SOCIOECONOMIC STATUS AND NATURAL RESOURCE DEPENDENCE*

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Abstract

The main objective of this paper is to investigate the socioeconomic status of households in a rural area does matter for NTFPs dependency. To accomplish the ultimate aim, the present paper employs the latest nationwide household survey, Lao Expenditure and Consumption Survey (LECS-4). The paper firstly constructs a model with per capita income from NTFPs as the dependent variable and right-hand side variables include a wide range of variables representing the characteristics of household, family head, and villages. The empirical results reveal that household income per capita from both estimation methods is a statistically significant determinant of per capita income from NTFPs. The finding indicates that low-income households are likely to involve in the consumption of NTFPs.

Keywords: Socioeconomic; Households; Natural Resource Dependence

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Introduction

The biodiversity of natural forest has been substantially decreasing since the last century. Economic activities of human are regarded as the main cause of a loss in forest cover which seriously lessen abundance of the bio-system and in turn, negatively affects human well-being.

The interest in the causes of natural resource degradation is rapidly growing among researchers. There is a wide range of papers which share an understanding that human's economic activities have a significant effect on environmental degradation in various dimensions both macro and micro levels. A loss of natural forest land is believed to be partially caused by the government policy in highly depending upon the exports of timber and non-timber products without appropriate management. Due tothe rapid growth of population, a rising food prices, and high demand for agricultural land in developing countries, a large virgin forest area is converted to other land uses (Angelsen & Kaimowitz, 1999). Recently, a cause of biodiversity depletion which is attracting more attention and becoming a debating issue is poverty. This is increasingly proposed to be the main cause of biodiversity reduction in low-income economies.

As good news for Laos that this country is just reclassified into the list of lower middle income, shifted up from a low-income country (World Bank, 2011). Even though economic performance is very impressive, the economic foundation of the country is still and mainly dependent on natural resources, share more than one-fourth of Gross Domestic Product (GDP), namely processing wooden products, mining, and hydro-power projects. These sectors, however, cannot considerably contribute to poverty eradication which can be seen that there is still a high number of poor people and households. From the latest household survey, almost one-fourth of Laos' population from more than 160,000 households is living under the poverty line (DOS, 2009). Since most of the poor households are living in rural and mountainous areas, their likelihoods are highly related with nature around them. With poor socioeconomic status, they have no many income choices so that they are likely to involve in the utilization of forest products, particularly non-timber forest products (NTFPs). From this perspective, poverty is considered as an invisible obstacle of either socioeconomic development or the natural forest preservation.

The direction of the linkage between poverty and forest product uses is ambiguous. As income from forest products, particularly NTFPs, shares in total household income, the more benefit from non-timber products, the higher household income; this direction is hence very precise. On the other hand, some economists put concentration on the causal effect of poverty on forest depletion. It sounds that this linkage is still questionable, it is, however, attractive for the empirical research including the current research. Due to the absence of empirical paper about this topic, this paper tries to fulfill this shortage by using nationwide household data. The major aim of this paper is to quantify the relationship

between socioeconomic status and forest use in the margin of non-timber forest products in the case of Laos.

To address the principal objective, this paper employs the latest household data, Lao Expenditure and Consumption Survey (LECS-4), which was conducted during 2007 and 2008. The econometric model is constructed by including household, family head's and village characteristics as explanatory variables while dependent variable is per capita household income from NTFPs. The Ordinary Least Square (OLS) is initially implemented to regress dependent variable on three sets of characteristics. Thereafter, the OLS with district fixed effects is applied to control for unobserved characteristics across districts. Without appropriate control for this heterogeneity, the result estimated by the OLS may lead to biasness in parameters. The estimation results indicate that underlying independent variable, per capita household income, is a significant determinant of per capita income from NTFPs. However, there is quite different in parameters and significant independent variables estimated by the OLS with and without control for unobserved heterogeneity. This infers that different characteristics across districts do matter for the biasness of the OLS estimation. Even though the key explanatory, household income, is a powerful predictor, it is positively associated with household income from NTFPs. This unexpected result might be caused by selectivity bias because high income households are likely to gain nothing from NTFPs; they are consequently excluded from the estimation. To overcome this specification problem, the paper creates binary variable to use as new left hand side variable which equals to 1 if a household earns income from NTFPs, otherwise is 0. The finding from this estimation demonstrates that the sign of the correlation between a new dependent variable and household income becomes as expected. An increase in per capita household income can reduce the probability of gaining some income from NTFPs, ceteris paribus.

