Evaluating Income Distribution of Certified and Non-Certified Coffee Farmers in West Lampung Regency

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Abstract. Income distribution needs greater attention because an uneven distribution of income can leave farmers in a more vulnerable position to the effects of production risk. Many prior studies have focused on the impact of certification on income levels and limited focus on its effect on income distribution. Therefore, this study aims to compare the income distribution of certified and non-certified coffee farmers in West Lampung Regency, which was purposively chosen due to its status as the largest producer of coffee in Lampung Province. Using convenient sampling, 140 coffee farmers were surveyed, consisting of 70 farmers with and 70 without certifications. The data was analysed using the Gini ratio and World Bank's version analysis. The findings showed that the income distribution for coffee farming and household income distribution was even by Gini ratio approaches. Similarly, with the World Bank's version, coffee farming and household income distribution are classed as low inequality. In contrast with coffee farming and household income distribution, income outside of coffee farming distribution was unevenly distributed, showing that side jobs have a negative bias toward income distribution. These results suggest that the benefits provided to certified coffee farmers, such as regular training, contributed to coffee farmers' income equity.

1 Introduction

Most coffee production in the Lampung Province occurs in the West Lampung Regency, known as one of the largest sources of Robusta coffee in Indonesia, with a total production of 57,930 tons in 2021. This figure is equivalent to 49.97% of the total 117,092 tons of coffee production in Lampung Province[1]. The potential of the West Lampung Regency can also be seen from the area of coffee plantations, which consists of 54,563 hectares, approximately 34% of the total area in Lampung Province. Even though coffee is one of the leading export commodities, all coffee plantations in West Lampung are managed by smallholder plantations and are often characterized by low production and quality [2]. Given the increasing consumer demand for high-quality coffee, the inability to produce quality coffee is a loss of economic opportunity. Global consumers are beginning to prioritize the importance of quality coffee and are willing to pay a higher price for higher-quality coffee

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[3]. Therefore, coffee farming management is needed so coffee products have a higher selling price and coffee farmers can improve their income.

Ton et al. explained that the income of coffee farmers increased when there was an increase in farm scale and farmer capacity to bear production risks, as well as increased post-harvest quality [4]. Other research also explains that coffee farmers who receive training in internal quality control systems tend to produce higher prices and can reduce the intensity of coffee rejection due to better coffee product quality [5]. The increase in income in the two previous studies is the effect of farmer participation in partnership or certification programs. This certification answers the need for more quality assurance by differentiating coffee quality through training. Certification tends to provide guarantees to foster farmers in the hope that it will sustainably increase production for increased income of farmers [6]. If the training runs effectively, then in addition to increasing farmers' abilities, the exchange of information between farmers will also be better [7].

One of the certifications in West Lampung Regency is the Rainforest Alliance certification. RA-certified farmers in West Lampung Regency must fulfil certification requirements by improving farmers' habits to cultivate destructive coffee. Coffee planting that does not consider environmental sustainability will reduce land productivity, affecting farmers' economic and social conditions. This system differs from coffee farmers not participating in certification programs, whose cultivation systems are carried out more freely. Improvements in cultivation in the certification program will make coffee farming more efficient and thus minimize costs for farmers. The benefits farmers receive by making these improvements to optimize their economic conditions can be calculated quantitatively from the income side. Variations in the application of coffee farming cultivation, by certification or without certification, cause differences in farming productivity and income. Thus, there may be differences in the level of income distribution.

Disparities arise along with economic growth [8]. The disparity can also be the size of the gap between low-income individuals and high-income groups [9]. If inequality is high, then groups of farmers with low incomes will be more vulnerable to fluctuations in coffee prices and production disruptions because they do not have good financial capabilities. Therefore, this study will examine the level of income distribution of certified and non-certified farmers.

2 Methodology

This research was purposively conducted in West Lampung Regency, considering that this district is the most significant contributor to coffee production in Lampung Province. The Way Tenong District and Batuk Brak District in West Lampung Regency were selected, due to the presence of Rainforest Alliance-certified assisted farmers. Respondents totalled 140 coffee farmers with an even split of Rainforest Alliance-certified and non-certified farmers and were selected by purposive sampling. Purposive sampling is sampling with a deliberate selection of respondents [10], which in this study included certified farmer respondents who passed the annual RA evaluation and non-certified farmer respondents.

