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Principes de Statistique Théorique et Appliquée by Armand Julin; M. Lucien March

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REVIEWS OF STATISTICAL AND ECONOMIC BOOKS.

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1.—*Principes de statistique théorique et appliquée*. Par Armand Julin : avec une préface de M. Lucien March. Tome premier, statistique théorique. xxiv + 712 pp., la. 8vo. Paris : Marcel Rivière ; Brussels : Albert Dewit, 1921.

This stately volume by M. Julin, now General Secretary of the Ministry of Industry, Labour and Food at Brussels is, we are informed in the preface by M. Lucien March, the development of a *précis* written some twelve years ago, and contains the substance of lectures delivered by the author at the University of Louvain and the Institut Supérieur de Commerce at Antwerp.

Later volumes will deal with specific applications ; the present is devoted solely to "theoretical statistics," "theory," it being understood, covering not merely the principles of handling data supposed already obtained, but all general considerations relating to organisation, collection and reduction. The volume is divided into an introduction and three books. In the introduction, after a brief discussion of the phenomena studied by the aid of statistics, the author gives an outline of the historical development of the subject and a critical discussion of the different conceptions that have been held as to its function and scope, including that perennial question "La statistique est-elle une science ou une méthode ?" M. Julin, emphasizing the unity of the method and the diversity of the applications, rightly, we think, concludes that it is preferable to regard statistics as a method :—"Une méthode qui, par le relevé "en masse et l'expression numérique de ses résultats, arrive à la "description des phénomènes collectifs et permet de reconnaître ce "qu'ils présentent de permanent et de régulier dans leur variété, "comme de variable dans leur apparente uniformité" (p. 43). In the following chapter the conception of statistical regularity is

explained, and the elements of the theory of probability are given. The concluding section of this chapter, on the relation of mathematics to statistics, contains a very interesting confrontation of views from different writers: Fourier, champion for mathematical methods—"Les sciences statistiques ne feront de véritables progrès que lorsqu'elles seront confiées à ceux qui ont approfondi les théories mathématiques" (p. 77); Racioppi and Laurent, firm on the same side; Messedaglia and Ferraris, very cautious; Bodio, doubtful in the extreme, but on a ground which surely is inadequate?—the ground that mathematicians, from sheer joy in their tools, will use the assay-balance when the steelyard would be more appropriate. Von Mayr holds the sweeping opinion that arithmetic alone is necessary. Bowley's views are well known to the readers of the *Journal*, and are subjected to detailed examination. M. Julin's summary of the whole discussion is judicial and judicious; "Ni l'éloignement ni l'indifférence ne sont plus de mise," he concludes: "les mathématiques ont fait leurs preuves, elles font partie de la technique" (p. 85).

In Book I the author turns to considerations of practice. Section I deals with "Le relevé statistique ou relevé direct," i.e. the statistical investigation proper, typified by the Census: Section II with "Le relevé indirect," i.e. the partial investigation by way of sample or estimate, the special enquiry in a limited field, and the monograph that proceeds by way of description of the typical case (or the case that the monographer would have you regard as typical) "La statistique et la monographie" as M. Julin remarks "ne parlent pas le même langage." Section II then takes up the very important subject of the critical attitude in statistics: the meaning of precision: the influence of organisation (e.g., centralisation) on the precision of results: constant and accidental errors: the influence of psychological factors on the accuracy of returns, e.g., fear of taxation, fear of other disadvantages attaching to particular replies, negligence or ill-will on the part of agents employed. We would like in this connection to cite a sentence from an earlier chapter (p. 146): "S'il est permis d'exprimer une opinion assez paradoxale au sujet de la capacité intellectuelle à exiger des agents recenseurs, nous voudrions dire que les plus intelligents ne sont pas les meilleurs"—as intelligent agents are on the whole less likely strictly to follow their instructions. The necessity for critical examination of the returns before reduction is strongly enforced with illustrations from the author's own experience, and Section IV then proceeds to the actual processes of reduction and tabulation—organisation and methods; use of machinery and calculators; the presentation of results. Let me quote again one characteristic comment (p. 295): "A quel moment faut-il s'occuper de la préparation des cadres de publication? Nous répondons, sans hésitation: dès le début du travail, avant même de rédiger le questionnaire ou bulletin. Il faut savoir où l'on va pour ne pas surcharger le bulletin de questions inutiles, ni omettre l'un ou