The remaining part of this paper is organized as follow: the next part presents the literature review; this part points out the different perspectives of papers have done in the past. The third part draws an overview picture of the current situation of natural resource uses and poverty eradication in Laos. Data source and Research methodology are correspondingly described in the fourth part. The empirical result with the interpretation is reported in the fifth part which includes the discussion. Concluding remark and recommendation are given in the last.

Literature Reviews

Dependence on environmental resources is jointly accepted by numerous researchers, development practitioners, and government agencies as a common likelihood of rural households in low-income countries (Mamo et al., 2007). The

direction of the association between poverty and natural resource use is widely debated among environmental economists. There are two main schools of thought that have different standing points. One school strongly believes that forest products, including NTFPs, can make a significant contribution to rural people's well-being. As income from natural resources is a part of aggregate household income, it can partially gain the agreement from another side that income from natural resources can eliminate poverty status of rural households (Mahapatra, 2005; Godoy et al., 1997).

It seems that the predominant economists argued that the causation runs from socioeconomic status, especially household income to environmental degradation. Household income and wealth are believed to adversely affect forest resources, specifically NTFPs. Gunatilake et al. (1993) found that contributions of NTFPs to incomes in Sri Lanka declined as incomes rose. Vedeld et al. (2007) investigated the impact forest environmental incomes and the rural poor. By using data from 17 countries, the finding indicated that total income is positively correlated with total forest income. Total income will increase by 0.47 percent as the further 1 percent increase in total forest income. A better non-farming employment opportunity is found to reduce forest clearance for agricultural production (Angelsen & Kaimowitz, 1999).

In the case of Nicaragua, Godoy et al. (1995) concluded that a rise in household income can lessen the importance of non-timber forest products. The explanation is given that other income sources of household in rural, namely agriculture, wage employment, and self-employment will increase relatively high to the income from environmental resources. This finding is consistent with the result of Swinton and Quiroz (2003) who suggested that the probability of engaging in the tree extraction is decreased when people have better access to financial credit and agricultural land. As the value of labor rises with increasing wealth, the opportunity cost of continuing to spend time gathering food, rather than purchasing it, becomes increasingly unattractive (Byon & Arnold, 1999). The argument is that many forest-based activities are arduous and generate low returns that can be easily dropped as alternative income become available. A number of work make an attempt to conduct a comparison of whether poor household gains more benefit from natural resources than wealthier households. By employing household data from Zimbabwe, Cavendish (2000) found a piece of evidence to conclude that poorer households are more dependent on the resources. Analogously, the same empirical result was found in the case of Peru (Escobal & Aldana, 2003).

Until the present, each school of thought sticks on its perspective to make an argument against another group that has an opposite viewpoint. Due to the absence of proper instrument variable to capture simultaneous causality, the direction of poverty-natural resources association is still mysterious. Therefore, there is no robust evidence to judge which side dominates another.

Methodology

1.1. Data Description

It is true that conducting empirical research in Laos is a challenging work due to unavailability of data. While doing research about Laos' case by employing time series data is quite complicated with low reliability, cross-section data can gain more attraction from researchers. In order to investigate the relationship between household income and natural resource dependence, particularly non-timber forest products (NTFPs), this research is performed by relying upon the cross-section data set from the Lao Expenditure and Consumption Surveys (LECSs). Due to the existence of technical assistance from the Swedish International Development Agency (SIDA) and Statistics Sweden, these nation-wide household surveys, LECSs, are broadly recognized as a high-quality survey reflecting the living standard of Lao people in various dimensions.

The series of LECSs, financially supported by the Canadian International Development Agency, are a five-year household survey which was initially conducted in the period of 1992-1993. Data from 450 villages with 8,882 households were collected in the first survey of this series. For the later surveys, LECS-2 and LECS-3, approximately 150 villages with 2,868 households and 540 villages with 8,092 households were respectively included in the surveys. The latest version of this series obtained information from 518 villages with approximately 8,300 households which are representative of the whole country, both urban and rural areas from 18 provinces.

