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Effect of Agricultural Policy on Rice Farmers in Vietnam

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The study investigated the effectiveness and impacts of agricultural policies on rice farmers in Vietnam by using the data of Vietnam Household Living Standard Survey 2005– 2006 (VHLSS 2006). The connections of agricultural policies with technology, off– farm income and the life improvement were determined. The results indicated that there were no positive relationships of agricultural policies with the technical efficiency and life improvement of rice farmers. Farmers who benefited from policies were less able to grow rice efficiently improve their lives. Nevertheless, the study revealed that agricultural policies were partly effective for the poor farmers in terms of life improvement. The more they enjoyed the benefit of agricultural policies the better their life improved.

Key words: Probit function, stochastic frontier analysis, technical efficiency, VHLSS 2006

INTRODUCTION

Vietnam's topography and climatic conditions are favorable for growing tropical as well as subtropical crops. About 2.8 million hectares of land are being cultivated of which one million hectares are being irrigated. The agricultural sector of Vietnam grew by about 4.1 percent annually during the 2000s. The agricultural sector dominated about 22.1 percent of GDP, 13 percent of export revue, 8 percent of total import values and created employment for 61 percent of the labor force in 2009. Although the shares of agriculture in GDP and total employment have gradually been decreasing over years, the agriculture sector still plays an important role in economic development of Vietnam.

However, although the contribution of farmers is very important for agriculture as well as for the economy of Vietnam, farmers' earnings are much lower than the rest of the population. This fact has created an income gap between rural and urban people. To solve this problem, the government has applied a variety of agricultural policies to increase the farmers' income, for instance, training courses with the aim of supporting and introducing new technologies to farmers or other policies related to agricultural outputs and inputs. However, studies on the effectiveness and impacts of such policies are still limited. Have farmers grown their product efficiently with the available resources and technologies? What is the impact of government agriculture policies on the rice production and technical efficiency of rice farmers? These are some of the questions that the study partly seeks to answer.

The main purposes of the study are to estimate the technical efficiency of rice production by applying a stochastic frontier employing a stochastic frontier analysis and to determine the factors affected agricultural policies undertaken by government employing the Probit model. Particularly, studies on the connections between agricultural policies and technology (represented by a technical efficiency score), off– farm income and the life improvement by using the data of Vietnam Household Living Standard Survey 2005– 2006 (VHLSS 2006). The results of the study are useful to policy– makers, and also help us better understand the effects of the current agricultural policies undertaken by the government.

DATA AND EMPIRICAL MODEL

Data

The data from the VHLSS 2006 were used in the study. The survey included a household questionnaire of 85 pages. The questionnaire was based on the format used by the World Bank and other measurement surveys of living standards. The survey was adjusted to reflect the conditions in Vietnam. It was conducted by the General Statistics Office of Vietnam, with technical advice from the World Bank.

Data from a total of 9,189 rural and urban households were collected all over Vietnam. Approximately 4,216 rice farmers were interviewed. Households with missing information were eliminated, thereby reducing the number of households in the study to 3,733.

Empirical model

Technical efficiency is used to measure the capacity of a farmer to achieve the maximum output with given and obtainable technology (Farrell, 1957; Tim Coelli and George, 2005). There are several functional forms for estimating the physical relationship between inputs and output. One of the most popular functions is the Cobb–Douglas production function. In this study, the Cobb–Douglas production function is estimated

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with nine input independent variables. The independent variables are seed expenditure, pesticide cost, fertilizer quantity, machinery service, hired labor for rice production, family labor for rice production, rice land area, small tools and energy, and other farming expenditure. Family labor for rice production is calculated by multiplying the percentage rice value for a farm with the total family labor for the farm. Rice land area and fertilizer quantity are measured in units of hectares and kilograms, respectively. Other inputs are calculated from the expenditures in Vietnamese currency (VND). The Cobb–Douglas stochastic frontier model is written as

$$\ln(Y_i) = \beta_0 + \sum_{j=1}^{9} \beta_{ij} \ln X_{ij} + v_i - u_i \quad (1)$$

where Y_i is the rice output in kilograms, X_{ij} represents the nine inputs mentioned above, v_i is the two– sided random error, and u_i is the one– sided half– normal error.

