Scopus®

Does Contract Farming Enhance Income of Farmers? Evidence in Tea Production of Vietnam

Anh Tru Nguyen[*]

ABSTRACT

Purpose: *The theme of effects of contract farming on income of farmers has been strongly debated by scholars in recent years, especially in developing countries. This article attempts to investigate the influence of contract farming on the income of farmers in tea production in Phu Tho province of Vietnam.*

Research Method: *Primary data for the study is gathered by a cross-sectional survey on 358 tea farmers in five districts of Phu Tho province between March and June 2016. Propensity score matching is employed to assess effects of contract participation on income of tea farmers in Phu Tho province, Vietnam.*

Findings: *Our results suggest that contract farming can have a minor positive impact on farmers' incomes. The average income of contracted farmers is found to be higher than that of their counterparts by about US$720 per year. Due to this small difference of income, contract farming plays an important role in procuring leaf tea, stabilising prices of leaf tea and generating employment rather than enhancing income for tea farmers.*

Originality/value: *The research contributes to the empirical work by providing an evidence on influences of contract farming on income of tea farmers as well as re-examining the importance of contract farming to improving livelihood of tea farmers in Phu Tho province, Vietnam.*

Keywords: *Contract farming, income, tea production*

INTRODUCTION

Tea *(CameliaSinensis)* production plays an important role in generating employment, improving income for small farm households and contributing to poverty reduction in rural areas of Vietnam. At present, tea products of Vietnam are exported to more than 100 countries and territories all over the world (Khoi *et al.*, 2015). In Vietnam, more than 40 percent of rice and tea come from contract farming (ActionAid, 2015). Contract farming of tea production has been seen as one of the instruments to enhance income of farm households in the rural area of Vietnam in recent years. However, results from previous studies in Vietnam, have raised questions on its effectiveness in poverty reduction. Some have concluded that contract farming positively affects income of tea farmers (Saigenji andZeller, 2009; Oanh *et al.*, 2016), while others did not find a positive relationship between contract farming and farmer income (Ngoc *et al.*, 2014).

In recent years, contract farming has become a significant development in global agriculture (Trang, 2014). There are various definitions in contract farming. Contract farming is known as an agreement between farmers and a buyer, which specifies production and marketing of

* *Faculty of Accounting and Business Management, Vietnam National University of Agriculture, Trau Quy, Gia Lam, Ha Noi, Viet Nam.*

nguyenanhtru@vnua.edu.vn

https://orcid.org/0000-0002-3345-2009

agricultural products (Minot, 1986). Contract farming is an agreement between farmers and firms in producing and providing agricultural products with a certain price (Eaton and Shepherd, 2001). Contract farming is a type of vertical integration which continues to evolve (Rehber, 2007).

In Vietnam, contract farming (agricultural contract) has been promoted in 2002 after the Prime Minister released the Decision 80/2002/QD-TTg to encourage the linkage between enterprises and farmers in terms of purchasing agricultural produce via contracts. Further, in 2013, the Decision 62/2013/QD-TTg of the Prime Minister has been implemented to facilitate coordination among producers, cooperatives and enterprises in production, processing and marketing of agricultural commodities based on large-scale production.

In Vietnam, the proportion of tea products traded via contract farming between producers and enterprises has grown rapidly in recent years. For instance, in 2010, only 9 percent of tea production in Vietnam was traded between producers and enterprises via contracts (Khoi, 2014), but this proportion increased to more than 40 percent in 2014 (ActionAid, 2015).

In Vietnam, tea trees are mainly planted in three distinct geographic areas; the Northern midlands and mountainous regions, the North Central and Central coastal areas, and the Central Highlands (ADB, 2004). As illustrated in Figure 01,

harvested area of tea significantly increased by more than 5,600 hectares from nearly 116,000 hectares in 2012 to more than 121,000 hectares in 2013 because of a massive area expansion for tea cultivation. However, harvested area of tea rapidly decreased in the following year because planted area for tea has been transferred to cultivate other crops in addition to negative effects of climate conditions. By 2016, the harvested area of tea slightly declined by 400 hectares compared to previous year, while tea production increased by 10,000 tonnes and this implies that production techniques might be improving as more tonnage can be harvested from a smaller area (Figure 01). By 2014, tea products of Vietnam were being exported to more than 100 countries and annual export value reached US$200 million (Khoi *et al.*, 2015).

