Implementation of Trend Moment Method for Stock Prediction as Supporting Production

B P Candra¹, Kusrini² and H A Fatta³

¹,²,³ Magister Teknik Informatika, Universitas AMIKOM Yogyakarta, Indonesia.

Email: beda.candra@students.amikom.ac.id

Abstract. Companies in each activity are accompanied by production planning activities. Determining the right amount of production will minimize the risk of loss. To assist companies in carrying out production planning activities, a system is needed that can predict the right number of products to achieve the company's targeted profit. In this study analyzing a forecasting method is a trend moment method to analyze sales trends, then combined with the season index method. Testing using the MAPE method shows the moment trend produces an error value of 10.60%, while the combination of the trend moment method with the season index produces an error of 7.83%. The test results show that the influence of the season index can reduce the forecasting error value by 2.77%.

1. Introduction

In a business required a development of the business system. To be able to do development on business systems can mnafaatkan existing data information on the business for analysis, so it can be used in support managerial piha to assist analysis of a company manager. Company CV. XYZ is a company engaged in the food industry, the product sold is suki onigiri. Marketing model conducted by CV company. XYZ is currently selling or consigned, working together with minimarket network. There are more than 300 minimarket network outlet points located in some areas.

Based on the business model that has been run by the company CV. XYZ, then as the supplier must be able to consider how the right amount of stock to be produced. The availability of the right stock can meet the demand of each distributor. Consideration of precise stock counts can also minimize loss rates due to several factors that may occur, such as excess in production or lack of production in meeting demand. Taking into account the quantity of production can measurably optimize the company's profits.

Settlement of the case in this research used trend moment method. The method is a common method used in forecasting techniques. The use of trend moment method can still be improved the results of forecasting using season index factors. Testing of the modeling method used MAD, MSE, MAPE. This method is a common method used to measure the error rate generated from the forecasting method.
2. Related Work

Previous research has been done using trend moment methods such as in the case of [1] Global market analysis can prove beneficial to all users of system interest. A system that focuses on patterns generated in stock trading over a period of time. In the case of [2] trend moment method is used to forecast sales based on sales data in the months or in previous years. In the case of [3] one of the factors for a boutique to compete in the business world is the planning and availability of goods to meet market demands. Trend moment method uses certain methods of statistican and mathematical calculations to know the straight line functionality as a substitute for dashed lines formed by the company data. In the case of [4] projection method of forecasting of goods one of which is the trend moment, can be a tool in supporting decision making. Activity results for forecasting or forecasting minimize the uncertainty that may occur in the future. This activity to avoid or reduce the likelihood of occurrence of the opposite between the things that really happened with the forecast. In the case of [5] there is difference between the actual value of sales with forecasting results using trend moment. Using data with different amounts as forecasting data, greatly affects the forecasting result. The more the amount of data entered will be less selship between the actual value with the forecasting results. From the results of forecasting obtained the average difference between actual sales of -6.042.61. If the percentage of -10 or lower 10% of the actual value. In the case of [6] rice sales forecasting can provide predictors of the next month as desired based on data in previous months using trend moment. The average percentage error rate in test data ie May to October 2015 is 0.20%. The largest percentage error is 0.29%. the more the amount of data used as a reference forecasting calculation, then the difference will be smaller.

3. Research Method

3.1. Method

Trend moment method includes forecasting method which in its technique uses statistical calculations and certain mathematical calculations aims to determine the straight line function instead of the dashed line formed by the company's historical data. With such techniques subjective elements can be avoided [7]. The used trend equation is shown in equation 1 below:

\[ Y = a + bX \] (1)

With the mathematical method, the values a and b of the above linear trend equation are determined by using the following normal equations shown in equations 2 and 3:

\[ a = \frac{((\sum Y \cdot \sum X^2) - (\sum XY \cdot \sum X))}{(n \cdot \sum X^2) - (\sum X \cdot \sum X)} \] (2)

\[ b = \frac{((\sum Y \cdot \sum X) - (\sum XY \cdot n))}{((\sum X) \cdot \sum X) - (n \cdot \sum X^2)} \] (3)

Terms:
Y = Periodic data or trend value of certain period
X = Periode of time (day, week, month, year)
a = Constant value
b = Koevisen X, slope of th trend line
n = Amount of data
3.2. Season Index
Season index is a periodic series that has regular movements and almost happens at certain times, considered to have seasonal movement [8]. Ordinary movements are influenced by certain variables that have a seasonal relationship due to natural conditions as well as factors of human activity. The following seasonal index formula that can be used is shown in equation 4:

\[
\text{Season Index} = \frac{\text{average sales of a certain period}}{\text{average sales } \sum \text{period}}
\]  

(4)

3.3. Prediction Accuracy Value
3.3.1. Mean Absolute Deviation (MAD). Mean absolute deviation error is a method to perform testing or evaluation on forecasting method. Using the number of absolute mistakes [9]. MAD is the first stage of the overall forecasting error for the model. The formula used to calculate MAD is shown in the following equation:

\[
\text{MAD} = \frac{\sum_{t=1}^{n} |Y_t - F_t|}{n}
\]  

