# CONFERENCE REPORTS

## *Quantitative Methods in History*

**Stefania Kowalska-Glikman**
Institute of History of the Polish Academy of Sciences, Warsaw

The last half century has witnessed considerable progress in the historical sciences. This discipline, which hitherto simply described events which took place in the past, now aims to explain the historical process in global terms. Formerly the historian asked: « What happened? », whereas today he also asks: « Why did it happen? ». He is no longer content merely to accumulate past facts and to discuss them with his contemporaries. Scholars ask questions of the past and seek relationships and links within a given period. This induces historians to confront new problems and to choose new research methods and also to take advantage of methodological progress made in related scientific fields.

There is little need today to argue in favour of the application of quantitative techniques in history. However the role and significance of quantitative research in historical study is still a matter for lively discussion in academic circles. Is literally all past human activity quantifiable and can it be expressed in the form of a complex mathematical formula? Every historian is aware that not all phenomena are suitable for such treatment. Hence the question arises: what are the limits to the application of quantitative methods?

The quantitative approach to history is one of several possible approaches to the study of the past. However it cannot be denied that, at the present level of development of the social sciences, quantitative methods do provide sound and significantly precise criteria for testing. But quantification in historical research does not consist only in the perfection of the historian's « toolbox ». Primarily the task is to provide new research prospects in the field of economic and socio-cultural history. In the search for the truth — the fundamental and *prima rationale* of historical study — quantitative methods

introduce several new factors. They make the analysis of mass sources possible and facilitate comparative study over long periods of time. And, as is well known, the margin of error is likely to decline with the extension of the period under study. On the other hand the study of the past through mass quantification tends to disguise the outcome of individual actions. But such merits and demerits characterize virtually all types of research. It is therefore understandable that by some they are viewed with scepticism and by others with optimism. It was with this in mind that an international colloquium was organized at the *Institute of History of the Polish Academy of Sciences* in Warsaw (13th-16th November 1973), devoted to quantitative methods in historical research. This provided a forum for the exchange of ideas and experiences in the field of quantification in historical studies. It was the first symposium of this type to bring together representatives of the humanities from Poland and abroad. More than 100 individuals took part in this colloquium and they represented the major universities and research centres in Poland as well as 14 guests from Belgium, Czechoslovakia, France, the German Democratic Republic, Hungary, Italy and the Soviet Union. Representatives of various branches of the social sciences, history, ethnography, demography, archaeology, economics, sociology etc. all took an active part in these debates.

The inter-disciplinary character of the conference was a welcome feature because any refinement of quantitative methods can only take place on the basis of mutual cooperation and the exchange of experiences between the various branches of the social sciences.

During the four days of debate 14 papers were presented, and more than 50 speakers took part in the discusions. The speakers focussed on three main topics: the methodological implications and consequences of the application of quantitative methods, the methodological premises for their application, and examples of particular analyses.

General methodological problems were discussed mainly in the papers by François Furet, Jerzy Topolski and Herman Van der Wee.

F. Furet (Ecole Pratique des Haute Etudes (E.P.H.E.) - Paris) in his paper « From descriptive to problematic history » traced the development of the social sciences. The scholar investigating the past increasingly tends to reject mere description in favour of « history with problems » — history with equations. In a sense description can be seen as an attempt to reconstruct order from the chaos of events. Such an approach takes biography as its model, that is the clearly defined span of a given life from birth to death, during which the events that take place at certain moments are more important than those which can be traced across the whole span of the biography. Works of this sort, typically entitled « The History of France » (or of any other country) share common research assumptions. It is this type of history that is undergoing change, claimed F. Furet. Instead of the

traditional narrative of events or individual facts, selective questions are formulated and addressed to the past. The mere facts, as recorded by persons living in a certain period, are no longer satisfactory. The historian must « conceptualize » the subject of his study, integrate it in a meaningful network and so make it comparable. The task of the historian is also to arrange and classify archive sources in order to provide both a description and an interpretation of the phenomenon under study in relation to a range of previously constructed hypotheses. It is here that the importance of quantitative methods greatly increases, provided, however, that they are properly adjusted to a given set of problems and appropriately supervised.

