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METHODOLOGICAL REMARKS ON PROGNOSIS IN THE FIELD OF DEMOGRAPHY

SOCIAL PROGNOSIS

Secular social change is typical of the human community. On the great stage of social reality the scenes are continually changing; cultures rise, flourish and fall; economic systems replace each other; populations show rapid growth and then stagnate.

The rapid social changes in the beginning of the 19th century, and especially the disastrous shocks which accompanied them, supplied the psychological conditions necessary for the birth of sociology. Perhaps it is for this reason that since the time when Comte first gave its name to this science, no social phenomenon has been studied so intensively as that of social change. It was not so much scientific curiosity that drove the scientists, as the expectation that, in gaining insight into the conditions under which these changes occur, man would at the same time discover the instrument with which he could influence them. The idea of social planning has accompanied sociology from its inception.

For many decades this idea went no further than the writings of scholars and politicians. A liberal society offered no opportunity for its realization. This opportunity came in the Netherlands for the first time after the First World War, when it was introduced in the field of town and country planning, which remained for a long time the only field to which it was applied. A prolonged economic depression and a Second World War were necessary before social planning could be developed more extensively. Now social planning is to be met with in almost every section of social life, especially where government is intensively interested in its development and where extensive investing of public funds is involved. As an example I need only mention the amount of work which goes, in these days, into the preparation of governmental decisions as to the extension and localization of higher education. This example could easily be supplemented by dozens more. Next to economic planning, social planning has become the hallmark of modern government. The society of today cannot be imagined without it. This applies equally to social prognosis.

No prognosis is valid without knowledge of the facts. Where — as in the early years of sociology — systematized knowledge of social facts is lacking, a reliable statement as to the future of social events cannot be expected. The early statements bore more the character of prophecies. They bore witness to the ideals of their authors rather than to their scientific insight. Later — at about the beginning of this century — with the increasing knowledge of the facts of social life, the pronouncements became more realistic, but even then they were little more than naive extrapolations of macro-sociological phenomena. Modern social prognosis, the taxation of future social developments based on quantitative analysis could only appear when, with the help of modern statistics, the registration of the quantifiable aspects of society was begun on a large scale, with great regularity and entering into the smallest details.

The first modern prognoses, in the meaning of the word indicated here, appeared in this country soon after the First World War, at the same time that social planning also began to make its humble appearance. They belonged to the field of demography. Work on prognosis certainly made no rapid progress here. The number of population prognoses, national or regional, prepared in this country between the two world wars, scarcely amounts to a dozen. I know of no examples of long-term economic advance calculations in this country for the same period. Demographic prognosis was then, almost without exception, the work of individuals feeling their way in spite of many setbacks. Nowadays the preparation of prognoses is for the most part concentrated in specialized institutions — both in the demographic field as in that of other, e. g. economic or socio-cultural, phenomena.

The production amounts to many dozens of prognoses a year, and proves that it is almost universally realized how indispensable prognosis has become.

It proves nothing, however, as to the evaluation of the product. The more prognoses that are published which contradict (or seem to contradict) each other, the more prognoses that are disproved by the facts, the greater the distrust on the part of the consumer as to the usefulness of the calculation results offered him. Of this the customers often make no secret. Amongst the researches a weariness can sometimes be detected, sometimes an obvious dislike for this work which, since it is nearly always carried out professionally, cannot be avoided. This mood is not without its importance as an aid to administration. Since prognoses will be asked for and made as long as planning takes place, it must be worth while to subject the whole prognosis problem to an investigation. It is interesting to deal here with the problems connected with prognosis and especially with population prognosis.

I shall begin with a few remarks of a theoretic nature. The theory of social prognosis is scientifically underdeveloped territory. The makers of social prognoses — whom for brevity's sake I shall now call researchers, although there

is no question of research in the actual making of a prognosis — do not as a rule much about the theoretical basis of their work. Here and there in the literature of demographic prognosis one comes across a modest attempt in that direction — but a serious endeavour to lay bare in a monograph the basic ideas of prognostic thought — such as Morgenstern¹⁾ for example has already done, more than thirty years ago, for economic prognosis — hat not yet been undertaken.

