3. Measurement of Seasonal Variation

Measurement of Seasonal Variation

There are three ways to measure seasonal variation,

1. Averages of unadjusted data / Method of monthly (or quarterly) averages
2. Ratio to moving average
3. Ratio to trend

   Note
   Here we assume a multiplicative model unless stated otherwise

Averages of Unadjusted Data

When there is no trend or cyclical variation in the series then we use this method to find the seasonal variation. Here the only thing we have to eliminate are the irregular variations and that is done by averaging the monthly / quarterly / weekly values over different time points.

Let Y_{ij} be the observation for the j^{th} month of the i^{th} year.

$$\overline{Y_j} = \frac{\sum_i Y_{ij}}{\text{no. of years}}$$

This $\overline{Y_j}$ measures the seasonal component for the j^{th} month, $j = 1, 2, ..., 12$. To express $\overline{Y_j}$'s as seasonal indices, they should be expressed as percentages of a grand mean.

$\therefore$ seasonal index for the j^{th} month

$$= \frac{\overline{Y_j}}{\overline{\overline{Y}}} \cdot 100$$

Hence the total of seasonal indices for monthly data would add up to 1200 and for quarterly data, it would be 400. In general the sum of seasonal indices is given by $100 \times$ no. of seasona. For additive model, the grand mean is to be subtracted from $\overline{Y_j}$ and the sum of all seasonal indices would be 0.

Ratio to Moving Average

This method is preferred when your data contains both trend and cyclical movement.

Let Y_{ij} be the observation for the j^{th} month of the i^{th} year. Given that we have have assumed a multiplicative model, Y_{ij} is composed of $T_t \cdot S_t \cdot C_t \cdot I_t$. So from monthly data, we compute the moving averages as y_{ij}. This y_{ij} gives a rough estimate of the combined effects of $T_t \& C_t$.

Then the ratio $\frac{Y_{ij}}{y_{ij}}$ gives an estimate of the seasonal variation along with irregular variation for the j^{th} month.

$$\therefore r'_{ij} = \frac{Y_{ij}}{y_{ij}} \times 100$$

shows some variation from year to year. The values of r'_{ij} for each month are averaged over the years to remove irregular fluctuations.

i.e. we compute

$\sum_j r_j \neq 1200$, the seasonal indices of monthly variations are then obtained by adjusting the $r'_j s$ to add upto 1200. The adjustment factor is

$$\lambda = \frac{1200}{\sum_j r_j}$$

Then the required seasonal indices are given by

$$S_j = \lambda \cdot r_j \quad ; 1, 2, ..., 12$$

Ratio to Trend

This method is recommended when cyclical variartion is known to be absent or when it is not so pronounced even if present.