The discussion of theoretical models as well as the explanation of the use of models in economic history were the subject of papers by H. Van der Wee and J. Topolski. These problems were also dealt with indirectly by Denis Richet (E.P.H.E. - Paris) in his paper on « Quantitative history or retrospective econometrics? — a description of the approach ». The author criticized the approach of Jean Marczewski and his « school » which, among other things, has completed a macro-economic analysis of the French economy from the 18th to the 20th centuries. The economists' conclusions have been challenged by historians. Studies of retrospective econometrics, which were initiated by J. Marczewski's team, have undoubtedly enriched the methods and findings of economic history particularly with regard to macro-economic problems, claimed Richet. However a number of Marczewski's methodological conclusions were viewed critically by historians. Richet was particularly critical of the way in which Marczewski dealt with such problems as 1) the choice of sources, 2) a sufficiently critical approach to them, 3) periodization, 4) the methods of reducing certain magnitudes e.g. prices, to the common unit value, although they are subject to fluctuations over long periods. Historians have objected most strongly, however, to the application of contemporary models to the past. Can a national model worked out in the context of twentieth century technology be applied to past centuries, D. Richet asked. Are different values of the same article (even when reduced to a common unit) produced in 1689 and 1969 respectively, comparable in any meaningful way? Are not variations in the price structure of goods and expenditures of prime significance to the historian? Marczewski's model, D. Richet concluded, was not then suitable for the study of more remote times which constitute both long periods of equilibrium and short and medium periods of imbalance. D. Richet argued the case for partial, rather than comprehensive, models, but if the object is to reproduce a complete historical picture then it is necessary to employ other research methods as well.

H. Van der Wee (Louvain) in his paper on « An application of concepts and models derived from the social sciences to quantitative history » drew attention to the overall progress in the humanities that has been achieved in the last half century. This progress is expressed by the growth of

specialized studies with simultaneous use made of the methodological progress that has been achieved in related disciplines. Historical knowledge should aim at the comprehension of general and even universal phenomena. This can be achieved in two ways: through heuristics and critical analysis of sources and through rational and explanatory interpretation. In his search to understand and explain historical reality the scholar increasingly makes use not only of sources but also of concepts and theoretical models derived from other social sciences. A theoretical model worked out by the historian should contain a working hypothesis that is subject to verification. With regard to the latter the problem of the representativeness of « samples » plays a role of primary importance. But the introduction of comprehensive concepts and theoretical models into historical research paves the way towards an integral history and strengthens its position as a science.

In his paper on « Quantification and the use of models in economic history » J. Topolski (University of Poznan) distinguished between a traditional and a new type of quantification in economic history. The latter is the deliberate application of models. In constructing a model, use should be made of both knowledge of the period under study and of theory, taking advantage of achievements in other scientific fields. However the construction of a model is only the initial stage in the whole model approach, for the central part of this method is concerned with the procedure of '*concretization*', or experimentation with the model.

The author discussed the ways in which '*concretization*', or the filling out of the model, could be achieved by applying it « to non-simplified reality » although he emphasized at the same time that not all models are suitable for such a procedure. However, it is only such a procedure that makes it possible to ascertain whether an approximation to the true picture had indeed been achieved and whether this is at all possible. Thus '*concretization*' is an infinite process. According to F. Braudel the study progresses from reality to the model and then back from the model to reality constantly aiming at improvement and correction.

As well as the above papers, which focussed on theoretical aspects of the model method in economic history, in his paper on « An experience in the elaboration of a mathematical model: a case from the peasant economy of the late feudal period » E. Tarvel (The Institute of History, the Estonian Academy of Sciences - Tallin) presented some results of his research. From calculations made possible by the EDP technique the author produced a model of a typical peasant economy of the XIIth century based on data from the territory of Estonia and Byelorussia. This type of peasant economy is comparable with others of similar inter-regional climate zones and was characterized by certain features such as the size of holdings, number of draught animals, amount of seed, the number of cows and the number of men employed in a household. The author presented two methods of

constructing a model of this peasant economy: the first was based on using the model average, and the second was based on a regression analysis. The latter approach, in the author's view, provides the historian with the opportunity to enlarge the scope of his study significantly.

