

Corrado Gini

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MEASUREMENT OF INEQUALITY OF INCOMES

I HAVE read with the greatest interest the article by Mr. Hugh Dalton ("The Measurement of the Inequality of Incomes") which appeared in the September number of this JOURNAL, and I admire the simplicity and ease of the method which he suggests for measuring the inequality of economic welfare, on the hypothesis that the economic welfare of different persons is additive. The methods of Italian writers, which are explained by Mr. Dalton, are not, as a matter of fact, comparable to his own, inasmuch as their purpose is to estimate, not the inequality of economic welfare, but the inequality of incomes and wealth, independently of all hypotheses as to the functional relations between these quantities and economic welfare or as to the additive character of the economic welfare of individuals. The same methods are, on the other hand, applicable not only to incomes and wealth, but to all other quantitative characteristics (economic, demographic, anatomical or physiological), and they have, in fact, been actually employed to obtain a rough estimate of the various degrees of inequality which the distribution of these characteristics presents.

Mr. Dalton explains these methods with precision and brevity, and Italian writers must be most grateful to him for having directed the attention of English economists to the subject. Perhaps, however—as a supplement to Mr. Dalton's article—I may be permitted to draw the attention of readers of the ECONOMIC JOURNAL to certain papers, a perusal of which, in my opinion, is necessary to enable one to form an exact idea of the applicability and character of the methods in question. These are: E. Czuber, "Beitrag zur Theorie statistischer Reihen," in *Versicherungswissenschaftlichen Mitteilungen*, Neue Folge, Vol. IX., p. 101 *et seq.*, Vienna, 1914; C. Gini, "Sulla misura della concentrazione e della variabilità dei caratteri," in the *Transactions of the Real Istituto Veneto di Scienze, Lettere ed Arti*, Vol. LIII., Part ii., p. 1203 *et seq.*, Venice, 1914; G. Pietra, "Delle relazioni tra gli indici di variabilità," in the *Transactions of the Real Istituto Veneto di Scienze, Lettere ed Arti*, Vol. LIV., Part ii., Venice, 1915; Paper I., p. 775 *et seq.*; Paper II., p. 793 *et seq.* Probably these papers have escaped Mr. Dalton's attention owing to the difficulty of access to the publications in which they appeared.

Mr. Dalton rightly attaches importance to the degree of laboriousness of the various methods, and to their applicability to such imperfect statistics of income as we possess. It may perhaps be noted here that Professor Czuber has suggested (p. 126 *et seq.*) and has worked out a procedure for the calculation of the mean difference which is simpler than the one I used in *Variabilità e Mutabilità* (compare also on this question Pietra, "Sulla teoria della variabilità nelle serie statistiche," in the *Rivista Italiana di Sociologia*, May-August, 1915, p. 417); and, if I am not mistaken, a still more rapid procedure is described in my paper, "Sulla misura della concentrazione" (p. 1210 *et seq.*). In this paper, moreover, the calculation of the mean difference in the case of imperfect statistics¹ is examined in detail, and suitable correction coefficients are given (pp. 1211-1223). On the other hand, the calculation of the mean difference can often be made advantageously, in the case of very imperfect statistics, by a graphical method based on the area (area of concentration) contained by the curve of concentration and the line of equal distribution. Many subsequent applications of this procedure have convinced me of its great practical utility.

In this same paper (pp. 1237-1238) the relation between the mean difference and the area of concentration (to which Mr. Dalton alludes on p. 354) is established, and also the relation (to which Mr. Dalton refers on p. 360) between the mean difference and the reciprocal of Pareto's a when the distribution follows Pareto's curve is given (p. 1244; *cf.* also on this point, *Variabilità e Mutabilità*, pp. 60-63). From these relations, it is easy to corroborate the further relations between our δ and the area of concentration which Mr. Dalton establishes on p. 360.

I should like, therefore, to direct the attention of readers of the ECONOMIC JOURNAL more particularly to the two excellent papers of Dr. Pietra. In the first of these the relations are brought to light which exist between the mean deviation from the arithmetic mean, the mean deviation from the median, and the area of concentration.²

In the second paper the ranges of variation of the relative

¹ In my article I am really concerned with the determination not of the mean difference but of the *concentration ratio*, which is the quotient of the mean difference by twice the arithmetic mean; but what we say of one will apply equally to the other.

² *N.B.*—On pp. 784-786, the proof that distributions having a concentration curve, to which a parallel to the line of equal distribution is tangential, have all the same relative mean deviation. This proof Mr. Dalton, on p. 354, mistakenly attributes to Ricci. Dr. Pietra had already called attention to the possibility of such a confusion. Compare "Recenti Pubblicazioni di Metodologia Statistica," in the *Rivista Italiana di Sociologia*, March-June, 1917, pp. 312-317.

mean difference, of the relative mean deviation from the arithmetic mean, of the relative mean deviation from the median, and of the relative standard deviation are established, the causes of discrepancy between these various indices of variability are examined, and the limits are fixed within which these discrepancies can be verified.

R. Università di Padova, Gabinetto di Statistica.

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