RURAL LIVELIHOOD DIVERSIFICATION IN THE SOUTH CENTRAL COAST OF VIETNAM

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Abstract: *The study aims to investigate patterns and determinants of rural livelihood diversification and household income in the South Central Coast of Vietnam using a balanced panel data set by extracting from the Vietnam Household Living Standards Surveys (VHLSSs) at household and community levels in 2004, 2006 and 2008. The Simpson Index of Diversity (SID) is used to generate the extent of diversification and to quantify the contribution of the diversification of income sources to rural household income in the region. In sequence, the Tobit model is applied to investigate the determinants of SID and two stage least squares (2SLS) estimations is employed to examine the correlation between SID and household income. The descriptive statistics results show that the involvement of household in economic activities and sources of income in the region are quite diverse. There is a slight increase in income share from salary and wage associated with an increasing participation proportion in economic activities of rural household in working for wages; however, agriculture is still a key livelihood earning for almost rural households and working for wages does not seem to dramatically increase total household income. Moreover, the diversification of income sources is found to be influenced by the variables of age of household head, female head, ethnicity of household head, number of dependents, household labors as well as community infrastructures. In addition, the variables of the estimated value of SID, household labors, and average years of education of labors have positive and statistically significant effects on household income. The results imply that these factors need to be considered by policy makers for enhancing household income in the region.*

Keywords: Rural household, livelihood diversification, income, The Simpson Index of Diversity (SID), determinants, the Tobit model, the South Central Coast

1. Introduction

The South Central Coast of Vietnam consists of 6 provinces/cities (Da Nang, Quang Nam, Quang Ngai, Binh Dinh, Phu Yen, Khanh Hoa) with an area of 33,192.30 square km (accounting for 10.0% of the national area) and a population of 7,095.60 thousand people (accounting for 8.16% of the national population) (GSO 2011a). Most of the people still live in rural areas (with a rural population of approximately 66%) and participate in the primary sector. Over past decade, the South Central Coast of Vietnam achieved relatively high economic growth, improved significantly regional per capita income as well as remarkably reduced poverty rate. However, the region ranks just below the national average. For instance, in 2010 per capita income of the South Central Coast reached VND 1,162.1 thousand/person/month (equivalent to VND 14.0 million/person/year at current prices) by 0.74 compared to the Red River Delta, and only 0.54 compared to the South East) (GSO 2011b) and its poverty rate decreases from 25.2% in 2002 to 12.7% in 2010 but it is considerably higher than those of the Red River Delta and the South East (GSO 2011b).

There are substantial researches done on livelihood diversification, especially concerning in rural areas in developing countries. Generally, livelihood diversification refers to attempts by individuals and households to find new ways to raise incomes and reduce risks. In view of these outstanding issues, various empirical studies have identified the socio-economic rationale of rural livelihoods for facilitating and evaluating policies. Several empirical studies have investigated heterogeneities in livelihood strategies across regions, their association with resource management technologies, as well as the effects of agro-ecological factors, demographic and economic conditions (Evans and Ngau 1991, Barrett et al. 2000, Barrett et al. 2001, Smith et al. 2001, Block and Webb 2001, Staal et al. 2002, Josh et al. 2003, Ellis and Freeman 2004, Homewood 2005, Kristjanson et al. 2005, Tittonell et al. 2005, Lemi 2006, Kruseman et al. 2006, Iiyama 2006, Iiyama et al. 2008, Fabusoro et at. 2010). In Vietnam, there have been several studies related to household income diversification such as Minot (2003), Hoang Xuan Thanh et al. (2005), Minot et al. (2006), Bui Thi Tam (2010), Le Tan Nghiem (2010),

CIEM et al. (2013). The studies demonstrate that there is a wide range of income generating activities within agricultural sector as well as across economic sectors which is captured by rural households; crop-based agriculture still plays an important role for livelihood earnings of the poorer groups whereas wages and other off-farm employments are main source of income for the richer ones. They urge that the involvement in non-farm may not be the best option to improve household income; hence, policies and programs should aim to promote agricultural diversification and farm productivity in general.

This study aims to figure out the rural livelihood diversification and to investigate the relationship between the extent of diversification and rural household income in the region. The question remains to be answered here is: What are the main livelihood strategies being pursued by the clusters of rural households in the South Central Coast of Vietnam? In addition, what are the determinants of income diversification and household income in the South Central Coast of Vietnam? Therefore, the empirical analysis of the study will address the following hypotheses: (i) Livelihood diversification results in higher rural household income; (ii) there is gender difference in choosing the main livelihood diversification strategies; (iii) rural development programs have positive effect on livelihood diversification.

To solve the problem of unobserved variables over time and time invariant variables, we construct a balanced panel data set by extracting from the Vietnam Household Living Standards Surveys (VHLSSs) at household and community levels in 2004, 2006 and 2008 that contain around 770 households in the South Central Coast (547 households in rural and 223 households in urban). The Simpson Index of Diversity (SID) is used to generate the extent of diversification and to quantify the contribution of the diversification of income sources to rural household income in the region. In sequence, we apply the Tobit model to investigate the determinants of SID and two stage least squares (2SLS) estimations to examine the correlation between SID and household income.

This paper is structured into five sections. The second section synthesizes and

discusses the background literature. The third section introduces the methodology and the data used in the study on livelihood diversification in the rural area of the South Central Coast. The fourth section presents the empirical findings and discussions. Finally, the fifth section proposes several policy recommendations for enhancing household income in the region.