Located in the northern midlands and mountainous areas of Vietnam, Phu Tho province has 277 commune-level administrative units, in which 218 are mountainous communes and 72 are extremely poor. By the end of 2016, the rate of poor and near poor households in this province reached 10.51 percent and 8.03 percent, respectively and average income per capita accounted for US$1,454.8 (Statistics Office of Phu Tho province, 2017). In Vietnam, Phu Tho province stands in the third on production and the fourth on planted area of tea (Department of Agriculture and Rural Development in Phu Tho province, 2015).
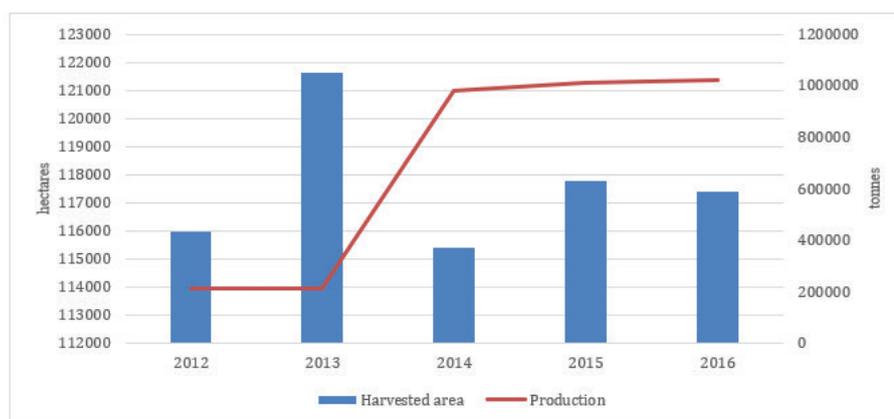
Figure 01: **Harvested area and production of tea in Vietnam**

Source: General Statistics Office of Viet Nam, 2017

Tea is a key crop cultivated by farm households in the rural area of Phu Tho province. However, knowledge about the impacts of contract farming of tea production on poverty reduction in this province is still limited. The study aimed to estimate determinants affecting contract participation and investigated the impact of contract farming on income of tea farmers in Phu Tho province.

The rest of this paper is organized as below. Section 2 discusses theoretical and empirical frameworks. Research methods are presented in section 3. In section 4, we present results and discussion. Lastly, conclusion and policy implications are summarized in section 5.

THEORETICAL AND EMPIRICAL FRAMEWORKS

Participation of farmers in the contract is non-random since contract participation depends on either selection of contractors or situation of farm households. If the ordinary least square (OLS) model is used to estimate factors affecting contract participation of farmers, then correlation between explanatory variables and the error term has violated one of assumptions in the OLS model and this leads to a bias estimation. Different methods are proposed to deal with this issue such as the Heckman two-step model and the instrumental variable (IV) (Meshesha, 2011; Bellmare, 2012; Key, 2013). However, the Heckman two-step model depends heavily on the assumption of normal distribution in error terms, while IV is strict because it is very difficult to specify appropriate instruments in the estimation.

Propensity score matching (PSM) is the most common method which matches individuals in the comparison group to members in the treatment group with a set of observed characteristics in the form of a propensity score. The propensity is used to predict probability of participation in an intervention. In PSM, average outcomes of participants and non-participants are compared under the condition of the propensity score value. Hence, the match is good if the treatment group is matched to the control group with a closer propensity score (Baker, 2000). PSM is useful because it uses observational data to estimate the treatment effect on an outcome and reduces the selection bias due to nonrandom treatment assignment (Dehejia and Wahba, 2002;Garrido *et al.*, 2014).

In terms of contract farming, PSM is used to investigate influences of contract farming on crop productivity and income of farmers (Ragasa *et al.*, 2018; Mulatu *et al.*, 2017; Mwambi *et al.*, 2016;Hu, 2013).

In this study, PSM is employed to assess impacts of contract farming on income of tea farmers in Phu Tho province, Vietnam because it can correct the potential selection biasedness which tends to increase due to systematic differences between the participants and non-participants (Ali *et al.*, 2013). For an example, contracted farmers may sell a bigger volume of leaf tea compared to independent ones because businesses assure to purchase leaf tea after harvesting based on terms of the contract.

To evaluate the impact of contract participation on income of tea farmers, all observable characteristics need to be homogeneous between contracted farmers (the treatment group) and independent farmers (the control group). The expected treatment effect of contract participation or average treatment effect on the treated (ATT) could be measured by the difference between the actual income and income if farmers did not participate in the contract. ATT may be specified as follows:

$$ATT = E(Y_{1i} - Y_{0i} / P_i = 1) \qquad (1)$$

Where: ATT denotes average treatment effect on the treated for farmer income; Y_{1i} represents income when the farmer participates in the contract; Y_{0i} represents income when the farmer did not participate in the contract; and P_i denotes the contract participation (1 for contract participation and 0 for otherwise).