Table 1: Number of observations in both household and village levels.

	LECS-1 (1992/93)	LECS-2 (1997/98)	LECS-3 (2002/03)	LECS-4 (2007/08)
Number of villages	450	146	540	518
Number of households	8,882	2,868	8,092	8,296

Source: Department of Statistics, Ministry of Planning and Investment (MPI)

The current paper employs LECS-4, which is the latest version of a household survey in Laos, to examine the socioeconomic status as the determinants of natural resource exploitation in a rural area. Analogous to the first three surveys, the aims of this survey are widely determined to cover the consumption and expenditure of household, investment, production, saving and other socioeconomic indicators. The survey provides a wide range of information which is essential for the assessment of Lao socio-economic development in each period of time. This survey series is drawn based on a random sample of the

population, LECS-4 collected data from the same representative village with the previous survey to make sure the comparability and 16 households were randomly selected from each representative village. The field survey was done by a number of enumerators for period 12 months from April 2007 until March 2008.

The LECS-4 contains two types of questionnaires, household, and village questionnaires. The first one includes questions about household decomposition, daily expenditure, and consumption of a household, household status, individual time allocation, etc. Another questionnaire consists of a number of questions about general economic condition in the village, production, infrastructure, health care services, wages and prices in the village.

1.2. Model Specification

There are a variety of indicators influencing on natural resource dependency, particularly non-timber forest products (NTFPs). In accordance with the literature, the following equation can be constructed and expressed:

$$NTFP = \beta + \alpha Y + \delta FC + \lambda HC + \mu VC + \varepsilon$$

In the above equation, *NTFP* is annually household income per capita from non- timber forest products; *Y* represents annually household income per capita; *FC* denotes the set of household head's characteristics variables which includes age, gender, ethnic, education of household head; *HC* denotes the set of household characteristics which has two variables, dependency rate and predicted house rental rate; *VC* stands for village characteristics, there are three variables, number of villagers, forest area, and road access to the village in wet season. α, δ, λ, and μ respectively denotes the set of parameters of explanatory variables, annual household income per capita, household characteristics, household characteristics, and village characteristics. β and ε accordingly represent the constant term and stochastic disturber. The dependent and some key independent variables were transformed into natural logarithm form; estimated parameters, therefore, can be simply interpreted as elasticity.

This paper begins with the estimation of the above equation by using Ordinary Least Square (OLS). Despite there are a number of variables considered for the inclusion in the model, some variables are unobserved and excluded in the paper. It is high possible that unobserved characteristics may be statistically associated with independent variables. For instance, district infrastructure; Households which are located in the district with good infrastructure are likely to have more sources of income and earn more than household in the district with poor infrastructure.

Moreover, due to convenient infrastructure, households can access to the market and sell their NTFPs with higher prices. If there is an existence of the possible case assumed above, the OLS may lead to an upwardbias ness. On the

other hand, there is a possible case that household living in the district with good condition of infrastructure may have less reliance on the natural resources including NTFPs due to income diversification. If the case just mentioned takes place, the parameter estimated by the OLS may be downward bias. To overcome this plausible biasness, the method of the OLS with the district fixed effects will be exploited to estimate the equation. The parameters estimated by the OLS with and without fixed effects will be compared to see the disparity. If there is a big difference from one to another, this means that unobserved district characteristics do matter for the biasness of estimation in applying the OLS without appropriate control for the omitted variables.

1.3. Variable Descriptions

Household head's characteristics

The household head is the leader of the family who is mainly responsible for taking care of the household members. There is no doubt that the characteristics of the household head have an influence on household income from various sources, particularly from a natural resource. This paper attempts to control for some characteristics of the household head, sex, age, ethnicity, and education, which may be the key determinants of income from natural resources.

It is possible that gender of family head has a significant influence on household income and decision. Due to man and woman have different characteristics, these may do matter for the level of NTFPs dependency. In this paper, dummy variable, proxies for family head whose sex is gentle, is created to control the different influence of gender on natural resource degradation. Family head who is man is believed to be able to harvest more NTFPs than who is female. Nevertheless, man-head of household is likely to have a variety source of incomes; he may be less reliant upon income from natural resource due to high opportunity cost. Therefore, the sign of correlation between income from NTFPs and sex of household head remains ambiguous.

