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ARTICLES AND PAPERS OF ACTUARIAL INTEREST

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50th Anniversary Commemoration Volume 1954

PRAWITZ, H. *Investigation of mortality from different causes of death as a basis for forecasting future trend.*

This paper reports the investigation carried out for the 'Commission of Swedish Life Insurance Companies for Actuarial and Statistical Research' by a committee of which the author was a member. The general methodology involved the extrapolation of general population mortality from the trend exhibited over the period 1937–49, the mortality being first subdivided by cause-group. The cause-grouping was made from a list of a hundred groups of causes, the latter being classified according to whether they had been variable (V) or more constant (C) over the review period, and whether they were specific to certain sections of the population (P) or generally operating (N), and put together in twenty-five groups so that each one in its entirety would belong to one of the four head groups (VP, VN, CP, CN). The mortality was further subdivided into broad age-groups—seven for males and eight for females. Adjustment was made for the effect of diagnostic improvement upon cause classification.

The group rates were converted to force of mortality at the middle of the quinquennial age intervals by an interpolation process, and age graduation formulae were then applied. These formulae were derived by first elaborating a theory of mortality in a heterogeneous population subject to simplifying assumptions, viz. that for P causes, the population can be divided into those *with* predisposition, entirely responsible for P cause mortality but experiencing average mortality for other causes, and those *without* predisposition who have no mortality for the P cause in question but average mortality for other causes. For N type causes, Makeham formulae were adopted but for P type causes special formulae were developed from a consideration of the age variation in the proportion of predisposed among the general population.

The graduation was carried out for each year of experience, and variation in the two main parameters was observed. The time variation in these parameters was further graduated and a regression line relating the two was also obtained. One parameter was graduated both by a linear and an exponential function, and two extrapolations were carried out to produce complete generation mortality tables. The separate cause mortality was then added together. Certain causes, e.g. breast cancer, were extrapolated directly without age graduation.

Annuitants' mortality tables were then derived by comparing past actual mortality of annuitants with the graduated mortality of the general population. To avoid the practical inconvenience of a generation table, an aggregate table was constructed appropriate to entrants in 1955–65, subject to certain premium restraints, to maintain equality with the generation table.

Golden Jubilee Paper

SVERDRUP, PROF. E., PH.D. *Scientific Requirements in the Actuarial Profession.*

This paper is concerned with the academic background necessary for an actuary. Prof. Sverdrup suggests three possibilities.

(1) Specialized technical training in life contingencies, compound interest and the construction of mortality tables. Not very much mathematical background is required.

(2) The same as under heading (1), except that a broader mathematical basis is required. The theory of probability is emphasized and is applied in the theory of risk. The syllabus would also contain some aspects of demography.

(3) The student is first given a broad education in pure mathematics up to an advanced stage and in mathematical statistics. Then follow courses in economics, demography and finally an advanced course in insurance mathematics.

Prof. Sverdrup favours possibility (3) which is that generally practised on the Continent. His main arguments in favour of this practice are:

(i) If young students are given a too technical training, it will be found that instead of making them experts in a special field, they will be made experts only in doing routine work. Real experts are developed only by many years of academic and practical work.

(ii) The actuarial profession's contribution to the nation ought to be judged by its ability to advance the scientific front and by its initiative and imagination when facing new situations which frequently arise under present-day conditions. The daily routine in an actuarial department can to a large extent take care of itself.

(iii) Graduates with a statistical and actuarial training should not limit themselves to careers which are actuarial in a narrow sense.

The Journal of Hygiene, Vol. 52, No. 3, September 1954

SPICER, C. C. *The Generation Method of Analysis applied to Mortality from Respiratory Tuberculosis.*

The author tests the hypothesis that for every generation the mortality rates from respiratory tuberculosis according to age are in proportion. The hypothesis gives a good description of the rates over the period 1850–1930 and is unsatisfactory thereafter. During the period 1850–1930 the mortality rates according to age have a maximum at age-group 45–54 in the case of males and at age-group 35–44 in the case of females. After 1930 there has been a shift in the maximum for male lives to later life and for female lives to the youngest age-group. This shift is not accounted for by the hypothesis.

The Journal of Obstetrics and Gynaecology of the British Empire

Vol. 41, No. 4, August 1954

GEMMELL, A. A., LOGAN, W. P. D. AND BENJAMIN, B. *The incidence of toxaemia.*

This paper is of interest in that not only does an orthodox actuarial technique make a rare appearance in medical literature, but such a technique

represents probably the only way, certainly the easiest way, of solving the particular problem raised.

