


Application of Linear Regression Method in Predicting Chicken Egg Sales

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| Article Info | ABSTRACT |
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| <p>Keywords: Sales Prediction, Simple Linear Regression, Chicken Eggs, Downward trend, Historical Data.</p> | <p>This study aims to predict chicken egg sales using a simple linear regression method based on historical sales data for 12 months, from April 2024 to March 2025. This study uses a quantitative approach with a longitudinal study design. The total sampling technique is used because all monthly sales data is analyzed without exception. Data was collected through sales report documentation from a single egg distributor business unit that operated consistently during the study period. Data analysis was carried out through a preprocessing process, calculation of variable values X (month), Y (sales), and calculation of XY and XX to obtain regression coefficients. The results of the calculation show that the linear regression equation obtained is $Y=150.1515233-6.24126X$. This shows that there is an average decrease in sales of 6.24 egg boards every month. Furthermore, this regression model is used to predict chicken egg sales in the period April 2025 to March 2026. The predicted results show a continued downward trend, with sales projected to decline drastically to near zero by March 2026. The conclusion of this study is that there is a downward trend in chicken egg sales during the two years of observation. These results provide an early warning for business actors to evaluate business strategies and take anticipatory steps. This research also opens up opportunities for further study of external factors that may affect sales.</p> |
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INTRODUCTION

The demand for food products, especially chicken eggs, has fluctuated significantly in line with changes in people's socio-economic conditions and market dynamics (Tanjung & Mardani, 2024). Chicken eggs are one of the main food commodities that have an important role in meeting the animal protein needs of the Indonesian people (Nuraeni et al., 2022). Fluctuations in the price and sales volume of chicken eggs can have an impact on the welfare of farmers and the stability of the domestic market (Harahap et al., 2024). In the context of marketing livestock products, the ability to predict sales is an important aspect that can help business actors in determining the right production and distribution strategy (Djazuli & Hidayat, 2024). Therefore, an analysis method is needed that is able to provide a quantitative and accurate picture of sales movements. One of the methods widely used in sales forecasting research is linear regression (Arya Della et al., 2021).

The linear regression method is a statistical technique used to analyze the relationship between one dependent variable and one or more independent variables (Lusiana et al., 2021). In the context of sales, this method can be used to model sales patterns based on time, season, and other economic factors (Nugraha, 2022). With accurate sales predictions, business actors can optimize stocks, minimize losses, and improve supply chain efficiency (Dewi et al., 2024). Several previous studies have successfully applied the linear regression method in predicting the sales of various products such as rice, cooking oil, and chicken meat (Widyastuti, 2023). However, research on the application of linear regression in predicting chicken egg sales, especially on a local or regional scale, is still limited. This shows the need to conduct more specific and contextual research on chicken egg products.

In addition, sales predictions are also needed to assist the government in regulating distribution policies and maintaining food price stability. The role of technology and statistical data processing is indispensable in supporting data-based decision-making. Therefore, the use of the linear regression method in predicting chicken egg sales is considered relevant to the development of information needs in the livestock and trade sectors. As competition in the market increases, farmers and business actors are required to not only focus on the production process, but also pay attention to the aspect of sales planning through the use of predictive methods. With a scientific approach and based on historical sales data, the resulting predictions can be used to improve business competitiveness and long-term business planning.

Based on this description, it can be concluded that the application of the linear regression method in predicting chicken egg sales is very important to support the effectiveness of business decision-making, market stability, and sustainable development of the livestock sector. The purpose of this study is to apply the linear regression method in accurately predicting the sales of chicken eggs based on historical sales data.

METHODS

This study uses a quantitative approach with a descriptive method and simple linear regression analysis. The research was conducted to predict chicken egg sales based on historical data for 12 months, starting from April 2024 to March 2025. The research design used is a longitudinal study, where data is collected periodically over a period of one year. The focus of this study is to identify monthly sales patterns and determine prediction models that are relevant to the trend of chicken egg sales. The population in this study is all data on chicken egg sales from one business unit or egg distributor that operates consistently during the research period. The sampling technique used is total sampling, because all monthly data is analyzed without exception. Data is collected through documentation techniques, namely by accessing and recording sales data that has been available from the company's sales report.

RESULTS AND DISCUSSION

Determining Research Data Used

In the table below, sales data will be presented starting from April 2024 to March 2025.