This weakness of the theoretical basis is reflected in an inexact use of words and causes confusion. Thus far — following the terminology used in the Netherlands — I have been using word prognosis. Wherever possible, however, it will be wiser to avoid doing this. The word forecast is no better in this respect. For in its original mythical meaning 'forecast' implies the announcement of an inevitable future event, knowledge of which has been arrived at by non-rational means. The word suggests, as does the French word 'prévision' or the word 'prognosis', that the developments calculated in advance are inevitable. This is by no means always the case.

The rational counterpart of the forecast is the advance calculation. An eclipse of the sun or the moon is not forecast, but calculated in advance, („vorausberechnet“). An engineer calculates the results of the work he is planning to carry out.

Both the examples of advance calculations given here, have this in common, that their results are given with two reservations: rebus sic stantibus et ceteris paribus. There is not absolute certainty that the phenomenon will indeed take place as calculated.

The two examples given above show also an essential difference, precisely in connection with the subject under discussion. Man cannot influence the stars in their course. Only because the astronomer is exactly informed as to the position, the mass and the speed of the celestial bodies in the neighbourhood of the sun, and because he has at his disposal an excellent theory describing the movement of those bodies in relation to each other, do astronomical advance calculations bear the character of inevitability that is implied in the word prophecy. In this case the use of such words as prognosis, forecast and prediction can cause no misunderstanding. The calculations of the engineer, on the other hand, have the character of an imagined experiment. The results of his advance calculations can lead to an alteration in his design or even to its rejection. The character inevitability is lacking.

The prognostic work of the demographer — as also that of other social-scientific investigators — bears neither the prophetic character of the astronomer's advance calculations, nor the character of the imagined experiment. The demographer occupies a position between the astronomer and the engineer. His

¹⁾ Morgenstern, O. „Wirtschaftsprognose“. Eine Untersuchung Ihrer Voraussetzungen und Möglichkeiten, Wien 1928.

work can be compared to that of the astronomer in so far as society, like the solar system, shows a certain tendency to autonomous movement. The structure of society changes even though no one tries to alter it. Often the social forces behind such changes are not at all or only slightly capable of being influenced, either because haven't sufficient information as to the conditions which call them into being or because no agreement exists in the community as to the direction in which it is desirable that such changes should be guided.

An example of such an autonomous demographic movement has been seen in western Europe, and can still be seen in the Netherlands, in the decrease in marital fertility. This process appears under the influence of a complicated pattern of interdependent social, cultural, psychological and economic factors, difficult of approach for quantitative analysis. Apart from the occurrence of wars and other social disasters, which are merely incidental and therefore incalculable, this process runs an extremely regular course. Its further course, therefore, *ceteris paribus*, seems to be more or less „predictable“. Other demographic processes show the same characteristic — though perhaps rather less obviously — as for instance the rise in the marriage frequency and the fall in the average marriage age. Similar movements are also to be found outside the field of demography, for example in the increase in the density of cadre functions in industry and society, in technological development, in the decreasing importance of agriculture, in urbanisation and so on.

When making advance calculations in the field of such phenomena, all the demographer can do, as a rule, is to suppose that the observed trend will continue unaltered. Here certain subjective moments inevitable intrude; for example the choice of the period of which the observed series will be extrapolated into the future, the choice of formula to describe the observed series, the duration of the projection period and similar factors. As far as possible the investigator must try to reduce these subjective moments to the minimum, for example by taking into account the course the phenomena to be observed have taken in analogous cases. This can lead to the choice of some formulae and the rejection of others.

Before proceeding to the extrapolation of a series of observations one should first find out if it is possible to analyse it in other series which are basic to it. The basic series should then be extrapolated. In an advance calculation of births, for instance, the future absolute numbers will be calculated not directly by extrapolation; but undirectly by an advance calculation of the absolute numbers of women capable of bearing children in combination with the extrapolated general fertility rates. This indirect method in no way guarantees a regular course for the absolute numbers of births. This is no objection, however; the regular course of several basic series gives more confidence than the regular course of a series resulting therefrom. Since experience has taught that differences in fertility appear even within the population group which is capable of

reproduction, preference will be given to the use of a series of fertility rates specified according to age rather than to the use of general fertility rates. In making advance calculations of birth rates one is drawn into increasingly detailed specification.

This refining process comes to an end, in practice, when the point is reached where further specification has no influence on the final result, or experience as to the deeper lying basis series is lacking. The aim is to achieve by means of extrapolation the highest possible regularity within the system of the elements which call the final phenomena into being.

