Why is ethnic minority poverty severe? The case of rural Vietnam

Abstract: In Vietnam, poverty is prevalent and extreme severe among rural ethnic minorities (REM). This study employs binary and fractional logit models to investigate the determinants of poverty and the poverty intensity of the REM. Data are obtained by combining the 2012, 2014, and 2016 Vietnam Household Living Standards Surveys.

The results show that both household and commune-level factors affected the likelihood and intensity of poverty of the REM. Among the household-level factors, education, wage-paying employment, housing conditions, and domestic remittances reduce poverty and its intensity. Poverty incidence reduction also hinges on development programmes on credit and scholarships. The likelihood and shortfall of poverty declined for households residing in the Red River and Mekong Deltas, and in southeast Vietnam. However, language barriers, farm size and overseas remittances influenced the poverty intensity but not the likelihood of poverty.

At the commune level, the availability of high schools, paved roads, and production units contributed to poverty reduction. Additionally, limited access to the district hospital or post-office widened the poverty gap, although with no statistically significant impact on the likelihood of poverty. Our results suggest that previous studies using only logit models have neglected several influences of poverty intensity, which the current research overcomes.

Keywords: Ethnic minorities, poverty, poverty intensity, real per capita expenditure, fractional logit model, binary logit model.

Subject classification codes: I32, I31, and I38

Word count: 9503

1. Introduction

Over the past 30 years, Vietnam has achieved substantial progress in its socio-economic development and poverty alleviation (Glewwe et al., 2004; the World Bank (WB), 2018). The national poverty headcount ratio reduced significantly during the period of 1993 – 2016, from

58.1% to 9.8% (General Statistics Office of Vietnam (GSO), 2018). Despite the nation's success in poverty alleviation, many ethnic minority households still live below the poverty line. This fact has prompted the government to launch poverty reduction programmes. Although they have received substantial national and international assistance, these anti-poverty programmes have not been particularly effective, in part, because they do not meet the ethnic minority's needs (Bui et al., 2017; Nguyen et al., 2017; Van de Walle & Gunewardena, 2001). As a result, the poverty headcount ratio remains exceptionally high (44.6% in 2016) among the ethnic minority group. In short, many ethnic minority households live in persistent poverty (GSO, 2018). Moreover, the ethnic minorities' poverty gap[1] is more severe than that of the ethnic majority. In 2016, the ethnic minorities' poverty gap was 13.5% compared with only 0.5% for the ethnic majority.[2]

Scholars studying ethnic minority poverty in Vietnam have identified determinants related to location, and socio-economic and cultural characteristics. Specifically, ethnic minority poverty is distributed unevenly across Vietnam; it is associated with the uneven distribution of social and economic resources (Baulch et al., 2010; Baulch & Masset, 2003; Imai et al., 2011). Ethnic minority poverty is often more prominent in disadvantaged geographic locations like rural, remote and steep upland areas (Epprecht et al., 2011; Imai et al., 2011; WB, 2009). Scholars have tended to focus on the Midlands and Northern Mountains (MNM), Northern and Coastal Central (NCC), and Central Highlands (CH) of Vietnam because they are the poorest regions, with the highest levels of poverty (Nguyen et al., 2017; Pham et al., 2003; Tran, 2016). Unique characteristics associated with ethnic minority communes, such as an inability to speak Vietnamese or religious obligations, are considered barriers to their participation in national economic expansion and poverty reduction programmes (Baulch et al., 2010; Nguyen et al., 2017; Vasavakul, 2003).

This paper explores the determinants of poverty in relation to ethnic minorities in Vietnam. In particular, the study uses a binary logit regression model to test the factors that determine the likelihood of ethnic minority poverty. As poverty is concentrated and more pronounced in rural areas where there are more ethnic minority communes (Hinsdale et al., 2013; WB, 2018)[3], the paper focuses on this group: Rural ethnic minorities or REM for short. Although a large number of studies have identified characteristics of poverty, there are very few comprehensive studies on poverty in rural ethnic minority households in Vietnam. This study explores the social problems that accompany poverty at individual, household, commune and regional levels. We also examine the effectiveness of programmes designed to help ethnic minorities: the study uses various empirical models to assess the credit, scholarship, pension and free healthcare programmes.

