FORECASTING SALES OF GOODS AND MEDICINE IN UAD PHARMACY WITH LEAST TREND METHOD SQUARE

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ABSTRACT

The aim of this research is to predict or forecast the number of sales of a product in the next period (next month) using the Trend Least Square method. The subject of this research is the UAD pharmacy. The research method starts from a literature review where the researcher will collect theories from previous researchers who discuss the same method as reference material for research activities, then collect data, namely data taken from the UAD pharmacy, namely drug and goods sales transaction data from the period September- December 2022 to January-April 2023 totaling 1338 drug and goods data, then making predictions using the Trend Least Square method with forecasting accuracy testing using the Mean Absolute Percentage Error (MAPE) method. The variables used in this research consist of the name of the item, the quantity sold of an item (qty) and time. The final result of this research is a sales prediction for the next period resulting from forecasting calculations using the least square trend method with Mean Absolute Percentage Error (MAPE) as a measure of forecasting accuracy. Based on the final results obtained, the prediction system using the least squares trend method seems to be more accurate in predicting small sales, with a low MAPE, and less accurate in predicting large sales, with a high MAPE. This may be due to the greater complexity and variability in large sales data. So, to avoid losses to UAD pharmacies, the system created, namely forecasting using the least squares trend method, is not suitable for use. It is hoped that future researchers can make predictions using methods other than the least square trend method.



KEYWORDS Forecasting Trend Least Square Mean Absolute Percentage Error (MAPE) Apotek



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1. Introduction

If managed well, a pharmacy is a business or provider of medicines and other goods that can make a lot of money. UAD Pharmacy experiences an increase in sales every period. However, there are several obstacles experienced by pharmacies, one of which is the problem of controlling unstable supplies of medicines and goods which has an impact on the distribution process because it creates uncertainty for distributors. The result of less accurate management of drug and goods inventory in pharmacies will have an impact on losses. This is because there are still drugs that have not been sold or drug stocks are piling up [3].

In this research, making predictions or forecasting on sales of goods can be used as a solution, it is hoped that pharmacies will be able to see predictions of sales of medicines and goods sold in the future. Forecasting is the process of estimating the number of needs in the future [5]. This amount includes measures of quantity, quality, time and location needed to meet demand for goods or services. In this way,



the pharmacy obtains information as a reference for increasing profits by knowing how many goods will be sold in the next period (month) [6].

Forecasting activities require methods to understand and predict future demand. In this research, the method used to make predictions or forecasting is the Least Square method, which is a method in the form of periodic series or time series data, which requires data on sales of goods in the past to be used as material for forecasting sales in the future so that it can determined the results [7]. Least Square is a forecasting method used to see trends in time series data [8]. WithMean Absolute Percentage Error as a tool for measuring forecasting accuracy.

2. Method

2.1. Metode Trend Least square

This least squares method is a forecasting method used to see trends in time series data [17]. With the Least Square trend method, time series can be divided into two data cases, namely the first in the even data case and the second in the even data case. The following are the stages in the process of implementing the least square trend method:

- 1. First, look for a lot of data (N)
- 2. Second, to find the value of parameter If there are an even number of months, the X value is the minimum odd value from subtracting one from the total number of months used. Meanwhile, if the number of values in variable X has a difference of 1 then the amount of data is odd. The value of X is the number of months used and when added up the value ΣX=0. The following is an example of determining the value of X according to the statement above:
 - If the number of months used for forecasting is 6 months (even) then the X values used are ..., -5, -3, 1, 3, 5, ... so that it complies with the condition $\Sigma X = 0$
 - If the number of months used for forecasting is 7 months (odd) then the X values used are ..., -3, -2, -1, 0, 1, 2, 3, ... so that they comply with the condition $\Sigma X = 0$
- 3. Third, look for the values of X2 and XY.
- 4. Fourth, look for the values of variable a and variable b, using equations 2.1 and 2.2 below:

$$a = \frac{\sum Y}{n} \qquad (2.1)$$
$$b = \frac{\sum XY}{\sum X^2} \qquad (2.2)$$

Information:

 $\Sigma Y =$ Total number of actual sales data for variable Y.

n = Total of all months of data used.

