GIS Resource Document 02-11 (GIS-RD-02-11) **September, 2002**

Using DynESDA for Moran and Local Moran Plots

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Basics

DynESDA is an extension program for Arcview 3.x developed by Anselin and Smirnov (1999): see www.spacestat.com. An excellent article recent article describing the functionality of DynESDA is:

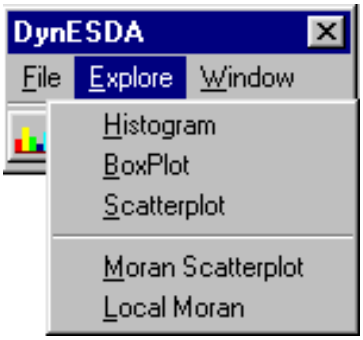
> Luc Anselin. 2002. Computing environments for spatial data analysis. Journal of Geographical Systems 2: 201-220 (pages 211-214 focus on DynESDA).

Using DynESDA

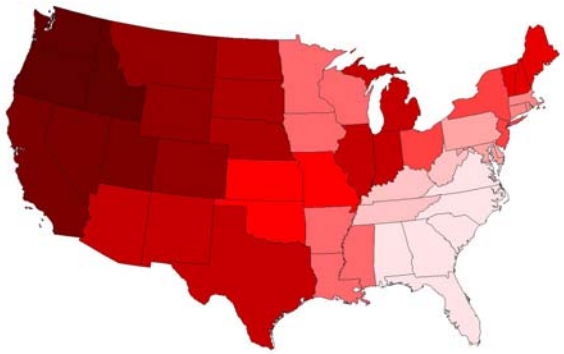
See GIS_RD_02-10 on instructions about setting up the DynESDA extension in Arcview 3.x.

This document assumes that your Arcview project already includes both geographic (shapes) and attribute data (tables) files.

Within Arcview invoke the DynESDA extension by clicking on the button. A floating toolbar appears with File, Explore and Window as the menus and five buttons. The buttons refer to options to produce a Histogram, a BoxPlot, a Scatterplot, a Moran Scatterplot and a Local Moran plot. Here we focus on the latter two options.



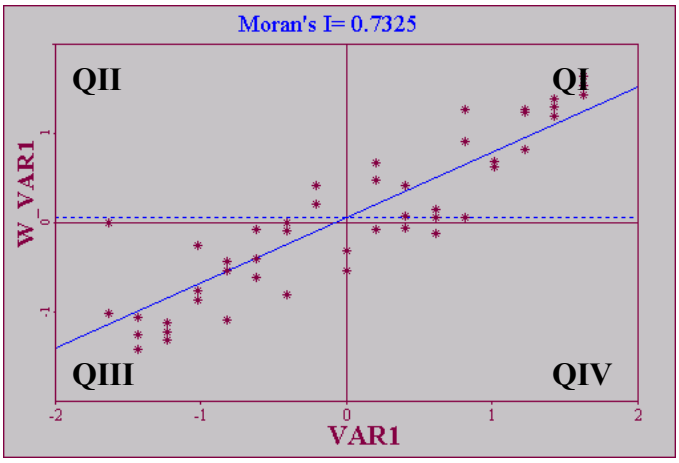
In this example we will explore the Moran scatterplot for an arbitrary variable mapped below (variable y -- Var 1). The map suggest high levels of spatial dependence or autocorrelation.



Map of Var 1

Moran's I provides an indication of the relationship between a vector of observed values, **y**, and a weighted average of values that neighbor, or are contiguous to, y. The latter are often referred to as the 'spatial lag of **y**', and is expressed as **Wy**, where **W** stands for the spatial weights matrix. The calculated value of Moran's I is the slope coefficient of a regression of **Wy** on **y**.

Select the Moran Scatterplot option, either by using the menu of the toolbar (Explore-Moran Scatterplot), or by clicking on the Moran Scatterplot (M) button  . Scroll down the list of variables until you find one you would like to explore. To select the variable double-click (or click once and then click on OK). A new window will open with a default Moran scatterplot for the selected variable. It is possible to select data elements and or dynamically brush the Moran scatterplot. Shin and Agnew (2002) write, "the scatterplot of individual components of Moran's I, measured in standard deviations, permits the visualization of the 'contributions' that each observation makes to the calculated statistics." The four quadrants represent the four types of spatial association that exist: Quadrant I - high values of **y** surrounded by similarly high values; Quadrant II - low values of **y** surrounded by dissimilarly high values; Quadrant III – low values of **y** surrounded by similarly low values; Quadrant IV – high values of **y** surrounded by dissimilarly low values.



Influential observations can be identified for their contributions, or leverage, by means of the two-sigma rule, or those observations falling more than two standard deviations from the origin (not an issue in the example above).

To explore Local Moran statistics, select the Local Moran tool (Explore-Local Moran) or select tool button  . Scroll down the list of variables and select the one of interest. A Local Moran BoxPlot Window will open. The box plot has a familiar form, with the dark area corresponding to the quartiles around the median (the blue dot in the middle), the thick lines above and below the box are "hinges" or "fences" (which can be set at 1.5 or 3 times the inter-quartile range) and outside the hinges are outliers. The definition of the "hinges" can be modified using the command Tools-Hinges menu item appearing in the BoxPlot Window.

DynESDA is installed on all GIA Core PCs and on the PCs in the Computer Lab in 806 Oswald. DynESDA resources are available on-line at www.spacestat.com. The GIS staff have experience using DynESDA.