

30 January 1931

Dr J.S. Lumby,  
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Dear Dr Lumby,

I think the example you sent me converges all right. I have made rather a mess of your original sheet, through working on it in trains and such places, so my best way will be to explain one complete cycle of substitutions, starting with any system of monthly values one likes.

On the enclosed sheet I have 12 columns for the months, headed by the number of observations available for each month. On the first line I have put down the month deviations in thousandths of 1 per mille with which I propose to start. Their total is -1, and though essentially the same result will eventuate if the same number is added to or subtracted from all 12 values, it is convenient to keep the total near to zero.

From the provisional monthly deviations, the yearly averages are obtained as follows. I have a column of 14 years, with the number of observations in each year, and in the 3rd. column the crude total of these observations

(ignoring the constant 35). The year 1904 has 6 observations in Feb., Mar., May, Aug., Sep. and Nov. The total of the provisional deviations for these months is -22, so I add .022 to the total 2.000 and divide by 6 to obtain the yearly average in column (i), .337. In the same way the other 13 yearly averages are obtained. Notice that I have omitted the years 1915 and 1926 having observations in only one month, since they can throw no light on variations from month to month, though they can be given yearly values, by subtracting from the one observation, the average deviation for the month.

From column (i) I have calculated line (ii) on the same principle. Jan. appears in the 3 years '08, '09 and '10. For '08 it scores 64 above the yearly value, for '09 it scores 60 above and for '10 it scores 72 below. In all this gives 52, which divided by 3 gives the new value,  $17\frac{1}{3}$ , for the January deviation. In the same way the other months are recalculated, and one is in a position to commence a new cycle.

Actually the changes are so small that you will only want to carry it out again to satisfy yourself as to method, and as to whether the slow creep remaining is really slowing up. For this purpose it might be worth while keeping a further decimal place, which you would, I imagine, never use in practice.

It has occurred to me that some of your original entries are themselves averages of 2 or more observations. If this is so it would be technically an improvement to give them ~~the~~ due weight by counting them separately and treating all entries in the same cell alike in making allowances for the year in deriving monthly deviations, and vice versa.

I hope this will go all smoothly. Do not hesitate to write again on this or other points.

Yours sincerely,