METHODOLOGY

Sample and surveys

Phu Tho province is chosen for the survey because of the following reasons; (1) the production of tea features largely in poverty reduction, employment generation and income improvement policies for farm households; (2) this province accounts, is the third largest producer and the fourth largest planted area of tea in Vietnam; and (3) there are still issues in tea production in Phu Tho province, consisting of low yield, over-dependence on chemicals, poor coordination between producers and enterprises, and lack of owned brands for tea products.

There are eleven districts planting tea in Phu Tho province. However, we are unable to select and interview farmers in all districts because of the limitations in human and financial resources. Hence, a four-stage sample is designed to collect primary data. First, from provincial level, we choose purposely five districts, including Thanh Ba, Ha Hoa, Tan Son, Thanh Son and Yen Lap districts. Secondly, nine communes are chosen purposely from five districts of which, three communes are chosen in Thanh Ba district, a commune in Ha Hoa district, three communes in Tan Son district, a commune in Thanh Son district and a commune in Yen Lap district proportional to the population of the communes. A total of 18 villages were selected from the nine communes (two villages in a commune) and 358 households are chosen randomly from the 18 villages for interview.

The sample size for the household survey was determined as below: $n = [Z^2 P(1 - P)]/d^2$ (DanielandCross, 2013) where n is the sample size; Z is Z-Score (with a 95% confident interval, Z is equal 1.96); P is expected prevalence or proportion ($P = 0.5$ is large enough for the sample); and d is precision ($d = 5\%$ can be accepted for this research). Based on above formula, the calculated sample size is 385 farm households (n = 385). However, due to isolation of some households in remote areas, we only have interviewed 358 households. Therefore, finally the information of 358 households is entered and analysed for this research. Of the 358 households, 164 were contracted farmers and 194 were independent farmers.

The face-to-face interviews were conducted by trained research assistants (RAs). The RAs were trained with the questionnaires (translated into Vietnamese) which they used to conduct a pre-test survey to ensure reliability and clarity before the actual survey.

Data analysis

The procedure of PSM includes six steps, consisting of (1) estimation of determinants affecting contract participation; (2) demonstration of common support region; (3) selection of a matching algorithm; (4) assessment on the match quality; (5) estimation of average treatment effects on the treated (ATT); and (6) implementation of sensitivity analysis.Covariates in the treatment effect model for income of tea farmers are presented in Table 01.

RESULTS AND DISCUSSION

Characteristics of tea households in Phu Tho province

In terms of demographic characteristics, the average age of household heads is 48.7 years old and the age of contracted and independent farmers is nearly the same. The average number of school years of household heads accounts for nearly eight years and this implies that almost household heads have only graduated the secondary school (Table 02). Moreover, this result is consistent with features of labourers in the rural area of Vietnam since most of high-educated labourers often do not choose to work for agricultural sector because of high uncertainties and low salaries and instead, they prefer to work for other sectors such as industry, construction, and service to gain a higher income.

Table 01:   **Description of covariates in the treatment effect model for farmer income**

Variable definitions	Label	Unit	Expected signs of coefficients
1. Treatment variable: contract participation (P=1 for contract participation and P=0 for otherwise)	P		
2. Covariates			
Age of household head	X_1	years	+/-
Gender (1=Male and 0=Female)	D_1		+/-
Household category[a] (1=Poor household and 0=Otherwise)	D_2		+/-
Family labour	X_2	person	+/-
Land size for tea plantation	X_3	sao[b]	+
Tea yield	X_4	100kg/sao/year	+
Price of leaf tea	X_5	[c]VND1,000/kg	+
3. Outcome variables			
Income of tea household	Y_1	VND1,000/year	
Income per capita	Y_2	VND1,000/year	
Income per labour	Y_3	VND1,000/year	

Notes: [a]poor households are specified based on criteria for 'poor' for the period 2016–2020 in Decision number 59/2015/QD-TTg of the Prime Minister of Vietnam. In Vietnam, poor households in rural areas are households that have average capita income less than or equal to VND700,000 per month (US$31/capita/month).