(5)

Terms:
Xt = Actual data of period t
Ft = Forecasting value in period t
n = Amount of data

3.3.2. Mean Square Error (MSE). Mean square error is a method with another technique to test the error rate of the forecasting method [9]. Each error is squared. This approach technique sets the big forecasting error because the errors are squared. MSE is the second way to measure the magnitude of overall forecasting errors. The MSE is the average of the difference of the square between the predicted value and the actual value. The MSE formula used is shown in the following equation 6:

\[
\text{MSE} = \frac{\sum_{t=1}^{n} (X_t - F_t)^2}{n}
\]  

(6)

3.3.3. Mean Absolute Percentage Error (MAPE). Mean absolute percentage error (MAPE) is a method of measuring error in forecasting methods with an absolute error technique in each period divided by a real observational value for that period [9]. Furthermore the result is calculated the average value of the absolute percentage error. MAPE is an error test that searches the percent value of the difference between actual data and forecasting data. The MAPE value can be calculated by the following equation 7:

\[
\text{MAPE} = \left(\frac{100\%}{n}\right) \sum_{t=1}^{n} \frac{|X_t - F_t|}{X_t}
\]  

(7)

4. Result and Evaluation
Data collection in CV. XYZ consists of 16 months from January 2017 to April 2018. Modeling uses 1 year data or 12 months data serves as modeling data. Then the 4 months data from January 2018 to April 2018 is displayed as test data. The following actual sales data at XYZ company is addressed in Table 1.
Table 1. Actual Sales Data

| n  | Month     | Sales (Y) |
|----|-----------|-----------|
| 1  | Jan-17    | 2230      |
| 2  | Feb-17    | 2359      |
| 3  | Mar-17    | 3023      |
| 4  | Apr-17    | 2534      |
| 5  | May 2017  | 2569      |
| 6  | Jun-17    | 1785      |
| 7  | Jul-17    | 1900      |
| 8  | Agu 2017  | 2032      |
| 9  | Sep-17    | 1935      |
| 10 | Okt 2017  | 2211      |
| 11 | Nov-17    | 1803      |
| 12 | Des 2017  | 2089      |
| 13 | Jan-18    | 1845      |
| 14 | Feb-18    | 1741      |
| 15 | Mar-18    | 2083      |
| 16 | Apr-18    | 2113      |

4.1. Modeling Forecasting

The following is a forecasting data modeling table consisting of 12 monthly sales data. Referring to Table 1 data is taken from January 2017 to December 2017 as modeling data. Modeling can be seen in Table 2 below.

Table 2. Forecasting Modeling

| n  | Month     | Sales (Y) | X | XY  | X^2  |
|----|-----------|-----------|---|-----|------|
| 1  | Jan-17    | 2230      | 0 | 0   | 0    |
| 2  | Feb-17    | 2359      | 1 | 2359| 1    |
| 3  | Mar-17    | 3023      | 2 | 6046| 4    |
| 4  | Apr-17    | 2534      | 3 | 7602| 9    |
| 5  | May 2017  | 2569      | 4 | 10276| 16   |
| 6  | Jun-17    | 1785      | 5 | 8925| 25   |
| 7  | Jul-17    | 1900      | 6 | 11400| 36   |
| 8  | Agu 2017  | 2032      | 7 | 14224| 49   |
| 9  | Sep-17    | 1935      | 8 | 15480| 64   |
| 10 | Okt 2017  | 2211      | 9 | 19899| 81   |
| 11 | Nov-17    | 1803      | 10| 18030| 100  |
| 12 | Des 2017  | 2089      | 11| 22979| 121  |
|    | Total     | 26470     | 66| 137220| 506  |
|    | Average   | 2205.83   |    |      |      |
Calculate the values of $a$ and $b$:

$$a = \frac{((26470 \times 506) - (137220 \times 66))}{((12 \times 506) - (66 \times 66))}$$

$$= 2527.56$$

$$b = \frac{((2205 \times 66) - (137220 \times 12))}{((66 \times 66) - (12 \times 506))}$$

$$= -58.50$$

Calculate the season index:

$$\text{Season Index} = \frac{\text{average sales of a certain period}}{\text{average sales } \Sigma \text{ period}}$$

Average demand for January = $\frac{2230}{1} = 2230$

Index season of January = $\frac{2230}{2205.83} = 1.011$

In the Table below is a calculation of the season index value for 4 months, namely January, February, March, April which is used as forecasting modeling in Table 2 earlier. The following results of the calculation of the season index value are shown in Table 3.

| Number | Month  | Season Index |
|--------|--------|--------------|
| 1      | January| 1.011        |
| 2      | February| 1.069       |
| 3      | March  | 1.370        |
| 4      | April  | 1.149        |

The forecasting results for the next period use the trend moment method and that uses the addition of the season index effect:

$$Y_{\text{January}} = 2527.56 + -58.50 \ (12)$$

$$= 1826$$

$$Y^*_{\text{January}} = 1826 \times 1.011$$

$$= 1846$$

The forecasting result for the next period use the trend moment method and that uses addition of the season index effect are shown in Table 4.
Table 4. Trend moment forecasting result and the influence if the season index

| Month       | X  | Y   | Y*  |
|-------------|----|-----|-----|
| January 2018| 12 | 1826| 1846|
| February 2018| 13 | 1767| 1890|
| March 2018  | 14 | 1709| 2342|
| April 2018  | 15 | 1650| 1896|

4.2. Testing forecasting error result

Testing the results of the forecasting modeling of trend moment and season index effect using MAD, MSE and MAPE testing methods.