When considering this aspect of advance calculation one realizes that in the last resort the question as to the trustworthiness of an advance calculation cannot be posed positively, but only in a negative sense. Not: „What reasons have we to suppose that the phenomenon calculated in advance will indeed take place as expected?“, but: „What reasons are to be found for supposing that the end result will give the lie to the advance calculation?“ The absence of such reasons is experienced as a positively coloured confidence which, however, is misleading in so far as the absence of such reasons by no way excludes the possibility of the emergence of a behaviour pattern of the phenomenon not hitherto experienced and deviating from the calculation.

Here we are concerned with the attitude or procedure of the investigator when faced with social processes which are almost or entirely incapable of being influenced. This must be an attitude of expectation, trusting in the invariability of surrounding reality, in constant relations, regular movements.

Frequently the demographer finds himself faced with processes which show a less regular course and are, moreover, susceptible to influence. Amongst these — with a certain reserve — one can count migration. In such cases the demographer, in making advance calculations, has to rely on ad hoc hypotheses and then his calculations will obviously bear the character of an imagined experiment. One may not conclude from this that the investigator may give free rein to his imagination. If his calculations are to make sense he must draw up his hypotheses with extreme care. He may not be in any way arbitrary; as for example when calculating the consequences of certain political measures or when testing the possibility of realizing certain aims. In every case it is advisable to introduce hypotheses which are closely connected with recent experience and which therefore answer the question as to what situation will arise if no influence is exerted on the process or if — supposing policy has already exerted influence thereon — policy itself undergoes no change. The position of the demographer then resembles to a certain extent that already described above; an expected situation is calculated on the supposition that no change will take place in the elements that have called it into being. There is, however, this essential difference: the situation calculated in advance is not inevitable.

The comparison of demographic with astronomical phenomena is limited in that the astronomical phenomena in question — the movements of the solar system — are periodical, which demographic phenomena are not. This has consequences for extrapolation. For example, extrapolation of the series of observations describing the fall in marital fertility in this country leads to the unimaginable situation that in the near future almost every marriage will be childless. Experience warns us against the acceptance of such a result. The fall in marital fertility began earlier in other west European countries than in the Netherlands. In some of these countries the process has already come to an end, and marital fertility has become stable with a figure of two to three children per family. So long as there is no reason to suppose that such a stabilization will not take place in this country we will be wise to reckon on its appearance here within a short time. According to the results of the Netherlands statistics for marital fertility this stabilization is already to be seen; amongst the non-church-going section of our people and those belonging to the majority of the small protestant denominations, a low and stable level has already been reached. With such knowledge available it is unreasonable not to use it. It must be supposed that in a continued fall in marital fertility in other denominations the observed limit will not be passed. It is not easy to give this hypothesis because it is based on wider experience receives more confidence than a „blind“ one.

In determining what limit is suitable for a certain development, the conventional character that will always be typical for advance calculations is clearly revealed. Sometimes experience offers various limits and the choice between these can lead to differences of opinion amongst investigators. The precept which the investigator must then follow lies in a careful motivation for his choice, in which all the available information must be assimilated. If he doesn't succeed in convincing his opponent, then the task of proving the 'uselessness' of the chosen limit rests with the latter. If, after careful analysis the investigator is unable to give preference to any one of the possible limits, he must then use them all. Of necessity such a situation leads to more than one observation period to be used for extrapolation and in the choice of the formulae to be applied.

Where no limits are available, the investigator has to rely on blind extrapolation. It is then advisable to keep the projection period as short as possible, especially where he is faced with quickly moving phenomena. For in that case the uncertainty, which arises where there is more than one formula available for extrapolation, is considerably lessened; as a rule the results given by different formulae applied during a short period do not differ greatly from each other.

In theory, when preparing a population projection, it is desirable to make first a projection of marriages according to the age of the wife, whether or not combined with the age at marriage of the husband. Based on this projection of the forming of families, the births should then be calculated, using data connected

with the order of birth and the parity of the mother. Furthermore in this model, dissolution of marriages should be taken into account as well as the re-mariages of the divorced or the widowed. Statistical material for the application of this model is usually lacking. Irrespective of this, one comes up against problems of a mathematical nature hitherto unsolved, proceeding in part from the interdependence of the marriage chances of men and those of women, owing to which some rather inelegant adaptations are necessary.