Household head's age is expected to have a partial effect on income from non-timber products. As the requirement of physical strength, a young family head is likely to gain more benefit from natural resources than family head with higher age. In addition, as household head's age reflects his working experience affecting on his economic return, there is less incentive for experienced household head to solely rely on income from NTFPs. From these mentioned issues, there is possible to have both positive and adverse relation between age and dependent variable, age and age square of household head are included to reflect an inverted U-shape correlation.

Different ethnic groups have different characteristics and cultures which may be significantly associated with different dimensions of natural utilization. Laos is a multicultural country with different 49 ethnics acknowledged by the government (Fenton, 2010). There are a number of ethnics that are mainly

dependent on traditionally medical treatment by using natural herbs obtained from forest. To capture the influence of ethnicity on NTFP dependency, the binary variable of household head's ethnicity is definitely included in the equation. According to the data set, there are 4,221 out of 8,293 households which household head are Lao ethnic, majority group; the remaining ethnics are the baseline group.

Educational attainment of the household head in this study is categorized in 4 different groups, no formal education or primary school, junior secondary school, and senior secondary school, and higher than senior secondary school. Based on these groups, three dummy variables were generated for the completion of primary school, lower secondary school, and upper secondary school, and higher than secondary school, with reference to the baseline group (no formal educational attainment or primary school).

Household characteristics

Characteristics of household are generally recognized as a factor affecting income from natural resources, particularly NTFPs. there are four variables of household features, household income from NTFPs, household income per capita, dependency rate and richness, considered for the inclusion in the model.

The likelihood of people in rural area of Laos is highly related with nature around them. The products from natural resources have played a crucial role in supplying some basic needs, foods, shelters, and medicines, for a number of rural people. Due the presence of increasingly demand for forest products, some rural people can make a lot of income by selling both timber and non-timber forest products. This empirical research attempts to investigate the impact of socioeconomic status on the utilization of forest products mainly focusing on non-timber products. Therefore, per capita income from this source is used as dependent variable. Based on information from the household survey, average income of household in rural area from NTFPs is approximately 0.63 million Kip which is much more than average level of country in this sources. Household income per capita is an underlying independent variable in this research. This potential variable can be calculated by dividing the total household income, the summation of income earned by all household members within 12 months, by number of household members during the time of survey. Based on the fourth expenditure and consumption survey, twelve-monthly household income in rural area of Laos is on average 10 million Kip which is lower than the whole country, 14.9 million Kip; the mean of household income per capita of rural people is roughly 2.1 million while the average of country is about 3.2 million Kip. Since the hypothesis of this study is that higher income households are less reliant on

income from natural resources, particularly NTFPs, the sign of relationship between these two primary variables is expected to be negative.

Collecting NTFPs is a kind of activity which requires physical strength. Household with many adult people, who are unambiguously stronger, tends to gain more benefit from natural resources than household with many child and elderly members. From this point of view, the present paper generates a variable, called dependency rate, in order to capture the impact of age range on income from NTFPs. This variable is calculated by dividing of the summation of child and elderly members, whose age is in that order less than 10 and greater 60 years old, by number of adult members whose age ranges between child and elderly family members. The result is anticipated that there is a negative association between income from NTFPs and dependency rate implying that the more number of child and elderly household members, the less income from NTFPs.

In addition to the dependency rate of household, the wealth of the household is one of potential independent variables in the model. Richer households would tend to be less dependent on natural resources than poor households. Estimating the equation without controlling for richness of the household may produce a downward biased result because wealth is positively correlated with household income whereas it is adversely associated with income from NTFPs. To alleviate this probable omitted bias, this paper utilized a predicted rental rate of the house as a proxy for richness of the household. Based on general intuition, a higher rental rate of house implies a wealthier household.

Village characteristics

In accordance with household and family head characteristics, village explanatory variables, number of villagers, forest area, and infrastructure, are also taken in account.