In the discussion of E. Tarvel's paper it was pointed out that his model of a typical Estonian and Byelorussian peasant economy of the XIIth century contained certain new elements when compared with other attempts to construct a model of a peasant economy undertaken in Poland, for example (see the study by A. Wyczanski, for instance).

Tarvel's model was constructed on the basis of averaging a certain number of sample households, and is a purely theoretical construction that does not correspond to any household that actually existed. Using the model average, however, such drawbacks are reduced, but even so a model based on such averages impoverishes the reality under study and even more importantly it presents only a static picture. A model worked out on the basis of regression analysis, which is by its very nature dynamic and able to include a wide range of historical phenomena, would seem much more suitable for such a purpose. But it must always be remembered that as with any model, even such an interesting proposal as E. Tarvel's can make only a limited contribution to historical knowledge, for it would always entail a certain amount of simplification and hence an impoverishment of reality, for other peasant holdings would have different features from those which appear on a mass scale and are included in the model.

* * *

Lively discussion was provoked by such questions as the concept of a model, its elaboration and the application of model to historical study. Since these matters are closely connected with the papers just described, although concerned with separate themes, it seems worthwhile to report briefly on the views put forward.

The discussion drew attention to the relationship between the procedure of quantitative '*concretization*' and the use of models in the process of historical cognition. A basic aspect of this relationship is the fact that quantitative verification serves to verify the model. In the paper by J. Topolski the problem of the model's verification by means of quantitative '*concretization*' was seen to be of secondary importance. Yet this is the fundamental link which determines, in a historical study, the passage from quantitative description — practically a statistical one — to the establishment of functional relationships, that is, to the verification of the model. On the other hand, the principal condition for verification is the observation and analysis of relationships arising in time, that is over longer periods. These

problems, for example, have been illustrated by the application of a Marxian model of the accumulation of capital to the study of conditions of the Polish working class in the inter-war period.

Doubts concerning ways of verifying the models were further expressed by subsequent speakers. The discussion pointed out that the danger was that an insufficient knowledge of the situation under study lead to the construction of false models. The starting point for the construction of a model is always the analysis of a particular historical situation. Deep analysis and the understanding of this historical context is an indispensable condition for the proper elaboration of a model, for if at the beginning of the research even a fragment of the historical situation is wrongly assessed the error cannot be rectified by the model at a later stage. Although the reasoning would then be logical and rationally correct the original fault will nevertheless still be there. Therefore proper analysis of the historical context becomes an indispensable point of departure in the use of the model. Without such an analysis this approach, like any other method, should not be recommended.

A model provides a simplified construction of a certain segment of a historical situation. It should aim at pointing to the connections, mechanisms and the relationships between them. For this reason a model should be constructed in such a way as to make possible the observation of changes in certain of its components through change in other magnitudes or variables. In other words a model should aim at elasticity and flexibility in order to include the changes and trasformations taking place in reality and so become an artificial replica for comprehension. With these characteristics the use of models would assist the historian in deciphering those elements of the past he is studying which do not directly reveal themselves in his sources. It could then help in spelling out the possible alternative changes and developments in a given situation and this would seem to be an important function of the use of models in historical studies. These problems are connected with a further question about the construction of a model, that is its dynamic nature and whether it is capable of encompassing the comprehensive character of historical phenomena, including the dimension of time.

In his desire to deal exclusively with the problems presented by the past the historian cannot abstract from time: it is the most precious part of the study and at the same time the most difficult problem for model construction. The difficult of historical conceptualization derives from the fact that history is a social science whose aim and task is to search for, and to explain, the mechanisms responsible for a passage from one situation or one system to another situation or system for which, in turn, the original model usually becomes insufficient as far as explanation and understanding are concerned. Models derived from other social sciences such as economics and sociology are very often of a static nature. Nor are mathematical models developed

for other fields of science, such as physics, generally applicable to the social sciences. It is necessary then to develop a new type of histo-mathematical model with many variables which can embrace the specific nature of historical reality and adapt to changes in this reality as well.

* * *

Other papers of a methodological nature dealt with specific research problems. The authors presented the results of their researches using mass historical sources and modern quantitative methods.

