ON FITTING CURVES TO OBSERVATIONAL SERIES BY THE METHOD OF DIFFERENCES

By

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I. PRELIMINARY STATEMENT

Curve fitting may be technically described as the representation of a series of observations by a mathematical function. Given the observations and the function to be fitted, the problem is to determine the constants of the equation in such a way as to secure a valid representation. The method to be employed in the determination of these constants must take into account the object which the fitting process is intended to serve. If the object is to interpolate for undetermined items between specified ordinates of the series, any method which will give the constants of the equation will suffice, since the representation of the given ordinates is exact. In this case, questions of method will hinge on considerations of convenience. If, however, the object is to secure the representation of *all* the items of the series by means of a single function, questions of method will hinge on the validity of the representation, which, in this case, can only be approximate.

Functions used as approximate representations of observational series fall into two general classes: first, those which have the force of a law descriptive of a necessary sequence of events; and, second, those which depict a norm as a characteristic trend in growth. These two types of representation merit separate methodological consideration; and, in what is to follow, we shall make an analysis of the problems involved and develop a method, which, it is believed, will place in the hands of the statistician a new and serviceable instrument.

II. FUNDAMENTAL TYPES OF OBSERVATIONAL SERIES

For the purpose of fixing attention on certain characteristics of observational data, let us consider two distinctly different sorts of series. Let us suppose that the first series consists of a set of observations on a comet moving through space, and that the second consists of the record of gold production in the United States.