Portland Bus Ridership Monthly Time Series Report

A: Summary:

The data represents a monthly average count of bus ridership of the Portland transportation since Jan 1960 to Jun 1969. And the aim of this report is to use time series to construct a good model for analyzing and predicting the future trend.

(1) Seasonality check.

First of all, we need to check whether the data has seasonal fluctuations or not and we can have a prediction according to the Graph 1 that there is no seasonality in this data. And we can also use autocorrelation to analyze the residuals from the different smoothing interval to testify it. In this way, I choose m=3, 4 and 5 three situations and we can find that , , both of them are satisfied.

Graph 1

(2) Brown’s method.

1) n=1.

Before, we need to use Function LINEST to calculate the coefficient a and b, as to then . And . Applying to data, we need to try every combination of and , from 0,1 to 0,9, and by comparing the value of , we can find that when = 0,9 and = 0,1, we get the minimum value which shown in Table 1.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | 𝛼 | 𝛽 |
| MIN | 4,55133773 | 0,9 | 0,1 |

Table 1

2) n=2.

In contrast to n=1, under current situation, we need to bring one more variable c except a and b. In this case, I calculate the value of the first estimated value with a and b, then let c be equal to the difference of and . . And . Through the same way, we can get the minimum value of Mad is 4,55331917 which is larger than Mad when n=1.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | 𝛼 | 𝛽 |
| MIN | 4,62911215 | 0,9 | 0,1 |

Table 2

(3) Holt model.

In this case, I leave the last three lines to check the accuracy of the model. . And . After getting the value of the last line, we need to use of last line to forecast 04, 05, 06 of 1969s. And trying different combination of , we could find that when = 0,9, = 0,9, the sum of the square of error is the minimum which is equal to 3752,06 like Table 3.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | 𝛼 | 𝛽 |
| SUM MIN | 3752,06 | 0,9 | 0,9 |

Table 3

(4) MAPE.

Calculating the value of MAPE of different model, we find that Brown’s method(n=1) has the minimum MAPE and as I have mentioned previous, Mad(n=1) = 4,55133773, Mad(n=2) = 4,55331917, Holt Mad = 5,7727456, we can clearly find that when using Brown’s method(n=1), we also get the minimum Mad, thus we could use Brown’s method(n=1) model to forecast the future 6 period.

|  |  |
| --- | --- |
|  | MAPE |
| Brown(n=1) | 0,41% |
| Brown(n=2) | 0,42% |
| Holt | 0,51% |

Table 4

(5) Forecast the future 6 periods.

Using formula , we can get the future performance shown in Table 5. And also we can check the Graph 2, as the graph represented, the estimated values match the real data quite well in the previous stage, the orange part shows the future 6 periods performance.

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 1969-07 | Forecast | 1267,24762 |
| 2 | 1969-08 |  | 1207,10942 |
| 3 | 1969-09 |  | 1146,97123 |
| 4 | 1969-10 |  | 1086,83303 |
| 5 | 1969-11 |  | 1026,69483 |
| 6 | 1969-12 |  | 966,556637 |

Table 5

Graph 2

B: Question:

1) Since the data can’t have the seasonal fluctuation, I don’t know how to apply Holt-Winters model to this case because Holt-Winters model is designed for the data with seasonality?

2) Although the estimated values match the real data well in the previous stage, it looks not reasonable that during the latter 6 periods the trend keeps going down?