2. Literature Review

There are substantial researches done on livelihood diversification, especially concerning in rural areas in developing countries (for instance De Janvry et al. 1991, Evans and Ngau 1991, Kinsey et al. 1998, Ellis 1998 & 2000, Bryceson 1999 & 2000, Barrett et al. 2000, Barrett et al. 2001, Block and Webb 2001, Joshi et al. 2003, Ellis and Freeman 2004, Homewood 2005, Lemi 2006, Iiyama 2006, Iiyama et al. 2008, Fabusoro et at. 2010). The underlying theme is that natural, physical and social capital assets are key factors that determine livelihood options available to households.

There is a consensus in literature that livelihood is about the ways and means of 'making a living.' The most widely accepted definition of livelihood stems from the work of Chambers and Conway (1992) that defined livelihood as comprising the capabilities, assets (including both material and social resources) and activities required for a means of living. In line with the Sustainable Livelihoods Approach (SLA) (such as Chambers and Conway 1992, Carney 1998, Scoones 1998), Ellis (1999) revised the livelihood concept as "the activities, the assets, and the access that jointly determine the living gained by an individual or household". Livelihood adaptation generally means either specialisation or diversification of income sources. There are different ways that livelihood diversification can be defined. For instance, Ellis (1999) defined rural livelihood diversification as "the process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in order to improve their standards of living"; in research of Anke Nieof (2004), diversification was defined as "the process by which household construct increasingly livelihood portfolios, making use of increasingly diverse combinations of resources and assets"; Iiyama (2006)

conceptualised “diversification has been understood to be a rational response to lack of opportunities for specialisation”; according to Fabusoro (2010), diversification occurs “when a household unit produces a new product or renders a paid service without ceasing to produce any of the existing ones”. Generally, livelihood diversification refers to attempts by individuals and households to find new ways to raise incomes and reduce risks. Besides, diversification may be looked at from different perspectives, either at the macro or micro level of the economy (Ashley et al. 2003). Moreover, Ellis (1999, 2000) also emphasized that livelihood diversification is not necessarily synonymous with income diversification.

People pursue diversification as a livelihood strategy for different motivations. According to Ellis (2000), there are two reasons: necessity or choice. Necessity refers to involuntary reasons while choice refers to voluntary and proactive reasons. Most livelihood literature consider risk management, especially climatic risk as one of the most critical motivations for diversification (Evans and Ngau 1991, Bryceson 1999, Ellis 2000, Francis 2000, De Haan 2000). Barrett et al. (2001) supplemented this idea with risk reduction, realization of economies of scope, diminishing returns to factor use in any given application, response to crisis, and to overcome liquidity constraints. Béné et al. (2003) also stated that there are two interpretations of livelihood diversification. In the first interpretation, diversification is seen as a coping strategy or an involuntary response to crisis. The second interpretation is that diversification is a considerate decision of pro-active households. In this case, it is a way to reduce risk, which based on the idea of risk-spreading portfolio. For the first interpretation, diversification strategy is seen as “diversification for survival” while for the second interpretation it is seen as “diversification for accumulate” (Béné et al. 2003). The authors then conclude that diversification is both a way to survive for the poor and a way to accumulate for the richer (Béné et al. 2003). Another aspect of livelihood diversification unfolded by Davis et al (2007); that is the combination of three livelihood pathways which often enhance each other and can be operated at the same time: farming, labor and migration. Rural households can diversify in looking for a means of subsistence by doing farming and

participating in agriculture labor market or in the rural non farm economy and they might get remittances from their migratory members.

Diversification helps households to combat instability in income and thereby increases the likelihood to maintain livelihood security and reduce vulnerability. It is widely accepted that households will be beneficial from diversification. Even though it has negative outcomes, its positive effects seem to outweigh its negative ones (Ellis 2000). In reality, diversification has become an important income source in rural areas of developing countries. In Africa, Bryceson (1999 & 2000), Barrett et al. (2000), Barrett et al. (2001), Smith et al. (2001), Block and Webb (2001) pointed out that one important pathway towards livelihood sustainability involves avoidance of long-term dependency on only one or two income sources; in addition, income diversification has been shown to be positively associated not only with wealth accumulation but also with an increased ability to withstand exogenous shocks. In South Asia, Joshi et al. (2003) stated that the agricultural sector is gradually diversifying in favor of high-value commodities, namely fruits, vegetables, livestock and fish products; indeed, much of the diversification come, if at all, with only little support from the governments. From a case study in Southwestern Kenya, Freeman and Ellis (2005) found out that poorer households are engaged in strategies with low-return off-farm activities while well-off households are diversified into high-return off-farm activities. Similarly, in case study on livelihoods diversification of the Kerio River Basin community, Iiyama (2006) asserted that livelihood diversification portfolios affect income levels through economic returns involved in components of livelihood activities; hence low-return combinations of activities without much diversification yield little income, while low income does not allow households to move out of the vicious cycle of poverty traps. Moreover, in case of Ethiopia, Lemi (2006) established that participation in off-farm activities is mainly driven by demographic factors, whereas land and other asset ownership as well as crop production and income affect intensity of off-farm activities. A study conducted in Nigeria demonstrates that diversification accounted for 69.1% of household income (Fabusoro 2010). Fabusoro (2010) suggested that improving the capabilities of rural

people through capacity building, credit, and broad-based development will increase participation in non-farm income.

