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Impact of access to agricultural extension services on tea household's income in the Northern Region of Vietnam

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Introduction

The Northern Upland of Vietnam is one of the poorest regions of Vietnam where local people are highly dependent on agriculture to earn income. The region has the lowest Human Development Index as compared to other regions. Around 56% of this region's households are poor while the average national proportion is 17.2% (GSO, 2012). In the region, tea plants play an important role in generating employment and improving income for farmers. Agriculture extension services for tea production such as pest and disease control, fertilizer application, new varieties application are available to support tea farming activities and help farmers to overcome poverty. Extension is assumed to increase farmers' awareness of new technologies (e.g. new varieties, optimal input use, marketing strategies) and improve the management skills that are needed to implement these technologies effectively. However, the determinants of access to tea extension services and the impact of these services on improving tea productivity and farmer's income still remain questionable. In this context, this paper analyzes the determinants of access to and estimate the impact of agricultural extension services on tea household income. The results can be of interest because they can provide necessary information for further improvements of the extension services.

Material and Methods

Data were obtained from a household survey of 120 households with and 180 tea households without access to agricultural extension in three provinces (Thai Nguyen, Phu Tho and Tuyen Quang) in the Northern Upland Region of Vietnam where tea plants play an important role in generating income for farmers.
Propensity Score Matching (PSM) is employed to analyze the factors affecting accessibility of tea households to agricultural extension services and measure the impact of extension services on tea household's income. This is a robust estimator because it is less sensitive to minor changes in specification of regressions and is adequate for removing the biased associated with the differences in covariates (Dehejia,R.,and Wahba,S, 2002). PSM estimates the income difference between tea households who received agricultural extension services and those who did not receive services. The objective is to estimate the Average Treatment Effects on the Treated (ATT), which can be expressed formally as:

$$ATT = E(\Delta/D=1) = E(Y^1/D=1) - E(Y^0/D=1) \quad (1)$$

Where:

ATT measures the difference between the expected household income with and without agricultural extension services for the actual participation households.

E(Y1/D=1) represents expected income for households who received services.

E(Y0/D=1) is the hypothetical income that would have resulted if the accessed household had not participated.

In summary, equation (1) allows extraction of the effect of the agricultural extension on the tea households from the total effects estimated. Finally, equation (1) is used in the present study as an estimator to answer this counterfactual question: "What would be the state of those households who actually accessed to agricultural extension services if they had not participated?"

The equation (1) may be subject to selection biases, as E (Y0/D=1) is an unobserved counterfactual outcome of accessed households. If the approximation E (Y0/D=1) = E (Y0/D=0) holds true, then non-accessed households can be conveniently used as the comparison group. However, with non – experimental data, this condition does not generally hold, since the components which determine the participation decision also determine the outcome variable of interest. Thus, the outcomes of the accessed households would differentiate even the absence of agricultural extension, leading to selection bias.

When the bias is due to observables, we face a scenario known as self – selection bias. This type refers to the case that the outcomes are not observed for all households since they can not access to agricultural extension at the same time. One way to handle this type is implementing matching procedures, such as covariates matching (as in Rubin 1973) and propensity scores as suggested by Dehejia R.(2005), which use Propensity Score Matching (PSM) to handle the bias since it solves the problem of multi-dimensionality, which arises from the application of covariate matching procedure due to large number of covariates.

In the context of this study, bias is defined as the difference between the outcomes of accessed households and non-accessed households. Formally: Bias = E (Y1/D=1) – E (Y0/D=0) (2)

As the effect of interests of those accessed households is captured by (2), we need to remove further the effect of non-accessed households, which is defined as: E(Y0/D=0) – E(Y0/D=1) (3).

Equation (3) defines the sub-set of all households who are non – accessed and has not received agricultural extension services.

Therefore, the bias defined as follow: ATT – [E (Y0/D=0) – E (Y0/D=1)] = E (Y1/D=1) – E (Y0/D=1) - E (Y0/D=0) + E (Y0/D=1) = E (Y1/D=1) - E (Y0/D=0) (4)

In the ideal case, the bias is zero, which implies: E (Y1/D=1) - E (Y0/D=0) = 0 <=> E (Y1/D=1) = E (Y0/D=0) (4). Therefore, ATT is identified only when equation (4) holds, thus solving the issue of self-selection.