K. V. Khvostova (Institute of History, USRR Academy of Sciences - Moscow) gave a paper on certain general problems connected with the application of mathematical methods in historical studies. The author was interested in the possibility of introducing into historical studies formal-logical interpretations which would enable us to arrive at general laws underlying social processes. This would be used, in particular, in a case of insufficient availability of information. Theoretical considerations were combined with the findings of her own research and she dealt in particular with the question of a mathematical interpretation of social inequality during the pre-capitalist period, also presenting her own ideas for a model approach to this subject.

Professor V. E. Poletayev (Institute of History, USSR Academy of Science - Moscow) in turn spoke on « Methodological problems connected with the means and techniques used in studies of social structure in Soviet society ». He drew particular attention to the methodological difficulties encountered by the Historian of socialist society who tries to use mass sources and modern research methods. In order to apply the EDP technique, it is necessary to have available a universal system of information and coding, as well as to create appropriate conditions for cooperation between historians and mathematicians. Thanks to the EDP technique, it has been possible to undertake studies in the Soviet Union using such mass sources as personal files and records, surveys among young workers etc. which have not been used until recently. A successful attempt to apply mathematical methods to social history was the use of personal registration sheets for workers in large industrial combines. Another example of the application of modern techniques to the analysis of mass sources are studies based on surveys of young workers in towns and in the country. The first analyses of this type were undertaken in 1936 and 1938 but they were not fully completed due to the absence of EDP techniques. Similar studies based on surveys of young workers in these same industrial enterprises have recently been undertaken by Soviet researchers in order to assess the changes that have taken place over the whole period. These comparative studies are based on the surveys

made in 1938. At present both groups of surveys are being comprehensively analysed and the final results seem promising.

Luigi de Rosa (Naples) in his paper on « An application of quantitative methods to the economic history of Italy » pointed to the reasons for the slow adoption of quantitative methods by Italian historians, although at the same time there has been constant progress in the social sciences in Italy. Between 1873 and 1885 a new school of economics was formed which took an interest in the quantitative aspects of historical studies. Among a great variety of studies concerned with various aspects of economic and social life, which included a number of quantitative historical studies, a leading position was held by works on economic statistics. Economic history, as a developed and independent discipline, has had a rather difficult road to follow. During the 1930s Italian historians became increasingly interested in quantitative problems, as is shown in the development of historical demography, and particularly in studies on the history of prices. With the increase in such studies, problems about correct research methods have arisen. As Fanfani pointed out, the history of prices is an example of a problem which cannot be fully solved without the application of quantitative methods. But the difficulty with which these methods have been introduced in Italy is a feature which is characteristic of many other countries, since virtually everywhere these methods have been critically viewed and opposed in professional circles. However, quantitative research has finally obtained a firm place in the study of economic history and the methods have also played an important role in related fields, such as historical demography.

Studies of national income and economic growth have greatly increased interest in the problem of dynamics in economic history. Such problems as long-term transformations, their regularity and continuity, gave rise to the author's interest in the problem of continuity in history, in general, and in economic history in particular. What is meant by this concept? Does it imply — asked L. de Rosa — that history is uninterrupted? In concluding, the author claimed that the continuity of historical statistical series may assume fundamental importance and throw light on the whole historical process, provided, however, that they are designed to illustrate both the interesting breaks and the modifications in this continuity. In other words, by means of a quantification procedure it should be possible to arrive at a logically arranged quantitative series. It must be remembered, however, that quantitative procedures do not consist simply in arrangement of numerical data, but that their task is rather to point to the relationships and linkages between these data.

The problem lies in the appropriate arrangement and comparison of data. While this is rather easy in the case of qualitatively invariable models, it becomes a difficult task in cases of « qualitative change ». The problem

becomes still more difficult when account is taken of the fact that quite often one is dealing with apparent qualitative changes, that is with such changes that are quantitative in reality. Statistical methods open immense research possibilities, provided, however, that the study can be confined within an unchanged qualitative framework. Using such methods it becomes possible to analyse a quantity of relevant factors, to point to relations between them while also taking into account the time scale. But qualitative changes taking place in the historical context under study must, however, be accounted for, and a statistical analysis may often prove insufficient for understanding individual phenomena in the dynamic historical process. Theory is indispensable, since it is theory that makes it possible to formulate and pose questions, to classify and relate phenomena and, finally, to select suitable sources for research. A knowledge of basic economic theories relevant to a given period, to the phenomena and to the subject matter of the study, is a basic requirement for a researcher — stated the author — and are indispensable in studies in economic history.