Since the 1990s, a number of approaches to sustainable development, such as the Sustainable Livelihoods Approach (SLA), are genuinely transdisciplinary as they are produced, disseminated and applied in the borderland between research, policy, and practice (Knutsson 2006). The SLA provides a way of breaking down the complexity of people's lives and livelihood strategies by addressing their access to a range of assets (human, social, financial, physical and natural), the way that access is affected by policies, institutions and processes, trends, seasonality and shocks (IMM 2008). The effectiveness of these strategies is assessed in terms of their effects on livelihood outcomes for different stakeholders. The SLA framework is used specifically to understand the factors supporting or inhibiting change within each of those elements of the framework and also emphasizes the many relationships between these factors. It brings out a more realistic framework for assessing the direct and indirect effects on people's living conditions than, for example, one dimensional productivity or income criteria (Krantz 2001) and a fundamental role of heterogeneous constraints and incentives determining livelihood diversification patterns (Barrett et al. 2001).

Researchers have recently explored the ways in which households diversify their livelihood strategies and aimed at facilitating and evaluating policies. Several empirical studies have investigated heterogeneities in livelihood strategies across regions, their association with resource management technologies, as well as the effects of agro-ecological factors, demographic and economic conditions (Evans and Ngau 1991, Barrett et al. 2000, Barrett et al. 2001, Smith et al. 2001, Block and Webb 2001, Staal et al. 2002, Josh et al. 2003, Ellis and Freeman 2004, Homewood 2005, Kristjanson et al. 2005, Tittonell et al. 2005, Lemi 2006, Kruseman et al. 2006, Iiyama 2006, Iiyama et al. 2008, Fabusoro et at. 2010). Some household level studies have revealed that households pursuing highly diverse strategies, usually including off-farm options, are more likely to take up new farming technologies; besides, some others at the community level have revealed skewed access to, and dependence on, communal natural resources and

infrastructures.

Some researchers use both resource endowment variables and proxies for degree of income diversification. For instance Evans and Ngau (1991) used non-farm revenue, the number of income sources and livestock asset values separately as proxies for income diversification; Bryceson (2000), Barrett et al.(2000), Barrett et al.(2001), Block and Webb (2001), Tittonell et al. (2005), and Fabusoro et al. (2010) categorized households based on resource endowments (land, labor, livestock) and other variables, such as production orientation (self-consumption vs. market orientation), main constraints faced (capital, land or labor), position in farm cycle (age of the head, family size) and main source of income. Block and Webb (2001) used the Herfindahl index, whereas Joshi et al. (2003) and Fabusoro et al. (2010) did Simpson Index of Diversity (SID) to generate the extent of diversification. In addition, Reardon and Vosti (1995) examine linkages between capital asset endowments of households and the choice of livelihood diversification strategy. Within a small area, it is probable that households are relatively homogenous in terms of natural (rainfall, temperature, vegetation) and physical (infrastructure, markets) capital asset endowments. On the other hand, they will be highly heterogeneous in terms of human (labor, skill, knowledge) and financial (land, livestock) capital asset endowments. Indeed, Freeman and Ellis (2005) and Fabusoro et al. (2010) found that poorer households lacking in education and specialized skills are constrained to diversify livelihood strategies in farm and off-farm activities. Access to social institutions and kinship networks, or social capital asset endowments, also are classified as the constraints and options of households (Ellis 1998 & 2000, Ellis and Freeman 2004).

In Vietnam, there have been several studies of household income diversification. Minot (2003) used household data extracted from the Vietnam Living Standards Surveys (VLSSs) from 1993 and 1998 to quantify the contribution of crop diversification and non-farm diversification to the growth of household income in the northern upland region by decomposing income growth into increases in crop income and increases in other income. The results demonstrated that poor households are particularly dependent on

crop income growth, while higher-income households rely more on non-farm diversification to increase their incomes (Minot 2003). Van de Walle and Cratty (2004) found a clear association between rural diversification and standards of living. Diversification in income sources helps reduce poverty, thus increasing standards of living. In addition, Minot, Epprecht, Tran and Le (2006) conducted comprehensive research on income diversification and poverty in the Northern Uplands in Vietnam. Income diversification can be decomposed into two changes such as the shift from farm-only agricultural activities to higher-value agricultural activities and the shift from agricultural activities to non-farm enterprises and wage labor (Minot et al. 2006). Recently, based on the Vietnam Access to Resources Household Surveys (VARHSs), CIEM et al. (2013) demonstrates that there are number of activities observed in the provinces and working for a wage currently plays an important but smaller role, with a lot of variation in relative importance across provinces. The households are increasingly reliant on wage-based employment outside the household; however, income-earning activities are most diversified in poor provinces (CIEM et al. 2013). This consistent with a large number of researches showing that economic development is associated with specialization. The study also points out that ethnic minorities are less likely to connect with rural labor markets, and those ethnic minority members that have jobs appear to earn significantly less income from wage labor (CIEM et al., 2013). Hoang Xuan Thanh et al. (2005) applied both qualitative and quantitative to analyze the livelihood diversification and rural-urban linkages in Vietnam's Red River Delta with two case studies, namely Ngoc Dong village-a well-known centre for rattan and bamboo craft-and Nhat village-a highly diversified agricultural production-in Ha Nam Province. Hoang Xuan Thanh et al. (2005) pointed out Nhat village relies primarily on agricultural intensification and diversification, although in combination with non-farm activities while Ngoc Dong village moves out of agriculture and engage almost exclusively in handicraft production. Besides, there are positive correlations between their recent economic development and market accesses and production linkages. Moreover, in the case of South Central Coast, Bui Thi Tam (2010) used databases of 5 consecutive VHLSSs

from 1993-2006 to examine the patterns of changes in farmer responses and poverty under the dramatic changes of new land law, trade liberalization by exercising some statistical indicators and the Hirschman-Herfindahl concentration index. The study showed that rural farm households in sub-South Central Coasts have diversified their income portfolio, in which the shift is observable across quintile household groups from farm-based income to wage and non-farm income; however, the common pattern is that the poorer households, the more they diversified their livelihood activities, but the opportunities of labor market may not benefit much for the poor households in the region (Bui Thi Tam 2010). In another case of the Mekong River Delta, Le Tan Nghiem (2010) exploited the cross-section and the panel data from 1993-2006 VHLSSs to investigate factors that drive diversification by applying the Tobit model. The empirical findings demonstrated that income diversification is strongly influenced by household labor capacity while other variables such as land or financial capacity have no significant impact (Le Tan Nghiem 2010).