[b]Sao is the most common area unit used by farmers in Northern Vietnam (1 sao = 360 m²)

[c]VND means Vietnam Dong (Vietnamese currency unit)

For socio-economics characteristics, the average number of members and labourers in a family accounts for 5 and 2.7, respectively and contracted farmers have slightly higher members and labourers than independent ones. The total land size and land size for tea of contracted households are higher than those of independent ones by more than eight sao and six sao, respectively. Asset value of tea households accounts for about VND53 million (or US$2,311). Capital for tea production of contracted farmers is higher than that of their counterparts by nearly VND3 million. Similarly, tree density of contracted households is higher that of independent ones by nearly 100 trees/sao. However, tea production experience and tea age of independent farmers are higher than those of contracted households. The number of tea harvests of both households is more than five times a year (Table 02). Results reflect that contracted households take advantages in socio-economic attributes such as land size for tea, asset value, and capital for tea production compared to their counterparts. However, independent farmers have more experience in tea plantation than contracted ones by about four years.

T-test results show that there are different characteristics between contracted and independent households, except age, hired land, and asset value. The majority of farmers plants tea in their own land and consequently, there is no difference between two groups in hired land. Asset value of two groups is homogenous and this suggests that there is no difference in asset ownership between two groups of farmers who live in the same community (Table 02).

Table 02:   Characteristics of tea households in Phu Tho province

Items	Unit	Contracted households (n = 164)		Independent households (n = 194)		Overall (n = 358)		T-test (Difference)
		Mean	SD	Mean	SD	Mean	SD	
1. Demographic characteristics								
Age	years	48.44	8.34	48.92	10.79	48.70	9.74	0.48
Gender (1=Male and 0=Female)		0.95		0.79		0.86		-0.16***
Ethnicity (1=Kinh and 0=Otherwise)		0.26		0.78		0.54		0.52***
Education	years	7.62	2.24	8.31	2.29	7.99	2.29	0.69***
Household category (1=Poor household and 0=Otherwise)		0.04		0.12		0.14		0.18***
2. Socio-economic characteristics								
Household members	person	4.53	1.08	4.12	1.15	5.01	1.17	0.90***
Family labourers	person	3.01	0.97	2.55	1.05	2.76	1.04	-0.45***
Total land size	sao	27.49	17.61	20.49	19.29	23.69	18.84	-6.99***
Land size for tea plantation	sao	22.60	17.00	16.49	13.24	19.29	15.36	-6.10***
Hired land (1=Yes and 0=Otherwise)		0.01		0.01		0.01		-0.00
Asset value	VND1,000	53202.9	33889	52252.11	40523.86	52687.67	37581.71	-950.78
Capital	VND1,000	13682.93	11194.33	11039.69	8036.40	12250.56	9688.65	-2643.23***
Credit (1=Yes and 0=Otherwise)		0.17		0.32		0.25		0.15***
Experience	years	15.26	7.17	19.94	9.08	17.79	8.57	4.68***
Tea tree age[a]	years	17.90	9.19	22.79	11.40	20.55	10.71	4.88***
Density	trees/sao	603.10	91.01	513.91	119.99	554.77	116.39	-89.19***
Harvest times	times/year	5.47	0.65	5.31	0.84	5.39	0.76	-0.15**

Source: Author's calculation, 2019

Notes: SD means standard deviation; [a]tea tree age is calculated by the average years of tea trees grown by a household.*, **, ***

Impacts of contract farming on farmer income

Estimation of determinants affecting contract participation

The logistic model is employed to estimate effects of determinants on contract participation. The objective of this assignment is to estimate propensity scores of covariates in the sample of both contracted and independent farmers.

Value of Pseudo R squared is equal to 0.229 implies that 22.9 percent of variation in contract participation is explained by independent variables in the model. All independent variables are statistically significant, except age and tea yield. Gender, family labors, land size for tea, and tea prices have positive relationships with contract participation, while household categories negatively affects contract

participation. Specifically, the livelihood in contract participation of male-headed households is higher than that of female-headed households by 33.9 percent, ceteris paribus. In farm households in the rural area of Vietnam, important activities are often decided by men. In addition, male-headed households tend to accept risks rather than female-headed households (Table 03).

Family labour and land size are key resources for tea production. Hence, if labour and land size of households increase by one person and a sao, then probability of contract participation rises by 7.3 percent and 0.4 percent, respectively, ceteris paribus. If tea prices rise by VND1,000, then the livelihood of contract participation increases by 9.4 percent, ceteris paribus. It is not too hard for explaining because when participating in the contract, farmers often expect to gain a higher price for tea (Table 03).

