IMPACT OF CONTRACT FARMING ON SMALLHOLDERS IN LAMPUNG: THE CASE OF COFFEE GROWERS

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Abstract

The aim of this study was to analyze the impact of contract farming on the performance of coffee farming in Lampung. The research site was the coffee production center in Tanggamus and West Lampung. The survey of farmer households was conducted in May-June 2018. Sampling of respondents was 170 respondents consisting 98 contract farmers and 72 non-contract farmers. This study estimated the impact of contract farming using Propensity Score Matching (PSM) technique. The results showed that farmer participation in contract farming was influenced by the head of family age, number of family members, harvesting area, farmer cooperative (KUB) distance, middlemen distance, and market distance. The results of PSM analysis showed that contract farming affects the performance of coffee farming such as increasing income, productivity, and prices received by farmers.

Keywords: coffee, contract farming, impact

Introduction

Coffee is one of the plantation commodities which plays an important role in the economic of Indonesia. Coffee is a source of income for 1.9 million farmer households in Indonesia (Bappenas 2014). Aside from being a source of income for the community, coffee also contributes as a source of foreign exchange. Coffee contributions in 2017 reached US $ 1.175 billion or 32.01 percent of the total value of Indonesian agricultural exports (BPS 2018).

Coffee plantations in Indonesia are managed by smallholder plantations reach 95.67 percent, the rest are national plantations of 2.10 percent and private plantations of 2.23 percent (BPS 2017). In general, smallholder plantations use uncertified seedlings and some of the plants are already old and damaged plants (Rubiyo et al. 2013), they also practice inadequate garden management, harvesting and post-harvest handling systems (Purba et al. 2013) which result in low productivity and quality of coffee produced. The low quality of coffee produced caused farmers to get lower prices than they should have received. The problem of low production, productivity, quality and the prices faced by farmers will have an impact on the welfare of farmer households.

On the other hand, consumer demands for coffee quality, quantity and continuity issues have encouraged roasting companies and coffee exporters to conduct business partnerships or contract farming with coffee farmers in Indonesia. Contract farming is a cooperative agreement between farmers and processing companies or marketing companies for agricultural products to produce agricultural products in accordance with the agreement of both parties (Eaton & Shepherd, 2001; Dhillon & Singh 2006). Contracts between farmers and companies can be written or unwritten (Rehber 2007), a well-defined binding that contains rights and obligations along with product specifications desired by the company (Catelo & Costales, 2008; Prowse, 2012).

Contract farming for companies is one way to get raw materials that are in accordance with the standards desired by the company (Eaton and Shepherd, 2001). As for farmers, the existence of contract farming is expected to be a solution for farmer households in technological and market access, productivity, quality, and institution issues (Eaton and Shepherd, 2001; Singh, 2002; Simmon, 2012). Neilson and Hartatri (2014), stated that coffee farmers obtain positive benefits from direct trading systems in the form of more certain markets, higher prices and easier access to technology, knowledge and financing.

Direct benefits for farmer welfare are still being debated. A number of researchers revealed that contracting companies prefer to cooperate with large-scale farmers, thus small farmers become increasingly excluded (Little and Watts 1994). Another negative impact of contract farming is the potential "trapping" of small farmers in contracts, the emergence of negative social impacts from the "commercial economy", the narrowing of local markets because contracts cause local production to be pressed, violation of contractual agreements, and concerns about multinational company behavior in developing countries (Singh 2000). Therefore, this study aimed to analyze the impact of contract farming on coffee farming performance.

Methods

The data used to analyze the impact of contract farming on coffee farm households is primary data collected using a questionnaire. Information collected in the form of farm household demographic characteristics, land and non-land assets, agricultural production, income, marketing, and transaction costs. Data collection was carried out in May-June 2018. This study was conducted in Tanggamus and West Lampung which were the coffee production center in Lampung. Study sites were determined deliberately with consideration in the area which contract farming between coffee farmers and *PT Nestle Indonesia*.