3. Methodology and Data

The analytical approach of livelihood diversification in this study is basically based on a combination of the SLA framework and Ellis (1999, 2000). This approach is suitable to comprehensively examine the factors involving rural livelihood diversification patterns. In terms of definition, livelihood diversification refers to a portfolio of economic activities or employment by which household pursues to generate the income. The level of income that farm households receive in relation to those of other professional groups appears to be significantly concerned. Their relative earnings will be a major factor in determining the rate at which households leave agriculture and which resources are transferred to other operators. In addition, the literature on rural income patterns varies in its use of terms such as “non-farm” and “off-farm”. For instance, Barrett et al. (2001) explained that the basic distinctions among activities and incomes are to be made along sectoral and spatial lines. The “farm” and “non-farm” distinction revolves around sectoral classifications derived from standard national accounting

practices while the “on-farm” and “off-farm” distinction reflects the spatial distribution of activities, with “off-farm” income generated away from one’s own land (Barrett et al. 2001). In this study, we distinct “farm” or “agricultural” and “non-farm” or “non-agricultural” based on the sectoral classifications of national accounting systems (SNA). Therefore, household income includes income from agricultural (farm) and non-agricultural (non-farm), salary, wage, pension, scholarship, income from loan interest and house rental, remittances and subsidies; besides income from agricultural production comprises crop income, livestock income, forestry income, aquaculture income, and income from other agriculture-related activities (GSO 2006).

The Simpson Index of Diversity (SID) is used to generate the extent of diversification of income sources and defined as:

$$SID = 1 - \sum_{i=1}^{n} p_i^2$$

where p_i is the proportion of income source i in the total household income, and n is the sources of income.

The value of SID ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity (or infinite specialization).

We propose that how a rural household derives income from a combination of observable activities for grouping households pursuing similar livelihood diversification strategies. Several statistical indicators are employed to quantify the trends and patterns of livelihood diversification; for example, the transitions of household participation in economic activities and income structures and the SID are used to indicate the extent of diversification of income sources. In addition, the study investigates determinants of income diversification as well as household income in the South Central Coast by using the Tobit model and two stage least squares (2SLS) estimations.

In this study, two equations are estimated:

SID = f(demographic factors, human capital factors, financial factors, community factors) *(1)*

Household Income = f(SID, demographic factors, human capital factors, financial factors) *(2)*

In the equation (1), the explained variable SID ranging from 0 to 1 is estimated by using the Tobit model (Greene, 2003). This model assumes that there is a latent variable (unobservable) y^* explained by the vector of explanatory variables X. The observable variable y_i is defined to be equal to the latent variable whenever the latent variable is above left censored observations y_L and below right censored observations y_R.

$$y_i = \begin{cases} y^* \ \text{if}\, y_L < y^* < y_R \\ y_L \ \text{if}\, y^* \le y_L \\ y_R \ \text{if}\, y^* \ge y_R \end{cases}$$

$$y^* = \beta X + u_i$$

$$u_i \sim N\left(0, \sigma^2\right)$$

The unconditional expectation of y given X:

$$E(y_i \mid X) = (1 - \Phi(-X_i\beta/\sigma))X_i\beta + \sigma\phi(-X_i\beta/\sigma)$$

The log likelihood for the general model:

$$L = -\frac{1}{2}\sum_{j\in C} w_j\left[\left(\frac{y_i - \mathbf{x}\boldsymbol{\beta}}{\sigma}\right)^2 + \log 2\pi\sigma^2\right]$$
$$+\sum_{j\in L} w_j \log\Phi\left(\frac{y_{Lj} - \mathbf{x}\boldsymbol{\beta}}{\sigma}\right)$$
$$+\sum_{j\in R} w_j \log\left[1 - \Phi\left(\frac{y_{Rj} - \mathbf{x}\boldsymbol{\beta}}{\sigma}\right)\right]$$
$$+\sum_{j\in I} w_j \log\left[\Phi\left(\frac{y_{2j} - \mathbf{x}\boldsymbol{\beta}}{\sigma}\right) - \Phi\left(\frac{y_{1j} - \mathbf{x}\boldsymbol{\beta}}{\sigma}\right)\right]$$

Where Φ is the standard cumulative normal distribution, ϕ is the standard normal probability density function, and the w_j is the normalized weight of the jth observation.

In the equation (2), we employ two stage least squares (2SLS) estimations to examine determinants of household income including the estimated value of SID from the equation (1). We apply three common approaches found in panel data estimation are constant coefficients, fixed-effects and random-effects (Yaffee 2003). To reduce the effect of outliers, we take the natural logarithms of the continuous variables. Several specifications are exploited and combined with sensitivity analysis. Different statistical tests are exercised, such as the t test (or z test) for individual variable, the F test for group of variables, Hausman test for endogeneity, Hausman test for fixed or random effects.

