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METHODS FOR COMPUTING CYCLICAL AND TREND GRADUATIONS AND MOVING SEASONALS

CYCLICAL GRADUATION

THIS is a 'smoothing' or graduation designed to depict as well as possible what the various series would be like if all seasonal and merely erratic fluctuations were removed. It is calculated by taking a 5-month moving total of a 5-month moving total of an 8-month moving total of a 12-month moving total and applying to the results a 17-month weighted moving total with the following simple weights: +7, —10, 0, 0, 0, 0, 0, 0, +10, 0, 0, 0, 0, 0, 0, —10, +7; the final results being divided by 9600. To obtain a value for any given month, data for 43 months are used, 21 preceding the given month and 21 succeeding it. It is a 'fifth degree parabolic graduation' in that it is designed to fit a curve exactly representable by an equation of the form

$$y = A + Bx + Cx^2 + Dx^3 + Ex^4 + Fx^5$$

as closely as is possible with such simple multiples as 7 and 10. Its other mathematical characteristics, including its ability to describe cyclical material such as could be represented by a superposition of sine curves of various periods, are discussed in full in *The Smoothing of Time Series,* by Frederick R. Macaulay (National Bureau of Economic Research, 1931), pp. 73–5, etc.

TREND GRADUATION

This is a 'third degree parabolic graduation'. It will fit almost exactly any curve representable by an equation of the form

$$y = A + Bx + Cx^2 + Dx^3.$$

For a description of its mathematical characteristics see *The Smoothing of Time Series,* pp. 59–60, etc. To fit it to monthly data, take a 4-month moving total of an 8-month moving total of the data. Subtract a 17-month moving total of the data. Take a 2-month moving total of a 12-month moving total of the results. Divide by 360. This graduation was applied to the 43-term cyclical graduation described in the preceding section by taking as the 'months' to which this graduation was to be applied the Januaries, Mays, and Septembers of the 43-term graduation. Intermediate values were read off a large scale chart on which a smooth curve had been drawn through the calculated values with French curves.

MOVING SEASONALS

The moving seasonals of Chart 20 were constructed by taking a 7-month moving average of a 9-month moving average of the deviations of the data for successive Januaries, Februaries, etc., from the 43-term graduation of the series as a whole. These twelve moving averages, one for each nominal month, were then smoothed with French curves. This preliminary moving seasonal was then corrected for irregularities in the algebraic sum of successive twelve-month periods by taking a 2-month moving average of a 12-month moving average of the preliminary moving seasonal and calling the deviations of the preliminary seasonal from this graduation the final moving seasonal.