A binary logit regression model can estimate only the likelihood that a household is poor. It cannot estimate the effects of various factors on the poverty gap (an indicator that shows how poor the poor are). The poverty headcount ratio is the most commonly used measure to determine the proportion of poor people residing in an area. Whereas two areas may have the same poverty headcount ratio, the total cost of lifting all the poor up to the poverty threshold may vary in different regions. The poverty headcount ratio does not include information about the poverty gap, or how far below the poverty line an individual's spending falls (Foster et al., 1984). This gap is the intensity of the poverty (known as the poverty intensity); governments need this information to determine how much funding to allocate for poverty elimination. Rodgers and Rodgers (2000) claim that most empirical studies of poverty in Australia and other countries lack evidence of poverty intensity. Moreover, very few studies have attempted to model poverty intensity. For example, Osberg and Xu (1999) did not model the influences of poverty intensity in Canada. They note only that poverty intensity is increasing because of decreased social assistance. Others, who modelled poverty intensity, do not go far enough. For

example, Bhaumik et al. (2006) provide empirical evidence of the determinants of poverty intensity in Kosovo, but do not examine some key determinants such as access to infrastructure. Likewise, Tran et al. (2015) provide some initial evidence of the determinants of poverty intensity in Northwest Vietnam, but ignore language barriers, remittances, and government support. To overcome this limitation, we determines the poverty intensity of the REM in Vietnam using a fractional logit model that is the most appropriate approach for estimating a fractional outcome variable (Papke & Wooldridge, 1996).

Our study differs from prior research in two respects. First, we examines the determinants of poverty and poverty intensity in a middle-income country for the year 2009. In 2010, Vietnam implemented an updated the GSO-WB poverty monitoring system, based on the Vietnam Household Living Standards Survey (VHLSS), and a new method for measuring poverty (Dang, 2011; Gibson et al., 2017). In 2010, the GSO designed a new sample frame for the VHLSS. This frame was based on a list of interviewed communes from the 2009 Housing and Population Census (HPC) (Hinsdale et al., 2013). As a result of the 2010 VHLSS findings, a new poverty line was calculated. The government also updated and improved the spatial cost-of-living indexes (Scolis). Before 2010, the VHLSSs used regional consumer price indexes (CPI) that provide inaccurate results when measuring spatial differences in living costs[4] (Gibson et al., 2017; Hinsdale et al., 2013). This study is based on poverty measures that are calculated from real per capita household expenditure converted by the Scolis. Economic well-being and poverty measures enable a consistent comparison of these indicators over different times and regions. Secondly, the study merged three national surveys to generate a bigger study sample. This provides us with more information and thus increases the model's predictive precision.

The paper is organised as follows. Section 2 describes the data used for analysis. Section 3 outlines the study's empirical methods. Section 4 provides a descriptive analysis of

the REM's expenditure, income and poverty measures. Section 5 discusses the results. Section 6 concludes the paper by outlining the policy implications of the study's findings.

2. Data

We uses data from the VHLSSs (2012, 2014, and 2016) conducted by GSO. From 2010 onwards, the surveys used different sample frames and consumption calculations to reflect changes in living standards and poverty rates. The VHLSS was designed to systematically collect data related to the living standards of Vietnam's population, using geographically stratified sampling (Bui & Imai, 2019). The sample selection process for the VHLSSs involves three-stages. The first stage involves selecting which communes to sample. In the second stage, organisers choose three enumeration areas (EAs) from within each selected commune. However, only one EA is used for each national survey. In the third stage, three households within the selected EA are interviewed to obtain both income and expenditure data. Both communes and EAs are selected with probability proportionate to size, the size being the number of households according to the 2009 HPC.

GSO uses two different sets of questionnaires, each with its own purpose. Household-level data include demographic and socio-economic characteristics and information about household participation in targeted programmes. Commune data are obtained by directly interviewing commune leaders and relevant local officials. They include general characteristics of communes in rural areas; every survey year includes general information about the populace, their ethnicity(ies) and religion(s). It also summarises common economic resources, infrastructure, agricultural and non-agricultural opportunities, aid and relief programmes, and social and environmental affairs. By combining data from the three national surveys, our study obtained a sample size of 4,284 ethnic minority households living in 2,330 rural communes.

Our study analyses the REM's poverty rates and the intensity of poverty using real per capita household expenditure (RPCE). We uses expenditure because it reflects a household's actual material living standards (Mukherjee & Benson, 2003). Our study is based on the assumption that members of a single family use common family resources. These resources are shared equally among the family members, thus, each person's standard of living is similar. This assumption allows the study to use the nominal expenditure per capita data published in the VHLSSs. To generate nominal income and expenditure per capita, GSO divides nominal total household income and expenditure by household size.

