

Analysis of Factors that Influence the Price Index Received by Farmers in East Kalimantan

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ABSTRACT

The Farmer Exchange Rate (NTP) is the ratio of the price index received by farmers (It) to the price index paid by farmers (Ib). This research aims to understand the calculation of NTP and analyze the factors influencing NTP. The study focuses on East Kalimantan Province, where in 2022, there was an increase in NTP due to a 6.34% rise in the Farmers' Received Price Index (It), while the Farmers' Paid Price Index (Ib) only increased by 1.89%. Given various factors affecting the subsector of farmers' exchange rates in East Kalimantan, the research employs factor analysis—a statistical tool to reduce influencing factors to a set of indicators without significant information loss. The variables for the subsector Nilai Tukar Petani (NTP) include food crops, horticulture, smallholder plantation crops, livestock, and fisheries.

Keywords: NTP, IT, factors analysis, Price Index

I. INTRODUCTION

The essence of agricultural development, namely aims to improve the welfare of the agricultural sector [2]. Considering that the agricultural sector is a sector that is related to people's lives. Farmer Exchange Rate (NTP) is a comparison of the price index received by farmers (It) to the price index paid by farmers (Ib) [3]. The price index paid by farmers (Ib) is a price index that shows the development of prices for farmer household needs, both needs for household consumption and needs for agricultural production processes.

The price index received by farmers (It) is a price index that shows the development of producer prices for farmers' production. From the It value, we can see fluctuations in the prices of goods produced by farmers. This index is also used as supporting data in calculating agricultural sector income [4]. It is calculated based on the sales value of agricultural products produced by farmers, including the rice, secondary crops, livestock products, people's plantations, vegetables, fruit and fishery products (capture and aquaculture).

If the NTP is greater than 100, then the Price Index Received by Farmers (It) is greater than the Price Index

Paid by Farmers (Ib). If the NTP is equal to 100, then the general relationship between the price level of commodities sold by farmers and the prices of goods purchased by farmers is the same. If the NTP is less than 100, then the Price Index Received by Farmers (It) is smaller than the Price Index Paid by Farmers (Ib). [5] The benefit of the Farmer Exchange Rate (NTP), namely the Price Index Received by Farmers (It), can see developments in commodity prices or agricultural products sold by farmers periodically. From the Prices Paid by Farmers Index (Ib), it can be seen developments in the prices of goods and services consumed by rural farmers as well as developments in the prices of goods and services needed to produce commodities or agricultural products. NTP is one of the instruments used by the Central Statistics Agency (BPS) to find out the level of welfare or purchasing power of farmer-fishermen in a region and is announced every month. [6].

The higher the NTP, the relatively more prosperous the level of life of farmers. This also happened in East Kalimantan. Where the agricultural sector still has a high role in regional development, especially East Kalimantan. This statement is reinforced by the large amount of land used for agriculture. The Central Statistics Agency noted that irrigated and non-irrigated rice fields in East Kalimantan in 2022 will be 64,030 hectares.

For from That, need is known magnitude well-being for farmer with use NTP as indicator well-being. This is intended to find out how prosperous farmers are so that the government can take steps to improve welfare. To find out what factors influence farmers' welfare, the factor analysis method is used to reduce existing data into a number of new factors so that these factors are able to explain the high level of diversity in the data from the original variables.

II. THEORETICAL BASIS

Factor analysis is one a form of multivariate statistical analysis that looks at the relationship between several items and finds the relationship between these items which at first appear to be mutually exclusive can be grouped into several variables. [7]

Mathematically, the factor analysis model is written as follows [8]:

$$X_p - \mu_p = l_{p1}F_1 + l_{p2}F_2 + \dots + l_{pm}F_m + \varepsilon_p$$

Or in matrix notation it is written:

$$X_{(p \times l)} - \mu_{(p \times m)} = L_{(p \times m)} F_{(m \times l)} + \varepsilon_{(p \times l)}$$

Information:

L : A constant whose value is unknown and is called the loading factor matrix.

