GENERALIZATION MODELS IN ECONOMIC GEOGRAPHY *

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1

Methodological problems in geography can be approached from two principal points of view, concerned with either (1) the subject and methods applied in this science, or (2) the logical character of propositions which build up geographical knowledge. Economic geography is composed, as all empirical sciences, of a certain amount of propositions accumulated during researches carried out by geographers. This leads to a question of the type of such propositions, which can be answered at its simplest by a suggestion to include geography into idiographic sciences following a well known division, introduced by W. Windelband [15] and H. Rickert [14], into idiographic and nomothetic sciences. According to them both groups are radically opposed to each other; nomothetic sciences lead to scientific laws, idiographic ones — to singular statements.

Consequently, the problem of scientific laws has induced fundamental discussions on methodological questions in the geographical sciences. R. Hartshorne ([6] p. 146) wrote on this subject as follows: "Of all the problems of current concern in the thinking of geographers, the most disturbing appears to be the question whether geography 'like other sciences' can develop 'the knowledge of the principles, laws and general truths' — or whether its function is merely to describe innumerable unique areas".

As the discussion of this problem is difficult because of the ambiguity of the notion "the scientific law", used by many authors in their descriptions of the structures and cognitive tasks of the fundamental types of learning, it seems worth while starting this paper by defining its meaning.

Literature concerned with methodology describes many various con-

* The author considers economic geography to be synonymous with human geography in its broad notion, as opposed to physical geography.

ditions which are required for a proposition to become a scientific law. These conditions, however, have been influenced by the notion of the scientific law as developed on the basis of exact sciences, especially physics. The main problem, therefore, consists of discovering what kind of propositions should be classified as scientific laws.

It is generally accepted that for a proposition to be classified as a scientific law (an empirical science), it is necessary to be of a strictly universal character, and furthermore to comply with the following conditions: essential significance in a given domain of research, compatibility with commonly recognized facts, confirmation by prediction, empirical contents and universal acceptance by specialists from within a given branch of knowledge (J. Giedymin [5], p. 155).

From among the conditions listed above the first one, i. e. the strictly universal character, deserves fuller investigation, as it is a condition sine qua non for a proposition to become a scientific law (law-like statement).

The proposition is strictly universal unless spatio-temporal limits of phenomena described arise from its contents. Such limits can occur either in the form of proper nouns (e. g. "in England"), or of terms which cannot be defined without using proper nouns denoting mainly time characteristics (e. g. "in the nineteenth century"). It should be noted, moreover, that all time characteristics can be defined only by using proper nouns, e. g. by the passage of time from the beginning of our era. The strictly universal proposition, therefore, can contain neither proper nouns nor terms denoted by means of proper nouns.

Statistical statements reflecting the relative frequency of observable random variable can be rated among strictly universal propositions on condition, however, that the variable is not bounded by spatio-temporal co-ordinates.

It should be stressed, however, that the strict universality of laws does not mean that they are unconditional statements. Usually, they are expressed as conditional sentences according to the following pattern "always whenever conditions $C_1 \ldots\ldots C_n$ occur, they are followed by phenomenon Z" or "always whenever object X possesses quality F, it also has quality G".

Such generalizations which similarly to laws go beyond the contents of the investigated material, i. e. outside the framework of a report and therefore are bounded by spatio-temporal co-ordinates, should be differentiated from scientific laws. They are called statements of numerical universality or historical generalizations. This differentiation, introduced by K. Poper ([13] p. 6) implies that strictly universal propositions (scientific laws) are statements with an unlimited number of individuals,

and therefore cannot be replaced by a conjunction of a finite number of singular statements. Statements of numerical universality (historical generalizations) refer only to a finite class of specific elements within a finite individual or particular spatio-temporal region.

2

After this introductory analysis, aimed at eliminating any misunderstanding in the notion of the scientific law, we may return to the fundamental question set by R. Hartshorne ([6], p. 146): "does geography seek to formulate scientific laws or to describe individual cases". I would like to suggest analysis of the following three questions: (1) what kind of statements, as far as the degree of their generalization is concerned, are made within economic geography, (2) does the subject of economic geography permit us to formulate scientific laws, (3) should an attempt be made at formulating scientific laws in economic geography.

The answer to the first question cannot be given without analyzing what in fact geographers do.

Geographers rarely speak about making laws and above all stress the individual character of investigated objects and relations. At the same time the perusal of geographical works shows that they contain many generalizations. They are characterized by a tendency towards more or less clearly defined spatio-temporal limits, and are, therefore, shaped as historical generalizations and not as strictly universal propositions, i. e. scientific laws.