This study mainly relies on data from the VHLSSs conducted by the General Statistics Office of Vietnam (GSO) at household and community levels. To capture the fixed-effects and random-effects, we construct a balanced panel data by extracting from the VHLSSs that contain around 770 households having the same identifications in 2004, 2006 and 2008 in the South Central Coast (547 households in rural and 223 households in urban) because sample sizes and master samples of VHLSS 2004, 2006 and 2008 differ from those of VHLSS 2010. As a result, demographic factors are a vector of characteristics including age of household head, dummy variables indicating female-headed household, ethnicity of household head and number of dependents; human capital factors are presented by years of education of household head, household labors, average years of education of household labors and the highest household's training certificate; financial factors are a vector including value of houses and land uses, value of fixed assets. We also incorporate community factors which are a vector incorporating roads, electricity, irrigation, market places as dummy variables. Summary statistics of each variable in the empirical model are described in Table 1 in Annex.

4. Empirical Results

The involvement of household in economic activities and sources of income in the South Central Coast are quite diverse. The Table 2 figures out an overview of household participation in economic activities and income shares from different sources

of households in the South Central Coast. There is a slight increase in income share from salary and wage from 36.9% in 2004 to around 40.5% in 2008 while the income share of farm activities gradually decreases from 23.3% to 20.4% during the period. In rural areas, there is a similarity in structure of rural household income with income share from salary and wage growing from 26% to around 29% associated with an increasing participation proportion in economic activities of rural household labor in working for wages from 61% to around 64% in this period (see more in Table 3). These demonstrate that agriculture is still a key livelihood earning for almost rural households and working for wages does not seem to dramatically increase total household income.

Table 2. Income shares from different sources of households in the South Central Coast

Unit: %

Year	Salary or wage	Agriculture	Forestry	Fishery	Industry	Construction	Trade	Services	Others
2004	36.9	17.4	1.2	4.7	5.5	0.2	11.0	8.5	14.5
2006	38.6	15.5	0.9	4.5	6.9	0.3	10.3	8.5	14.5
2008	40.5	16.2	1.0	3.2	4.5	0.3	9.2	8.1	17.1

Source: Author's calculation from VHLSSs 2004, 2006, 2008

Table 3. Participation in economic activities in the rural areas in the South Central Coast, 2004-2008

	% household			% income		
Economic activities	2004	2006	2008	2004	2006	2008
Farm activities	88.72	86.15	88.95	32.86	43.21	49.41
Wages and Salaries	61.11	63.76	64.08	26.20	32.12	29.03
Non-farm activities	40.91	19.83	19.86	15.30	5.43	4.88
Other activities	96.80	98.46	97.41	25.64	19.25	16.61

Source: Author's calculation from VHLSSs 2004, 2006, 2008

The structure of rural household income by economic activities presents patterns of livelihood diversification strategies. The importance of agriculture is decreasing across income quintiles during the 2004-2008 period. In 2004, about 40% of the poorest households' income comes from agriculture, around 24% from salary and wage, 8.4% from non-farm activities, and nearly 27% from other activities. These figures are 43.6%, 14.6%, 4% and 37,5% in 2008, respectively. For the middle group in 2004, about 31% of household income is from agriculture, 26% from salary and wage, 20.5% from non-farm

activities. These figures in 2008 are 51%, 33% and 6%, respectively. For the richest group, only 16.5% of their income comes from agriculture, about 33% is from salary and wage and 23% from other activities in 2004 but these figures significantly change in 2008 with 46% from agriculture, around 37% from salary and wage, 3% from non-farm activities (see more in Table 4). The common trend is that the richer the households, the less dependent they are on agriculture and the higher income is from wage and non-farm activities. These findings explain rural households tend to engage in non-farm employment to utilize seasonal idle time and to improve their earnings.

Table 4. Structure of rural household income in the South Central Coast by income quintiles, 2004-2008

Unit: percent

Quintile	Year	Farm activities	Wages and Salaries	Non-farm activities	Other activities
Poorest	2004	41.25	23.61	8.41	26.73
	2006	39.42	15.27	4.59	40.72
	2008	43.62	14.57	3.97	37.47
Poor	2004	33.39	30.97	17.17	18.47
	2006	47.89	31.04	7.01	14.06
	2008	52.56	32.77	5.10	9.57
Middle	2004	30.68	25.84	20.53	22.95
	2006	46.66	38.00	5.31	10.03
	2008	50.89	33.28	6.00	9.84
Rich	2004	28.27	31.11	15.23	25.39
	2006	42.70	37.39	5.78	14.13
	2008	52.44	33.20	5.24	9.12
Richest	2004	16.52	15.03	23.14	45.31
	2006	31.50	46.72	2.46	19.32
	2008	46.23	37.42	3.29	13.05

Source: Author's calculation from VHLSSs 2004, 2006, 2008

The Table 5 indicates the livelihood pattern in the South Central Coast that the poorer households the more income sources they have. The Simpson Index of Diversity tends to decrease when the household income is higher. This means the poor tends to be more diversified, whereas the richer seems to be more specialized.

