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Research Article

The Effect of Land Area and Labor on Production of Coffee in Indonesia

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Abstract.
Indonesia is an agricultural country where most of the population works in the agricultural sector. Therefore, the agricultural sector contributes significantly to its economic growth. This study aims to determine the effect of land area and labor production of coffee in Indonesia. The study uses secondary data. Data analysis technique in this study is multiple linear regression with data panels in 32 provinces of high production coffee in Indonesia from 2017 until 2021. Dependent variable is coffee production and the independent variables are land and labor. Results show that land area has a positive and significant effect on coffee production. It means that raising the land area significantly increases the coffee production. However, labor has a positive but not significant effect on coffee production. This study is expected to help Indonesian policy-makers for drafting policies to increase coffee production in Indonesia.

Keywords: coffee production, land area, labor, panel

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1. Introduction

Indonesia is an agricultural country with geographical location in the tropics which has high rainfall, so that is planted with various kinds of plantations (Rondhi & Hariyanto Adi, 2018). Kementerian Pertanian (2021)statistical report states that the agriculture, forestry and fisheries sectors have quite an important role in the economy in Indonesia. This can be seen from contribution in contributing to the third largest Gross Domestic Product (GDP) in Indonesia. The first contributors to Gross Domestic Bruto were the manufacturing industry at 19.86%, the wholesale and retail trade/repair of cars and motorcycles at 13.02% and the agriculture, forestry and fishery industries at 12.81%. During the economic crisis, the agriculture sector was also a sector that was strong in facing economic shocks and reliable in national economic recovery (Nurliyah, 2019).

One of the agriculture sub sectors that has great potential is the plantation subsector. The contribution of the plantation sub sector to GDP is 35% or is in first place in agriculture, livestock, hunting and agriculture services sectors (Kementerian Pertanian, 2021). As for the types of plantation commodities, one of them is coffee. The contribution of the coffee commodity to the Indonesian economy is reflected in trade performance and an increase in added value. This is because coffee contributes to GDP and its commodities are exported to various countries such as: United States, Japan, Egypt, Malaysia, Italy, etc. As an export product to many countries, this coffee commodity can contribute as a foreign exchange earner and state revenue, able to create jobs, as a source of income for farmers, driving growth in the agribusiness and agroindustry sectors, regional development and environmental preservation. Apart from providing considerable opportunities for export, this coffee commodity is also wide open in the domestic market (Prasetyo, 2018); (Putri et al., 2018).

Coffee is a plantation product that has quite a potential, when viewed from the area of the coffee plantations owned by Indonesia (Tungga, 2021). The level of production produced will be decided based on the amount of labor used by the landowner. Coffee production apart from requiring land are, also requires labor. This is because production will not run if not those who run the production process. South Sumatra and Central Java have a higher number of workers. However, the level of production in Central Java is much lower than in South Sumatra. This is because the land area in Central Java is smaller than South Sumatra. In addition to land area, there is a labor factor which is an important factor affecting production results. In the process of increasing production, natural resources land and labor are related to each other. An increase in labor and land area will increase the amount of production coffee, and the increased amount of production will also increase agriculture productivity.

The problem of imbalance in production that occurs in various provinces in Indonesia is a challenge for the coffee industry and also the government. Sufficient land wealth in Indonesia and supportive climate, this can be a driving force to increase Indonesia coffee production by maximizing the area of land and manpower owned. Research Windiarti & Kusmiati (2011); Dewi & Yuliarmi (2017); Haryoko et al. (2018); Zen & Budiasih (2019); Nurliyah (2019) say land are has a positive and significant effect to production coffee. However, Alamsyah & Purnomo (2021); Nadila & Tridakusumah (2022) says that land has a negative and no significant production of coffee.

Putra & Wenagama (2012); Ardiansah et al., (2014); Pertiwi & Sutrisna (2019); Nurliyah (2019) say that labor has significant to production of coffee. However, Dewi & Yuliarmi (2017); Putri et al., (2018); Haryoko et al., (2018); Alamsyah & Purnomo (2021); Nadila

TABLE 1: Top Number of Coffee Farmers in 10 Provinces.

