

Week-02-L-01

Agricultural Statistics in Practice

Forecasting Techniques in Agriculture

Measurement of Seasonal Component

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Types of seasonal variation

There are four types of seasonal variation:

1. Simple averages
2. Ratio to the types of trends
3. Percentage moving averages
4. Link related



Types of seasonal variations

Simple averages:

- This type calculate seasonal variation by taking the average of the values for each season.
- It provides a basic measure of variation but may not capture underlying trends or patterns accurately.

Ratio to the types of trends:

- This type compare each observation to a trend line to identify seasonal variations.
- Ratios are calculated by dividing the observed value by the corresponding trend value, allowing for relative analysis of seasonal changes.



Types of seasonal variations

Percentage moving averages:

- This type use moving averages to smooth out fluctuations and calculate seasonal variations as a percentage change from the moving average.
- It helps identify the relative magnitude of seasonal patterns compared to the overall trend.

Link related:

- This type examine the relationship between consecutive periods to identify seasonal patterns.
- They compare the current period with the previous period, taking into account any changes or shifts in seasonal variation, allowing for more accurate forecasting and analysis.

Methods to measure –

1. Method of simple averages

- Simplest of all the methods of measuring seasonality.
- Based on the additive modal of the time series. That is the observed values of the series is expressed by: $Y_t = T_t + S_t + C_t + R_t$ and in this method we assume that the trend component and the cyclical component are absent.

R_t = irregularities for time t
 C_t = cyclic for time t

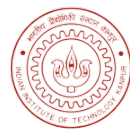
Advantages

Method of simple average is easy and simple to execute.

Disadvantages

The method assumes data lacks trends and cycles, but since most economic time series have trends, it has limited practical use.

T_t = trend for time t
 S_t = seasonal for time t



Steps involved

Mon-
Jan
Feb

2000
5000

1. Arrange the data by years and months (or quarters if quarterly data is given).
2. Compute the average \bar{x}_i ($i = 1, 2, \dots, 12$ for monthly and $i = 1, 2, 3, 4$ for quarterly) for the i^{th} month or quarter for all the years.
3. Compute \bar{x} of the averages i.e.

$$\bar{x} = \frac{1}{12} \sum_{i=1}^{12} \bar{x}_i \text{ for monthly and } \bar{x} = \frac{1}{4} \sum_{i=1}^4 \bar{x}_i \text{ for quarterly}$$

4. Seasonal indices for different months (quarters) are obtained by expressing monthly (quarterly) averages as percentages of \bar{x} .
Thus, seasonal indices for i -th month (quarter) = $\frac{\bar{x}_i}{\bar{x}} \times 100$



Methods to measure – 2. Ratio to trend method

- This method is an improvement over the simple averages method and this method assumes a multiplicative model = $T_t \times S_t \times C_t \times R_t$

<i>Advantages</i>	<i>Disadvantages</i>
The computation and understanding of this method are straightforward.	The ratio to trend method cannot accurately <u>capture cyclical swings</u> .
Compared to the method of monthly averages, it offers a more logical approach for measuring <u>seasonal variations</u> .	A seasonal index calculated using the ratio to moving average method <u>may be less biased</u> .
It has an advantage over the ratio to moving average method as it provides ratio to <u>trend values</u> for each available period, unlike the ratio to moving average method.	



Steps involved

1. Calculate trend values using the least square method with a straight line or second degree polynomial.
2. Convert the original data into percentages relative to the trend values, including seasonal, cyclical, and irregular components.
3. Eliminate the cyclical and irregular components by averaging the percentages for different months (quarters).
4. Adjust the indices obtained in step 3 to a total of 1200 for monthly or 400 for quarterly data by multiplying them by a constant K given as:

$$K = \frac{1200}{\text{Total of the indices}} \text{ for monthly \& } K = \frac{400}{\text{Total of the indices}} \text{ for quarterly}$$



Methods to measure –

3. Ratio to moving average method

Seasonal variations it can measure.

- The ratio to moving average method is also known as percentage of moving average method.
- It's the most widely used method of measuring seasonal variations.

<i>Advantages</i>	<i>Disadvantages</i>
The ratio to moving average method is widely used and satisfactory for measuring <u>seasonal variations</u> .	The method underutilizes the data as it does not provide seasonal indices for the first and last six months in a 12-month moving average.
The method provides flexibility and is considered the most suitable approach.	The method lacks comprehensive utilization of data due to incomplete coverage of seasonal indices for certain periods.
Fluctuations in indices calculated using the ratio to moving average method are generally lower compared to other methods.	



Steps involved

1. Calculate the centered 12-monthly moving average (or 4-quarterly moving average) of the given data.
2. Convert the original data into percentages relative to the centered moving average values.
3. Obtain the seasonal indices by averaging these percentages, eliminating irregular components using either arithmetic mean or median.
4. Adjust the sum of the indices to a total of 1200 for monthly or 400 for quarterly data by multiplying them by a constant K:

$$K = \frac{1200}{\text{Total of the indices}} \text{ for monthly \& } K = \frac{400}{\text{Total of the indices}} \text{ for quarterly}$$



Methods to measure –

4. Link relative / Pearson's method

- Pearson's Method is a statistical approach developed by Karl Pearson for assessing the correlation between variables, providing a measure of their linear relationship through the use of a correlation coefficient.

<i>Advantages</i>	<i>Disadvantages</i>
The link relative method utilizes a larger amount of data compared to the <u>moving average</u> method.	The link relative method requires complex calculations and is less straightforward than the moving average method.
	Link relative averages include trend and cyclical elements, which are corrected for elimination.



Steps involved

1. The link relatives for each period are calculated by using the below formula

$$\text{Link relative for any period} = \frac{\text{Current periods figure}}{\text{Previous periods figure}} \times 100$$

2. Calculate the average of the link relatives for each period for all the years using mean or median.
3. Convert the average link relatives into chain relatives on the basis of the first season. Chain relative for any period can be obtained by

$$\frac{\text{Average link relative for that period} \times \text{Chain relative of the previous period}}{100}$$

the chain relative for the first period is assumed to be 100.



Steps involved

4. Now the adjusted chain relatives are calculated by subtracting correction factor “kd” from (k+1)th chain relative respectively. Here $k = 1, 2, \dots, 11$ for monthly and $k = 1, 2, 3$ for quarterly data and

$$d = \frac{1}{N} [\text{New Chain relative for first period} - 100]$$

where N denotes the number of periods i.e. $N = 12$ for monthly $N = 4$ for quarterly

5. Finally, calculate the average of the corrected chain relatives and convert the corrected chain relatives as the percentages of this average. These percentages are seasonal indices calculated by the link relative method.

Thank You