In practice, therefore, a simpler model is used for population projection. For this the population is divided according to age and sex, projected in periods of five years, with survival rates. The population is then divided into unmarried, married etc. in every age-group, with the help of percentages obtained through extrapolation. The extrapolations can be based either on the percentages, placed consecutively for every civil status in each age group, or on the course of these percentages for separate generations (cohort-method). The female population divided thus according to age and civil status is considered as being subject to specific chances of childbirth and supplies the new generations. In broad lines this is the model hitherto followed by the Netherlands Central Bureau of Statistics. The future figures for marriages, divorces and dissolutions of marriages due to the death of one of the partners need not be calculated.

The forming and dissolution of families is not taken into consideration.

Projection of numbers of households

(In collaboration with Dr. A. Vermeulem. Tilburg.)

Data referring to the numbers of households are usually collected during a population census. Occasionally these data are obtained by means of a separate census, as in the Netherlands by means of the housing census of 1956. The fact that not always the same definitions are used makes it difficult to draw comparisons in time and space. The U. N. O. is now trying, as far as possible, to reach agreement on this point.²⁾ Without going into details we give here the chief categories to be distinguished, namely between *private* households and *institutional* households. In the latter category are reckoned those who live in boarding schools, hospitals, hotels, boarding-houses etc.; which concepts, however, need further definition. For instance, a household in which the number of paying guests exceeds five is counted as a boarding-house. By a private household is understood a number of persons really making use of one dwelling³⁾ to live in, or of part of the same, who take their main meals together and who share the provisions for the primary necessities of life. A *person living alone* or using a

²⁾ *Handbook of Population Census Methods*. Vol. III. Demographic and Social characteristic of the population. Studies in methods. Series F. no 5 Rev., statistical office of the United Nations, New York 1959.

³⁾ U. N. O. Demographic Yearbook 1962, page 36. U. N. publication (statistical office) sales no. 63. XIII — 1.

separate room in part of a dwelling, without in any way joining up with the rest of the occupants to form a plural household or sharing their meals, is considered to be a separate household. Private households are for the most part *family households*, that is to say, they are bound to each other by a parent-child relation or by adoption.

Servants, lodgers (less than 6) and other members of the family living with them are also regarded as members of the private household.

A brief but extremely clear exposition of the problems relating to the differentiation of private households according to their composition is to be found in Calot and Febvay.⁴⁾

The numbers of households in a certain population and their distribution among certain categories (purely family households, households of single persons, households where families share with other persons) changes under the influence of a complicated pattern of interdependent social, economic and demographic factors. Of great importance is the development of the supply of dwellings and also of the number of marriages contracted and dissolved. These in their turn are dependent on the changing age structure of the population. Among the social (cultural) factors must be reckoned for instance, the tendency — to be seen in most western countries — to marry at an earlier age and to be content with a simpler housing than in previous generations. It is important for the projection of the numbers of households to know the future significance of these factors as they react on each other. On this point, however, our knowledge falls short. Only in connection with the development of a few demographic factors reasonable expectations can be formulated, as for instance in relation to development of the total number of the population and its structure according to age, sex and civil status. In practice one is forced to restrict oneself to the measurement of the importance of these demographic variables, so that the *ceteris paribus* clause soon enters into the model.

The methods to be used in estimating the future numbers of households can be divided into two categories, namely:

A. Methods which depend on the extrapolation of the average size of households.

B. Methods depending on the extrapolation of percentages of heads of households in different categories of the population.

The methods ad A can vary from very simple to highly differentiated. By means of extrapolation of the future population is divided into one part (a) living in institutional households and another part (b) living in private house-

⁴⁾ Calot, G. et Febvay, M. "L'analyse de la composition des ménages dans le Recensement français de 1954", from Union internationale pour l'étude scientifique de la population. *Congrès international de la Population*. New York 1961. Tome I: 206—215. London 1963.

holds. In the least detailed model the number of household is taken as increasing at the same rate as the population indicated under (b); in other words the average number of the private households is kept constant. If sufficient information is available the average size can be projected into the future. A rough estimate of the age distribution of the population can be made by making separate calculations for (a) and (b) for persons over and under a certain age (e. g. 20 yrs).

Assuming then that the number of private households increases as rapidly as the population (b) of 20 years and older (in other words the average number of those over nineteen in private households is kept constant) then by adding a more rapidly or more slowly increasing youth population (b) the average size of the private households can increase or decrease. A further refinement can be obtained by taking into account the distribution of private households into different categories and by using different extrapolations of averages next each other. In doing this, changes which have taken place on the past in this distribution, must be taken into account; for this, distribution formulae must be used.