Number of villagers is expected to be strongly correlated with dependent variable. As some forest area and products is a public good with characteristics of open access and non-exclusive, it is a common sense that villages with a more number of households and villagers have a tendency to decrease the share in utilization of forest products. Analogous to number of villagers, there is no doubt about the correlation between forest area and household income from NTFPs. With the assumption of larger forest area reflects its abundance; more forest area can increase household income from forest products including NTPFs. Therefore, variable of forest area are of course considered for the inclusion in the model.

With better road condition, villagers conveniently access to forest, as the result, they can collect more forest products and earn higher income from NTFPs. In addition, good infrastructure can facilitate villagers to access to market; they have more choices to sell the products, so that they can enjoy selling with a better price. On the other hand, villagers in some extent can have more opportunity to

earn income from various sources so that they may be less reliant upon natural resources. From above case in point, the sign of correlation between infrastructure variable and dependent variable can be both positive and negative.

Results and Discussions

The results of estimation by the OLS with and without district fixed effects can be seen in the table 3. In order to make a comparison between two above mentioned econometric techniques, the paper respectively gives explanation of each variable estimated by the OLS with and without the control for the characteristics across districts.

As can be seen in the first column, per capita household income is statistically significant at the 5 percent level. There is a positive correlation between income and income from NTFPs which the parameter is 0.0502; this means that 1 percent increase in per capita household income is associated with an increase in household income from NTFPs by 0.05 percent, ceteris paribus. From the result, while some characteristics of household head, sex, age, and ethnicity, do not show any influence on income from NTFPs, formal education attainment do matter for the level of income from natural resource. Household head that completed lower secondary school is likely to earn more income from NTFPs than the reference group, household head who finished primary school or unfinished any formal education. However, the negative correlation as expected between household head with higher educational attainment and income from NTFPs meaning that high education can reduce the forest dependency of household. The result implies that higher education provide more job opportunity with higher income, collecting forest products can cause higher opportunity cost of high educated household head and other members. Therefore, household with household head and other family members attained high educational level is less reliant on NTFPs.The dependency rate and richness household, represented by predicted rental rate of house, show an influence on income from natural products. Both variables are correspondingly significant at the 1 and 5 percent level. As expected Dependency rate is negatively associated with dependent variable. This is true that harvesting NTFPs is an adult's task, while more adult people in household can increase income from NTFPs, more child and elder members in household can gain less benefit from that source. Despite dependency rate is consistent with economic intuition, similar to per capita household income, the richness variable is positively correlated with dependent variable. According to the result, by holding other variables fixed, 1 percent change in predicted rental rate of house is statistically associated with on average 0.13 percent change in per capita income from NTFPs with the same direction. Although predicted rental rate of house is statistically significant, the nature of correlation between this variable and per capita income from NTFPs is still questionable. Besides the

characteristics of family head and household, the estimation result explicitly shows that the feature of the village is also the powerful determinants of income from natural resources. Three variables represent a different aspect of the village included in the model; an only number of villagers cannot explain the deviation of income from NTFPs while the number of forest area and dummy variable of infrastructure in the village can explain the change in income from NTFPs with the confidence 99 and 95 percent, respectively. The signs of two parameters are as expected; forest area in village is positively correlated with NTFPs income whereas accessible road in rainy season indicates a negative relation. With better road condition, villagers can have more opportunity to earn income from various sources so that they are less reliant upon natural resources.

Overall, there are quite different in parameters of key and controlled variables obtained from the estimation with and without controlling for heterogeneity across districts. This implicitly demonstrates that unobserved characteristics of districts can bias the result if they are not properly controlled. A sharp increase in R-square from 0.12 to 0.60 after the application of the OLS with fixed effects evidence that the later estimation is superior and preferable. However, putting highly attention only upon R-square may be an illusion and misleading (Woodridge, 2009). Carefully concentration is put on the number of observations, it is obvious that a number of the household included in the estimation rigorously dropped from more than 5,700 to 431 households in the countryside.

There is a doubt that most households included in the model are low-income households that highly rely upon NTFPs while a large number of households excluded from the model are likely to have high household income per capita that do not gain any income from natural resources, including NTFPs. If this suspicion becomes true, it is high possibility that the empirical result in table 3 may be subjective to selectivity bias. To address this potential bias, the current paper creates a new binary variable which equals 1 if household obtains income from NTFPs and otherwise equals to 0. This dummy variable will later be used as the dependent variable to estimate new equation by applying the logistic model. For the key and controlled explanatory variables in the new model remain the same as the last equation. Table 5 reports the result estimated by the logistic model, the principal result of the logistic model can be seen in the first column. Since the language of logit and odd ratio are difficult to understand, to make the result easier for the interpretation, marginal effects of each variable are computed and shown in the second column.