However, the national surveys and the expenditure module were conducted over different time periods and in different regions. To ensure consistent comparisons over time and geography, we converted nominal household expenditure into the constant prices of January 2010 using three types of price indexes. These data were converted using three steps: (1) using the within-year monthly consumer price index (CPI) included in each database, the nominal household expenditures were converted into the constant prices of January in each survey year (Benjamin et al., 2017; GSO, 2013, 2016, 2017); Nguyen et al., 2017). The conversion excluded the price change by survey month as the number of interviewed households in each survey were allocated in different months of the year. This conversion was necessary to correct for high inflation in different years; (2) to exclude changes in prices among the three surveyed years, we used the annual CPI (with the base year, 2010, published by the WB) to adjust January prices from 2012, 2014, and 2016 into January 2010 prices (Benjamin et al., 2017); and (3) we used the Scolis index to convert expenditure and remove geographical differences associated with living costs (Gibson et al., 2017). Using these steps enabled us to generate total real household expenditure (Benjamin et al., 2017). Other monetary variables were also converted into January 2010 prices using the same conversion method. We applied cross-

sectional sampling weights (the original weights provided in each survey) to ensure the precision of the descriptive statistics and model estimations.

3. Methodology

First, the sampled REM households were divided into two groups using the expenditure poverty line developed by the GSO and the WB[5]: the rural poor ethnic minorities (RPE) and the rural non-poor ethnic minorities (RNPE). The study used three common poverty measures, developed by Foster et al. (1984), to calculate the REM's poverty headcount, intensity and severity. Next, we used a binary logit model to estimate the probability of being poor, combined with a fractional logit model to estimate the determinants of poverty intensity. The empirical models were estimated using two levels of data.

3.1. Poverty Measures

This section discusses three poverty indexes developed by Foster et al. (1984). These are, the incidence of poverty, the poverty gap and the severity of poverty. These indexes are given as

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z-Y_i}{Z}\right)^\alpha \quad (1)$$

where N is the population; Y_i represents the *i-th* household's per capita expenditure; Z is the poverty line (threshold); and q is the number of people with average per capita expenditure below the poverty line;

If $\alpha = 0$, then $P_\alpha = P_0 = \frac{q}{N}$, is the headcount index (incidence of poverty) which measures the percentage of the population living in poverty. P_0 is the most commonly-used measure of poverty because it is easily understood and simple to calculate. However, P_0 counts only the number of poor people; it does not take into account the intensity and depth of poverty

in a country or region. In other words, P_0 just classifies all individuals below the poverty line as poor; it cannot distinguish who is poorer or the poorest in that country or region.

To measure the intensity of poverty, Foster et al. (1984) developed the poverty gap index. If α = 1, then $P_\alpha = P_1 = \frac{1}{N}\sum_{i=1}^{q}(\frac{Z-Y_i}{Z})^1$, represents the "poverty gap or the depth of poverty". This index is used to measure the distance between the poor's expenditure and the poverty threshold. P_1 takes a value between 0 and 1. A larger poverty gap means more severe poverty. The non-poor have a zero poverty gap. P_1 is more effective for measuring poverty than P_0 because P_1 reflects the extent of poverty and the distribution of the poor under the poverty benchmark. P_1 can be used by states to determine how much they must spend to lift the poor out of poverty or above the poverty line. However, this measure of poverty does not consider differences in the severity of poverty because it assigns equal weight to each individual's poverty gap.

If α= 2, then $P_\alpha = P_2 = \frac{1}{N}\sum_{i=1}^{q}(\frac{Z-Y_i}{Z})^2$, represents the mean value of "squared poverty gap" of each poor person. P_2 is called "poverty severity." This indicator refers to the inequality that exists among the poor: a higher weight is assigned to those whose level of expenditure is the furthest away from the poverty line (Coudouel et al., 2002).

3.2. Binary Logit Model

Binary logit regression is employed to estimate the probability that a REM household is poor. The logit model takes the form (Tran et al., 2015) outlined below:

$$p_i = P(Y = 1|X) = \frac{Exp\,(\beta_S' X_S')}{1+Exp\,(\beta_S' X_S')} \quad (2)$$

where $p_i(Y = 1|X)$ denotes the likelihood that the *i-th* household is poor; Y is a binary outcome that has two values: 1 (a poor household) and 0 (a non-poor household); the

coefficients β'_S represents the parameters that are estimated in the model; and X'_S represents the model covariates. We estimated two logit models using both household and commune-level data. Appendix A, Tables A1 and A2 provide definitions, measurements and expected signs for the explanatory variables.