An attempt is made to estimate the proportion of women having at least one maternity who suffer from some type of toxaemia during their child-bearing life—a fact of clinical importance, hitherto unknown. Estimates are available of the incidence of toxaemia in first pregnancies in all women pregnant for the second or subsequent time (whether previously suffering from toxaemia or not) taken as a whole group, and of the proportion of women who having toxaemia at a second or later pregnancy have also suffered from toxaemia on a previous occasion. (A previous history appears to be a predisposing factor.) The distribution of women by the number of pregnancies they experience in their childbearing life is estimated from 1951 Census data and used in conjunction with assumed attack rates at first and later pregnancies (distinguishing those with a previous history of toxaemia) to produce a multiple decrement table, the assumed rates being adjusted until the table closely reproduces the established facts; the re-quired estimate is then derived from the table.

AMERICAN STATISTICAL ASSOCIATION

Journal, Vol. 49, No. 267, September 1954

MYERS, R. J. *Factors in interpreting mortality after retirement.*

The author first suggests from general reasoning the effects of different retirement conditions on pensioners' mortality. He then tests his sugges-tions by an examination of the rates of mortality experienced in several funds, namely: The Old-age and Survivors Insurance System, The Rail-road Retirement System, The Civil Service Retirement System, The Group Annuity Plans of the Assurance Companies, and finally three self-administered private pension schemes.

THE OXFORD UNIVERSITY INSTITUTE OF STATISTICS

Bulletin, Vol. 16, Nos. 7 and 8, July and August 1954

LYDALL, H. F. *The Methods of the Savings Survey.*

The results of the Savings Survey have been given in previous Bulletins and were noticed in *J.I.A.* **80**, 118. In the present article the author gives a detailed account of the methods used. It will be useful to students and practitioners in sample survey work. The author does not merely describe the methods, but discusses them in the light of general principles, so that the reader who is not expert in this type of work will obtain a good intro-duction to it.

ECONOMETRIC SOCIETY

Econometrica, Vol. 22, No. 4, October 1954

FRISCH, RAGNAR. *Some Basic Principles of Price of Living Measurements.*

The article sets out in simple language the conditions that must exist for it to be possible to compare the cost of living within an economy at different times. In the light of these principles he criticizes the usual type of index

numbers, e.g. Laspeyre's and Paasche's index numbers, that are used for this comparison. He also considers briefly the comparison of the cost of living at different places.

PAISH, E. W. AND PEACOCK, A. T. *Economics of Dependence* (1952–82).

The article is in three parts. Part I is concerned with compiling an index of the estimated cost of maintaining and educating the non-working population per equivalent adult male worker over the period 1952–82. The equivalent adult male population is obtained from the estimated actual working population by weighting the number of women and juveniles at work in proportion to their relative earnings.

The calculations involve, *inter alia*, a projection of the population to 1962, 1972 and 1982 classified in age-groups and according to sex and marital status. The assumptions regarding mortality, fertility and marriage are stated.

Assuming that the same proportion of the population as in 1952 will continue to work after retiring age, it is concluded that the rate of increase in the cost will be appreciably less than the rate at which the average output per head of the working population has increased during the past 40 years.

In Part II the authors estimate how far the needs of the non-working population will be met by state provision. This requires an examination of the claims which are made by the different age-groups on the social services. The authors point out that these estimates involve a considerable amount of guess-work. They estimate that, unless contributions are increased, the provision from general taxation will rise from some £400 m. in 1952 to some £1000 m. in 1982. Thus, whilst there will not be a 'resources problem', there will be a 'transfer problem'.

In Part III the authors consider methods of solving the transfer problem. They show that the saving resulting from even drastic changes in the pension age will be small and that a solution by way of an increase in contributions would mean an increase in both employer's and employee's contribution to 15s. per week by 1982. These calculations assume constant prices and current benefits. The authors conclude that perhaps it would be best to concentrate on measures which will accelerate the growth of the national income.

ADAMS, A. A. AND REDDAWAY, W. B. *The British Economy—A Longer View.*

The article analyses the gross domestic product of the United Kingdom in real terms for each of the years 1948–54. Estimates of consumers' expenditure, government expenditure and gross domestic capital formation are given, and the last two items are further subdivided into several broad classes. The changes that have occurred over the period are discussed.

The final part of the article discusses whether the Chancellor of the Exchequer's recent suggestion, that it should be possible to double the standard of living in 25 years, is consistent with a reasonable projection to 1979 based on the experience of 1948–54.