Sampling method employed was the cluster sampling method for contract farmers, while the sampling for non-contract farmers was carried out using the snow ball sampling method. The farmer household samples in this study were 170 respondents consisting 98 contract farmers and 72 non-contract farmers.

The impact analysis of farmer participation in contract farming on the performance of coffee farming was estimated using Propensity Score Matching (PSM) technique. The advantages of using PSM method are able to correct selection bias and able to calculate the impact of farmer participation in contract farming at the same time (Wanaina et al. 2012; Maertens and Velde (2017). This study used Statistics software (*Stata version 13*) to calculate using PSM technique. Steps taken to analyze the impact of contract farming participation on coffee farming performance are as follows:

1. The first stage used to measure the impact is estimating the probability of participation using the logit model with the maximum likelihood method. Farmer participation in contract farming is a binary form that has a value of 0 and 1, where farmers who participate in contract farming or called contract farmers are given value 1 and non-participating farmers or non-contract farmers are given a value of 0. The general form of the logit model is written as follows (Hosmer and Lemeshow 2000).

$$P_i = \text{Ln}\frac{P_i}{1-P_i} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots \ldots \ldots \ldots \ldots + \beta_i x_i \qquad (1)$$

where Pi represents the probability of farmers participating in contract farming (1 = contract farmer, 0 = non-contract farmer). In this study the factors that are thought to influence farmer participation in contract farming consist of the age of family head, education, number of family members, proportion of the number of productive age family members, harvest area, number of motorcycle assets, distance to KUB (Joint Business Group), distance to middlemen and market distance.

2. The second stage is matching observations from the group of contract farmers (treatment) and non-contract farmers (control) based on their propensity score using Nearest Neighbor

Matching (NNM). NNM is a matching method with the closest propensity value. This method gives the same weight for each unit with the ratio of the nearest propensity value.

3. The third stage is the analysis of the common support, namely matching characteristics between contract farmers and non-contract farmers by matching their propensity value. Individuals whose propensity score is out of range will be dropped.
4. Last is to calculate the effect of treatment by comparing farm performance between groups of contract farmers and groups of non-contract farmers with the following equation:

$$ATT = E\{E[Yi|p(Xi); D = 1] - E[Yi|p(Xi); D = 0]|D = 1\} \quad (2)$$

where ATT is an average treatment on treated (impact of contract farming), D = 1 is a group of contract farmers and D = 0, a group of non-contract farmers.

Results and Discussion

Characteristics of Households and Farming Business

Table 1 represents the household and coffee farming characteristics. Coffee farm households have different characteristics. Difference in these characteristics influences farmer participation in the contract farming. The statistical analysis of the t test shows that two groups had a significant difference in the average head of the family age, education, number of family members, harvesting area, KUB distance, and market distance at p-value $<\alpha = 0.05$.

Table 1. Comparison of contract and non-contract farmer household characteristics

Variable	Mean (St.Dev)		p-value
	Contract	Non Contract	
The head of family age	41.6* (9.6)	46.1* (11.3)	0.0061***
Education	9.3* (3.3)	8.3* (2.5)	0.0368**
Number of family members	3.5* (0.9)	3.9* (91.2)	0.0098***
The proportion of productive family members	66.2 (18.2)	60.6 (20.3)	0.0620*
Harvesting area	2.0* (1.1)	1.64* (0.9)	0.0267**
Number of motorcycle assets	2.1 (1.04)	1.9 (1.2)	0.2785
KUB distance	20.3* (18.9)	26.1* (11.5)	0.0148***
Middlemen distance	1.2 (5.3)	0.46 (0.8)	0.1653
Market distance	2.3* (1.8)	3.84* (2.9)	0.0002***

Description:

*Significant at p < 0.10, **Significant at p < 0.05, ***Significant at p < 0.01

Factors influencing farmer participation in contract farming

Table 2 represents the estimation results of factors that influence farmer participation in contract farming. Farmer participation in contract farming is influenced by age, number of family members, coffee harvesting area, KUB distance, middlemen distance, and market distance. The test results on the goodness of fit using Hosmer-Lemeslow test obtained the probability value of chisquare statistical test with 0.1917, which was greater than $\alpha = 0.05$, meaning that the model is worthy of being used in predictions. The model ability to predict correctly is obtained at 77.06 percent.