Table 1. Research Data

| No. | Month and Year | Egg Sales (Board) |
|-----|----------------|-------------------|
| 1. | April 2024 | 190 |
| 2. | May 2024 | 189 |
| 3. | June 2024 | 200 |
| 4. | July 2024 | 50 |
| 5. | August 2024 | 45 |
| 6. | September 2024 | 78 |
| 7. | October 2024 | 10 |
| 8. | November 2024 | 89 |
| 9. | December 2024 | 117 |
| 10. | January 2025 | 178 |
| 11. | February 2025 | 49 |
| 12. | March 2025 | 120 |

From table 1 above, it can be seen that the data has been sequenced from April 2024 to March 2025. After data collection, the next stage is to pre-process the data that has been obtained. This stage includes the implementation of data filtering where the required variables are eliminated and the sales of chicken eggs are grouped according to the order per month, starting from April 2024 to March 2025. With variable X is the time period (months) while Variable Y is the sale of chicken eggs (board).

Calculation of values of X, Y, XY, XX

Table 2 Calculation of X,Y,XY,XX values

| No. | Month and Year | Egg Sales (Board) | X (t) | Y (t) | XY | XX |
|----------|----------------|-------------------|-------------------|---------------------|---------------------|--------------------|
| 1. | April 2024 | 190 | 1 | 190 | 190 | 1 |
| 2. | May 2024 | 189 | 2 | 189 | 378 | 4 |
| 3. | June 2024 | 200 | 3 | 200 | 600 | 9 |
| 4. | July 2024 | 50 | 4 | 50 | 200 | 16 |
| 5. | August 2024 | 45 | 5 | 45 | 225 | 25 |
| 6. | September 2024 | 78 | 6 | 78 | 468 | 36 |
| 7. | October 2024 | 10 | 7 | 10 | 70 | 49 |
| 8. | November 2024 | 89 | 8 | 89 | 712 | 64 |
| 9. | December 2024 | 117 | 9 | 117 | 1053 | 81 |
| 10. | January 2025 | 178 | 10 | 178 | 1780 | 100 |
| 11. | February 2025 | 49 | 11 | 49 | 539 | 121 |
| 12. | March 2025 | 120 | 12 | 120 | 1440 | 144 |
| Addition | | | $\sum Xt$ = 78 | $\sum Yt$ = 1315 | $\sum XY$ = 7655 | $\sum XX$ = 650 |

Table 2 caption:

- The variable X (t) is the time period (months) used in the study. The number of time periods (months) is 12 using the numbers 1 to 12.
- Variable Y is the sales figure of chicken eggs.
- Variable XY is the multiplication between Variable X and Variable Y.
- Variable XX is the multiplication between Variable X and Variable X.
- Then a sum is made on each of the contents of the Variable so that $\sum Xt = 78$, , , and $\sum Yt = 1315$ $\sum XY = 7655$ $\sum XX = 650$

Calculations a and b

First we calculate the value of b, which is as follows:

With the formula:

$$b = \frac{n \sum xy - \sum x \cdot \sum y}{n \sum x^2 - (\sum x)^2} \quad (1)$$

Then the value b is obtained:

$$b = \frac{12 \times 7655 - 78 \times 1315}{12 \times 650 - (78 \times 78)}$$

$$b = \frac{91860 - 102570}{91860 - 102570}$$

$$b = \frac{7800 - 6084}{-10710}$$

$$b = \frac{1716}{-10710}$$

$$b = -6.24126$$

From the formula above, b= -6.24126 is obtained. Furthermore, after getting a value of b, a value will be searched with the formula below:

With the formula:

$$a = \frac{\sum Yi - b \sum xi}{n} \quad (2)$$

Then a value is obtained:

$$a = \frac{1315 - (-6.24126) \times 78}{12}$$

$$a = \frac{1801,81828}{12}$$

$$a = 150.1515233$$

From the calculation above, the value of a = 150.1515233, and the value of b = -6.24126.