Table 5. The Simpson Index of Diversity (SID) and annual household income by income quintiles, 2004-2008

	SID			Household Income (thousand VND)		
Quintile	2004	2006	2008	2004	2006	2008
Poorest	0.51	0.34	0.36	7914.94	6808.52	10244.96
Poor	0.52	0.48	0.47	16478.81	15421.77	22761.78
Middle	0.54	0.50	0.49	23688.26	22382.37	34302.87
Rich	0.52	0.48	0.52	35311.54	32653.82	51165.86
Richest	0.41	0.40	0.44	83257.89	86775.55	99099.54
Average	**0.51**	**0.45**	**0.46**	**24735.14**	**25489.78**	**36105.60**

Source: Author's calculation from VHLSSs 2004, 2006, 2008

Initially, we apply the Tobit regression to investigate the determinants of SID. The result with sensitivity analysis for the region presents in Table 6 in Annex. The result reveals that sigma_u and sigma_e are statistically significant at 1 percent. This shows that the models have good fit to the data. However, the estimated coefficients of the variables *Age of household head*, *Ethnicity of household head*, *Number of dependents, Household labors* are not statistically significant at 10%.

Next, we separately examine the determinants of SID for urban and rural areas as shown in Table 7 in Annex and Table 8. Estimated results demonstrate that the variables *Age of household head*, *Female head, Ethnicity of household head*, *Number of dependents, Household labors* have statistically significant effects on diversification of income sources in rural areas while they do not in urban areas. In addition, the estimated coefficients the variables *Roads for car, National electricity, Irrigation system* are positive and statistically significant at 10% (see Table 8).

Table 8. Maximum Likelihood Estimates of Tobit Regression for SID in rural areas

Explanatory Variables	*Explained variable: SID*							
	Pooled estimator				Panel estimator (Random effects)			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Age of household head	0,003**	0,004***	0,006***	0,005**	0,003**	0,004**	0,005**	0,004*
	(0,001)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)
Female head =1	-0,099***	-0,100***	-0,082**	-0,065*	-0,108***	-0,106***	-0,084*	-0,060
	(0,027)	(0,030)	(0,037)	(0,036)	(0,033)	(0,036)	(0,043)	(0,042)
Years of education of household head	0,001	0,011	0,005	0,002	-0,001	0,008	0,007	0,003
	(0,003)	(0,007)	(0,008)	(0,007)	(0,004)	(0,007)	(0,008)	(0,008)
Ethnicity of household head (Kinh=1)	-0,061	-0,041	-0,082	-0,053	-0,054	-0,036	-0,096	-0,076
	(0,042)	(0,043)	(0,068)	(0,068)	(0,052)	(0,053)	(0,076)	(0,076)
Number of dependents		-0,004	-0,009	-0,006		-0,005	-0,011	-0,007
		(0,010)	(0,011)	(0,011)		(0,011)	(0,013)	(0,012)
Household labors		-0,014	-0,021	-0,019		-0,007	-0,011	-0,008
		(0,014)	(0,017)	(0,016)		(0,015)	(0,018)	(0,017)
Average years of education of household labors		-0,023*	-0,011	-0,009		-0,019	-0,011	-0,009
		(0,013)	(0,015)	(0,015)		(0,013)	(0,016)	(0,015)
Highest		0,008	0,006	0,007		0,005	0,004	0,005

household's training certificate		(0,008)	(0,009)	(0,009)		(0,008)	(0,009)	(0,009)
Value of fixed assets (in logarithms)			-0,025***	-0,026***			-0,023***	-0,023***
			(0,008)	(0,008)			(0,008)	(0,008)
Value of houses and land uses (in logarithms)			0,001	-0,001			0,004	-0,000
			(0,017)	(0,017)			(0,016)	(0,017)
Roads for car = 1				0,026				0,025
				(0,024)				(0,019)
National electricity=1				0,527***				0,506***
				(0,138)				(0,147)
Irrigation system = 1				0,047**				0,055**
				(0,024)				(0,023)
Inter-commune market =1				-0,028				-0,007
				(0,028)				(0,030)
_cons	0,368***	0,368***	0,713***	0,215	0,377***	0,383***	0,673***	0,211
	(0,068)	(0,078)	(0,183)	(0,224)	(0,084)	(0,094)	(0,196)	(0,241)
/sigma_u	0,210***	0,209***	0,197***	0,190***	0,163***	0,161***	0,137***	0,129***
	(0,008)	(0,008)	(0,009)	(0,008)	(0,011)	(0,011)	(0,014)	(0,014)
/sigma_e					0,134***	0,134***	0,143***	0,140***
					(0,007)	(0,007)	(0,009)	(0,009)
Number of observations	396	396	282	282	396	396	282	282

*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses*

And then, we employ two stage least squares (2SLS) estimations to examine determinants of *Household Income* including *the estimated value of SID* applying constant coefficients, fixed-effects and random-effects. Table 9 provides the estimates result with sensitivity analysis for rural areas. We also test some assumptions in the random-effects models by using Hausman test for fixed or random effects (Table 10, Table 11 and Table 12 in Annex). The Hausman test shows that the difference between the estimated coefficients of random effects and fixed effects are not systematic; hence, the random effects model is selected. The estimated coefficients of the variables *the estimated value of SID*, *Household labors*, *and Average years of education of household labors* are positive and statistically significant at 1% to *Household Income*, but not statistically significant for urban areas (see Table 9).

Table 9. The two-stage least squares (2SLS) estimation for determinants of Household income in rural areas

Explanatory Variables	*Explained variable: Household Income* (in logarithms)		
	Pooled estimator	**Panel estimator (Random-effects)**	Panel estimator (Fixed-effects)
Estimated value of SID	4,271***	**3,838*** **	-0,568
	(0,688)	**(0,737)**	(2,935)
Household labors	0,222***	**0,232*** **	0,406**
	(0,063)	**(0,066)**	(0,167)
Average years of education of household labors	0,157***	**0,142*** **	-0,178
	(0,044)	**(0,047)**	(0,147)
Highest household's training certificate	-0,073**	**-0,070***	-0,004
	(0,036)	**(0,037)**	(0,076)
Value of fixed assets (in logarithms)	0,065*	**0,057**	-0,014
	(0,035)	**(0,036)**	(0,074)
_cons	6,275***	**6,638*** **	10,823***
	(0,667)	**(0,703)**	(2,172)
Number of observations	281	**281**	281

*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses*

As a result, we can make several interpretations from these empirical models.