Unlike the last estimation results, household income is negatively associated with income from non-timber forest products (NTFPs) which is statistically significant at the 5 percent level. The parameter of this correction is -0.0288 suggesting that a 1 percent increase in household income per capita, on

average the log of odds in favor of gaining some income from NTFPs declines by 2.88 percent. From the marginal result, with a higher household income per capita by 1 percent is estimated to reduce the probability of gaining some income from NTFPs by approximately 0.3 percent, holding all other factors constant. Besides household income variable, some household head's characteristics, age, age squared, and ethnicity can significantly explain the dependent variable while sex of household head and his education are not significant. The result displays an inverted U-shape relationship between age and NTFP income as expected implying that household with a household head who is young is likely to gain some income from NTFPs, after a certain age level, an increase in age of family head, the household is likely to be less reliant on non-timber products. By the logit model, a number of villagers, area of forest land, and road condition of the village are the powerful predictors which are all significant at the 1 percent level.

Conclusion and recommendations

The interestin the fundamental linkage between natural resource degradation and household income in a rural area is growing over the years. There are two schools of thought about forest product utilization and income of the household. Some researchers believe that income from the natural resource can significantly alleviate the poverty status of a household, it seems that this is true for the case in Laos where most of the poor people living adjacent to natural resources. Since they have no many choices about source of income, their likelihood is still reliant on the abundance of the environment around them. On the other hand, another side proposes that socioeconomic status is the main cause of natural resource dependency. The primary objective of this paper is to examine whether the socioeconomic status of households ina rural area does matter for NTFPs dependency. To accomplish the ultimate aim, the present paper employs the latest nationwide household survey, Lao Expenditure and Consumption Survey (LECS-4). The survey provides a variety of data of 518 villages with more than 8,000 households which are representatives from all provinces in Laos. The paper firstly constructs a model with per capita income from NTFPs as a dependent variable and right-hand side variables include a wide range of variables representing the characteristics of household, family head, and villages. The empirical results reveal that household income per capita from both estimation methods is a statistically significant determinant of per capita income from NTFPs. The richness of the household can explain the deviation of income from NTFPs while it is statistically significant when the application of the OLS exists. Nonetheless, the sign of association between left-hand side variable and household income and wealth are not as the expectation. Dependency rate and household head's education are both powerful predictors of NTFP income, this is true not only when the OLS without fixed effects is employed but also another

estimation method. Village features, number of villagers, forest area, and infrastructure are also the important predictor of the dependent variable. In addition to the application of the OLS with and without control for unobserved heterogeneity, the present paper applies the logistic model in order to eliminate selectivity bias. The finding indicates that low-income households are likely to involve in the consumption of NTFPs. The result also shows an inverted U-shape correlation between age of household head. Similar to his age, the ethnicity of the family head can explain per capita income from NTFPs while his education is not a significant determinant as the last two estimations. It is obvious that the divergence of NTFP income can be estimated by the representative characteristics of the village included in the model, but cannot be explained by household characteristics. From the result of the logistic model, there is a piece of evidence explicitly indicating that low-income households tend to gain more benefit from a natural resource, particularly NTFPs.

Natural resource conservation is regarded as one of the potential action for sustainable development. Laos is a country that highly utilizes natural resources in different dimensions both legal and illegal ways. Natural resource, particularly non-timber forest products (NTFPs), is an important factor in eradicating poverty in a rural area. Conversely, the evidence is given in the current research that socioeconomic status of rural people also plays a crucial role in natural resource protection. In order to make natural resource in Laos, especially NTFPs, to be utilized in the sound of sustainable development, the Lao government should accelerate poverty eradication and educate people living near resource area to realize the importance of reasonable exploitation of natural resources. Additionally, forest allocation program and other preservation programs should be seriously taken action in order to ensure diversity of natural resources for long-term development.

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