Provinsi	Petani Kopi			
	2018	2019	2020	2021
Jawa Timur	336.997	337.369	337.504	335.642
Jawa Tengah	208.498	208.997	210.269	219.466
Sumatera Selatan	201.740	201.740	214.363	214.196
Sumatera Utara	134.929	147.510	147.748	135.791
Jawa Barat	125.800	116.224	130.135	123.916
NTT	120.025	120.736	121.349	120.019
Aceh	103.434	104.598	104.919	104.475
Bali	71.857	71.639	71.185	70.264
Bengkulu	65.410	67.914	68.365	62.487
Jambi	27.548	27.973	28.141	30.932

Source: Primary Data, Processed (2022)

& Tridakusumah, (2022) says that labor has not significant to production coffee. In Indonesia, there are already many studies about coffee production. However, there are still differences and debates. Because of that, researchers are interested in researching the effect of land area and labor to produce coffee In Indonesia, 2017 – 2021.

2. Literature review

Production is process used to produce a product or service. Both goods and services, both are the result of moving capital and labor (Ardiansah et al., 2014). Every production activity has a goal to maximize profit. The production function in the form of a mathematical formula is: $Q = f\,(X1, X2,\ X3, \ldots,\ Xn)$, which is Q = output of variable that is affected, and X = input or influencing variable. A function or equation involving two or more variables of the production function is called Cobb Douglass. The Cobb Douglas production function states that the two variables are the dependent variable (Y) and the independent variable (X). Mathematically the Cobb-Douglas production function, is formulated $Y = aX_1^bX_2^c$, which is Y = output; X1, X2 = Input, a = efficiency index input use in producing output; b and c = the production elasticity of the input used. Factor of production are all the components used in process of making goods and services. Factors of production in the agriculture sector are resources, namely natural resources (land), human resources (labor), and capital.

(Putra & Wenagama, 2012) says that production factors that cannot be made by humans are the main (original) factors of production, for example nature and labor. Meanwhile, factors that can be made by humans are derivative factors of production, for example capital or assets. Factor of production that are no less important for the agriculture and plantation sector are land. Because land is the place where production is produced. Land has a broad and relatively fixed nature and has a high increasing demand. In farming, have a large area of land, it will certainly be efficient. If the land is narrow, the production produced will be small, so that is economically unable to make ends meet.

A production process will not be carried out if there are no human resources to do it. This resource is called labor. In an economic perspective, labor is a person who has a contribution in a process of producing goods or services in the economy. The factor of production in farming that is important to have been labor or farm laborers.

3. Methodology

This study uses a quantitative approach, to determine effect of land area and labor on coffee production in Indonesia. Analysis using multiple linear regression with panel data. The sample of this study covers all province in Indonesia, except DKI Jakarta and Riau Archipelago. Based on statistical data from the Ministry of Administrative and Bureaucratic Reform (2021), DKI Jakarta Province is a province that does not have coffee plantation land. Meanwhile, Riau Archipelago is a province where almost the entire territory is in the form of waters. So, from 34 provinces in Indonesia, minus 2 provinces included in this study, there are 32 provinces in Indonesia used in this study. The time is 2017 until 2021. So, the number of observations in this study is 162 observations.

The data used is secondary data from the Central Bureau of Statistics (BPS) and the Ministry of Agriculture. Dependent variable is the production coffee, while the independent variable: land area and labor. Definition variable in Table 2.

TABLE 2: Definition Operational Variabel.

Variable	Explain	Unit
Production	Total production per unit area harvested	Ton
Land Land	Land area used to grow coffee	Hectare (Ha)
Labor	People working on planting coffee	Person

Source: Authors' Own Research, Data Processed (2022)

The analyst is multiple linear regression to determine the direction and how much influence the independent variable had on the dependent variable. The analysis tool uses Eviews 9. The uses and equations of this research model are as follows:

$$Pro2t = \alpha 1 + \sum_{j=1}^{k} \beta 11 LAt - j + \sum_{j=1}^{k} \beta 12 Lab\, t - j + \epsilon t$$

Which Prod is production; LA is land area; Lab is labor; α is constant, is coefficient regression X1 and X2; and t is time, J is province, and e: error term.