First, demographic, human capital and financial factors have various effects on diversification of income sources in rural areas. In terms of demographic factors, the older the household heads tend to decide to diversify their income sources; however, the female heads are likely to obtain fewer economic activities for their households. The households have a tendency toward specialization when the households have more labors, a higher educational level and a greater value of fixed assets.

Second, the economic infrastructure such as roads for car, national electricity, irrigation system drives the diversification of income sources and then positively affects rural household incomes.

Third, there is a positive association between the household income and the extent of diversification of income sources. The empirical finding explicates rural households search for non-farm activities to improve their incomes.

Fourth, human capital factors such as household labors and the education level of labors have positive effects on household incomes. This implies that the labors with higher education are better in decision making ability to participate in activities and earn better income.

In conclusion, this study mainly relies on data from VHLSSs in 2004, 2006 and 2008. In the fact that, there are a lot of missing values of the explanatory variables and all community factors are dummy variables; therefore, the statistical consistency of the empirical results considerably takes into account.

5. Policy Implications

Based on the findings, several policy recommendations are proposed for enhancing household income in the region.

First, households need to be acquainted with educational and training programs (formal and non-formal) in order to improve skill and knowledge of rural household labors.

Second, central and local governments should continuously reform economic institutions on land policy, property rights and rural credit to encourage households to accumulate lands and to invest in fixed assets for large scale-farms and small and medium businesses in order to create more off-farm and non-farm employment in rural areas.

Third, it is crucial that central and local governments promote and improve the effectiveness of National Target Program on New Rural Development especially for investment in economic infrastructure as well as enhance the participation of citizens in the process of planning and policy decisions in rural areas.

Fourth, central and local governments could establish more intensives and supports to attract private sectors to invest in agriculture and rural areas prioritizing public private partnership (PPP) projects.

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Annex

Table 1. Data summary statistics in the panel data, 2004-2008

Variables	Unit	Obs	Mean	Std. Dev.	Min	Max	Missing
Household income	Thousand VND	770	31856,4	27254,4	0	320740	0
SID	0-1	770	0,4	0,2	0	1	0
Demographic							
Age of household head	Year	770	50,5	13,9	16	94	0
Female head =1		770	0,3	0,5	0	1	0
Years of education of household head	Year	574	8,0	3,9	0	19	196
Ethnicity of household head (Kinh=1)		770	0,9	0,2	0	1	0
Number of dependents	Person	770	1,8	1,2	0	6	0
Human capital							
Household labors	Person	770	2,3	1,3	0	7	0
Average years of education of household labors	Year	698	8,5	3,3	0	20	72
Highest household's training certificate	Year	698	10,1	3,5	0	22	72
Financial							
Value of fixed assets	Thousand VND	617	2497041	8319701	0	111250000	153
Value of houses and land uses	Thousand VND	770	197984	341649	850	3000000	0
Community							
Roads for car *= 1*		770			0	1	0
National electricity=1		770			0	1	0
Irrigation system = 1		770			0	1	0
Inter-commune market =1		770			0	1	0

Source: Author's calculation from VHLSSs 2004, 2006, 2008

Table 6. Maximum Likelihood Estimates of Tobit Regression for the Simpson Index of Diversity

Explanatory Variables	*Explained variable: SID*							
	Pooled estimator				Panel estimator (Random effects)			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Age of household head	0,001	0,001	0,004*	0,003	0,001	0,001	0,003	0,002
	(0,001)	(0,001)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)	(0,002)
Female head =1	-0,093***	-0,082***	-0,063*	-0,052	-0,103***	-0,096***	-0,071*	-0,059
	(0,023)	(0,025)	(0,035)	(0,035)	(0,029)	(0,030)	(0,041)	(0,041)
Years of education of household head	-0,014***	-0,003	0,008	0,006	-0,013***	-0,004	0,007	0,006
	(0,003)	(0,006)	(0,008)	(0,008)	(0,003)	(0,006)	(0,008)	(0,008)
Ethnicity of household head (Kinh=1)	-0,060	-0,041	-0,039	-0,000	-0,051	-0,034	-0,072	-0,047
	(0,044)	(0,045)	(0,071)	(0,072)	(0,054)	(0,054)	(0,082)	(0,083)
Number of dependents		0,001	-0,006	-0,004		0,000	-0,007	-0,005
		(0,010)	(0,012)	(0,012)		(0,010)	(0,013)	(0,013)
Household labors		-0,012	0,002	0,001		-0,015	0,005	0,005
		(0,012)	(0,016)	(0,016)		(0,013)	(0,017)	(0,017)
Average years of education of household labors		-0,026**	-0,017	-0,017		-0,023**	-0,022	-0,021
		(0,011)	(0,015)	(0,015)		(0,010)	(0,016)	(0,015)
Highest household's training certificate		0,013*	0,007	0,009		0,012*	0,008	0,009
		(0,007)	(0,009)	(0,009)		(0,007)	(0,009)	(0,009)
Value of fixed assets (in logarithms)			-0,021***	-0,023***			-0,018**	-0,018**
			(0,008)	(0,008)			(0,008)	(0,008)
Value of houses and land uses (in logarithms)			-0,059***	-0,053***			-0,035**	-0,041***
			(0,015)	(0,016)			(0,015)	(0,016)
Roads for car = 1				-0,008				0,019
				(0,027)				(0,020)
National electricity=1				0,575***				0,524***
				(0,168)				(0,180)
Irrigation system = 1				-0,006				0,019
				(0,026)				(0,024)
Inter-commune market =1				-0,064**				-0,024
				(0,033)				(0,035)
_cons	0,531***	0,513***	1,284***	0,728***	0,519***	0,509***	1,054***	0,611**
	(0,067)	(0,078)	(0,174)	(0,237)	(0,082)	(0,093)	(0,194)	(0,259)
/sigma_u	0,233***	0,232***	0,228***	0,223***	0,187***	0,186***	0,178***	0,173***