Table 2. Logit regression results from factors influencing farmer participation in contract farming

Variable	Coefficient		S.E	P > | z |	Marginal effects
The age of family head	-0.0536	***	0.0202	0.008	-0.0127
Education	0.0274		0.0674	0.684	0.0065
Number of family members	-0.5669	***	0.2071	0.006	-0.1348
The proportion of productive family members	0.0146		0.0111	0.186	0.0034
Harvest area	0.6347	***	0.2218	0.004	0.1509
Number of motorcycle assets	0.0470		0.1940	0.808	0.1112
Distance of KUB	-0.0443	***	0.0136	0.001	-0.0105
Distance of middlemen	0.2985	**	0.1496	0.046	0.0710
Market distance	-0.2369	***	0.0936	0.011	-0.0563
Constant	3.8781	**	1.752	0.021	
Pseudo R2	0.2453		LR chi2		56.83
Hosmer-Lemeslow's (prob>chi2)	0.1917		Prob > chi2		0.0000
% of correct prediction	77.06%				

Description :

*Significant at p < 0.10, **Significant at p < 0.05, ***Significant at p < 0.01

The head of family age negatively affected farmer participation and was significant at p-value <α = 0.01. The value of age marginal effects was -0.0127, meaning whether the average head of family increases by a year, the probability of farmers participating in contract farming decreases by 1.27 percent. Based on the data obtained from the study results, the average farmer participating in the farming contract was young farmers.

The number of family members had negative and significant effect on p-value <α = 0.01. The value of the marginal effect of the number of family members was obtained at -0.1348, which means that if the average number of family members increases by 1 person, the probability of farmers participating in contract farming decreases by 13.48 percent. This condition can be confirmed from the data obtained that the average contract farmer has fewer family members than non-contract farmers. This trend shows that households with fewer family members have a greater probability of participation than non-contract farmers.

The coffee harvesting area had positive effect on farmer participation and significant at p-value <α = 0.01. The marginal effect value of the coffee harvesting area was obtained at 0.1509, which means whether the average coffee harvesting area increases by 1 hectare, the probability of farmers participating in the farming contract increases by 15.09 percent. This discovery is in line with the study results by Wang et al. (2011), Arumugam et al. (2012) and Ntaganira (2017), who stated that farmers with large areas have higher chance to participate in farming contracts.

KUB distance had negative effect on farmer participation and significant at p-value <α = 0.01. The marginal effects from KUB distance was obtained at -0.0105, which means whether the average distance of farmer houses to KUB increases by 1 km, the probability of farmers participating in contract farming decreases by 1.05 percent. This study results are in line with the results of Ntaganira at el. (2017), who mentioned that further distance between farmers and middlemen in the contract farming system causes decreased level of farmer participation.

The middlemen distance was positive towards farmer participation and significant at p-value <α = 0.05. The marginal effects from the distance of the farmer houses to middleman was 0.0710, meaning whether the average distance of farmer houses to middlemen increases by 1 km, the probability of farmers participating in the farming contract increases by 7.10 percent. The

results of field observations found that coffee farmers have a dependency on middlemen. Arifin (2010), stated that the closeness of the relationship between farmers and middlemen is due to the middlemen provide cash during the production process without complicated procedure. As a result, coffee farmers must sell their crops to collectors.

The market distance negatively affected farmer participation and was significant at p-value $<\alpha = 0.01$. The marginal effect of buyer finding cost is obtained at -0.0563, meaning whether the average distance of farmer households to the market increases by 1 km, the probability of farmers participating in contract farming decreases by 5.63 percent. This result is similar to the study conducted by Maertens and Velde (2017), who stated that the farther market distance, the more increased probability of farmer participation in contract farming.