Three methods used are *Pooled Least Square* (PLS) *Model*, *Fixed Effect Model* (FEM), *Random Effect Model* (REM) (Gujarati, 2009). Chow test to see the right *common effect* or *fixed effect* model to determine panel data, the Chow test hypothesis is as follows:

H $_o$ = *Common Effect Model*

H $_1$ = *Fixed Effect Model*

Decisions viewed from the *Cross-Section* F. If the value *Cross-Section* F < (α = 0.05) then Ho rejected, Ha accepted and chosen model is the *fixed effect model*. Whereas if Values *Cross-Section* F > (α = 0.05) then H $_o$accepted Ho rejected and the chosen model is the C*ommon effect model*. In order to obtain the most appropriate model, it is necessary to carry out further testing with the Hausman test (Gujarati, 2009).

Hausman test to choose *Fixed effect* or *Random effect* estimation model. The Hasuman Test Hypothesis, namely:

H $_o$ = *Random Effect Model*

H $_1$ = *Fixed Effect Model*

The decision is seen from *Cross Section-F*. If the value of *Cross-section Random* < (α=0.05) means that Horejected and the most appropriate type of model to use is the *Fixed Effect Model.* Meanwhile, if *N* use values *Cross-section Random* > (α = 0.05) means that Ho is accepted and the most appropriate model used is the *random effect model* (Gujarati, 2009).

Next, the Lagrange Test Statistical testing to determine the appropriate estimation model *Random Effect Model* or *Common Effect Model.* The hypothesis, namely:

H $_o$ = *Common Effect Model*

H $_1$ = *Random Effect Model*

The LM test is seen from the *chi square* distribution with a *degree of freedom with the* number of independent variables. If the value of LM statistically greater than the critical value of statistical chi squares then reject Ho, meaning that the most appropriate model to use *Random Effect*. On the other hand, the statistical LM value is smaller than the chi square statistical value as a critical value, so H $_{0\ is}$accepted, which means that

the estimation used in panel data regression is the *Common Effect* method (Gujarati, 2009).

We analyzed the classical assumption test which included normality test, multicollinearity, and heteroskedasticity test (Ginting & Widyawati, 2022). Normality test aims to determine the independent variable and dependent variable normally distributed. The normality test of this study used the *Jarque-Berra Test*. The decision is that if the calculated JB value < the X_2 table value or the calculated JB probability value > the probability value = 5% (0.05) then the hypothesis which states that the residual, t, is normally distributed. On the other hand, if the calculated JB value > X_2 table value or the calculated JB probability value < = 5% (0.05), the hypothesis which states that the residual, t, is normally distributed, is rejected.

The multicollinearity test aims to determine whether the equation of the regression model used by the researcher has a correlation between the independent variable and the dependent variable. This test is done by looking at the value/result of the partial correlation between the independent variables. If the value of the correlation between variables > 0.8 then there is multicollinearity, otherwise if the correlation value between variables < 0.8 then there is no multicollinearity.

Heteroscedasticity test aims to determine the data used by researchers, including data that has deviations or not. The researcher's Heteroscedasticity test used *Breush-Pagan LM*. The hypothesis of the Breush-Pagan LM test, that is, if the value of X_2 count > the value of X_2 table or the probability value of X_2 count < probability value α = 5% (0.05), then the hypothesis which states that there is no heteroscedasticity is rejected. On the other hand, if the value of X_2 count < value of X_2 table or probability value of X_2 count > probability value α = 5% (0.05) then the hypothesis which states that there is no heteroscedasticity is rejected

The next step is to test the statistical determination (R^2), t test, F test. "The coefficient of determination (R^2) is essentially to measure how far the model's ability to explain the dependent variable (Widyawati et al., 2021). T test is used to see whether or not each independent variable is significant to the dependent variable (Hariani et al., 2022); (Widyawati, 2017). The F test is carried out to see whether or not the independent variable is simultaneously (overall) significant to the dependent variables (Kuncoro, 2011).

Subsequently, researchers conducted statistical tests to test the coefficient of determination (R^2), t Test, and Test F. Testing the coefficient of determination (R^2) is used to measure the ability of the model that has been created in the research to explain the dependent variable. If R^2 is getting a little closer to 0, then in explaining the variation

of the dependent variable is getting weaker, but if the value of 1 than in explaining the variation of the dependent variable, the better.

The t test is used to see the significance or not of each independent variable on the dependent variable partially or individually.