Table 03:   Logistic model of factors determining contract participation

Variables	Coefficient	Standard error	z	P>[z]	Marginal effect
Dependent variable: contract participation (1 for contract participation and 0 for otherwise)					
Age	-0.006	0.013	-0.49	0.621	-0.001
Gender	1.887***	0.520	3.62	0.000	0.339***
Household categories	-1.888***	0.456	-4.14	0.000	-0.339***
Family labour	0.409***	0.124	3.29	0.001	0.073***
Land size for tea	0.025***	0.008	2.88	0.004	0.004***
Tea yield	-0.017	0.048	-0.35	0.724	-0.003
Price of leaf tea	0.527***	0.102	5.14	0.000	0.094***
Constant	-4.745***	1.029	-4.61	0.000	
Number of observations	358				
LR chi2(7)	113.52				
Prob > chi2	0.000				
Pseudo R2	0.229				
Log likelihood	-190.12				

Source: Author's calculation, 2019

*Note:***denotes statistical significance at 1% level*

Probability in contract participation of non-poor households is higher than that of poor households by 33.9 percent, ceteris paribus. Non-poor households tend to participate in the contract rather than poor households since the number of labours and amount of land and capital of non-poor households are bigger than those of their counterparts. Moreover, conditions in the minimum land size and capital in the contract requested by contractors have become constraints which limit the participation of poor households in the contract (Table 03).

Demonstration of common support region

The purpose of this step is to demonstrate the distribution of households with respect to the estimated propensity scores of both contracted and independent farmers.The overall estimated propensity scores lie between 0.00345 and 0.99678. Amongst contracted farmers, the propensity scores vary between 0.00982 and 0.99678, while the propensity scores range between 0.00345 and 0.94611 for independent households. This implies that the region of common support would lie between 0.00982 and 0.94611. Thus, outliers, which lie below and above this range, need to be dropped. Out of 358 households, 8 observations (7 from contracted farmers and 1 from independent farmers) were dropped from the analysis since

their propensity scores lie outside the region of common support. Hence, only 350 observations are sufficient to predict the impact of contract participation on income of farmers (see details in Table A1 of the appendices).

Selection of a matching algorithm

The main objective of this step is to balance comparison groups by matching treatment group individuals with suitable controls. Several criteria, such as the number of explanatory variables with insignificant mean difference between the match groups of contracted and independent farmers, pseudo R^2, and matched sample size, are tested to choose appropriate matching algorithms. We implement two matching methods, consisting of the Nearest Neighbor Matching (NNM) with replacement and Kernel Matching (KM). The NNM is used because it is the most straight forward matching method which matches each individual in the treatment group to a member in the control group by the closest propensity score (Baker, 2000; Gemici *et al.*, 2012). The KM is employed since this is a non-parametric matching method, in which a weighted composite is given to a treated member for matching with comparable individuals within a range of the propensity score (Ali *et al.*, 2013; Garrido *et al.*, 2014). The main advantage of this method is the ATT that

can be estimated with a lower variance because it utilizes greater information (Wu *et al.*, 2010).

Matching methods are chosen if these have all explanatory variables with insignificant mean between the match of contracted and independent farmers, the lowest pseudo R^2, and the largest matched sample size (Tsadik *et al.*, 2015;Mulatu *et al.*, 2017). The most appropriate in this case is KM (0.25) because it has all insignificant explanatory variables, the lowest R^2 (0.005), and the largest matched sample size. Therefore, only KM(0.25) is selected to assess the impact of contract farming on income of tea farmers in this study (See details in Table A2 of the appendices).

Assessment on the match quality

This step aims to check the match quality of two matching methods by comparing means of the propensity score and explanatory variables before and after matching. Results of testing the propensity score and explanatory variables for the KM(0.25) are presented in Table 04.

Before matching, five covariates, including gender, household categories, family labors, land size for tea, and price, are statistically significant. After matching, however, covariates are balanced and statistically insignificant. The insignificant likelihood ratio tests of all covariates imply that the characteristics of two groups (contract and independent farmers) are balanced (Table 04).

Low pseudo R^2 and the insignificant likelihood ratio tests suggest that both treatment and control groups have the same distribution in covariates after matching and matching methods may balance characteristics of the treated and control groups (Chege *et al.*, 2015;Huluka andNegatu, 2016). Results demonstrated that KM (0.25) is relevant to assessing the effect of contract participation on income of farmers for this research due to the lowest pseudo R^2 and the insignificant likelihood ratio tests. Specifically, after matching, pseudo R^2 dropped from 0.205 to 0.009, the likelihood ratio is insignificant (0.785), and total bias decreased by 80 percent (See details in Table A3 of the appendices).

Estimation of average treatment effects on the treated for farmer income

The objective of this step is to estimate the average treatment effects on the treated (ATT) for income of tea farmers to indicate the impact of contract participation on farmers' income.