Getting a Linear Regression Equation

The coefficient a = 150.1515233, and the value b = -6.24126 that has been obtained is used to obtain the linear regression equation $y = a + bx$. The coefficient obtained results in a simple linear regression equation, namely: $Y = 150.1515233 + -6.24126 X$, with the value of Variable X being the running time period from April 2024 to March 2025. The linear regression equation can be determined in the form of the table below:

Table 3. Regression equations obtained from coefficients a and b

| No. | Month and Year | X (t) | $Y = 150.1515233 + -6.24126 X$ |
|-----|----------------|-------|--------------------------------|
| 1. | April 2024 | 1 | 143,910263 |
| 2. | May 2024 | 2 | 137,669003 |
| 3. | June 2024 | 3 | 131,427743 |

| | | | |
|-----|----------------|----|------------|
| 4. | July 2024 | 4 | 125,186483 |
| 5. | August 2024 | 5 | 118,945223 |
| 6. | September 2024 | 6 | 112,703963 |
| 7. | October 2024 | 7 | 106,462703 |
| 8. | November 2024 | 8 | 100,221443 |
| 9. | December 2024 | 9 | 93,9801833 |
| 10. | January 2025 | 10 | 87,7389233 |
| 11. | February 2025 | 11 | 81,4976633 |
| 12. | March 2025 | 12 | 75,2564033 |

Sales Prediction Decision Results

So the results of sales predictions for April 2024 to March 2025 are obtained with linear regression, which is as in the table below:

Table 4. Results of Sales Prediction Decisions April 2024 to March 2025 with Linear Regression

| No. | Month and Year | Sales Prediction Results |
|-----|----------------|--------------------------|
| 1. | April 2024 | 143,910263 |
| 2. | May 2024 | 137,669003 |
| 3. | June 2024 | 131,427743 |
| 4. | July 2024 | 125,186483 |
| 5. | August 2024 | 118,945223 |
| 6. | September 2024 | 112,703963 |
| 7. | October 2024 | 106,462703 |
| 8. | November 2024 | 100,221443 |
| 9. | December 2024 | 93,9801833 |
| 10. | January 2025 | 87,7389233 |
| 11. | February 2025 | 81,4976633 |
| 12. | March 2025 | 75,2564033 |

Making Predictions for April 2025 to March 2026

To make predictions for the coming year April 2025 to March 2026, what will be used is the *linear regression* equation that has been obtained. In this study, sales will be predicted from April 2025 to March 2026. The real data used is with the January Variable X(t) labeled the 13th to 24th month. As below:

Table 5. Sales Prediction Decision Results April 2025 to March 2026 with Linear Regression

| No. | Month and Year | X (t) | $Y = 150.1515233 + -6.24126 X$ |
|-----|----------------|-------|--------------------------------|
| 1. | April 2025 | 13 | 69,0151433 |
| 2. | May 2025 | 14 | 62,7738833 |
| 3. | June 2025 | 15 | 56,5326233 |
| 4. | July 2025 | 16 | 50,2913633 |
| 5. | August 2025 | 17 | 44,0501033 |
| 6. | September 2025 | 18 | 37,8088433 |

| | | | |
|-----|---------------|----|------------|
| 7. | October 2025 | 19 | 31,5675833 |
| 8. | November 2025 | 20 | 25,3263233 |
| 9. | December 2025 | 21 | 19,0850633 |
| 10. | January 2026 | 22 | 12,8438033 |
| 11. | February 2026 | 23 | 6,6025433 |
| 12. | March 2026 | 24 | 0,3612833 |

Information:

Calculation of Value $Y = 150.1515233 + (-6.24126)$ multiplied by Variable Value $X (t)$. After completing all calculations on the data sample, the results obtained that the results of the sales prediction decision using the linear regression method show a declining graph, so that it can be stated that the results of the sales prediction decision in April 2025 to March 2026 have decreased.

CONCLUSION

Based on the results of the analysis of chicken egg sales data for 12 months from April 2024 to March 2025 using a quantitative approach and a simple linear regression method, the regression equation $Y = 150.1515233 - 6.24126X$ was obtained. This equation shows that each month there is an average decrease in sales of 6.24 egg boards. A constant value of a of 150.15 indicates an estimated sales at the beginning of the observation period (1st month), while a negative regression coefficient value b indicates a downward trend in sales from month to month. The results of sales predictions from April 2025 to March 2026 using the regression model also show a significant decline to close to zero at the end of the period (March 2026). Thus, it can be concluded that there is a consistent downward trend in chicken egg sales during the two-year observation and prediction period. These findings are important as a basis for business actors in designing marketing strategies, product diversification, or operational efficiency to overcome these declines. It is recommended that an analysis of external factors such as market prices, consumer purchasing power, and distribution be carried out to understand the causes of the downward trend more comprehensively.

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