To determine whether there are differences between coffee farming profiles and coffee farmer income analysis between certification and non-certification patterns, an independent two-sample t-test was conducted. This test is used to determine whether there is a significant difference between the means of two independent groups. This t-test assumes that the two groups being compared have identical means [11].

The calculation of income distribution of certified and non-certified farmers is tested by functional and individual income distribution. Functional income distribution is the proportion of income received by each factor of production [12]. The functional distribution of income focuses on how much the overall share of the workforce receives and compares it to the percentage of the total income distributed in the form of rent, interest, and profits. One

method of calculating the input value contribution to production value is the accounting method with the following formula:

$$IC_i = \frac{Certain\ input\ payments}{Production\ value} = \frac{P_{x_i} \times X_i}{P \times Q} \quad (1)$$

Where IC is the contribution of the input value, P is the price (IDR), Q is the amount of production (kg), X is the total of inputs, and i is the kind of inputs.

Functional income distribution is examined by two approaches: factor share and earner share. Factor share is an approach used to determine input contribution to production value, and earner share is used to determine input contribution to income received by income recipients, namely production input owners, farm workers, and farmers.

This study analyses the distribution of individual income using the Gini Ratio and the World Bank approach. Gini Ratio analysis is stated in the formula [13]:

$$G = 1 - \sum_{i=1}^{k} f_i\ (Y_i + Y_{i-1}), 0 < G < 1 \quad (2)$$

Where G is the Gini Ratio, f is the cumulative frequency, y is the farmer's income, i is the index of farmers in the population, and k is the number of farmers in the population.

The value of the Gini coefficient ranges from 0 – 1. The coefficient value of 0 indicates perfect income equality, while 1 indicates the highest inequality. The income distribution category in this study uses the following theories from Todaro & Smith [12]:

a. Income distribution is unequal if the Gini ratio is 0.50 – 0.70.
b. Medium income distribution if the Gini ratio is 0.36 – 0.49.
c. Income distribution is relatively even if the Gini ratio is 0.20 – 0.35.

The measurement of the World Bank's criterion of income distribution is called relative inequality. Relative inequality is defined as inequality in the distribution of income received by various groups of people. The relative inequality criteria are:

a. High inequality, if 40% of the population with the lowest income receives less than 12% of the income share.
b. Moderate inequality, if the lowest 40% of the income population receives between 12% and 17% of the income share.
c. Low inequality, if the 40% of the population with the lowest income receives more than 17% of the income share.

3 Results

3.1 Respondent's profile

Table 1 summarizes the characteristics of the coffee farmer respondents, which consist of certified and non-certified farmers.

Table 1. Profile of Coffee Farmer Respondent.

Category	Certified			Non-certified		
	Mean	**Min**	**Max**	**Mean**	**Min**	**Max**
Age (yar)	44.10	27	70	44.30	19	72
Education (year)	8.50	3	18	9.70	6	16
Farming experience (year)	18.21	10	45	18.57	6	50
Family member (people)	3.76	2	6	3.64	1	6

The average age of the respondents between certified and non-certified farmers did not differ much, both with a mean age of 44 years. The certified farmer has a lower education

than the non-certified, which is 8.5 academic years or in the junior high school category. In comparison, non-certified farmers have an education of 9.7 years or are in the early junior high school group. The average farming experience of certified and non-certified farmers shows little difference. The average years' experience of certified farmers is 18.21 years; meanwhile, the experience of non-certified farmer groups is 18.57 years. The number of family members of certified and non-certified farmers also shows little difference, with an average of 4 people per family. The profiles of the respondents between the two groups of farmers indicate that the two groups have almost the same criteria.

3.2 Coffee farming profile

Table 2 provides information regarding the general description of certified and non-certified coffee farming. The average area of land used for non-certified coffee farming is 1.56 hectares, which is higher than the 1.31 hectares used for certified coffee farming. The average age of the coffee plants is similar, with both certified and non-certified farming programs' coffee age being around 22 years old. This fact indicates that the age of coffee plants in Lampung is generally old. Even in Tanggamus, the age of coffee plants ranges from 20-28 years, as reported by Evizal and Prasmatiwi [14]. Even though the area of certified coffee farming is less than non-certified, the number of coffee plants owned per hectare is higher in certified farming. The average plant for certified coffee farming is 3,165.71 trees/farmer, while for non-certified coffee farming is 3,096.30 stems/ha. The productivity of certified farm coffee was much higher than that of non-certified ones, being 926.73 kg/ha for certified farms and 758.86 kg/ha for non-certified farms.