 $\Sigma XY = Total sum of the products between variables X and Y.$

 $\Sigma X2 = Total of the sum of the squares of variable X.$

a = Trend variable value at the beginning of the month or intercept value

b = Average trend variable value for each month

5. Fifth, find the Y' trend value with the following equation 2.3:

$$Y' = a + bx \qquad (2.3)$$

Information:

Y' = the variable being searched for or the trend

x = value on the time variable (number of months used + number of predicted months).

2.2 Forecast

Forecast error is a stage for calculating errors/evaluating forecast results, there are several methods commonly used to evaluate forecasts, one of which is Mean Absolute Percentage Error (MAPE) is a method of evaluating the accuracy of a prediction, MAPE is a form of the percentage of the average calculation of the difference between predicted value with actual value, the smaller the MAPE value, the more accurate the prediction results. The following are the MAPE assessment standards [19] [20].

- If the MAPE value is <10% then the forecasting results are very good
- If the MAPE value is 10% -20% then the forecasting results are good
- If the MAPE value is 20% -50% then the forecasting results are decent (quite good)
- If the MAPE value is >50% then the forecast results are inaccurate.

The formula for Mean Absolute Percentage Error (MAPE) can be seen in equation 2.4 below:

$$MAPE = \frac{\sum_{Y1-Yt|}^{|Y1-Yt|}}{n} *100\%$$
 (2.4)

Information: Y1 = actual data Yt = prediction result n = Total amount of actual data || = absolute value

Mean Absolution percentage Error (MAPE), which is a measure of the error rate of forecasting accuracy, where the average absolute error during a certain period is multiplied by 100% to obtain the final result in the form of a percentage.

3. Results and Discussion

For calculations using the methodTrend least square The researcher will use 10 sample item data, namely data for the months from September – December 2022 to data for January – April 2023, the total months used are 8 months of sales data with a total of 1,338 data items for sales predictions, namely:

		Qty							
No.	Nama item	Sep(22	Okt(22	Nov(22	Des(22	Jan(23	Feb(23	Mar(23	Apr(23
))))))))
1	Acarbose 100								
	mg	10	20	20	10	10	10	30	50
2	Acarbose								
	50mg	50	110	110	70	100	70	90	60
3	Acetylcystein e 200 mg	445	400	510	435	234	564	456	346

Tabel 2. 1 Sales Sampel Data

4	Acnol Gel 10 gr	200	251	245	270	281	220	350	240
5	Acnol Lotion 10 ml	1	2	1	2	2	1	1	1
6	Actifed (Hijau) 60 ml	12	4	7	2	8	2	4	1
7	Actifed (Kuning) 60 ml	1	7	5	4	1	3	5	7
8	Actifed (Merah) 60 ml	11	5	6	50	2	6	6	2
9	Acyclovir 400	25	30	150	40	40	4	30	5
10	Acyclovir Cr 5%	28	120	29	38	32	37	80	10

With the sample data above, the researcher will use Acarbose 100 mg data as an example of manual least square trend calculation by first finding the values of variables X, Y, X2, XY as in the following table:

Tabel 2. 2 Calculation of predictions for Acarbose 100 mg

N	Periode	Y	Х	X^2	XY
1	Sep '22	10	-7	49	-70
2	Okt '22	20	-5	25	-100
3	Nov '22	20	-3	9	-60
4	Des '22	10	-1	1	-10
5	Jan '23	10	1	1	10
6	Feb '23	10	3	9	30
7	Mar '23	30	5	5	150
8	Apr '23	50	7	49	350
$\Sigma_n = \frac{1}{8}$		$\Sigma Y = 160$		$\Sigma x^2 = 168$	$\Sigma X Y = 300$

After that, look for the values of variable a and variable b using equation 2.1 and equation 2.2 below:

$$a = \frac{\sum Y}{n}$$

= 160 / 8
 $a = 20$
 $b = \frac{\sum XY}{\sum X^2}$
= 300 / 168
 $b = 1,79$

If the values a and b have been obtained, then look for the Y' trend value of the item to predict the number of sales for the next month. From the sales data above, a prediction will be made of sales of goods in the next period, namely May 2023, so that the value of x = 9. So the calculation is obtained

Y' = a + bx

= 20 + 1,79 x 9

Y' = 36,07

From the results above, we get Y' = 36, so based on prediction calculations using the Trend least squares method, sales of Acarbose 100 mg items in the next period (May 2023) will be 36.07.