Table 04: **Propensity scores and covariate balancing for the KM(0.25)**

Variables	Sample	Mean		% bias reduction		T-test	
		Treated	Control	% bias	|bias|	t	P-value
Age	Unmatched	48.573	48.865	-3.0		-0.28	0.781
	Matched	48.573	48.048	5.4	-79.7	0.48	0.635
Gender	Unmatched	0.955	0.792	50.4		4.56	0.000
	Matched	0.955	0.951	1.2	97.6	0.16	0.869
Household categories	Unmatched	0.044	0.227	-55.3		-4.99	0.000
	Matched	0.044	0.047	-1.0	98.2	-0.14	0.887
Family labors	Unmatched	3.025	2.554	45.9		4.25	0.000
	Matched	3.025	2.896	12.5	72.7	0.98	0.326
Land size for tea	Unmatched	22.301	16.521	41.7		3.90	0.000
	Matched	22.301	20.14	15.6	62.6	1.27	0.206
Tea yield	Unmatched	5.241	5.440	-7.4		-0.66	0.509
	Matched	5.241	5.104	5.1	31.0	0.54	0.589
Price	Unmatched	3.834	3.028	53.5		4.82	0.000
	Matched	3.834	3.731	6.8	87.3	0.71	0.478

Source: Author's calculation, 2019

Table 05:   Estimation of ATT for income

Matching methods	Outcome indicators	Unmatched and ATT	Difference (VND/year)	Standard error	T-stat
KM(0.25)	Household income	Unmatched	21668.942	7235.06	2.99
		ATT	16809.027	8103.31	2.07
KM(0.25)	Income per capita	Unmatched	5134.811	1666.52	3.08
		ATT	4174.666	1868.80	2.23
KM(0.25)	Income per labour	Unmatched	6689.763	2131.94	3.14
		ATT	5003.825	2399.60	2.09

Source:Author's calculation, 2019

Notes: ATT denotes the average treatment effects on the treated for income of tea farmers; KM means Kernel matching; VND means Vietnam Dong (Vietnamese currency unit)

Results show that income of contracted households is higher than that of their counterparts by VND16.8 million a year (US$720/year). The annual income per capita and per labourer of contracted farmers is higher than the annual income of independent ones by VND4.1 million (or US$175) and VND5 million (or US$214), respectively (Table 05).

Implementation of sensitivity analysis

The Rosenbaum bounds (rbounds test) is employed to test the presence of hidden bias due to unobserved covariates for both the KM (0.25). Results address that means for all outcome variables estimated, at various levels of critical values of gamma, the p-critical values are significant which imply that important covariates affecting both participation and outcome variables have been considered. Indeed, we are unable to get the critical value gamma where the estimated ATT is questioned even if we have set largely up to 10. Therefore, we can conclude that ATT values are insensitive to unobserved selection bias (see details in Table A4 of the appendices).

DISCUSSION

We found that income of contracted households is VND16.8 million a year (US$720/year) higher than their counterparts. The annual income per capita and income per labourer of contracted farmers are higher than those of independent

farmers by VND4.1 million (US$175) and VND5 million (US$214), respectively. In 2016, the average income per capita in Vietnam and Phu Tho province accounted for US$2,215 and US$1,365, respectively (General Statistics Office of Viet Nam, 2017; and Statistics Officeof Phu Tho province, 2017). The difference in the annual income per capita between contracted and independent households is US$175 and this is equivalent to 7.9 percent compared to the average income per capita of the whole country and 12.8 percent compared to the average income per capita of Phu Tho province in 2016. Therefore, due to small differences in income between the two farmer groups, contract farming has played a negligible role in improving the income of farm households.

Previous studies demonstrated that contract farming has a positive impact on the income of tea farmers, but some authors did not provide evidence to support this assessment. For an example, Oanh *et al.,* (2016) concluded that tea farmers in Phu Tho province obtained higher turnover and value addition compared to partial contracted and independent households. Manjunatha *et al.,* (2016) argued that contract farming in India increases the income of contracted households because it improves market access and provides better use of resources and better management of technology. In contrast, Ngoc *et al.,* (2014) claimed that contract farming was not an effective instrument to increase farmers' income in tea production in Thai Nguyen and Phu Tho provinces, Vietnam.