X : Random vector that has p components in the observation

μ : Vector to the orbit

F : Common factors or what are called common factors

ε : error vector

The following is the equation of covariance [9]:

$$\Sigma = Cov(X) = E(X - \mu)(X - \mu)' = LL' + \Psi$$

or it can be written as:

$$Var(X_i) = l_{i1}^2 + \dots + l_{im}^2 + \varphi_i$$

$$Cov(X_i, X_k) = l_{i1}l_{k1} + \dots + l_{im}l_{km}$$

The covariance for the random variable X and the common factor F is:

$$Cov(X, F) = E(X - \mu)F' = L$$

In general it can be written:

$$Cov(X_i, F_j) = l_{ij},$$

with $i = 1, 2, \dots, p$ dan $j = 1, 2, \dots, m$

The variance of the i th variable contributed by m common factors is called the i th communality. The value $Var(X_i) = \sigma_{ii}$ is the communality value added to the specific variance value [10].

$$\sigma_{ii} = l_{i1}^2 + l_{i2}^2 + \dots + l_{im}^2 + \varphi_i$$

The i th communality is denoted as h_i^2 , or by using the notation above we obtain the equation:

$$h_i^2 = l_{i1}^2 + l_{i2}^2 + \dots + l_{im}^2, \quad i = 1, 2, \dots, p$$

The i th communality value is the sum of the squares of the loading factors of the i th variable on m factors. The loading value shows the correlation between the general factors formed and the original variables, the greater the loading value, the closer the relationship between the two [11].

Next, determining the rotation factor is done by maximizing the weighting factor. The method that is often used is the orthogonal transformation of the loading factors which has been obtained in the general form:

$$L^* = L_{(p \times q)} \cdot T_{(q \times q)}$$

The varimax rotation method with orthogonal transformation is carried out by maximizing the following form:

$$V = \frac{1}{p} \sum_{j=1}^m \left[\frac{\sum_{i=1}^p \hat{\ell}_{ij}^{*4} - (\sum_{i=1}^p \hat{\ell}_{ij}^{*2})^2}{p} \right]$$

by definition $\hat{\ell}_{ij}^* = \hat{\ell}_{ij} / \hat{h}_i$

In calculating factor scores, there are several methods that can be used, namely the Weighted Least Square Method and the Regression Method. The weight least square method is used to estimate loading values used method maximum probability. Estimated factor scores using the regression method can be obtained in the following way:

$$\hat{f}_{(n \times m)} = (x_j - \bar{x})_{(n \times p)} S_{(p \times p)}^{-1} \hat{L}_{(p \times m)}, \quad \text{where } j = 1, 2, \dots, n$$

Information:

- \hat{f} : factor scores
- S : sample covariance matrix
- \hat{L} : estimated loading value

Or if with a correlation matrix the estimated factor scores become:

$$\hat{f}_{(n \times p)} = z_{(n \times p)} R_{(p \times p)}^{-1} \hat{L}_{(p \times m)}, \quad \text{dimana } j = 1, 2, \dots, n$$

$$z_{(n \times p)} = D^{-\frac{1}{2}}(x_j - \bar{x})$$

with:

R : sample correlation matrix [12]

III. METHOD

3.1 Data

In this research, the data used is secondary data. The data coverage used in this research is data for 2022. Data was obtained from BPS (Central Statistics Agency) through notes or archives created and published by institutions related to this research via internet-based information media, and will be processed with R software - Studio. Where the variables used in this research are 5 variables, namely food crops (X1), horticulture (X2), people's plantation crops (X3), livestock (X4) and fisheries (X5).

Table 3.1 below shows data for 2022 obtained from BPS (Central Statistics Agency). The following is the research data [13]:

Month	X1	X2	X3	X4	X5
1	102.35	118.01 1	191.55	113.38	108.07
2	101.64	117.19	190.50	114.08	107.33
3	100.48	118.60	199.44	114.48	108.58
4	100.11	118.92	204.19	116.04	108.37
5	99.89	121.12	167.05	118.87	109.82
6	100.33	131.93	173.84	122.87	109.98
7	101.82	133.14	144.65	122.72	109.51
8	102.59	127.51	157.00	120.33	109.24
9	102.83	128.64	176.36	121.50	110.83
10	103.38	126.70	181.38	122.42	111.30
11	103.82	124.70	194.29	122.34	111.37
12	105.46	125.77	199.53	121.31	110.90

The variables of this research can be seen in Table 3.1.1 below.