Results and Discussion

Table 1 below presents the number of sample households in term of access to extension. In the selected sample, 120 households (40%) accessed to extension and the rest of the sampled households did not.

Table 1: Composition of sampled tea households with and without access to agricultural extension

Households	Frequency	Percentage
With access	120	40
Without access	180	60
Total	300	100

Source: own calculations

Table 2: Determinants of accessing to agricultural extension services by tea households

Variables	Coefficients	SE.	Marginal effect
Age of household head (years)	-.01644	.01292	-.00706
Education of household head (years in school)	.00060	.00100	.00010
Family size (persons)	.03716	.02186	.01459
Ownership of land title (1=yes, 0=no)	.11237	.30829	.03001
Member of local mass organizations (1=yes, 0=no)	3.00730***	.64620	.28450
Total tea area (m^2)	.03552**	.01307	.00948
Experienced years of tea production (years)	.14743**	.06627	.03938
Family members or relatives work for local government (1=yes, 0=no)	.45985	.26548	.12282
Access to credit (1=yes, 0=no)	.60970**	.29379	.16285
Pseudo R-squared	42.24		
Correctly classified (%)	82.40		

Note: Dependent variable is access to agricultural extension services (1=yes, 0=no)

Source: own calculations

Table 2 presents the estimated results of the first step (the probit model) in the Propensity Score Matching Model. The probit models predicted 82.40 % of all households correctly and the Pseudo R_squared equals 42.24. These results indicate that the goodnesses of fit are satisfied. Pair correlations between explanarory variables in the model showed that there is no multicollinearity between independent variables.

Results reveal that the education level of household head, family size, land title and family members or relatives who work for local governments have no influence on the probability of accessing agricultural extension services. However, the membership of local mass organizations (Farmer, Women, Youth and Veteran Union) has a strong marginal effect on receiving agricultural extension indicating that the social network and farmer's access to information are so important to farmers. Total tea area and experienced years of tea production also have positive impact on the probability of receiving agricultural extension. This could be explained by the facts that those types of tea households are often selected to join in the extension demonstration models and best farmer contests. Households who are beneficial from tea production often allocate a larger area for tea plant. In addition, experiences of tea production such as fertilizer application, pest and disease control and so on were partly obtained from practical production.

Agricultural extension workers give priories for more experienced tea households to be selected with the expectation that their knowledge gained from extension services are more likely to spread to other tea households effectively. The other significant determinant is credit access. Households with access to loans are likely to access agricultural extension. Agricultural extension services not only improve knowledge, agricultural production skills but also provide households with necessary information about credit sources and credit institutions. In return, credit is an important complementary capital for tea production and trading.

The impact of accessing to agricultural extension was measured by Propensity Score Matching Approach. Income is determined as total monthly income of the whole household. The table below presents the results before and after matching to balance two household groups. The monthly income difference per household between accessed and non-accessed tea households before matching is 720,000 VND (US$36). The difference in average monthly income between two groups after matching is 1200,000VND(US$60) which is calculated as the average treatment on treated (ATT). Access to agricultural extension services has a significant impact on income of tea households.

Table 2: Impact of access to agricultural extension on income of tea households

	Average treatment effect on treated	SE	t-value
Unmatched	720,000 VND**	506,040	2.01
Matched by PSM	1200,000 VND**	601,953	2.87

Note: ** Significant at the 5% level
Source: own calculations

Conclusions and Outlook

Agricultural extension services have been considered to be important in agricultural production in general and in tea production in particular. Empirical results from this study are significant in identifying access constraints of households to extension services as well as estimating the effectiveness of agricultural extension programs on tea farmers. As it has been revealed in the econometric analyses, tea area, experienced years of tea production, membership of local mass organizations and credit access are main factors affecting on accessibility of tea farmers to agricultural extension services. Those services, in returns, have a significant impact on tea farmer's income.

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