Saigenji andZeller (2009) found that contract participation generates a higher income for tea producers by US$128 a year because technical efficiency of tea production of contracted households is higher than that of their counterparts by 11 percent. They also found that the membership of the Communist Party has a positive impact on contract participation of farmers in Moc Chau district, Son La province, Vietnam. Unlike conclusions of Saigenji and Zeller (2009), we found that family labour, land size for tea production and prices of leaf tea positively affected contract participation of tea farmers in Phu Tho province. In addition, non-poor households tend to participate in contract farming much more than poor households due to advantages in socio-economic conditions. Therefore, roles of contract farming in reducing poverty for the poor in a rural area like Phu Tho province, Vietnam should be carefully assessed.

CONCLUSION AND POLICY IMPLICATIONS

The article attempts to examine effects of contract farming on income of tea farmers in Phu Tho province, Vietnam. We found that impacts of determinants on contract participation are either positive or negative, or not significant. We also found that income of contracted households is higher than that of independent ones by US$720 a year. These results imply a positive impact of contract farming on income of tea farmers. However, due to small a difference in income, contract farming has played a negligible role in improving the livelihood of tea farmers.

Some policies should be recommended to the Government and Phu Tho province to facilitate the achievement of contract farming of tea production. First, policies released by the Government and Phu Tho province should be consistent with factors affecting contract participation. For example, family labours, land size, and tea prices have positive effects on contract participation. Policies, therefore, should focus on solving constraints related to labour availability, land area, and tea prices. Currently, the average planted area for tea of a household in Phu Tho province ranges from 0.6 hectares to 0.8 hectares. With a small area for tea cultivation managed by farm households, it is very difficult to construct a production zone for tea plantation in Phu Tho province which ensures to supply adequate quantity and homogenous quality of leaf tea to contractors, especially in tea exports to international markets. This bottle-neck can be overcome when the Government and Phu Tho province establish production zones for tea plantation and facilitate land concentration by expanding land quota up to 30 hectares for tea producers in midlands and mountainous areas based on the regulation of the Land Law issued in 2013. Secondly, contract farming presents a positive impact on farmers' income. However, by a small income difference (US$720 a year), contract farming has played an important role in procuring output, stabilising prices of leaf tea and generating employment rather than improving income for farmers.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

ACKNOWLEDGEMENTS

REFERENCES

ActionAid (2015). Contract farming and out-grower schemes: Appropriate development models to tackle poverty and hunger? Policy Discussion Paper, March 2015.

ADB (2004). The value chain for tea in Vietnam: Prospects for participation of the poor: Making Markets Work Better for the Poor. Discussion Paper No 01, November 2004.

Ali, A., Sharif, M., Mahmood, K. and Akmal, N. (2013). Determinants of cherry production and marketing in Pakistan: A propensity score matching approach. *Agricultural Economic Review*, *14*(1), 45-58.

Baker, J. (2000). Evaluating the impact of development projects on poverty: A handbook for practitioners. The World Bank, Washington D.C., 2000.

Bellemare, M. F. (2012). As you sow, so shall you reap: The welfare impacts of contract farming. *World Development*, *40*(7), 1418-1434. DOI: https://doi.org/10.1016/j.worlddev.2011.12.008

Chege, J. W., Nyikal, R. A., Mburu, J. and Muriithi, B. W. (2015). Impact of export horticulture farming on per capita calorie intake of smallholder farmers in eastern and central provinces in Kenya. *International Journal of Food and Agricultural Economics*, *3*(4), 65-81.

Daniel, W. W.and Cross, C. L. (2013). Biostatistics: A Foundation for Analysis in the Health Sciences. Tenth Edition. John Wiley & Sons, Inc, 2013.

Dehejia, R. H. and Wahba, S. (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics*, *84*(1), 151-161. DOI: https://doi.org/10.1162/003465302317331982

Department of Agriculture and Rural Development in Phu Tho province (2015). Report on tea production in 2015 and the direction for tea development in 2016. Phu Tho province, Viet Nam. DOI: https://doi.org/10.1162/003465302317331982

Eaton, C., and Shepherd, A. W. (2001). Contract farming: partnerships for growth. FAO Agricultural Services Bulletin 145. Food and Agriculture Organization of the United Nations, Rome.

Garrido, M. M., Kelley, A. S., Paris, J., Roza, K., Meier, D. E., Morrison, R. S. and Aldridge, M. D. (2014). Methods for constructing and assessing propensity scores. *HSR: Health Services Research*, *49*(5), 1701-1720. DOI: 10.1111/1475-6773.12182.

Gemici, S., Rojewski, J. W. and Lee, I. H. (2012). Use of propensity score matching for training research with observational data. *International Journal of Training Research*, *10*(3), 219-232. DOI: https://doi.org/10.5172/ijtr.2012.10.3.219

General Statistics Office of Viet Nam (2017). Statistical Yearbook of Viet Nam 2016. Statistical Publishing House, Ha Noi, 2017.

