FORECASTING QUARTERLY EARNINGS USING A TREND-SEASONAL MODEL

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Abstract:
In this work, a trend-seasonal model is selected, which shows the most optimal ways of showing the trend equations with additive forming and multiplicative forming models.

Keywords: Trend, seasonality, additive forming models, multiplicative forming models, moving average, smoothed series.

The value of a variable (for example, sales volume) changes over time under the influence of a number of factors. If the values of a time series variable change, some more or less stable feature is observed from year to year in a certain period of time, then the series is said to have seasonality. The overall change in the values of a variable over time is called a trend.

X_t- the observed value of the time series is considered a function of seasonality (S_t) and trends (T_t). These elements of the time series can be combined in several ways:

1. Additive forming models:

$$X_t = T_t + S_t$$

2. Multiplicative forming models:

$$X_t = T_t \cdot S_t$$

Below we present the steps for forecasting quarterly earnings using additive and multiplicative models

I. Forecasting with additive forming models.

1) The moving average is found:

$$y'_t = \frac{\frac{1}{2}y_{t-2} + y_{t-1} + y_t + y_{t+1} + \frac{1}{2}y_{t+2}}{4}$$

2) The difference between the actual value and the smoothed series is found

$$x_t = y_t - y'_t$$

3) The average value of x_t for quarters with the same name is found as follows where is the number of cycles taken from the second step.

$$\bar{x}_i = \begin{cases} \frac{1}{k}\sum_{j=1}^{k} x_{4j+i} & i=1,2 \text{ учун} \\ \frac{1}{k}\sum_{j=0}^{k-1} x_{4j+i} & i=3,4 \text{ учун,} \end{cases}$$

as follows where is k the number of cycles taken from the second step.

4) Seasonality values are found for each quarter

$$S_t = \bar{x}_i - \bar{x}$$

where is $\bar{x} = \frac{1}{4}\sum_{i=1}^{4}\bar{x}_i$.

5) The outliers of the moving average $y'_1,\ y'_2$ and $y'_{n-1},\ y'_n$ s are found. To do this, the average absolute change for the moving averages found above $\Delta y = \frac{y'_{n-3} - y'_3}{n-5}$ is found and will be equal to $y'_1 = y'_2 - \Delta y$, $y'_2 = y'_3 - \Delta y$, $y'_{n-1} = y'_{n-2} + \Delta y$, $y'_n = y'_{n-1} + \Delta y$.

6) For $y'_1,\ y'_2, \ldots, y'_{n-1},\ y'_n$ a straight line regression equation $y_t^{(1)}$ moving averages is found.

7) Predicted terms are found by the formula $y_t = y_t^{(1)} + S_t$

II. Forecasting with multiplicative forming models.

1) The moving average is found

$$y'_t = \frac{\frac{1}{2}y_{t-2} + y_{t-1} + y_t + y_{t+1} + \frac{1}{2}y_{t+2}}{4}$$

2) The ratio of the actual value and the smoothed series is found

$$x_t = \frac{y_t}{y'_t}$$

3) The average value of for quarters with the same name is found as follows

$$\bar{x}_i = \begin{cases} \frac{1}{k}\sum_{j=1}^{k} x_{4j+i} & i=1,2 \text{ учун} \\ \frac{1}{k}\sum_{j=0}^{k-1} x_{4j+i} & i=3,4 \text{ учун,} \end{cases}$$

where is k the number of cycles taken from the second step.

4) Seasonality values are found for each quarter

$$S_t = \bar{x}_i \bar{x}$$

where is $\bar{x} = \frac{1}{4}\sum_{i=1}^{4}\bar{x}_i$

5) The outliers of the moving average $y'_1,\ y'_2$ and $y'_{n-1},\ y'_n$ s are found. To do this, the average absolute change for the moving averages $\Delta y = \dfrac{y'_{n-3} - y'_3}{n-5}$ found above is found and will be equal to $y'_1 = y'_2 - \Delta y$, $y'_2 = y'_3 - \Delta y$, $y'_{n-1} = y'_{n-2} + \Delta y$, $y'_n = y'_{n-1} + \Delta y$

6) For $y'_1,\ y'_2, \ldots, y'_{n-1},\ y'_n$ a straight line regression equation moving averages $y_t^{(1)}$ is found.

7) Predicted terms are found by the formula $y_t = y_t^{(1)} + S_t$.

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