“l'autre point essentiel. Dresser un schéma du cadre de publication est la meilleur préparation qu'on puisse imaginer à la rédaction du bulletin.” This section concludes the book on the first branch of theory.

Book II is devoted to the methods of analysing the data now obtained. Here we come into contact with mathematical methods, or at least with conceptions that are mathematical in their nature. The author has regarded himself throughout as writing for the average statistician—the average official statistician or student of official statistics, we think we may say—and the demonstrations employed are the simplest possible: demonstrations on points that may present some difficulty are often repeated under different or varied forms. “Chercher et démontrer, par les procédés mathématiques” M. Julin remarks (p. 304) “que tel résultat s'obtient par telle formule, nous semble rentrer dans le rôle du mathématicien. Faire emploi de cette formule, montrer comment elle s'applique à des phénomènes statistiques, nous paraît la tâche du statisticien.” The five chapters of the book deal respectively with:—series, seriation and distribution; means, the median and the mode; dispersion, and its measurement; covariation (a term, due to M. March, that M. Julin prefers to “correlation” on the ground that it carries no suggestion of causality); and graphic method. Book III, which closes the volume, is devoted to the Law of Error, and concludes with an outline of the method of moments and Professor Pearson's frequency curves. It will be seen that the author has endeavoured to introduce the student to all the principal subjects in this interesting field, so far as this can conveniently be done within the limits of the assumption that the reader is not a mathematician; these limits are not, however, rigidly adhered to; for parts of the third book the student must be familiar with the notation at least of the differential and integral calculus. Space will not permit of a full outline of the treatment, but for the sake of illustration we may take the chapter on *correlation*—if M. Julin will forgive the use of the more familiar term. After a preliminary sketch of the purpose to be served by any sort of coefficient of dependence, various forms of coefficient are given and their use exemplified by numerical illustrations. This leads up to the product-sum coefficient, the meaning of which is deduced on the lines given by the present writer, and the deduction followed by arithmetical examples on the calculations necessary in the case of ungrouped observations. Time-series and Hooker's method afford further illustrations of the special problems that may arise, and the mode of calculation from a grouped table is then given. The equations of regression are then discussed, and a general revision of the theory concludes the section on the case of two variables. A final section deals briefly with the theory for three variables.

The exposition is throughout elementary and detailed, and the number of worked-out arithmetical examples an excellent feature, much more common in English than in foreign treatises. If any-

thing, the treatment appears to us at times almost too lengthy ; but on a such a point the practised hand is hardly a competent judge—the error, if it is an error, is at least a fault on the right side. In places, on the other hand, the reader may find some difficulty in grasping unfamiliar conceptions that are introduced at rather an earlier stage, for example the conception of probable error on p. 71. But M. Julin, we take it, has based his arrangement on personal experience in teaching, and has found such a development, involving the introduction of ideas that can only be fully discussed at a later stage, present a balance of advantage. Lists of references given at the end of each chapter will enable the reader to continue his studies ; the very wide reading of M. Julin both in English and foreign writers, as shown not merely by the references but by very numerous quotations in the text, cannot but strike the reviewer. A good detailed table of contents, and an index of authors' names, will be found at the end of the volume.