The technical efficiency of a farm is determined as

$$TE_i = \exp(-\hat{u}_i) \quad (2)$$

With the assumption of a half– normal model, a simple z– test is used to examine the technical inefficiency. The null and alternative hypotheses are H_0: $\lambda=0$ and H_1: $\lambda>0$. The test statistic is

$$z = \frac{\tilde{\lambda}}{se(\tilde{\lambda})} \sim N(0,1) \quad (3)$$

where $\tilde{\lambda}$ is the maximum likelihood estimator of λ and $se(\tilde{\lambda})$ is the estimator of its standard error.

In fact, there are differences in agricultural practices, cropping patterns, the types of agricultural land of rice farmers in various regions in Vietnam. Because this study is calculated by using the national information of rice farmers from the VHLSS data, which is mainly to measure living standards of households, the result of technical efficiency is estimated in the sum of cropping patterns a year with the assumption of no big differences in land and technology used by the rice farmers across the country.

In the study, the probit function with a dummy dependent variable of *Agricultural policy* is applied to determine which factors are affected by agricultural policies undertaken by the government. The probit function is given by:

$$Agricultural\ policy_i = \alpha_0 + \sum_{k=1}^{11} \alpha_k X_{ik} + u_i \quad (4)$$

where *Agricultural policy* is a dummy variable (a value of 1 indicates the existence of policy benefit, and a value of zero indicates no benefit from policy). X_{ik} is a variable representing factors related to agricultural policies or socio– economic characteristics of rice farmers. k is an *Ethnicity* (dummy variable is 1 if farmer is Kinh ethnicity, 0 otherwise) (k = 1), *Member* in natural log (the number of family members in persons) (k = 2), *Age* in natural log (the age of household owner years) (k = 3), *Experience* in natural log (the number of rice growing years) (k = 4), *Education* in natural log (the number of school year of header) (k = 5), Income in natural log (Household income in thousand VND) (k = 6), *Area* in natural log (the area of rice land) (k = 7), *Technical Efficiency* (k = 8), *Nonagri. income share* (proportion of total farmer income earned from nonagricultural sources) (k = 9), *Life improvement* (dummy variable is 1 if there is the existence of improving the present standard living compared with 2001, 0 otherwise) (k = 10), North (dummy variable is 1 if farmers in the North of Vietnam, 0 otherwise) (k = 11), ui is the error in the probit function.

EMPIRICAL RESULTS

Table 1 presents the results of the ordinary least squares (OLS) estimate for choosing the relevant variables and the results of stochastic frontier production for estimating technical efficiency. The variables estimated in the OLS and stochastic frontier models are statistically significant at 0.1 percent. The coefficient R^2 is equal to 0.94, meaning that about 94% of the variation in the dependent variable is explained by independent variables in the OLS model. The result indicates a mean of technical efficiency of 81.6 percent, suggesting that the average rice farm could reduce its input quantities by increasing the technical efficiency by 18.4 percent.

The presence or absence of technical inefficiency was tested in the study using the important parameter of log likelihood in the half– normal model $\lambda = \sigma_u/\sigma_v$. If λ = 0, there were no effects of technical inefficiency, and all deviations from the frontier were due to noise (Aigner *et al.*, 1977). The estimated value of $\tilde{\lambda}$ = 2.047 significantly differed from zero. The null hypothesis of no inefficiency effect was rejected at the 0.1 percent level using the Z– statistic (the test statistic is $Z = \tilde{\lambda} / se(\tilde{\lambda})$ = 2.047/0.01 = 204.7, exceeding the critical value $Z_{0.999}$ = 3.09), suggesting the existence of inefficiency effects for rice farmers in Vietnam.

