(1) An equivalent which corresponds exactly to the term is marked '='. (2) One that does not entirely correspond is marked '±'. (3) Where an equivalent does not exist and a paraphrase or a translation is given, this is marked '≠'. Of course, this is only a guide for the user. If he wants more precise information he will refer to the edition of the language in question.

A uniform definitive text does not mean that four editions have to make literal translations from the leading language. In each case the definitive text will follow the approach of the language concerned. Where one language uses a noun another may use a verb, e.g., for the French nouns 'glaciaire' and 'périglacière' the English has only the adjectives 'glacial' and 'periglacial.' The text, however, must be analogous in all editions.

The compilation of a multilingual dictionary requires openminded co-operation. It is a big task, but it is worth the effort. The preparation of the planned international dictionary will best realize the general aims of the IGU. It will serve as a means of promoting the exchange of information at an international level and at the same time be a step in the direction of future national and international standardization.

A note on the estimation of a spatially-autoregressive model

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In a recent paper, Cliff and Ord (1971) have discussed the use of multiple regression in regard to the problem of spatial forecasting. In that paper, it is acknowledged that the use of ordinary least squares (ols) in the estimation of a spatially-autoregressive model may be invalid. In this paper, an estimate of the size of the bias in ols estimators is presented.

Let a set of variables have defined values for each of N zones partitioning a map. A non-spatial hypothesis concerning these variables might take the form of

(1) \[ z_j = \alpha_1 x_{j1} + \alpha_2 x_{j2} + \ldots + \alpha_k x_{jk}, \] where \( z_j \) is the dependent variable, \( x_{ji} \) is the value of the \( i \)th independent variable, \( \alpha_i \) is the \( i \)th coefficient to be estimated, \( u_j \) is a random error term, and \( j \) refers to zone \( j \).

We can rewrite (1), in matrix notation, as

\[ Z = XA + U, \]

where \( X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1k} \\ x_{21} & x_{22} & \cdots & x_{2k} \\ \vdots & \vdots & \ddots & \vdots \\ x_{N1} & x_{N2} & \cdots & x_{Nk} \end{bmatrix}, A = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \vdots \\ \alpha_k \end{bmatrix}, U = \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_N \end{bmatrix} \)

Letting \( X^* = XMZ \) and \( A^* = \begin{bmatrix} A \\ \beta \end{bmatrix} \),

\[ Z = X^* A^* + U. \]

The ols estimator of \( A^* \) is given by

\[ \hat{A}^* = (X^* X^*)^{-1} X^* Z, \]

Using the calculus of mathematical expectations, we can derive that

\[ E(\hat{A}^*) = A^* + (X^* X^*)^{-1} V, \]

where

\[ V = E(Z' M' U). \]

The typical element in the summation making up \( Z' M' U \) is

\[ a_{jk} = u_j \sum \frac{m_{jk}}{k}. \]
TABLE 1. Bias

<table>
<thead>
<tr>
<th>β</th>
<th>σ² = 0.50</th>
<th>Bias α</th>
<th>Bias β</th>
<th>σ² = 0.75</th>
<th>Bias α</th>
<th>Bias β</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>3.89</td>
<td>-0.90</td>
<td>0.14</td>
<td>-1.35</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>5.27</td>
<td>-1.22</td>
<td>0.19</td>
<td>-1.83</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>0.7</td>
<td>7.27</td>
<td>-1.68</td>
<td>0.26</td>
<td>-2.52</td>
<td>0.39</td>
<td></td>
</tr>
<tr>
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<td>-2.42</td>
<td>0.39</td>
<td>-3.61</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>0.9</td>
<td>17.39</td>
<td>-4.00</td>
<td>0.63</td>
<td>-6.00</td>
<td>0.94</td>
<td></td>
</tr>
</tbody>
</table>