The impact of contract farming on farming business performance

To determine the propensity value of contract farmer and non-contract farmer groups, the same covariate variables were used with variables used in the logit regression to determine farmer participation in the contract farming. The propensity value was obtained from matching 170 farmer households consisting 98 contract farmers and 72 non-contract farmers. The propensity value for contract farmers ranged from 0.2193 to 0.9999 with an average of 0.7054 and for non-contract farmers ranged from 0.0161 to 0.9669 with an average of 0.4009. The distribution of propensity values for contract and non-contract farmers is shown in Figure 1.

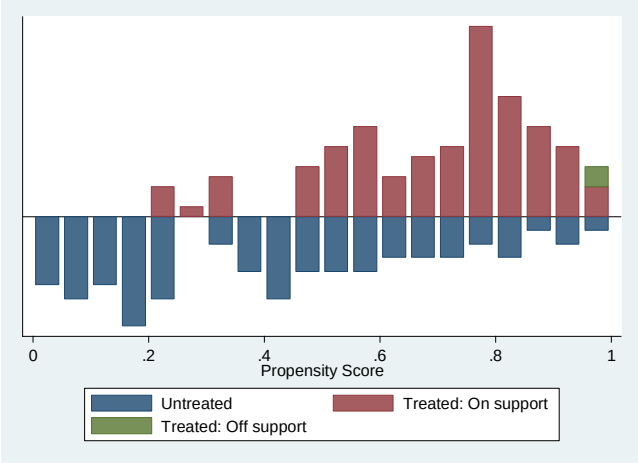

Figure 1 Distribution of propensity value between contract and non-contract

Figure 1 shows that the lower half of the graph is the propensity value for non-contract farmers, while the upper part is the propensity value for contract farmers. In the graph, it can be seen that there are individuals in the contract farmer group or treatment groups that are not supportive because they have values outside the range so they need to be issued.

Before the matching process, covariate balancing matching tests were carried out. Covariate matching was conducted to test the hypothesis that the covariates in two groups had the same distribution after matching. The test results showed that there were significant differences before matching the variables of family head age, education, number of family members, proportion of productive family members, harvesting area, KUB distance, and market distance between contract and non-contract farmers but after matching there were no variables showing significantly different. The test results of before and after matching covariates are presented in Table 3.

Based on the test results of covariate matching (Table 3), it can be concluded that the covariates used in matching have the same distribution between contract and non-contract farmers, hence the calculation of the impact of participation in contract farming is not constrained

by selection bias so that it can be continued to calculate the impact of participation on the performance of coffee farming business.

Table 3 Test results for matching covariates before and after matching

Variable	Sample	Mean		%bias	%bias reduction	t-test	
		Treated	Control			t	p-value
The age of family head	Unmatched	41.60	46.08	-42.5		-2.78	**0.006**
	Matched	41.89	40.36	14.5	65.8	1.03	0.302
Education	Unmatched	9.27	8.33	32.0		2.02	**0.045**
	Matched	9.17	9.25	-2.5	92.3	-0.19	0.848
Number of family members	Unmatched	3.54	3.97	-39.8		-2.61	**0.010**
	Matched	3.55	3.43	10.6	73.4	0.79	0.430
The proportion of productive family members	Unmatched	66.22	60.64	28.9		1.88	**0.062**
	Matched	66.03	68.58	-13.2	54.4	-0.96	0.337
Harvest area	Unmatched	2.01	1.64	35.1		2.21	**0.027**
	Matched	2.01	1.94	6.6	81.3	0.39	0.697
Number of motorcycle assets	Unmatched	2.16	1.97	16.6		1.09	0.279
	Matched	2.17	2.05	10.0	40.0	0.73	0.466
KUB Distance	Unmatched	19.69	27.09	-51.3		-3.18	**0.002**
	Matched	19.8	22.41	-18.0	64.8	-1.27	0.207
Middlemen Distance	Unmatched	1.23	0.46	20.1		1.21	0.229
	Matched	0.73	0.52	5.4	73.1	0.95	0.341
Market distance	Unmatched	2.30	3.84	-62.7		-4.19	**0.000**
	Matched	2.31	2.11	8.0	87.2	0.76	0.449