The study also examines the null hypothesis that there is a proportional output change when inputs in the model are varied or farms produce rice with constant returns to scale. The function coefficient of OLS is 1.035, showing the possibility of Vietnamese farmers increasing returns to scale in rice production. The restricted least squares regression with the null hypothesis of constant returns to scale is estimated. The computed F statistic of 35.48 is more than the critical value F (1, 3723) of 10.84 at the 0.1 percent level of significance[1]. Thus, the null hypothesis is rejected and the study con-

[1] Calculated by the formula $F = \frac{(SSE_R - SSE_U)/J}{SSE_U/(1-K)}$, where SSER and SSEU are the restricted and unrestricted sums of squared residuals and J is the number of restrictions.

Table 1. OLS and stochastic frontier production estimates [Ψ]

Variables	Mean	SD	OLS		Stochastic frontier	
			Coefficient	Std. error	Coefficient	Std. error
Seed expenditures†	363.05	577.89	0.060***	0.009	0.056***	0.008
Pesticide costs†	444.7	1101.24	0.039***	0.003	0.036***	0.003
Fertilizer quantity (kg)	389.18	579.59	0.125***	0.006	0.099***	0.006
Machinery services†	501.5	990.34	0.014***	0.001	0.012***	0.001
Hired labor†	413.07	1145.10	0.007***	0.001	0.007***	0.001
Small tools and energy†	134.49	368.21	0.015***	0.003	0.012***	0.003
Other rice expenditures†	134.77	266.46	0.013***	0.002	0.010***	0.001
Family labors for rice (hrs)	771.77	451.02	0.045***	0.005	0.026***	0.005
Rice land area (ha)	0.73	1.05	0.718***	0.011	0.758***	0.010
Constant			–0.021	0.053	0.179***	0.050
Function coefficient [a]			1.035		1.016	
F–statistic model			689.55***			
F–statistic CRTS [b]			35.48***			
σ_v					0.136	
σ_u					0.278	
σ_2					0.096	
$\lambda = \sigma_u / \sigma_v$					2.047***	0.010
Log likelihood					506.29	
R^2			0.943			
TE score	0.816	0.098				

Notes: 1) ***, ** and * indicate statistical significance at the 0.001, 0.005, and 0.01 levels respectively
2) [a] Sum of estimated coefficients
[b] CRTS= constant returns to size
† In thousand VND
[Ψ] Unit in sum of cropping patterns a year

Source: Estimates based on an appendix of data that is available from the authors by request.

Table 2. Descriptive statistics of some important factors associated with agricultural policy

Variables	Description	Mean	St.dev.
Agricultural policy	(1 = existing policy benefit, 0 = No–existing policy benefit)	0.116	0.320
Kinh ethnicity	(1= Kinh, 0 = Other ethnicity)	0.783	0.412
Member	(The number of members in a individual farmer)	4.483	1.664
Age	(The age of header in a individual farmer)	48.876	12.909
Experience	(The number of rice experience years)	19.504	10.855
Education	(The number of school year of header)	6.187	3.803
Income (Thousand VND)	(Household income per year)	18,335.480	51,459.620
Area (ha)	(The area of rice production)	0.732	1.054
Technical Efficiency	(Technical efficiency score)	0.816	0.098
Non–agr. income share	(Proportion of total income from non–agricultural sources)	0.131	0.256
Life improvement	(1=existing life improvement, 0 = No–life improvement)	0.888	0.315
North	(1=North region, 0=other regions)	0.973	0.163
Poor index	(1 = the farmers in poor list, 0 = other farmers)	0.160	0.367

Source: Own estimates; data appendix available from authors.

cludes that technology does not exhibit constant returns to scale.

To analyze the impact of agricultural policies on rice cultivation, the study applies the probit function composing the dummy dependent variable of *Agricultural Policy* (Households were asked about their perceptions of the three main agricultural policies of the government, namely preferential credit, provision of cultivation and for ethnic households, agro– forestry and fishery promotion. The variable is set to 1 if farmers have perceived benefits from one or more of these policies, and zero if they feel they have not benefited from government support programs) and related independent variables such as social– economic characteristics of farmers, farming condition and so on presented in Table 2.