Ho = independent variable (X) partially has no significant effect on the dependent variable (Y),

Ha = independent variable (X) partially significant effect on the dependent variable (Y).

The decision if the value of t count < t table or probability t count > α = 5% (0.05), Ho is accepted and Ha is rejected, meaning that the independent variable has no significant effect on the dependent variable. On the other hand, if the value of t count > t table or probability t count < α = 5% (0.05) then Ho is rejected and Ha is accepted, meaning that the independent variable has a significant effect on the dependent variable.

The F test is used to see the significance of the independent variable on the dependent variable simultaneously or together.

Ho = independent variable (X) simultaneously has no significant effect on the dependent variable (Y), Ha = independent variable (X) simultaneously has a significant effect on the dependent variable (Y).

The decision is taken if the calculated F value < F table or probability F count > α = 5% (0.05) then Ho is accepted and Ha is rejected, meaning that the independent variable (X) simultaneously has no significant effect on the dependent variable (Y). On the other hand, if the calculated F value > F table or F count probability < α = 5% (0.05) then Ho is rejected and Ha is accepted, meaning that the independent variable (X) simultaneously has a significant effect on the dependent variable (Y) (Widyawati et al., 2022).

4. Results and Discussions

The computational results for the description of production, land area, and labor presented in table 3.

Table 3, shows a summary descriptive statistic of some variable. The average production is 29.529,81; median is 5.801,00; maximum value is 250.305,00; minimum value is 1, and std. dev 44.902,8. The average land area of 4.347,74; median is 11.648,50; maximum value is 263.339,0; minimum value is 22; and std. dev 60.037,36. The average labor is 1635749; median is 125.651,50; maximum value is 2432794 and minimum value is

Table 3: Descriptive Statistics.

	Production	Land Area	Labor
Mean	29.529,81	4.347,74	59.249,91
Median	5.801,00	11.648,50	25.651,50
Max	250.305,00	263.339,0	337.504,0
Min	1,00	22	45.000,00
Std. Dev.	44.902.8	60.037,36	77.192,59

Source: Authors' Own Research, Data Processed (2022)

45.000; and std. dev is 77.192,59. This shows that the highest proudction is determined by the land area and labor.

In this study, classical assumption tests, including: multicollinearity test, heteroscedasticity test, autocorrelation test, and normality tests.

Table 4: Multicollinearity Test.

Variable	Area	Labor	Result
Area	1.00	0.63	No Multicollinearity
Labor	0.63	1.00	No Multicollinearity

Source: Authors' Own Research, Data Processed (2022)

Table 4, Multicollinearity Test using the Partial Correlation method between variables, there is no number more than 0, 8. The conclusion is that there is no multicollinearity

Table 5: Heteroscedasticity Test.

Variable	Sign	Result
Area	0.0076	No Heteroscedasticity
Labor	0.5172	No Heteroscedasticity

Source: Authors' Own Research, Data Processed (2022)

Table 5 show heteroscedasticity test. Heteroscedasticity test see from coefficient independent variable. Area variable, significant 0.0076 more big from α = 0.05 (5%) or 0.0076 > 0.05. Labor variable, significant 0.5172 more big from α = 0.05 (5%) or 0.5172 > 0.05. The result from all variables, $H_o$accepted and H_1 rejected, meaning that there is no heteroscedasticity in this data.

Table 6 show the results DW Calculate 1.747, then look for dL and dU. From the DW table, dL is 1.7182, then dU is 1.77681. So, 4 – dL (4 –1.7182) the result is 2.2818, for 4 – dU (4–1.77681) the result is 2.2319. So, autocorrelation can't be calculated.

Table 6: Autocorrelation Test.

D hitung	DW	Du	dL	4-Du	4-dL
Nilai	1.747	1.77681	1.7182	**4**-1.77681= 2.2319	**4**-1.7182= 2.2818

Source: Authors' Own Research, Data Processed (2022)

