cover, climate and terrain data are described:

- Climate
  - Precipitation (monthly)
  - Temperature (monthly)
- Terrain
  - Elevation
  - Roughness
  - Standard deviation of elevation
- Vegetation
- Soil Types

The data under the categories labeled climate and terrain were derived from the Climate Research Unit Average Climatology high-resolution data sets (denoted CRU CL 2.0). See New, et al. (2002). These continuous-valued data sets have a resolution of 10'-by-10' (10 arc minute square). This resolution is finer than the one degree by one degree resolution of the cells, and so elevation, temperature and precipitation cell means are calculated (temperature and precipitation for each month). Precipitation and temperature are long-term monthly averages (1961-1990).

Roughness and standard deviation of elevation are calculated as functions of the (up to) 36 10'-by-10' small cells in each cell. The standard deviation measure may be improved upon as a measure of the roughness (mountainousness) of a

*PhD Student, Department of Economics, Yale University, New Haven, CT. e-mail: kyle.hood@yale.edu.

cell, as data contain a spatial component that may be taken advantage of. To account for the spatial nature of the data, roughness is calculated. Each datum represents the average absolute change in elevation between each small (10'-by-10') cell and its neighbors above, below and to each side, averaged over an entire large cell, i.e.,

$$r_c = \frac{1}{2M_c} \sum_{j \in J(c)} \left(\sum_{i \in N(j)} |e_i - e_j| \right)$$

where r_c is the roughness of large cell c, M_c is the number of small cells in large cell c, $J(c)$ is the set of small cells in large cell c, $N(j)$ is the set of the small cells in c that neighbor small cell j and e_i is the elevation of small cell i. Roughness is assigned a value of zero for large cells containing only one small cell. An example will clarify the cases in which this measure is preferable to standard deviation. Suppose the data contain two cells, each containing $4 = 2^2$ small cells, half of which are at an elevation of 0 and half at an elevation of 1. Suppose the first cell's elevations are distributed

$$\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$$

and suppose the second cell's elevations are distributed

$$\begin{matrix} 1 & 1 \\ 0 & 0 \end{matrix}.$$

The first cell could represent a hilly or mountainous area and the second could represent a cell that contains an escarpment or plateau. Because the set of values contained in each cell are identical, the standard deviation measure would treat these cells identically. On the other hand, the roughness measure would assign a value of 1 to the first (mountainous) cell and a value of 0.5 to the second (plateau) cell.

Soil data are from the Zobler's World File for Global Climate Modeling (Zobler, 1986). The first of these two data sets contains 106 soil types and the second contains soil types aggregated into 27 great soil groups. See FAO-UNESCO (1987) for a description of these groups. Vegetation/Land Cover data come from Matthew's Vegetation and Land Use Data (Matthews, 1983). It reports natural (pre-agricultural) vegetation data based upon the UNESCO classification system, excepting areas denoted "desert," "ice" and "cultivation." The latter three areas are not part of the UNESCO classification system. These data are discrete. The file "legend_zobler_matthews.xls" contains the key linking the values in the data file to the name of the soil and vegetation classes.

References

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