Variable	Information
Y	Index accepted by farmers (It)
X1	Crops

X2	Horticulture
X3	People's plantation crops
X4	Farm
X5	Fishery

3.2 Research procedure

The procedure for this research is as follows:

1. Collect data from BPS East Kalimantan Province in 2022.
2. Describe characteristics data with use statistics descriptive.
3. Doing analysis factor with steps as follows:
 - a. View data correlation
 - b. Test the normality assumption
 - c. Performing a multivariate normality assumption test
 - d. Carrying out correlation tests
 - e. Carry out sample adequacy tests
 - f. Determine eigenvalues and eigenvectors
 - g. Determination of the number of factors
 - h. Doing analysis factor and determine the model
4. Interpret the research results.
5. Draw conclusions and suggestions from the research results.

IV. RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Table 4.1 below shows the descriptive statistics of the research variables obtained from the analysis results

No.	Variabl e	Min.	Maks.	Mean	St.Dev
1.	X1	99.89	105.46	102.06	1.694713
2.	X2	117.2	133.1	124.4	5.520318
3.	X3	144.7	204.2	181.6	18.48628
4.	X4	113.4	122.9	119.2	3.687395
5.	X5	107.3	111.4	109.6	1.334935

Based on table 4.1, standard deviation is an interpretation of the amount of data variation, meaning that if the standard deviation value is greater, then the mean value is a poor representation of the data and the data is classified as variable, and vice versa.

4.2 Data Correlation

Data correlation is needed to see relationship between variables in the data and see how big the correlation relationship is between the data [14]. Table 4.1 below illustrates the correlation between variables that will be used in factor analysis.

	X1	X2	X3	X4	X5
X1	1.000	0.254	0.135	0.391	0.560
X2	0.254	1.000	-0.676	0.905	0.622
X3	0.135	-0.676	1.000	-0.501	-0.134
X4	0.391	0.905	-0.501	1.000	0.857
X5	0.560	0.622	-0.134	0.857	1.000

4.3 Normality Assumption Test

The data normality assumption test was carried out with the Shapiro-Wilk Normality Test with the hypothesis::

H_0 : Data is normally distributed

H_1 : Data is not normally distributed

Variab le	P-Value	Decision	Conclusion
X1	0.6229	Do not reject H_0	Normally distributed
X2	0.3501	Do not reject H_0	Normally distributed
X3	0.4284	Do not reject H_0	Normally distributed
X4	0.0272	Reject H_0	Not normally distributed
X5	0.6312	Do not reject H_0	Normally distributed

Based on the Shapiro-Wilk Normality Test above, it can be concluded that the 5% significance level of the data on variables X1, X2, X3, dan X5 normally distributed and the data on variable X4 not normally distributed.

4.4 Multivariate Normality Assumption Test

Multivariate normality assumption test which used is the Mardia Test with the hypothesis:

H_0 : Data has a multivariate normal distribution

H_1 : Data does not have a multivariate normal distribution.

Factor analysis

	P-Value	Decision	Conclusion
Mardia skewness	0.7411	Do not reject H_0	Multivariate normal distribution
Mardia Kurtosis	0.1212	Do not reject H_0	Multivariate normal distribution

In Mardia Skewness, p-value = 0.7411 > α (0.05), and in Mardia Kurtosis, p-value = 0.1212 > α (0.05), so H_0 is not rejected. So at a significance level of 5% it can be concluded that the data has a multivariate normal distribution. So these variables meet the assumptions of multivariate normality.

4.5 Correlation Test

The correlation test used is Bartlett Test of Sphericity with hypothesis:

H_0 : There is no correlation between variables.

H_1 : There is at least one correlation between variables.

Based on the Bartlett Test of Sphericity, the p-value is < 2.22×10^{-16} , this means that the p-value is < α (0.05), so reject H_0 . So at a significance level of 5% it can be concluded that there is at least one correlation between variables.

4.6 Sample Adequacy Test

In the model adequacy test used KMO Test (Kaiser-Meyer-Olkin Test) to test the adequacy of each variable. The KMO test scale ranges from 0 to 1 with interpretation:

- If the KMO value is < 0,5 then there is an indication that the number of samples used is insufficient or that factor analysis is not suitable for use
- If the KMO value is > 0.5 then there is an indication that the number of samples used is sufficient or suitable for use for factor analysis [15]

The Measure of sampling adequacy (MSA) value can be seen in the following table:

X1	X2	X3	X4	X5
0.731	0.618	0.747	0.570	0.539

Based on the Kayser - Meyer - Olkin Test, the KMO value obtained was 0.6029805 > α (0.05), so it can be concluded that the sample used was sufficient or feasible to carry out or apply factor analysis.