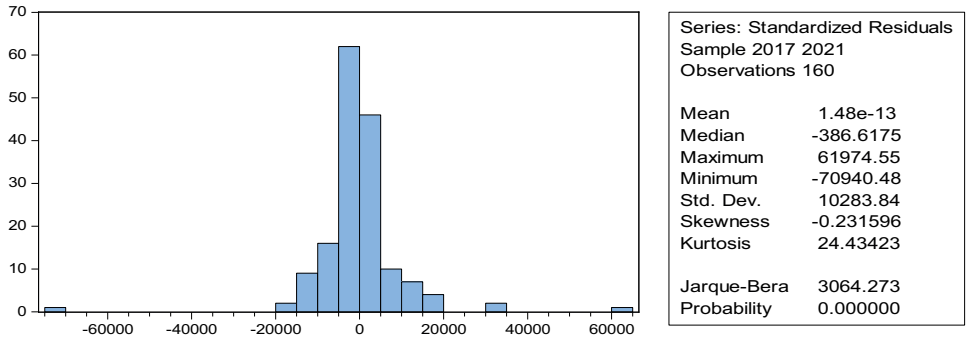

Figure 1: Normality Test. Source: Authors' Own Research, Data Processed (2022).

Figure 2, conclusion of the normality test: "If the value of significance > alpha, the result is normally distributed, and if the value of sig < alpha, the result will not be normally distributed". Table 5 in the below describes the probability test is 0.000 < α = 0.05 (5%). However, based on the Central Limit Theorem (CLT) when the degree of freedom value exceeds 30, data is normal.

Table 7: R Square and F-Test.

R Square	Adj.R Square	F-Statistic	Prob.
0.9475	0.9338	68.9755	0.0000

Source: Authors' Own Research, Data Processed (2022)

Table 7 show R Square and F-Test, which is value R Square is 0.9475, means independent variable explained variable dependent 94% and 6% is explained by variables outside the model. The result F-test statistic, means variable dependent who can explained by all independent variable. As a result, the probability F test is 0.000 more small from probability α = 0.05 (5%) or 0.000 < 0.005, so variable land are and labor simultaneous take effect significant to variable production coffee.

Table 8: T-Test.

Variable	Coefficient	t-statistic	Prob	α	Hasil
C	6549.077	2.313715	0.0223		
Land Area	0.479042	6.617768	0.0000	0.05	Significance
Labor	0.036662	1.801081	0.0741	0.05	Not Significance

Notes: significance at 5% level
Source: Authors' Own Research, Data Processed (2022)

From the result of t-test the following multiple linear regression equation is obtained:

Y = 6549.077 + 0.479042 Area + 0.036662 Labor

Table 8, coefficient is 6549.077 shows when land area and labor as constant (independent variable) to variable production, then variable production is 14912.36 units. Land area has influenced positively to production coffee in Indonesia 2017 - 2021. It means when land area increases by 1 hectare (ha), then production coffee will increase to 6549.077 ton. Probability land area variable is 0.0000 $< \alpha$ 5% (0.05), so H_o rejected and H_a accepted. Land area variable has a significant effect on the production demand variable. So, land area has influenced positively and significantly to production coffee in Indonesia 2017-2021. Research results in line with Windiarti & Kusmiati (2011); Putra & Wenagama, (2012); Dewi & Yuliarmi (2017); Haryoko et al. (2018); Zen & Budiasih (2019); Pertiwi & Sutrisna (2019); Nurliyah (2019);. However, this research different with Alamsyah & Purnomo (2021); Nadila & Tridakusumah (2022) which states that land area have negative and no significant effect on production of coffee.

Labor has had a positive influence on production of coffee. It means when labor increases by 1 person, then production coffee will increase 0.036662 units. Probability labor variable is 0.0741 $> \alpha$ 5% (0.05). H_o accepted and H_a rejected. Labor variable not significant effect to production coffee variable. So, labor has influenced positively and is not significant to production coffee in Indonesia 2017-2021. This research is in accordance with research Putra & Wenagama (2012); Ardiansah et al., (2014); Pertiwi & Sutrisna (2019); Nurliyah (2019). However, this study is not accordance with Dewi & Yuliarmi (2017); Putri et al., (2018); Haryoko et al., (2018); Alamsyah & Purnomo (2021); Nadila & Tridakusumah, (2022).

5. Conclusion

In this reseacrh discuss the effect of land area and labor to production coffee. The result of this study show that land area have a significant to production coffee. So if the amount of land area increases, it will increase production coffee in Indonesia during the research period. On the other hand, labor has no signficicant effect to production coffee. This study has limitations using only two independent variables, maybe for further research, it can use more than two variables.

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