Certified farmers can sell their coffee for an average of 23,818.57 IDR/kg for dry coffee beans, while non-certified farmers sell theirs for a slightly lower price of 23,350.00 IDR/kg. There is no premium fee received by certified farmers surveyed in this study, however, they received compensation in the form of equipment assistance and training. This is in line with findings in other research which stated that certified farmers in Lampung Province obtained no premium prices [15,16].

It can be said that the differences in coffee productivity and product price between the two groups are because of the benefits certified farmers receive, such as regular training. Wahyudi et al. explained that improvement in farming management can be achieved by training and mentoring farmers [17]. Certified farmers often receive training from a partner company, which becomes an intermediary between farmers and certification. Farmers from the certification program can sell their coffee to a partner company, with the condition that the water content is no more than 18%, the physical condition of the coffee beans is intact, not shriveled or discolored, and have good aroma and taste.

Table 2. Profile of Coffee Farming.

Category	Certified			Non-certified		
	Mean	**Min**	**Max**	**Mean**	**Min**	**Max**
Coffee farm area (ha)	1.31	0.5	3.7	1.56	0.5	3.9
Coffee plant age (years)	22.69	12	60	22.89	3	55
Number of coffee plants per farmer (trees/ha)	3,165.71	1,000	8,000	3,096.30	500	10,000
Coffee productivity (kg/ha)	926.73	450	1800	758.86	400	1200
Coffee's farmgate price (IDR/kg)	23,818.57	20,000.00	28,400.00	23,350.00	20,000.00	28,000.00

The comparison between certified and non-certified coffee farming profiles can be seen in Table 3. The coffee productivity between the two groups is significantly different at a confidence level of 99%, meanwhile, there are no differences in farm area, coffee plant age, number of coffee plants, and coffee's farmgate price between certified and non-certified farming.

Table 3. Comparative t-test Analysis Between Profiles of Certified and Non-Certified Coffee Farming.

Category	t-statistic	Sig. (2-tailed)	Std. Error Difference
Coffee farm area (ha)	-1.336	0.184	0.189
Coffee plant age (years)	0.225	0.822	2.032
Number of coffee plants per farmer (trees/ha)	0.316	0.753	271.454
Coffee productivity (kg/ha)	4.714	0.000	53.835
Coffee's farmgate price (IDR/kg)	1.079	0.282	434.096

3.3 Coffee Farmers' Household income

The coffee farmers' household income is illustrated in Table 3. Household income consists of on-farm income, off-farm income, and non-farm income. On-farm income is differentiated into two categories: coffee and non-coffee farming. The income of coffee farming consists of income from coffee plants and intercrops such as pepper, banana, and chilli. Most coffee farmer households' sources of income, both certified and non-certified, are obtained from coffee farming. The average income of certified coffee farming is 23,971,820.95 IDR/year which is higher than that of non-certified coffee farming, an average of 20,660,116.43 IDR/year. The income differences are caused by the higher level of productivity and selling price of certified farm coffee (see Table 2).

Overall, income from non-coffee farming activities does not contribute to household income for both certified and non-certified groups. Non-coffee farming activities include commodities often grown on non-coffee farms such as leek, celery, tomatoes, and strawberries. Off-farm income, originating from chicken farms and farm labour income, is higher for certified farmers than for non-certified farmers because many certified farmers have side jobs as farm labourers. This differs from non-farm income, which is mainly obtained from work as construction workers and sellers. Certified farmers' non-farm income is 12,672,619.05 IDR/year, while non-certified farmers it is 8,403,194.72 IDR/year.

Table 4. Household Income of Coffee Farmer.

Sources of income	Certified		Non-certified	
	Total (IDR/year)	Percentage (%)	Total (IDR/year)	Percentage (%)
On-farm				
Coffee farming	23,971,820.95	57.45	20,660,116.43	66.04
Non-coffee farming	85,714.29	0.21	253,424.66	0.81
Off-farm	4,994,857.21	11.97	1,965,523.48	6.28
Non-farm	12,672,619.05	30.37	8,403,194.72	26.86
Total	41,725,011.50	100.00	31,282,259.29	100.00

The comparative analysis of certified and non-certified farming is provided in Table 5. Although more certified farmers have off-farm jobs, there is no significant difference between the off-farm income of certified and non-certified farmers. It is found that there is a confidence level of 95% for coffee farming, non-farm, and total household income of certified and non-certified farmers. The insignificant difference between off-farm income between certified and non-certified scheme farmers does not affect the total household

income of farmers because the contribution of coffee farming and non-farm income is greater than the off-farm income. Non-coffee farming income between certified and non-certified farmers has a confidence level of 90%.