The following is a prediction of sales of goods using the least squares trend in the next period (May 2023) for all sample goods:

No	Name of goods	Prediction result
1	Acarbose 100 mg	39,07
2	Acarbose 50mg	76,07
3	Acetylcysteine 200 mg	400,79
4	Acnol Gel 10 gr	295,21
5	Acnol Lotion 10 ml	1,11
6	Actifed (Hijau) 60 ml	0,39
7	Actifed (Kuning) 60 ml	5,36
8	Actifed (Merah) 60 ml	5,32
9	Acyclovir 400	9,54
10	Acyclovir Cr 5%	30,25

 Tabel 2. 3 Forecast Results for All Item Data Samples

After the prediction results for all items have been found, the next step is to evaluate the accuracy of the forecast results using the methodMean Absolute Percentage Error (MAPE). MAPE will calculate the difference between the actual data minus the forecast data then divided by the actual data, then the value is absolute so that the MAPE value is positive. After that, it is divided by n (the amount of data used in this research is n = 1,338 data). After the division is done, the results of the division are multiplied by 100% to obtain the percentage of the results. Following are the calculationsMAP for Acarbose 100 mg:

$$MAPE = \frac{\sum_{1}^{|Y1-Yt|}}{n} *100\%$$
$$= \frac{\frac{160-36.07}{100}}{1338} *100\%$$
$$= \frac{159.77}{1338} *100\%$$
$$= 0.12 *100$$
$$= 12\%$$

So the MAPE value of Acarbose 100 mg is 12%

The following is a calculation table for evaluating forecasting results using the methodMean Absolute Percentage Error (MAPE) is explained in table 2.5:

No	Name of goods	Actual Sales(Y ₁)	Predictin sales (Y _t)	Difference (error) Y ₁ - Yt /Y ₁	Y ₁ - Yt /Y ₁ /n	(MAPE) Y ₁ - Yt /Y ₁ /n *100
1	Acarbose 100 mg	160	39,07	159,90	0,12	12
2	Acarbose 50mg	660	76,07	659,88	0,49	49
3	Acetylcysteine 200 mg	3385	400,79	3384,88	2,53	253
4	Acnol Gel 10 gr	2057	295,21	2056,86	1,54	154
5	Acnol Lotion 10 ml	11	1,11	10,90	0,01	1
6	Actifed (Hijau) 60 ml	40	0,39	39,99	0,03	3
7	Actifed (Kuning) 60 ml	33	5,36	32,84	0,02	2
8	Actifed (Merah) 60 ml	88	5,32	87,97	0,07	7
9	Acyclovir 400	324	9,54	323,97	0,24	24
10	Acyclovir Cr 5%	374	30,25	373,92	0,28	28

Tabel 2. 4 Tests Using Mean Absolute Percentage Error (MAPE)

Based on the results above, the MAPE value is relatively higher for large sales data, whereas on the contrary, the MAPE value tends to be low for small sales data.

4. Conclusion

In this research, predictions use the least square trend method, the results obtained show that this method is not effective or appropriate for high volume sales data. This can be concluded from the fact that the resulting Mean Absolute Percentage Error (MAPE) value reaches up to 200%, which is a very high error rate. This means that predictions with such methods are inaccurate or inadequate when applied to situations where there is a lot of sales data. Prediction systems using the least squares trend method appear to be more accurate in predicting small sales, with low MAPE, and less accurate in predicting large sales, with high MAPE. So, to avoid losses to UAD pharmacies, the system created, namely forecasting using the least squares trend method, is not suitable for use.

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