The working methods described sub B are clearer than those described above. If more detailed and refined population projections are available the use of this method is to be recommended, e. g. if the projections described previously are possible.⁵⁾ These methods rest on the definition that each household has only one head. The population of heads of households is then divided according to the same demographic characteristics as the population as a whole, that is according to age, sex, and civil status, whereby, in the most favourable case a distinction is made between unmarried (never having been married), married, divorced and widows or widowers. For every such class of combined characteristics the percentages of heads of family households is then determined. If sufficient information is available these percentages can be subjected to extrapolation. In general the variability of these percentages is not great and there is no objection to considering them as constant for not too long a period.

The extrapolated percentages are then applied to the projected population. Finally summation will give the number of private households. In order to determine the average size, it is necessary to know the size of the population denoted as (b). From the averages thus obtained, with the help of empirical or theo-

⁵⁾ As counterpart of the model for population projection mentioned, the ideal method for projection of households has to rely on relative frequency, which gives the "changes" for certain individuals in the course of a certain period — i. e. a period of five years — to change from one status to another. E. g.: the chance that an unmarried man of a certain age, and who is not the head of a household, will marry within years and — married and still living — at the end of the projection period will be present in the population as a head of a household, or the chance that a divorced woman who at the same time is the head of a household, will re-marry within a certain period and lose her status as head of he household and will still be alive at the end of the projection period. Up to now, both the knowledge and the skill to put this method into practice are lacking.

retical distribution formulae, the distribution according to the size of the households can be calculated.

The methods described above give an insight into the expected netto-result of the changes in the number of households during the projection period. From the point of view of market analysis it is also important to know the number of new formations. In so far as new family formations are not directly dependent on the disappearance of existing households — in which case, as a rule, part of the durable household articles in the first household pass on to the new household — they are very important for the acquisition of new household articles. By far the greatest number of new formations is the result of marriage. According to the calculations of the Central Bureau of Statistics the numbers of heads of families increased by 43 000 in 1956.

A good 85 000 marriages made a positive contribution to the netto result.⁶⁾ It is thus important to pay attention to projections of marriages. In connection with the difficulties noted above, a rough estimate will have to suffice. The use of the general marriage rates, that is the number of marriages per thousand of the population in a year could be considered for this purpose. The size of the figure must be inferred from experience over a long period in the past.

An extremely detailed application of method B is to be found:

Mr. D. M. and Paul C. Glick „Illustrative projections of the number of households and families.“

Current Population Reports, series P-20, nr. 90 from U. S. Departement of Commerce, Bureau of the Census, Washington. December 1958 and in the series P-20, nr. 123 April 1963 from Parke, R. and Glick, P. C.

For further application of this method we can refer you to:

Calot, G. „Perspectives du nombre des ménages de 1954 à 1976“.

Études Statistiques 12^e année, no. 2.

Supplément trimestriel du Bulletin Mensuel de Statistique. P. U. F. Paris 1961.

And to:

Pressat, R. „Une essai de perspectives de ménages“.

Internationaler Bevölkerungskongress, Wien 1959, 112—121.

Edition from „Union Internationale pour l'étude scientifique de la population. Wien 1959.

See also the contributions to the conference of this organisation held in Washington in 1961 and those for that held in Beograd for the World Population Conference of the U. N. O.

Finally two exceptionally fine studies from the Netherlands Central Bureau of Statistics published in „Statistische en Econometrische Onderzoekingen“, for

⁶⁾ „Calculations concerning changes in the numbers of households in the Netherlands“. *Statistische en Econometrische Onderzoekingen*. 1959: page 130—156. Central Bureau of Statistics, Zeist 1959. See page 148.

the years 1955 and 1959 must also be mentioned. The formularium developed and described there is closest to the model for population projection described in par. 19. It can however, only be used to determine changes in the numbers of households in a short period, using known data as to the numbers of marriages, divorces, immigration, dissolution of marriages due to death. For projection it cannot be used.

Finally we mention the articles of:

Hocking, W. S. „A method of forecasting the future composition of the population of Great Britain by marital status“.

Population Studies, november 1958: 131—148, London 1958.

And from the same periodical:

Walkden, A. H. „The estimation of future numbers of the private households in England and Wales“, November 1961.