Note that we can re-express (5) as

(9) \( Z = (I - \beta M)^{-1}XA + (I - \beta M)^{-1}U \),

where \( I \) is an \( N \times N \) identity matrix. Let \( w_{ij} \) be the typical element of \( (I - \beta M)^{-1} \) and reformulate (8) as

(10) \( a_{ij} = \sum_t [m_{jt} \sum_r [w_{rt} \sum_s [x_{is} \nu_s] + w_{rt}] ] \),

for which

(11) \( E(a_{ij}) = \sigma^2 \sum_r [m_{ij} w_{ij}] \),

and

(12) \( E(Z'M'U) = \sigma^2 \sum_r [\sum_s [m_{sr} (\beta(M)_{rs} + ...) + \beta(M^2)_{rs} + ...] ] \).

Unfortunately, \( w_{ij} \) is a function of \( \beta \) and, therefore, no simple adjustment to the OLS estimator, to make it unbiased, is possible.

However, suppose that \( |\beta| < 1 \). Then,

(13) \( (I - \beta M)^{-1} = I + \beta M + \beta^2 M^2 + ... \),

and

(14) \( w_{ij} = \beta(M)_{ij} + \beta^2(M^2)_{ij} + \beta^3(M^3)_{ij} + ... \).

Note that \( M \) is a Markov Transition Matrix and that

(15) \( \sum_s (M^k)_{is} = 1 \) for any \( k \) and \( s \).

Substituting (14) into (12) yields

(16) \( E(Z'M'U) = \sigma^2 \sum_r [\sum_s [m_{sr} (\beta(M)_{rs} + ...) + \beta^2(M^2)_{rs} + ...]] \).

(17) \( = \sigma^2 \sum_r [\sum_s (\beta^k(M^k)_{rs} + ...)] \).

If \( M \) satisfies the Ergodic Theorem, then

(18) \( \lim_{k \to \infty} (M^k)_{ij} = P_{ij} \) for any \( i, j \),

where \( P_{ij} \) is the ergodic probability of zone \( j \).

In the limiting case where \( \beta \) approaches unity, we can approximate \( E(Z'M'U) \) by

(19) \( \lim_{\beta \to 1} E(Z'M'U) = \lim_{\beta \to 1} \sigma^2 \sum_r [\sum_s (m_{sr} P_{ij} (1 - \beta))] \).

(20) \( \approx \lim_{\beta \to 1} \sigma^2 \beta (1 - \beta), \)

(21) \( \approx \infty. \)

From (17), we can see that when \( \beta = 0, \hat{A}^* \) will be unbiased. From (21), we can see that as \( \beta \) approaches unity, \( \hat{A}^* \) becomes totally unreliable. From (17), we can also conclude that, for values of \( \beta \) between zero and unity, the size of the bias is partly dependent on \( \hat{A} \).

A different estimator of \( A^* \) might be given, after (7), by

(22) \( \hat{A}^* = \hat{A} - (X^* X^*)^{-1} V \),

where the parameter values in the non-zero element of \( V \) are estimated by \( \hat{A}^* \). Then (22) can be solved iteratively for \( \hat{A}^* \).

It is not clear, however, that \( \hat{A}^* \) will, itself, be an unbiased estimator of \( A^* \) and the intractability of this problem has prompted consideration of the use of Monte Carlo simulation to test the properties of this estimator.

Cliff and Ord have estimated, using OLS, a model of the form

(23) \( Z_t = \alpha + \beta z_{t-1} + \epsilon_t, t = 1, 2, \ldots, 25 \),

where \( z_t \) is automobiles per 100 population, \( \alpha \) is the average value for \( z_t \) in contiguous counties (binary case), and the map consists of 25 Irish counties. Their estimates are

(24) \( \hat{z}_t = -1.165 + 1.1649 \alpha_t \).

Using their published data, it can also be derived that

(25) \( (X^* X^*)^{-1} = \begin{bmatrix} 3.0208 & -0.4644 \\ -0.4644 & 0.0723 \end{bmatrix} \).

