The risk of Arabica coffee farming in Enrekang Regency, South of Sulawesi, Indonesia

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Abstract. This study aims to determine the risks faced by Arabica coffee farmers and the factors that influence them. The site selection was carried out by purposive sampling, and two villages were selected in Enrekang Regency, South Sulawesi. The sample size of the study was 100 farmers, taken by random sampling and using the interview method and field visits. The results of the study using the coefficient of variance showed that the average value variability in the risk of Arabica coffee production was 0.407 or 40.7%. Factors that influence production risk are estimated by the Least Square Method, and the results show that the production factors of Urea and SP36 fertilizers are risk inducing, while KCl fertilizer and manure are risk reducing. The price of urea fertilizer and the price of pesticides are risk inducing.

1. Introduction

Coffee is one of the main farming commodity whose have an important role in the economic activity of Indonesia. The entry of coffee to Indonesia could not be separated from the ambition of the Dutch colonial business [1]. Coffee has given a significant contribution to the state foreign exchange, become a commodity of non-oil and gas export, and provide employment and revenue not only for the coffee farmer but also for another economic actors that involved either in the cultivating, processing, or in the chain of marketing. South Sulawesi is one of the province in East Indonesia Region that has a potency to the coffee development. This shown by the width of plantation and also the agroclimatologic condition that was very supportive. Coffee production in South Sulawesi was one of the province in East Indonesia Region that has a potency to the coffee development. This shown by the width of plantation and also the agroclimatologic condition that was very supportive. Coffee production in South Sulawesi from 2015 to 2019 30,548 tons in 2015, 31,901 tons in 2016, 2017 33,486 tons, 2018 as much as 32,841 tons, and in 2019 30,992 tons [2]. The locations are spread in seven different districts. Arabica coffee production in Toraja, Enrekang and Gowa also producing above than 1000 tons/year each [3]. Arabica coffee from Tana Toraja and Enrekang Regency in South Sulawesi also had been known internationally as Toraja coffee and Kalosi coffee.

Generally, coffee farming in Enrekang Regency are smallholder. Basically, smallholder's pattern has a very simple management, using low technology, such as shade trees that poorly maintained, lack maintenance of coffee plant such as there is no pruning on the plant. These things result in the low production, low quality of the coffee bean, late harvest time, or even unsuccessful harvest.

Beside this technical problem, others problem that founded become the problem of coffee farming are: less capital, low skill on farming, low experience in maintaining coffee plant, high salary of the coffee.
daily labor, climate, pest and bug, and local government policies. The risk resulted by these problem faced by the farmer and resulted directly on the production and income of the coffee farmer also affected the behavior of the farmer on making a farming decision.

The low productivity and coffee bean quality resulting in maximum profit reached yet. Not only paying attention to the profit that will be achieved, farmer also considering the level of the risk to be faced. Based on the illustration above, the problems that will be analyzed in this research are: “What kind of factors that can affected the production risk of Arabica coffee business in Enrekang Regency?”

Research using panel data, Just and Pope [4] shows that nitrogen fertilizer has impact of the productivity’s variation means that the use of this fertilizer can increase production risk. Different research by [5] shows that on rainy season actually the seed, fertilizer, nitrogen and phosphor, ownership of the area and insecticide input are risk inducing factors. Human employment and cattle are risk reducing factors. While on the dry season all of the production factors are risk inducing factors. On his review [6] about the risk of potato farming in highland Dieng concluded that seed and conservation technology has a characteristic of risk reducing means that the using of seed and the application of conservation technology patio bench type A can reduce production risk. While the land area, employee, inorganic fertilizer, and pesticide cost are risk inducing.

Coefficient of variation is a measure that is appropriate for decision makers specially in choosing one alternative from various business considering to the risk that need to be faced on every business for each return achieved. The basic idea of Just and Pope is to construct the production function as the sum of two components, one associated with the level of output, and the other associated with the output variability. The main focus of Just and Pope specification is input allocation that can caused the risk increase or production risk decrease.

2. Methodology
This research was conducted in Enrekang Regency by the consideration that it is a production central of Arabica coffee in South Sulawesi. In Enrekang Regency there is five distric that become the production central, namely Bungin, Buntubatu, Masalle, Baraka and Baroko. Research location decided by purposive sampling method, and the chosen location is Baroko Distric, next there are two village chosen, namely Baroko village and Benteng Alla village considering that those village are one of the Arabica coffee production central, beside that, it has more productive plants than the other distric which also the production central of this coffee. Farmer sample criteria is the household of the farmer who did the Arabica coffee farming. Sampling decided using random sampling method. The total number of sample are 100 farmers and it is equally distributed on these two village.