Table 5. Comparative t-test Analysis of Household Income of Certified and Non-Certified Coffee Farmers.

Sources of income	t-statistic	Sig. (2-tailed)	Std. Error Difference
On-farm			
Coffee farming	2.570	0.011	2,822,946.747
Non-coffee farming	-1.877	0.063	442,302.327
Off-farm	1.532	0.128	927,656.926
Non-farm	2.133	0.035	3,039,579.189
Total	2.536	0.012	4,219,732.206

3.4 Certification and Income Distribution

The impact of coffee certification on income distribution is analysed using functional income distribution analysis and individual income distribution approaches. Functional income distribution is used to calculate the effect of implementing certification on changes in the contribution of production factors to output which is calculated by the factor shares approach. Moreover, earner shares calculate the effect of coffee farming certification on income recipients' income contributions. The calculation of the distribution of individual income uses the Gini ratio and the World Bank's version.

3.4.1 Functional Income Distribution

The results of the analysis of the effect of certification on the distribution of functional income with the factor shares approach are presented in Table 4.

Table 6. The Contribution of the Production Factors Value to the Coffee Farming Revenue.

Production Factors	Certified		Non-certified	
	Total (IDR/year)	Percentage (%)	Total (IDR/year)	Percentage (%)
1. Fertilizers and pesticides	2,174,889.46	9.87	1,977,906.67	9.96
2. Labour outside the family	2,327,597.58	10.56	2,111,595.41	10.63
3. Labour in the family	2,192,209.75	9.95	2,266,860.79	11.41
4. Management	8,802,836.01	39.94	7,734,551.82	38.94
5. Other	1,081,578.51	4.91	827,784.36	4.17
6. Soil	5,459,154.00	24.77	4,944,212.72	24.89
Revenue	22,038,265.31	100.00	19,862,911.78	100.00

The certification program can increase land productivity, which is reflected in an increase in revenue. The contribution of fertilizers and pesticides to coffee farming revenues is 9.87% for certified farming and 9.96% for non-certified farming. The contribution of non-family workers to revenues is 10.56% for certified farming and 10.63% for non-certified farming. The contribution of fertilizers, pesticides, and labour to coffee farming revenues in the two programs are mostly the same. However, there is a tendency for certified farming to reduce revenue used by fertilizers, pesticides and paying outside workers. Although the utilization of fertilizer and pesticides between certification and non-certification programs is almost the same, they have different effects on their revenue. Revenue from the certification program indicates efficient and on-point usage of fertilizers and pesticides. Farmers participating in

the coffee certification program were found to reduce their use of chemical fertilizers and pesticides, especially those that contain harmful active ingredients. The reduction of the use of chemical fertilizers and pesticide use is offset by the use of organic fertilizers and pesticides to preserve the environment [17]. Functionally, the certification program will reduce the revenue contribution to paying for outside-family labour, working within the family, and purchasing production inputs, allowing for an increase in management contribution that smallholders can relish.

The results of the effect of the certification program on the income contribution received by the recipients of income (earner shares) are presented in Table 5. Income recipients consist of merchants, farm labourers, farmers, and other parties. Income for other parties includes income received by the government in terms of receiving taxes from farmers and transportation costs. Farmers receive net income which is the difference between revenue and costs for buying factors of production, paying farm labourers and other parties as income on land, wages for labour in the family, interest on own capital, wages for farmers as managers, paying for factors of production belonging to farmers, and profits.

Table 7. The Income Contribution of the Production Tools Owners, Farm Labourers, and Farmers to the Coffee Farming Revenue.

Revenue	Certified		Non-certified	
	Total (IDR/year)	Percentage (%)	Total (IDR/year)	Percentage (%)
Merchants	2,174,889.46	9.87	1,977,906.67	9.96
Farm labourer	2,327,597.58	10.56	2,111,595.41	10.63
Farmers	16,454,199.76	74.66	14,945,625.34	75.24
Other	1,081,578.51	4.91	827,784.36	4.17
Total	22,038,265.31	100.00	19,862,911.78	100.00

Based on Table 5, coffee farmers receive a large income contribution, with 74.66% for certified farmers and 75.24% for non-certified farmers. The table shows that there is almost no difference in the share of income received by farmers who participate in the certification program and those who do not. The earner share approach can reinforce the factor share approach that there is no difference in the income distribution of coffee farming certified coffee farming programs and non-certified coffee farming.