4.7 Eigen values

It can be seen that there are 2 eigenvalues those with a value > 1 are 3.078 and 1.326

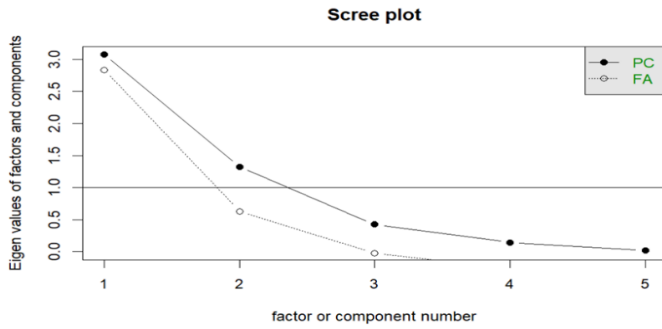
X1	X2	X3	X4	X5
3.078	1.326	0.425	0.146	0.022

4.8 Determining the Number of Factors

Determining the number of factors can be seen from eigenvalues from the data and can also be seen based on the scree plot.

If we look at the eigenvalues, 2 values are obtained which are > 1 with a cumulative proportion reaching 0.8810813 or around 88% which is already > 80%.

If you look at the scree plot, there are 2 points that have a position > 1. This corresponds to the eigenvalue, so it can be concluded that there are 2 factors taken for factor analysis.

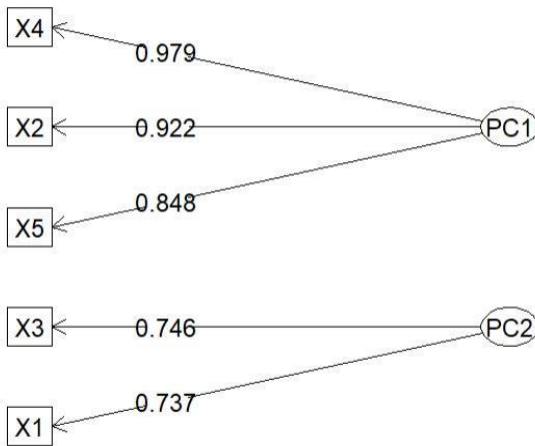


Based on the scree plot results, there are 2 points that are above the average eigen line which has a value of 1. So, the number of factors used in factor analysis is 2 factors .

4.9 Factor Analysis

Based on analysis factor with taking 2 factors, the model is obtained:

	F1	F2
X1	0.49	0.74
X2	0.92	-0.28
X3	-0.56	0.75
X4	0.98	-0.02
X5	0.85	0.39



$$F1 = 0.98X4 + 0.92X2 + 0.85X5$$

$$F2 = 0.75X3 + 0.74X1$$

The results of factor analysis show that there are 2 factors that greatly influence the index received by farmers. Factor 1 is influenced by the variables livestock (X4), horticulture (X2), and fisheries (X5), with the largest influence being livestock with a value of 0.98. Factor 2 is influenced by the variables of

community plantation crops (X3) and food crops (X1) with the greatest influence being community plantation crops with a value of 0.75.

V. CLOSING

5.1 Conclusion

In this research, the factor analysis method was used to identify what factors influence the price index received by farmers in East Kalimantan Province in 2022. The results of factor analysis show that there are 2 factors that greatly influence the index received by farmers. Factor 1 is influenced by livestock variables (X4), horticulture (X2), and fisheries (X5). Factor 2 is influenced by the variables of smallholder plantation crops (X3) and food crops (X1).

5.2 Suggestions

The results of this research are expected to be useful adding outlook knowledge related with factors that influence the Price Index Received by Farmers (It). It is best if, when conducting research using factor analysis methods, researchers are expected to first ensure the validity of the data so that it can be processed to a further stage. Apart from that, it is recommended that the government and related institutions can take appropriate steps in developing the Farmer Exchange Rate (NTP). It is hoped that the Price Index Received by Farmers (It) will be greater than the Index Issued by Farmers (Ib) so that the level of community welfare can continue to increase.

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