Let us now turn to the paper by M. Demonet (E.P.H.E. - Paris) on « Statistics and computers in the historical sciences ». From the studies undertaken at the Centre de Recherches Historiques, the author discussed various quantitative methods, and drew particular attention to the significance of statistics and mathematics in historical research. From a theoretical point of view, several of the methods used do not need the assistance of computers. Nevertheless, there are a number of works which — even if based on very simple methods — cannot be accomplished without their help. This is true, in particular, of studies making use of extensive data as background material. A characteristic example would be a military census or a cadastral survey. It has been possible, thanks to the computer, to undertake a study based on the conscript census of the years 1819-1830, registering 78 variables for 3 thousand districts. The Centre also has at its disposal a complete population census made in France during the second half of the 19th century. Until now French historians working on mass sources have mainly used descriptive statistics and three groups can be distinguished, namely: single variable statistical studies, comparisons including two variables, and analyses of several variables. In the future, the team intends to work on the application of methods of inductive statistics, although attempts have already been made to establish mutual relationship between variables, one example being the impact of capital assets on other variables. The results of these studies are being stored on magnetic tapes.

Computer facilities have also made it possible to carry out a study of the Florentine cadastral survey of the year 1427 which describes some 50 thousand families with 264 thousand persons of different age, sex, profession, wealth status, etc. The study has made it possible for a card record of the

Tuscan population to be devised, so providing a rich source for demographic and economic studies. An extensive report on this was given by Ch. Klapish (E.P.H.E. - Paris) in a paper on « The Florentine cadastral survey and a quantification ». The author has studied Tuscan society on the basis of the survey of 1427, and making use of additional sources (e.g., records on deaths, births, baptisms), she has attempted an analysis of the population structure, dealing in particular with the place of the family in society from the point of view of such factors as social and professional status, class and wealth. The study was based on the following premises: (*i*) the methods used were those developed by demographic historians examining social structures; (*ii*) use was made of statistical measurements of association and correlation, in order to answer problems of differential demography: and (*iii*) the study was based chiefly on descriptive statistics. The author presented the results of these studies and the conclusions drawn from the analysis of this cadastral survey. Although it was found that quantitative methods often greatly enriched the results of the study, the conclusions drawn from the rather labour-intensive quantitative analyses or models still depend to a large extent on the variables selected at the beginning of the study.

This analysis of the Florentine XVth century cadastral survey by Christiane Klapisch has been greeted as a sensational achievement in recent historical research, but several speakers made their own observations on the paper. For example in the discussion it was emphasized that it is also necessary to define those areas of social life in late medieval Florence that were not covered by the cadastral survey of 1427 in order to discover what had been left out of the analysis. Also the use of the distinction between the well-to-do and the poor means that a qualification of these concepts, a definition of their inclusiveness and an assessment of the size of the social groups that were so poor as not to deserve recording in the cadastral survey is essential. A fundamental problem which also needed to be related to the picture given by the survey concerns the structure of production in Florence at that time, for demographic studies have revealed that the structure of production had had an impact on, for example, a number of single men.

The studies undertaken by Mrs. Klapisch and Mr. Demonet should then be seen as experimental, while the methods developed by them would seem also to be useful for other mass sources.

Mr. E. Fügedi (Budapest), in his paper « On wealth and on social strata in medieval urban centres » discussed the usefulness and applicability of quantitative methods to the study of fiscal records. The author started with a description of German historiography concerning the wealth structure of urban populations in the 14th and 15th centuries. The geographical scope of these studies has recently expanded significantly, to cover apart the German towns, those of Italy, France and Hungary. The difficulty lies in reducing

these statistical series to a common basis and so making them comparable. E. Fügedi suggested a solution to this problem; he proposed applying the Lorenz curve, measuring the degree of income concentration, and the decimal method, measuring the same income distribution in a different way. Using fiscal registers from three medieval towns, the author has devised a wealth pattern for the population. He has proved that the two methods (the Lorenz curve and the decimal method) support each other in combination.