	(0,007)	(0,007)	(0,009)	(0,009)	(0,010)	(0,010)	(0,014)	(0,014)
/sigma_e					0,140***	0,139***	0,146***	0,145***
					(0,006)	(0,006)	(0,009)	(0,009)
Number of observations	574	574	359	359	574	574	359	359

*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses*

Table 7. Maximum Likelihood Estimates of Tobit Regression for SID in urban areas

Explanatory Variables	*Explained variable: SID*					
	Pooled estimator			Panel estimator (Random effects)		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Age of household head	-0,002	-0,003	-0,009	-0,003	-0,002	-0,005
	(0,002)	(0,003)	(0,007)	(0,003)	(0,004)	(0,008)
Female head =1	0,001	-0,007	-0,001	-0,018	-0,025	0,054
	(0,038)	(0,041)	(0,089)	(0,046)	(0,049)	(0,097)
Years of education of household head	-0,010**	-0,015	0,002	-0,008	-0,012	0,006
	(0,004)	(0,010)	(0,022)	(0,005)	(0,010)	(0,024)
Ethnicity of household head (Kinh=1)	-0,100	-0,105	-0,201	0,031	-0,000	-0,114
	(0,232)	(0,232)	(0,295)	(0,185)	(0,182)	(0,300)
Number of dependents		0,004	0,003		0,004	0,020
		(0,019)	(0,042)		(0,022)	(0,042)
Household labors		-0,004	0,054		-0,025	0,045
		(0,022)	(0,042)		(0,024)	(0,044)
Average years of education of household labors		-0,013	0,005		-0,020	-0,020
		(0,016)	(0,040)		(0,016)	(0,041)
Highest household's training certificate		0,022*	0,005		0,028**	0,006
		(0,012)	(0,025)		(0,013)	(0,025)
Value of fixed assets (in logarithms)			-0,034*			-0,008
			(0,020)			(0,019)
Value of houses and land uses (in logarithms)			-0,058			-0,030
			(0,047)			(0,042)
_cons	0,508**	0,489*	1,739***	0,401*	0,401	0,922
	(0,259)	(0,273)	(0,634)	(0,230)	(0,250)	(0,626)
/sigma_u	0,230***	0,228***	0,276***	0,182***	0,183***	0,240***
	(0,013)	(0,013)	(0,026)	(0,020)	(0,020)	(0,036)
/sigma_e				0,144***	0,140***	0,138***
				(0,012)	(0,012)	(0,024)
Number of observations	178	178	77	178	178	77

*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Standard errors are in parentheses*

Table 10. Hausman test random-effects vesus fixed effects for the South Central Coast

Explanatory Variables	Coefficients		(b-B)	sqrt(diag(V_b-V_B))
	(b)	(B)		
	Fixed	Random	Difference	S.E.
Estimated value of SID	-0.3094	4.5597	-4.8690	3.5211
Household labors	0.1607	0.2049	-0.0442	0.1875
Average years of education of household labors	-0.1378	0.1409	-0.2787	0.1439
Highest household's training certificate	0.0595	-0.0669	0.1264	0.0834
Value of fixed assets (in logarithms)	0.0079	0.0289	-0.0209	0.0826
Test: H0: difference in coefficients not systematic				
chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 4.72				
Prob>chi2= 0.4510				

Table 11. Hausman test random-effects vesus fixed effects for urban areas

Explanatory Variables	Coefficients		(b-B)	sqrt(diag(V_b-V_B))
	(b)	(B)		
	Fixed	Random	Difference	S.E.
Estimated value of SID	-4.9146	5.0529	-9.9675	16.6298
Household labors	-1.0414	0.2053	-1.2466	0.9750
Average years of education of household labors	-0.6206	0.2896	-0.9103	0.5701
Highest household's training certificate	0.7609	-0.1350	0.8959	0.4785
Value of fixed assets (in logarithms)	0.1347	-0.1256	0.2603	0.4305
Test: H0: difference in coefficients not systematic				
chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 5.5				
Prob>chi2= 0.3575				

Table 12. Hausman test random-effects vesus fixed effects for rural areas

Explanatory Variables	Coefficients		(b-B)	sqrt(diag(V_b-V_B))
	(b)	(B)		
	Fixed	Random	Difference	S.E.
Estimated value of SID	-0.5682	3.8381	-4.4063	2.9074
Household labors	0.4065	0.2317	0.1748	0.1571
Average years of education of household labors	-0.1778	0.1421	-0.3199	0.1426
Highest household's training certificate	-0.0041	-0.0700	0.0659	0.0687
Value of fixed assets (in logarithms)	-0.0141	0.0567	-0.0708	0.0663
Test: H0: difference in coefficients not systematic				
chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 7.48				
Prob>chi2= 0.187				