Table 2 presents the descriptive statistics of some important variables and socio– characteristics for analyzing the impact of agricultural policy. The results indicate that the rice farmers in Vietnam are old, low educated, small– scale, but have much experiences in rice cultivation and have large family size. The average age of rice farmers is about 49 years old. The average level of education is 6 years. The average family size of rice owners is 5 persons. Majority of the rice owners have been cultivating rice for 20 years. An individual household with an average of 0.7 ha rice farm could obtain an average income of 18 million, of which about 13 percent of income comes from off– farm sectors.

Table 3 shows the impact of agricultural policies on rice farmers in Vietnam. In model 3, the coefficients of *Kinh ethnicity, age, education, income, area, technical efficiency* and *life improvement* variables are significantly negative, indicating that Kinh ethnic farmers or those who have higher age, education, income and cultivate in larger– scale area receive the benefit of agricultural policies lower than others. The current policies are not very effective because rice farmers who perceive the benefit of agricultural policies do not get technical efficiency more highly and their life better. The

Table 3. The analysis of agricultural policy

Variables	Model 1 (*Poorindex* = 0)		Model 2 (*Poorindex* = 1)		Model 3 (Pooled data)	
	Coef. (Std.)	dy/dx (Std.)	Coef. (Std.)	dy/dx (Std.)	Coef. (Std.)	dy/dx (Std.)
Kinh ethnicity	–0.2271*	–0.0110	–0.1884	–0.0724	–0.4332***	–0.0780***
	(0.1203)	(0.0068)	(0.1274)	(0.0485)	(0.0683)	(0.0142)
Member	0.5925***	0.0246***	0.4644***	0.1796***	0.6907***	0.1052***
	(0.1645)	(0.0066)	(0.1490)	(0.0577)	(0.0894)	(0.0133)
Age	–0.5903***	–0.0245***	–0.9931***	–0.3841***	–0.7033***	–0.1071***
	(0.2037)	(0.0084)	(0.2184)	(0.0844)	(0.1186)	(0.0180)
Experience	–0.0407	–0.0017	0.1499*	0.0580*	0.0914*	0.0139*
	(0.0858)	(0.0036)	(0.0910)	(0.0352)	(0.0516)	(0.0078)
Education	0.0004	0.0000	0.0126	0.0049	–0.0182**	–0.0028**
	(0.0136)	(0.0006)	(0.0153)	(0.0059)	(0.0079)	(0.0012)
Income	–0.2735***	–0.0113***	0.0193	0.0074	–0.3998**	–0.0609***
	(0.0881)	(0.0036)	(0.1027)	(0.0398)	(0.0522)	(0.0078)
Area	–0.1206	–0.0050	0.2424***	0.0938***	–0.1246***	–0.0190***
	(0.0769)	(0.0032)	(0.0914)	(0.0353)	(0.0453)	(0.0069)
Technical Efficiency	0.0502	0.0021	–0.4077	–0.1577	–0.9478***	–0.1443***
	(0.5419)	(0.0225)	(0.4996)	(0.1933)	(0.2808)	(0.0428)
Non-agr. income share	–0.0815	–0.0034	–0.2793	–0.1080	–0.0681	–0.0104
	(0.2772)	(0.0115)	(0.3441)	(0.1331)	(0.1664)	(0.0253)
Life improvement	–0.5205***	–0.0343***	0.2163*	0.0846*	–0.3679***	–0.0678***
	(0.1393)	(0.0132)	(0.1285)	(0.0506)	(0.0820)	(0.0178)
North	0.3973	0.0112	–0.2444	–0.0909	0.3773	0.0445**
	(0.4406)	(0.0078)	(0.4988)	(0.1767)	(0.2370)	(0.0206)
Constant	3.2682***		1.2887		6.0571***	
	(1.1273)		(1.2606)		(0.6510)	
Log-likelihood	–332.969		–370.234		–1143.946	
Pseudo R^2	0.0969		0.0863		0.1458	
N	3131		599		3730	

Notes: ***, **, * indicate statistical significance of the 0.01, 0.05 and 0.1 level respectively

Source: Own estimates; data appendix available from authors.

result reveals that there is something wrong in the current policies being implemented by government or the model estimated is not correct due to biases modification (Walle and Gunewardena, 2001). The model is estimated again to reduce the effect modification by using the adjustment of *Poor index* variable and shown in model 1 and model 2. In the other words, the Probit function is calculated individually for farmers not and in the poor list with the expected result of the difference in the effect of policies these two kinds of farmers.