These methodological suggestions by E. Fügedi were welcomed by the conference. But in the discussion the need to relate this wealth pattern to social stratification and the need to define the relationship between the population groups seen from the property structure, on the one hand, and as the social groups, on the other, was pointed out.

A. Mączak (University of Warsaw), in his paper on « Prices, wages and costs of living in the Central Europe », explored new sources for the 16th century and proposed making use of the already known but nevertheless still not fully exploited « mass » source consisting of the reports of travellers. Information concerning the price of meals, sleeping places in lodging houses, fodder, etc., could be successfully used for comparative studies of the economic situation of different lands in Central Europe.

The analysis of travellers' reports as a historical source met with lively interest in discussion. It was pointed out that the comparison of expenses during travels in the Central Europe in the 16th century, and in particular the costs of forage, indicates price differentials closely related to the size of the town visited by the traveller. In larger towns such costs were usually higher than those in smaller towns. A cost level can, therefore, also be seen as an approximate indicator of urbanization. The discussion emphasised, moreover, that the costs of forage provides a far better basis for comparing the economic level of different lands and areas, than would the costs of human subsistence, for the latter were also influenced by national consumption and customs, etc.

In turn, J. Łukasiewicz (University of Warsaw) in a paper on « The index of industrial output on the Polish lands between 1810-1918 » discussed the methods by which a general index of industrial production might be drawn up. The ideal index would include the greatest range of information from all branches of industry and for the greatest number of industrial goods. In practice, however, this is unattainable. The general index presented by the author was based on 20 partial indices, which show the growth in industrial output on the Polish lands at the turn of the century.

T. Kuckzyński (Institute of Economics, German Academy of Sciences, Berlin), in a paper on « The statistical relevance of historical data » discussed the problem of the imperfections in the statistical and mathematical methods at present available when they are used to verify historical data, with

particular reference to the testability of errors in such data. In his analysis of this extremely important procedure, the author made several interesting and important observations.

* * *

A report on the papers and the discussions which followed should be supplemented by a mention of the more general reflections expressed during the conference by various participants. In this connection, it is worth reporting on the discussion concerning the relationship between formalization and quantification in historical research. Formalization — it was argued — is connected with model procedures since in most cases prior elaboration of the model is required. There is, however, a danger that formalized formulae may disguise statements or theorems that have been elaborated wrongly or intuitively, in a way that does not allow them to be verified. Such a situation may arise due to the kind of a psychological prestige which comes from mathematics, or from pseudo-mathematics. This danger may be a particular problem for younger, and insufficiently trained scholars.

It was emphasised several times that quantitative methods do not eliminate the need for a critical approach to sources, nor do they discharge the scholar from the necessity of evaluating the accuracy and representativeness of his numerical data. An important problem lies in defining under what conditions mass sources meet the criterion of representativeness, for the historian is often faced with insufficient source documentation. The question arises as to whether, in the case of a population sample, the incapacity to meet the principal criteria of representative method, does not, in most cases, render it useless. One might suspect that very often numerical studies carried out on uniform material would not produce results which could be treated as reliable were a representative procedure employed. Such a result could be obtained only in the case of a normal distribution in the population sample; but this is rather in historical studies. There is, then, the need to search for other new methods which will help to solve this rather important problem. Some hope can be placed in a simulation model that may serve to define the limits of representativeness in the case of a population sample. In the discussion it was suggested that neither mathematics nor statistics would be capable of solving all the difficulties encountered, but that both sciences can help.

In the discussion two clear positions emerged. Some speakers were worried by the danger of losing various values through an excessive economization and mathematization of history. They were, however, a minority. The majority did not share this apprehension about the side-effects of the application of quantitative methods and did not object, in general, to their function in the historical research.

The discussions emphasised that methodology is always linked with historical cognition and the critique of sources. On the other hand, the need for a modernization of the historian's « toolbox » and a need to get well acquainted with new research techniques, in particular the model approach was also generally stressed in the discussions. It was maintained that historical quantification will help to answer new questions, and will enable the verification of *a priori* working hypotheses.

The conference welcomed with satisfaction the proposal that a meeting be organized once every two years to provide scholars from scientific centers in Poland and from abroad with a forum for continuing these fruitful discussions of quantification in the social sciences, which were initiated in Warsaw.