Hu, W. Y. (2013). Effect of contract farming on the U.S. crop farmers' average return. *Agricultural Economics*, *59*(5), 195-201. DOI: https://doi.org/10.17221/100/2012-agricecon

Huluka, A. T. and Negatu, W. (2016). The impacts of farmer field school training on knowledge and farm technology adoption: Evidence from smallholder maize farmers in Oromia, Ethiopia. *Journal of Economics and Public Finance*, *2*(1), 1-21. DOI: https://doi.org/10.22158/jepf.v2n1p1

Key, N. (2013). Production contracts and farm business growth and survival. *Journal of Agricultural and Applied Economics*, *45*(2), 277-293.

Khoi, N. V., Lan, C. H. and Huong, T. L. (2015). Vietnam tea industry: An analysis from value chain approach. *International Journal of Managing Value and Supply Chains (IJMVSC)*, *6*(3), 1-15.DOI: 10.5121/ijmvsc.2015.6301.

Manjunatha, A. V., Ramappa, K. B., Lavanya, B. T. and Mamatha, N. C. (2016). Present status and prospects of contract farming in India. *International Journal of Agriculture Sciences*, *8*(7), 1072-1075.

Meshesha, J. G. (2011). Impact of contract farming on household income of smallholder farmers: the case of organic honey production in South West Ethiopia, Sheka zone. Master Thesis; the Wageningen University and Research Centre, the Netherland.

Minot, N. W. (1986). Contract farming and its effects on small farmers in less developed countries. Working Paper No. 31. Department of Agricultural Economics, Michigan State University.

Mulatu, G., Haji, J., Legesse, B. and Ketema, M. (2017). Impact of participation in vegetables' contract farming on household's income in the Central Rift valley of Ethiopia. *American Journal of Rural Development*, *5*(4), 90-96. DOI:10.12691/ajrd-5-4-1. Available at http://pubs.sciepub.com/ajrd/5/4/1.

Mwambi, M. M., Oduol, J., Mshenga, P. and Saidi, M. (2016). Does contract farming improve smallholder income? The case of avocado farmers in Kenya. *Journal of Agribusiness in Developing and Emerging Economies*, *6*(1), 2-20. DOI: https://doi.org/10.1108/jadee-05-2013-0019

Ngoc, N. T. B., Bac, H. V. and Huyen, N. T. (2014). Comparative analysis of non-contract and contract farmers in tea sector in Vietnam: The case study in Thai Nguyen and Phu Tho provinces. *Journal of Science & Technology*, *119*(05), 143-149.

Oanh, L. T. K., Nga, B. T. and Lebailly, P. (2016). Tea production between contract and non-contract farmers in Phu Tho province of Vietnam. *Scholars Journal of Agriculture and Veterinary Sciences*, *3*(2), 117-122.

Ragasa, C., Lambrecht, I. and Kufoalor, D. S. (2018). Limitations of contract farming as a pro-poor strategy: The case of maize outgrower schemes in Upper West Ghana. *World Development*, *102*, 30-56. DOI: https://doi.org/10.1016/j.worlddev.2017.09.008

Rehber, E. (2007). *Contract farming: Theory and practice*. The ICFAI University Press.

Saigenji, Y. and Zeller, M. (2009). Effect of contract farming on productivity and income of small holders: The case of tea production in North-western Vietnam. Contributed Paper Prepared for Presentation at the International Association of Agricultural Economists Conference, Beijing, China. August 16-22, 2009.

Statistics Office of Phu Tho province (2017). Statistical Yearbook in 2016 of Phu Tho Province. Phu Tho, July 2017. DOI: https://doi.org/10.25073/2588-1094/vnuees.4090

Trang, N. T. T. (2014). Legal policies and regulations governing contract farming in Vietnam. Unidroit Working Group for the preparation of a legal guide on contract farming. Fourth Meeting, Rome, 17-22 November.

Tsadik, E. T., Tamir, B. and Sahile, Z. (2015). The impact of village poultry technology adoption on the livelihood of smallholder farmers in Central Oromia Region, Ethiopia. *Journal of Biology, Agriculture and Healthcare*, *5*(17), 59-69. DOI: https://doi.org/10.5455/japa.20151118113244

Wu, H., Ding, S., Pandey, S. and Tao, D. (2010). Assessing the impact of agricultural technology adoption on farmers' well-being using propensity-score matching analysis in rural China. *Asian Economic Journal*, *24*(2), 141-160. DOI 10.1111/j.1467-8381.2010.02033.x.