• Forecasting with trend moment

Test results from forecasting using trend moment method shown in Table 5.

Table 5. Testing the trend moment method error

| Number | Month       | Y Real | Y     | Error | Error | Error^2 | Error |
|--------|-------------|--------|-------|-------|-------|---------|-------|
| 1      | January 2018| 1845   | 1826  | 19    | 19    | 376     | 1,03  |
| 2      | February 2018| 1741  | 1767  | -26   | 26    | 682     | 1,49  |
| 3      | March 2018   | 2083   | 1709  | 374   | 374   | 140166  | 17,95 |
| 4      | April 2018   | 2113   | 1650  | 463   | 463   | 214261  | 21,91 |

MAD | MSE   | MAPE
---|-------|-------
220,5| 88871 | 10,60 |

• Forecasting Trend Moment with season index

Test results from forecasting using trend moment method with season index shown in Table 6.

Table 6. Testing Trend Moment with Season Index

| Number | Month       | Y Real | Y*   | Error | Error | Error^2 | Error |
|--------|-------------|--------|------|-------|-------|---------|-------|
| 1      | January 2018| 1845   | 1846 | -1    | 1     | 0       | 0,05  |
| 2      | February 2018| 1741  | 1890 | -149  | 149   | 66864   | 12,43 |
| 3      | March 2018   | 2083   | 2342 | -259  | 259   | 47259   | 10,27 |
| 4      | April 2018   | 2113   | 1896 | 217   | 217   | 34067   | 7,83  |

MAD | MSE   | MAPE
---|-------|-------
156,5| 34067 | 7,83  |
Comparison of results from modeling forecasting the difference with real sales data can be seen in Figure 1.

![Comparison of Error](image_url)

**Figure 1.** Graph of Forecasting Comparison

From the graph shown in Figure 1 based on the comparison of Tables 5 and 6 shows the forecasting value with the influence of the season index closer to the actual value.

5. **Conclusion**

Based on the results of the tests that have been carried out on XYZ company sales data, the research can be concluded as follows:

1. Forecasting using the trend moment method gives an error value of 10.60%.
2. Forecasting using the trend moment method and the influence of the season index produces an error value of 7.83%.
3. The value of the season index can reduce the value of errors in forecasting by 2.77%.

6. **Suggestion**

Based on data analysis in this study, further research can be developed in several ways for optimization, including:

1. Forecasting techniques can be added with cyclical influences or other factors that affect the sales process.
2. Forecasting can be tested by other method techniques to compare accuracy values.
7. References

[1] Pahwa S N et al 2017 Stock Prediction using Machine Learning a Review Paper
   *International Journal of Computer Application* (0975-8887) Vol 163 No 5

[2] Ratningsih 2017 Forecasting Penjualan Rumah dengan Menggunakan Trend Moment
   Pada PT. Rumakita Prima Karsa *Perspektif* p-ISSN: 1411-8637 e-ISSN: 2550-1178
   Vol XV No 1 Maret

[3] N Fua and E Sulistiono 2016 Prediksi Penjualan Kerudung Rabbani di Griya Muslim
   Store Dukun Gresik dengan Trend Moment *JOUTICA-Press* ISSN: 2503-07103

[4] M H Poernomo Sinergisme Metode Trend Moment sebagai Model Pendukung Keputusan
   dalam Perancangan Visual Forecasting Penjualan

[5] A F Shimbun et al 2017 Sistem Peramalan Kebutuhan Stok Barang Menggunakan
   Metode Trend Moment *Jurnal PPKMI* ISSN-2354-869X

[6] Kusrini and D A B Utami 2016 Rancang Bangun Sistem Peramalan Penjualan dan
   Pengendalian Persediaan Beras Menggunakan Metode Trend Moment *Jurnal Telematika*
   ISSN: 1979-925X Agustus

[7] M I Hasan *Pokok-Pokok Materi Statistik-1 (Statisti Deskriptif)* Edisi Kedua (Jakarta:
   Bumi Aksara)

[8] N J Awat 1990 *Metode Peramalan Kuantitatif* (Yogyakarta: Liberty)

[9] F Pakaja and A P Naba 2012 Peramalan Penjualan Mobil Menggunakan Jaringan Syaraf
   Tiruan dan Certainty Factor *Jurnal EECCIS* Vol 6 No 1 Juni