One general suggestion may be made ; that in the revision of the volume for a new edition some reduction should be made in the number of digits retained in many of the numerical examples. The retaining of an excessive number of digits not only renders the work needlessly heavy, but gives a false conception of precision, and is a breach of the rules that the author has himself laid down (p. 213). As examples, we may cite the use of 8-figure logarithms for calculating a geometric mean of lengths ranging from 258 to 372 millimetres, where 3 or at the most 4-figure logarithms would have sufficed (p. 385) ; the retaining of the full number of 11 digits in the squares of such an example as that on p. 448, or of 6 digits on p. 545 and p. 546 : and the working out of a standard-deviation to 9 digits and a correlation to 7 digits on the same pages. Three decimal places in the standard deviation, and a couple of decimals for the correlation would have given all that is necessary, and would have made the work look much less formidable. We must also enter a gentle protest against the note on p. 408, stating that the calculation of the mean takes forty minutes : ten minutes, please ! From a reference to old tables of factorials on p. 60, and a reference to Davenport's tables on p. 673, we judge that the author is unfamiliar with Professor Pearson's *Tables for Statisticians*, published by the Cambridge Press. It would be of advantage, in a new edition, to bring Book III into accord with the use of these standard tables. Reference might also be made to Barlow's tables of squares, etc., and to some of the product-tables. In the first edition of any volume covering so wide an extent of ground there are bound to be some slips. The work on pp. 226, *et seq.*, seems to us to require reconsideration ; on p. 411 the decimal point in the result appears to be misplaced, and the slip carried forward on p. 444 : the chart of the sine-curve on p. 568 needs re-drawing—as it stands it is unsymmetrical : and the arithmetic of the fitting of the normal curve on p. 671 requires correction. Any one who has attempted the writing of such a volume himself will

take the mention of such slips as evidence rather than that the reviewer has really read the book than of any essential fault in the writer.

That such a work could have been undertaken and brought to a successful conclusion at all in the circumstances in which it was actually written—when Belgium was still under the heel of the invader, when the author was completely cut off from commerce and correspondence with his colleagues—is a fact that is absolutely amazing. The subsequent volumes, completing the encyclopædic scheme, will be awaited with interest. The first volume by itself, providing as it does an elementary introduction to modern methods for the student of economics, has filled a long-standing gap in the statistical literature available for those to whom French is the mother-tongue.

G.U.Y.

2.—*The Problem of Estimation : a seventeenth-century controversy and its bearing on modern statistical questions, especially index-numbers.* By Correa Moylan Walsh. 144 pp. P. S. King and Son, Ltd., 1921. Price 6s. net.

The reader who is interested in index-numbers of prices and wants to see the gist of what this author has to say on the subject is recommended to turn at once to pp. 91, *et seq.* Amongst several formulæ, between which he finds it impossible definitely to decide, he appears to prefer the ratio :—

$$\sqrt{\frac{\Sigma(q_1p_2) \Sigma(q_2p_2)}{\Sigma(q_1p_1) \Sigma(q_2p_1)}}$$

where q and p denote quantities and prices respectively and the subscripts 1 and 2 refer to the earlier and the later period. This form was, if we remember rightly, suggested incidentally by Professor Pigou in *Wealth and Welfare*. The practical difficulties involved in the construction of any index-number for which quantities consumed are assumed to be known, are not discussed, and no numerical illustrations are given. When the author says that the consistence or approximate agreement of formulæ is proved by trial, this has to be taken on faith.

The book opens with a description of the controversy in which Galileo was involved on the question : “ If a horse worth 100 crowns “ is estimated by one person at 1,000 and by another at 10, which “ of these two estimates is the less erroneous, or are they equally “ erroneous ? ” A couple of lines to say that it depends entirely on how you choose to define “ erroneousness ” would seem to be sufficient comment, but the author devotes 17 pages to it. Most readers will agree with Todhunter, whom the author cites, that the controversy is without “ any scientific interest or value.” There follows this a chapter on Averages and Errors, and then the third and last chapter, entitled Deviations and Variations. In this the first section deals with Axiometry or “ the measurement of general exchange-value, especially of money,” the second with weighting, the third, to which reference has already been made, with the

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