Analysis method that has been used are:
- The method used to assess production risks is to analyze the coefficient of variation which is the ratio between the standard value of deviation and the average value.
- To examine hypothesis, using ordinary least square (OLS) method. Regression model of the effecton production and input use on farm production risk arabica coffee in general is:

\[
\ln y = \ln \alpha_0 + \alpha_1 \ln x_1 + \alpha_2 \ln x_2 + \alpha_3 \ln x_3 + \alpha_4 \ln x_4 + \alpha_5 \ln x_5 + \alpha_6 \ln x_6 + \\
\alpha_7 \ln x_7 + \alpha_8 \ln x_8 + \alpha_9 \ln x_9 + \alpha_{10} \ln x_{10} + \varepsilon_1
\]

(1)

\[
(\varepsilon_1^2) = \ln \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \beta_5 \ln x_5 + \\
\beta_6 \ln x_6 + \beta_7 \ln x_7 + \beta_8 \ln x_8 + \beta_9 \ln x_9 + \beta_{10} \ln x_{10} + \varepsilon_2
\]

(2)

caption:
y: arabica coffee production per land area (kg/ha);
x_1: land area (ha);
x_2: number of productive trees (number of trees / ha);
x_3: Urea fertilizer per acre (kg/ha);
x_4: ZA fertilizer per acre (kg/ha);
x5: SP36 per acre (kg/ha);
\( x_6 \): KCl fertilizer per acre (kg/ha);
\( x_7 \): pesticides per acre (liters/ha);
\( x_8 \): herbicide per acre (liters/ha);
\( x_9 \): manure (kg/ha);
\( x_{10} \): labor per acre (HOK/ha);
\( \alpha_0; \beta_0 \): intercept;
\( \alpha_i; \beta_i \): coefficient of parameter estimators, where \( i = 1,2,3, \ldots, 10 \);
\( \varepsilon_{12} \): production risk (residual);
\( \varepsilon_1, \varepsilon_2 \): error term (residual);
\( 1 < \beta_i < 1 \) (diminishing return).

3. Result and discussion

Based on the calculation results, the variation coefficient value for production risk is obtained value of 0.407. The coefficient value of variation indicates the average variability value at the risk of arabica coffee production is 0.407 or 40.7%. To find out the factors that influence the risk of arabica coffee production is estimated with the Least Square Method by using computer package Eviews program. The results of the complete analysis are presented in table 1.

Table 1. Factors influencing the risks of coffee farming production Arabica in Enrekang Regency.

| Variabel             | Sign of hope | Coef. regression | Std. Error | t-count | Prob. |
|----------------------|--------------|------------------|------------|---------|-------|
| C                    | +/-          | -0.0833*         | 0.0458     | -1.8174 | 0.0725|
| Land Area            | -            | -0.0074*         | 0.0058     | -1.2898 | 0.2005|
| Number of productive plant | -          | 0.0064*          | 0.0056     | 1.1386  | 0.2579|
| Urea                 | -            | 0.0129*          | 0.0074     | 1.7441  | 0.0846|
| ZA                   | -            | -0.0001*         | 0.0036     | -0.0283 | 0.9775|
| SP36                 | -            | 0.0102*          | 0.0054     | 1.8809  | 0.0632|
| KCl                  | -            | -0.0174*         | 0.0067     | -2.6146 | 0.0105|
| Pesticides           | -            | 0.0019*          | 0.0051     | 0.3884  | 0.6987|
| Herbicides           | -            | -0.0058*         | 0.0039     | -1.4389 | 0.1537|
| Manure               | -            | -0.0072**        | 0.0034     | -2.1322 | 0.0357|
| Labor                | -            | 0.0082*          | 0.0094     | 0.8795  | 0.3815|

R-squared 0.791 \( ** \) = Significant 5%.
Adjusted R-squared 0.701 \( * \) = Significant 10%.
F-statistic 2.107 ns = non significant.

Based on the results of the analysis presented in table 1 it is known that the coefficient value of determination (R2) is 0.791. This means that as much as 79.1% variation of arabica coffee production risk can be explained by independent variable variations in the model, in other words 79.1% of independent variables jointly affect production risk and the remaining 20.9% is influenced by other unexplained things that are other variables outside the model, among others are the influence of weather and disease pests.

The use of Urea fertilizer has a positive and real effect on coffee productivity and the risk of arabica coffee production. The addition of Urea fertilizer has a positive and real effect on coffee productivity and the risk of arabica coffee production. The addition of Urea fertilizer by 1% will increase productivity by 0.199% and increase the risk of production by 0.0129%. Fertilizer by 1% will increase productivity by 0.199% and increase the risk of production by 0.0129%. This means that the increase in the use of Urea fertilizer will be followed by increased production to a certain extent required by plants.
SP36 fertilizer variables have a positive regression coefficient but do not have a significant influence on arabica coffee productivity and have a positive regression coefficient and have a real effect on production risk. This means that the use of SP36 fertilizer has no effect on production, but increasing the amount of SP36 fertilizer by 1% will increase the risk of production by 0.01%.

Based on the results of the variable parameter of manure, the value of the regression coefficient is -0.007, and the t test results show the use of manure has a real effect on the level of variation in arabica coffee production results. This indicates that the use of manure has not reached the maximum needs so that by increasing the amount of manure use within a certain limit, arabica coffee production will increase and the risk of production can be lowered.

4. Conclusions and policy implication

4.1. Conclusion
Urea fertilizer production factors and SP36 fertilizers are risk inducing meaning the use of Urea fertilizer and SP36 fertilizer can increase the risk, while KCl and manure fertilizers are risk reducing lower the risk.

4.2. Policy implication
Based on the results and discussion and conclusions can be formulated policy as follows: The use of urea and SP36 can increase production but also can increase the risk of production so we need a extension activities by relevant agencies regarding the application of fertilizer to farmers in accordance with the dose so as not to be a risk factor enhancer because its application is not appropriate. Similarly, the application of chemical pesticides at farm level. All parties, especially the government and other community advocacy groups (NGOs) pursue the implementation of Integrated Pest Management Field School (FFS-IPM) intensively so that farmers are skilled in applying pesticides and not carelessly buy pesticides that do not comply with the coffee plant resulting in increased risk of revenue.

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