The Chow test is applied to check the null hypothesis on there is no differences in the effect of policies between poor households and others. The computed LR is 881[2] much more than the critical value $\chi^2(12)$ = 26.22 at 1% percent level of significant. Thus, the null hypothesis is rejected and the result affirms that it is necessary to analyze separately the effect of agricultural policies for the poor and other farmers.

The coefficient of *Kinh ethnicity* variable is negative and statistically significant at the level of 1 percent in the model 3 (without the adjustment of *Poor index* variable).,The result reveals that Kinh ethnic famers, who dominated the largest population in Vietnam, perceive benefits from agricultural policies 7.8 percent less than other ethnicities. However, the non– significant coefficient of this variable in the model 2 exposes that the impact of agricultural policies undertaken by the government is equally effective among the poor farmers.

Agricultural policies could benefit more households who have large family size. It is reflected in the significant coefficient of *Member* variable at 1 percent level in the both three models. The marginal effect result of this variable in model 3 shows that farmers in the sample recognize the benefits of agricultural policies 10.5 percent more with an additional family member.

The significantly negative coefficients of *Age* variable at the level of 1 percent in the three models show that farmers' ability of policy benefit decreases if they, especially poor farmers, get older. They feel policy benefits less 10.7 percent for an extra year old and 38.4 percent for households in the poor list.

The coefficient of *Income* variable is significantly negative in the model 1 and 3, but not significant in the model 2. Although the results generally show that the higher income farmers earn, the less policy benefit they perceive, there is no difference in terms of the effect of policies among various income– level farmers in the poor list. The variable of *Area* is significantly positive in the model 2, but not significant in the model 1. This reveals that the larger– scale farmers in the poor list the higher benefit of agricultural policies they feel while it is not correct for those outside the poor list.

The study also shows that agricultural policies do not allow farmers to produce rice in a more technical efficient manner. Even households who obtain higher technical efficiency level perceive policies benefits of 14.4 percent less, represented by the insignificant coefficient of *Technical Efficiency* variable in the model 3. However, agricultural policies partly help poor famers improve their life of 8.5 percent as shown by the significant positive parameter of *Life improvement* variable in model 2 at the level of 10 percent.

CONCLUSIONS

Although the government has had a variety of agricultural policies aim at improving the lives of farmers, they have not been successful. The study revealed that there was no positive relationship between agricultural policies and the TE. Farmers who benefited from policies were less able to grow rice efficiently. There was also a negative relationship between agricultural policies and life improvement. Farmers who benefited from policies were less able to improve their lives. However, agricultural policies were partly effective for the poor farmers in terms of life improvement. In addition, the study also indicated that these policies are more favorable to the poor farmers with the big size of family members, much experiences and large scale.

Therefore, agricultural policies should be reformed more practically and efficiently depending on the types of policies. For credit policy, besides the further development of preferential credit for the poor farmers, the government should focus on encouraging and promoting a market– interest loan by reducing loan procedures and lowering mortgage assets for the farmers who really need production capital.

For the technology transfer policies, it is necessary to enhance trainings given by extension services more effectively. Besides guiding farmers on how to apply technologies, the current extension services should include training famers on how to manage their agricultural inputs and expenditure to adjust their resources relatively at competitive prices. Moreover, the government should support the establishment of agricultural cooperatives in charge of finding markets with the price stabilization for members' products that could make cooperative members to feel secure for their production.

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[2] $LR = -2(lnL_R - (lnL_{UR1} + lnL_{UR2}))$

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