\( \sigma^2 = 0.585. \)

Using (17), we can derive estimates for

(26) \( \sum_r [\sum_s [m_{sr} w_{sr}]] \)

for different levels of \( \beta \). Since \( \sigma^2 \) might be expected to lie between 0.50 and 0.75 in this case, let us calculate estimates of the biases in \( \alpha \) and \( \beta \) at these levels (see Table 1).

It is concluded, from this table, that, when \( \beta \) lies between 0.7 and 0.8, the bias produced is large enough to account for the \( \beta \) value of 1.1649.

Using (9), it can be seen that, having estimates for \( \beta \) and \( A \) and forecasts for \( X \), we can predict values for \( Z \). Suppose, however, that \( \hat{A}, \alpha, \) and \( X \) are to be changed for the prediction
of Z. We would like to be able to interpret both \( \beta \) and \( A \) so that we could make some meaningful statements as to how and why these are changing.

Let us consider the simplest spatially auto-regressive model; that given by (23). We have already interpreted \( \beta \) as the effect of \( z \)-values in neighbouring zones on zone \( j \). We can also show that

\[
\hat{z} = z - \hat{\mu} \tag{27}
\]

where bars indicate variable means. Thus, \( \hat{z} \) is directly related to the average value of \( z \). This suggests that, in order to predict a new map in this case, one needs only an old map, an estimate for \( \beta \), and an estimate of the new \( \hat{z} \). The value of \( \alpha \) which produces this \( \hat{z} \) can be determined iteratively. Further, it might be suggested that, if one wanted to use (9) for forecasting solely, an accurate and unbiased estimate for \( \alpha \) is not critical.


It is my apprehension that geography could be reduced to a mere skill or point of view, unless its thought-structure is lifted to a philosophical level from time to time. Not that all geographers should be doing this intellectual exercise, but at every phase of its development there must be a few 'arm-chair' geographers who would do some deep-thinking in the discovery and narration of a geographical philosophy. One great tradition (Pattison 1964) of geography has been in some kind of equation between man and environment, but of late a serious challenge seems to have been posed to convert geography into an analysis of spatial diffusion. The intellectual content, or the lack of it more often, in the field of geography has bothered me all along, and I have even been dissatisfied with the continued use of the very name of our field. Who does not agree that the name 'geography' does not signify today even a substantial part of the knowledge which has come to be associated with this discipline? The name is definitely inadequate to denote either the core or the periphery of the subject.

But is geography integrated enough to hold its own or likely to go into specializations? In the Soviet Union Academician I.P. Gerasimov has been accused of stressing research on physical components such as climates, soils, land forms, and vegetation and of supporting views which will lead to the liquidation of geography. On the other hand, the decline of physical geography in the land of W.M. Davis is well known and much regretted, as will be evident from the following statement of an American geographer: 'In some departments, physical geography has been dropped, perhaps in the expectation that it will be taken up by meteorology, geology or forestry' (Miller 1965, 3).

There appears to be, then, a 'cold war' between the Soviet and the American views on the nature and scope of geography. There is no doubt that a wide discrepancy exists between the Soviet and American points of view regarding the subject matter of geography. While the Soviet geographers have stuck to the 'mother of Science' concept of geography, post-world war II American geography has drifted towards social sciences. Both countries have, however, contributed valuable research to their respective areas of geography and also made considerable success of practical applications of the geographical method. Yet in both countries criticism has been put forward suggesting that the subject has been pushed ahead too much in one direction, to the neglect of the other. The Russians tend to utilize geographical research in the socialistic reconstruction of their regions: the Americans prefer to undertake resource-inventories and improvement of individual regions, through free enterprise. Over 10 years ago, while analysing this growing divergence of viewpoints between Soviet and American geography (Mookerjee 1957) I had spelled out a new statement on geography, 'as the study of man in the ordinary existence of life' (following Marshall's well-known definition of economics). In this