Historical generalizations in economic geography have been shaped as yet in their qualitative form. The following proposition may serve as an example: "The growth of old towns in the same way as the creation of new cities (west-European) is not due to increased urban activities but to their transformation as a result of confrontation with new forms of labour and groupings of the population" (P. George [4], p. 57). Even if we do not propose to discuss the accuracy of the terminology, we should stress that a great majority of generalizations formulated in such a way do not possess a clearly defined general quantificator. That is why it is hardly possible to classify them — even within the spatio-temporal framework — as conditional statements of the type "each A implicates B", and they should be included rather in the group of the statements built on the pattern "B sometimes follows A", i. e. in the group of specific statements. Such generalizations seem to be worded as if on the verge of descriptions, and therefore they are hardly checked up systematically, or reworded.

It is not the aim of this paper to analyze in detail the logic of such

statements; it should be mentioned only that many of them can be classified as hypotheses serving as the base on which proper historical generalizations are made up, first of all through presenting them in the more accurate form of statistical statements.

A broader application of mathematico-statistical methods in economic geography was accompanied by a more general use of quantitative historical generalizations, or generalizations formulated in result of a quantitative research. They are mostly shaped in the form of statistical relations. A good example of procedure and difficulties arising when generalizations of such a type are formulated is provided by the use of multiple-regression analysis by H. H. Mc Carthy and others [10] when they defined the degree of areal association among manufacturing industries in Japan and the US. This relation expressed in the form of the regression equation reads as follows:

$$Y = 0 \cdot 68\, X_1 + 0 \cdot 37\, X_2 + 0 \cdot 42\, X_3 + 0 \cdot 46\, X_4 - 44 \cdot 56$$

where Y is the distribution of the machinery industry, X_1 — the printing industry, X_2 — the chemical industry, X_3 — the spinning industry, and X_4 — the food industry.

Such generalizations, so often used in social sciences, although alien to methodological rigorism of exact sciences, constitute a considerable progress in the process of introducing generalizations to economic geography. Undoubtedly, many of them are worded with a certain degree of caution, and might be treated as hypotheses for more universal propositions. This, however, makes it necessary to define the theoretical base for the construction and estimation of descriptive equations as models for presenting such relations.

It can be said with a great degree of reliability that propositions which can be accepted as strictly universal statements, i. e. scientific laws, in economic geography are scarce. Some authors as W. Warntz [16] in the case of his "law of price" did make an attempt at drawing up such statements, but a closer analysis reveals that they are in fact nothing else but typical historical generalizations with clear spatio-temporal limits, that they refer to the territory of the US only, and cannot be applied in a broader sense without further systematic cheking up and rewording.

I would like to end this chapter with saying that in economic geography generalizations in the form of historical generalizations (and not of scientific laws) predominate, and that only quite recently under the influence of a broader application of mathematical methods a tendency has been visible to carry out systematical research aimed at the introduction of quantitative generalizations.

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The second question is whether the subject of economic geography permits us to formulate scientific laws. Two views are represented in discussions: (1) the negation of the possibility of formulating scientific laws in the domain of social sciences which also include economic geography, (2) the conviction that under the existing division of labour, economic geography represents a tendency to specify and not to generalize.

When the scientific law is understood as a strictly universal statement, in the domain of social sciences we are confronted with two characteristic views which — to use terms introduced by J. Giedymin ([5], p. 149) — can be called naturalistic and anti-naturalistic. The naturalistic approach maintains that the patterns of tasks and methods applied by natural sciences are applicable in investigations of social phenomena and therefore scientific laws can be formulated in social sciences. The anti-naturalistic approach is opposed to this thesis. It can be best exemplified by the doctrine of indeterminism quoted by R. Hartshorne ([6], p. 153). The thesis of inability to make experiments in social sciences, the thesis of the limited repetition of social phenomena, and the phenomenon of the influence exerted by the process of investigation on its subject and expressed in the self-destruction and self-realization of predictions — may serve as further examples of anti-naturalistic arguments.

Even without discussing in detail views expressed by anti-naturalists we may state that in the light of results achieved by such disciplines as sociology, social psychology and economics in the field of formulating scientific laws, their arguments cannot hold good. Such laws are, however, scarcer than in exact sciences, usually statistical in their character, often inadequately proved, and not always universally accepted. Lately, however, research on the basis of general hypotheses, systematically collected and verified, has greatly developed. This tendency has been hampered i. a. by the antagonistic approach to projects of applying statistical and mathematical methods, which form real progress in the procedure of making general statements.

