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Spatial Econometrics: Problem Set 1

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2020

1 Theory

1. Another method used for creating spatial weight matrices in Monte Carlo studies is the "k-ahead and k-behind" criterion in a circular world. (This was introduced by Kelejian and Prucha (1999)). In this approach, each spatial unit is assumed to have k neighbors which are ahead of it in the order of sample, and k units which are behind it. The number k is typically chosen to be small relative to the sample size. Thus, each spatial unit has $2k$ neighbors. Weighting matrices which are built on this framework are typically row normalized, and all of the nonzero elements in the matrix are $1/(2k)$. Suppose $n = 10$ and $k = 2$. Specify the third row of the 10×10 weighting matrix.

2. For a general sample size, say n, which corresponds to a checkerboard of squares, what is the minimum number of neighbors a unit can have if the weighting matrix is based on a queen pattern?

3. Let INC_r the income per capita in cross-sectional unit $r = 1, ..., n$. Consider the following specification for w_{ij}:

$$w_{ij} = \alpha \left[1 - \frac{|INC_i - INC_j|}{INC_i + INC_j} \right],$$

where α is some pre-selected positive constant. Show that α will cancel if the weight matrix is row-normalized.

2 Application

1. In this section you are asked to perform and ESDA for some variable you are interested in for Chile. First, go to the SINIM's webpage `http://datos.sinim.gov.cl` and choose one variable at the commune level for a given year. Then you have to merge this variable with the "comunas" shape file included in the "Chilean-Commune" folder. Be careful when merging the variable. Recall that the id from the shape file (COD_COM) must be the same as the id from your dataset. It is highly probable that the communes' ID from SINIM dataset will not be the same for some communes. So, you must be rigorous in this process! Otherwise: *"garbage in-garbage out"*. Last, but not least, I highly recommend working with Geoda in this homework. R can takes longer time to compute **W** matrices due to geographical fragmentation of the Chilean communes. If you insist working with R, you might create the spatial weight matrices in Geoda and then import them into R . You must send your final shapefile to me by e-mail.

   a) Compute a spatial weight matrix for the Chilean communes using both a queen and a distance approach. Provide a 'summary' of both matrices. What interesting pattern do you observe?

   b) Compute the Moran's I test based on Monte Carlo for your variable using at least 3 different weighting matrices. Provide a detailed analysis of your results using also the Moran Scatterplot. What do you conclude?

   c) Perform a LISA analysis to your variable. What do you conclude?

2. Create in R your own function to plot a Moran Scatterplot. Show that your function works well using an example.