3.4.2 Distribution of personal income

The impact of the certification program on the distribution of individual coffee farmers' income was analyzed using the Gini index and the World Bank's version of the income distribution.

Based on the Gini ratio index value, land tenure for coffee plants among farmers who take coffee certification and those who do not take certification is highly even because the Gini index is less than 35% [12]. However, if calculated based on the World Bank version, the two groups of farmers are in moderate inequality. Inequality can be applied to various variables, one of which is area [18,19]. In this research, areas are represented by land tenure. The level of equity reflected in coffee land tenure is due to the lack of variation in the land area of coffee farming of the two groups of farmers. Certified farming has a standard deviation of 0.65 hectares, while non-certified farming has a standard deviation of 1.13 hectares. The standard deviation value of coffee land tenure is the reason for the high equity distribution of farmer income.

In general, coffee farmers are in a state of low-income inequality for the income of coffee farming and their households. The Gini index value for both groups of farmers is less than 0.35. Meanwhile, for the World Bank approach, the income share of the bottom 40% of the

population is > 17%. The result is directly correlated with the slight variation in coffee farming land tenure, so the variation in farm and household income is also small.

The income distribution of certified and non-certified coffee farmers in West Lampung includes low inequality. However, the income distribution of non-certified farmers is more uneven than those who participate in certification. Therefore, the coffee certification program can improve the income distribution of coffee farmer households. This research differs from the results of Vellema et al. which found that the household income distribution of certified farmers was highly unequal [20]. Research from Vellema et al. highlighted the low wages of agricultural workers, whereas, in this study, certified and non-certified agricultural workers earned a minimum of 70,000.00 IDR/day of work.

Table 8. Level of Land Equity and Farmers' Income according to the Gini Index and the World Bank Version.

Category	Certified	Non-certified
Coffee land tenure		
Average land area	1.31	1.56
Gini ratio	0.25	0.32
World Bank (%)	24.06	21,29
Coffee farming income		
Average income (IDR/year)	23,971,820.95	20,660,116.43
Gini ratio	0.25	0.34
World Bank (%)	23.24	18.48
Income outside of coffee farming		
Average income (IDR/year)	17,753,190.55	10,622,142.86
Gini ratio	0.53	0.63
World Bank (%)	5.6	1.72
Household income		
Average income (IDR/year)	41,725,011.50	31,282,259.29
Gini ratio	0.27	0.35
World Bank (%)	20.72	17.77

Non-coffee farming activities come from off-farm and non-farm activities. There is high inequality in income outside of coffee farming. The Gini index value for certified farmers is 0.53, and for non-certified farmers is 0.63. This high inequality in the two groups of farmers is due to (a) not all farmers participating in non-agricultural side jobs and (b) households involved in non-agricultural activities earning income that is quite significant in contributing to household income.

The non-involvement of all farmers in secondary jobs is due to the disparity in access to work outside of farming. Farmers who do not have access to jobs outside of farming are found to have a small land area, low education, and limited capital compared to farmers with large land ownership, higher education, and high ownership of farming capital. Households with non-agricultural activities significantly contribute to household income, so including off-farm activities as a source of income impacts the total household income distribution. It is necessary to expand the development of non-agricultural activities and employment opportunities in rural areas so that rural households' access to this sector increases, intending to increase household income.

4 Conclusion

From the functional income distribution, including parties involved in coffee farming, namely merchants, farm laborers, coffee farmers, and others (factor shares and earner shares approaches), there is no difference in the income distribution of coffee farming in the coffee

certification program and non-certified coffee farming. However, there is a tendency for the certification program to reduce the contribution of production inputs (fertilizers and pesticides) and to reduce the contribution to paying outside workers.

In general, the farming and household income for certified and non-certified coffee farmers in West Lampung is evenly distributed. However, compared to the two, the income distribution of non-certified farmers is more unequal than those participating in certification. Therefore, coffee certification programs can improve the income distribution of coffee farming households.

Additional jobs aside from coffee farming have a negative bias or worsen income distribution. This finding implies that the development of activities and employment opportunities outside of coffee farming in rural areas needs to be expanded so that all farmers have equal access to this sector, increasing income and reducing income inequality.

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