The conviction that scientific laws can be formulated by social sciences does not necessarily mean that the same is true for economic geography, or that the scope of this discipline permits of their formulation. If, following R. Hartshorne ([6], p. 21) we state simply that geography is concerned with providing accurate, orderly, and rational description and interpretation of the variable character of the earth's

surface, such a goal does not eliminate the possibility of constructing generalizations concerned primarily with spatial relations. A descriptive approach, or better the description of individual events and relations, can be treated as either (1) a goal in itself, with the main interest focussed on individual relations, or (2) a starting point for formulating a certain general relation. When we, for example, analyze the growing degree of industrialization in a given town, induced by changes occurring in the structures of settlement, trade and services, the geographer is fully entitled to describe either this single case, or a certain group of cases, or also — if he wishes — to extend his research of the relations between industrialization and the structures of settlement, trade and services also on other towns, and thus to a try to discover a universal relation concerned with a certain group or type of industrialized towns. The first approach, which we can call a particularizing analysis, belongs to the traditional domain of geography, the second one — a generalizing analysis — shares common ground with other social sciences.

Generalization is in principle an inductive method. The inductive procedure aimed at forming universal statements is in economic geography faced with fundamental difficulties. Even if we do not propose to mention such difficulties, well known and widely discussed by other social sciences as those connected with comparability, a great number of multiple factors and a high degree of functionalism in investigated phenomena, we must pay attention to one question which is of special significance for economic geography, i. e. the fact — which was discovered by S. Nowak ([11], p. 30) — that socio-economic phenomena, analyzed from the viewpoint of their spatial aspects, tend to occur stubbornly in some durably correlated complexes with a defined spatio-temporal location.

The reason why geography limits itself to presenting only spatial location of a given phenomenon is the difficulty in tracing among a great number of factors varying spatially those which determine the given consequence. The geographer knows that the region in which a certain socio-economic phenomenon occurs, differs from other regions in many qualities out of which only certain are of significance to the occurrence of this phenomenon. Not knowing, however, how to discover them, he only defines the area in which the investigated phenomenon occurs. Those unknown components which determine the occurrence of the phenomenon under investigation, are often replaced in geographical research by spatio-temporal co-ordinates (regions). Thus, spatio-temporal co-ordinates are used as substitutes in certain complexes of conditions whose causal influence cannot be fully recognized and defined.

Analyzing the problem from this viewpoint we are faced with the question of whether spatio-temporal limits are specific only to the subject and methods applied in geography. It seems that the answer must be positive. Spatio-temporal co-ordinates, however, are used not only as substitutes in historical generalizations when components of more universal relations are missing, but also to provide information about the range of occurrence of unknown factors. The discovery of such factors will permit of replacing spatio-temporal co-ordinates by some defined complexes of conditions, and thus make it possible to formulate strictly universal statements, i. e. scientific laws.

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The third problem is to find an answer to the question whether or not geographers should make an attempt at formulating scientific laws.

Should the postulate of the maximal empirical evidence, or to put it in other words the least risk of obtaining distorted results, be a unique one which we have to fulfil when making scientific propositions — then it would have been necessary to give up beforehand all broad generalizations or generalizations entirely free from spatio-temporal limits. It is, however, a general requirement that the smallest possible number of scientific propositions should be able to explain the greatest possible number of phenomena. Such superfluous caution results in lack of economy in formulated statements; at the same time a too rash generalization creates a risk of their distortion. The dispute over the degree of generalization is above all a dispute over the approach — an empirical or a theoretical one — which the research worker should choose.

If we propose to implement the principle of economy in thinking, generalizations, i.e. the broadest propositions, make real progress.

In the domain of economic geography historical generalizations are much easier to make than strictly universal propositions; the danger of their distortion is lesser. Modern methodology requires, however, the formulation of the possibly broadest generalizations, free from spatio-temporal limits, i.e. strictly universal statements, because they contain more valuable information. Strictly universal statements make it possible to differentiate permanent relations and to arrive at the conclusion that the implementation of certain conditions (events) in any time and at any place is always followed by some defined consequences. The discovery and the making of such statements provide, therefore, knowledge needed for the transformation of reality.

In summing up I wish to state that in economic geography in contrast to the dichotomy (scientific law and individual fact) clearly visible in

the works by W. Windelband and H. Rickert, and subsequently by R. Hartshorne, there is an intermediate phase, i.e. the historical generalization. At the same time an important methodological difficulty also occurs as to how to overcome the spatio-temporal limits. Mathematical and statistical methods, and particularly mathematical models, are means which may solve this problem. It is, therefore, advisable:

(1) to carry out theoretical studies of principal problem complexes in economic geography, such as: agricultural and urban land use, industrial location, trade location, location of towns and the transport network. This will make it possible to draw up a number of hypotheses for separate problems with various degree of generalization.

(2) to work out one's own systematic methods of verification and transformation of such hypotheses into commonly recognized propositions in the form of historical generalizations and strictly universal statements.

(3) to arrange loose sets of general statements into theoretical systems internally consistent and hierarchically ordered.

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