The estimation results of contract farming participation on the performance of coffee farming business found that farmer participation in contract farming had a significant effect (t-test> 2) on coffee farming income, productivity and coffee prices. Whereas household income, production costs and transaction costs have no significant effect (t-test <2). The estimation results of contract farming impact are presented in Table 4.

Table 4. The estimation results of contract farming participation

Variable	Sample	Contract	Non contract	Difference	S.E.	T-stat	
Income of coffee (Rp/ha)	ATT	11690791	6924972	4765819	1674655	2.20	***
Production cost (Rp/ha)	ATT	7857832	8043049	-185217	1102585	-0.17	
Transaction fee (Rp)	ATT	172464	178470	-6007	28400	-0.21	
Productivity (kg/ha)	ATT	747	522	226	102	2.22	***
Price of coffee beans (Rp/kg)	ATT	23159	21839	1320	421	3.14	***

Description :

*Significant at p < 0.10, **Significant at p < 0.05, ***Significant at p < 0.01

Coffee farming business income was positive and significant at p-value $<\alpha = 0.01$, meaning that farmer participation in contract farming has an impact on increasing farmers income from coffee farming business. The magnitude of the impact of increasing farmers income from coffee farming business is estimated at Rp. 4.7 million per ha or increased by 44.84 percent from the average coffee farmer income. Minot and Sawyer (2016) in their review article stated that farmer participation in contract farming increased the income of small farmers with range of 25-75 percent. Although, these results are smaller than the results of Bolwig et al. (2009), the participation of organic coffee farmers in the contract farming in Africa increases farmer net income by around 75 percent of the average income from coffee.

Productivity shown to be positive and was significant at p-value $<\alpha = 0.01$, meaning that farmer participation in contract farming has an impact on increasing coffee farming productivity. The magnitude of the impact of increased productivity on coffee farming amounted to 226 kg/ha or increased by 32.41 percent from the average productivity of coffee farming in the study sites. Observation of contract documents carried out by farmers and companies leads to the technological transfer to increase the productivity, quality and price of coffee. The results of this study are in accordance with the results of other studies such as; Bolwig et al. (2009), contract farming has an impact on increasing coffee productivity by 7 percent of the average productivity per tree. Maertens and Velde (2017) found that rice productivity in Benin increased by 0.25 tons/ha or 13 percent compared to average productivity as a result of farmer participation in the contract farming.

Coffee prices had positive sign and significant at p-value $<\alpha = 0.01$, meaning that farmer participation in contract farming has an impact on increasing coffee prices. The magnitude of the impact of an increase in the price of coffee was obtained at Rp.1320/kg or 5.80 percent of the average price of coffee of farmers in the study sites. Increased price increase obtained by the contract farmer is related to the increased e quality of the coffee produced. The results of this study are in line with the study conducted by Maertens and Velde (2017), who stated that contract farming increased the average price of rice farmers in Benin by 11 percent. Miyata at al. (2009) also found that the contract farming of apple farmers in China had an impact on increasing prices at the farm level by 8 percent.

Conclusion

This study aimed to evaluate the impact of contract farming on the performance of coffee farming business. The performances analyzed in this paper were income, production costs, transaction costs, productivity, and prices. Farmer participation in contract farming was positively affected by harvesting area and middlemen distance. Whereas the head of family age, number of family members, KUB distance, and market distance negatively affected farmer participation in contract farming. Farmer participation in contract farming had an impact on the performance of coffee farming business such as increasing income, productivity and prices received by farmers. Therefore, increased in farmer participation in the contract farming based on fair and mutually beneficial principle can increase farmer productivity and selling prices, thus it has an impact on the coffee farmer welfare.

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