3.2.1. At the Household Level

The first logit model was estimated using household-level data. A linear function of the covariates in equation (2) is presented as follows:

$$\beta'_S X'_S = \alpha + \sum_{h=1}^{H} \beta_h \, HHH_{ih} + \sum_{j=1}^{J} \gamma_j \, HHC_{ij} + \sum_{l=1}^{L} \lambda_l \, REG_{il} \quad (3)$$

HHH_{ih}, HHC_{ij}, and REG_{il} are the household head, household, and regional characteristic vectors, respectively. We used common variables to analyse the determinants of poverty: age, gender, education, employment, marital status, living conditions, and assets. Regional dummies were used to control for the spatial impact of unobserved regional characteristics on the poverty of ethnic minorities. In addition, our study added ethnic minority languages (a unique REM characteristic), to the models to assess how language barriers contribute to poverty. To evaluate the efficiency of public resources allocation for the development of the REM, the study used free health insurance, scholarships, pensions and credit. Apart from employment, income from family members living overseas can help to reduce poverty (Acharya & Leon-Gonzalez, 2012); thus, we added both domestic and overseas remittance variables into equation (3). Finally, the interview year was used to control for unobserved characteristics in each year.

The notations H, J, and L refer to the total number of covariates representing the household head, household, and regional characteristics, respectively; β, γ, and λ represent the

vector of coefficients for the household head, household, and regional characteristics, respectively.

The selected independent variables in the logit model were based on the WB (2009) guidelines and previous empirical studies which show likely exogenous determinants of poverty. However, we did not not address potential endogeneity among covariates; for example, the relationship between remittances and education or between the preferential credit programme and durable assets (Adams & Page, 2005; Wade & Giang, 2009). To address the endogeneity concerns, the study might need to find instrument variables which strongly relate to the potentially endogenous regressor and affect only the outcome variable through the potentially endogenous explanatory variables. However, this was not the study's primary objective. Instead, the primary objective was to examine the influences of the likelihood and intensity of poverty of the REM. As a result, the study identifies the main proximate causes of poverty. To control for effects of development programmes, the logit model in equation (2) was estimated first with, and then without, the four variables related to development programme variables. After excluding the four variables, the logit model was estimated without the domestic and overseas remittance variables. The purpose of this process was to test whether there was a correlation between remittances and other explanatory variables in the models.

3.2.2. At the Commune Level

The second logit model was estimated using commune data to avoid potential correlation between household and commune-level variables. A linear function of the covariates at the commune level in equation (2) is presented as follows:

$$\beta_S' X_S' = \alpha + \sum_{k=1}^{K} \delta_k \, COM_{ck} \quad (4)$$

$\mathrm{COM_{ck}}$ are vectors of the commune characteristics that include commune geography, religions natural calamity, population density, infrastructure, irrigated cropland, non-farm

employment opportunities, and interview years; K refers to the total number of covariates representing the commune characteristics; δ represents the vector of coefficients for the commune characteristics.

The models in equation (2) used sample survey data from the VHLSSs with multi-stage stratified sampling. We applied the pseudo-maximum likelihood approach to estimate the model parameters in the logit model, incorporating sampling weights (Archer et al., 2007; Smith et al., 1989).

3.3. Fractional Logit Model

The study identifies the factors that influence the REM's poverty gap using the fractional logit model suggested by Papke and Wooldridge (1996). As the poverty gap is a fractional outcome variable, we employed a nonlinear function to estimate the expected values of the poverty gap conditional on a vector of covariates:

$$\mathrm{E}(\mathrm{Y}_i|X_i) = G(\beta'_{\mathrm{S}}\mathrm{X}'_{\mathrm{S}}) \tag{5}$$

where Y_i is the poverty gap of the *i-th* household in the REM sample; $0 \leq \mathrm{Y} \leq 1$; the coefficients β'_{S} are estimated parameters in the model and X'_{S} represents the predictor variables; $G(\beta'_{\mathrm{S}}\mathrm{X}'_{\mathrm{S}})$ indicates the logit cumulative distribution function of poverty intensity, expressed by $P_i = P\{\mathrm{Y}_i = 1|X_i; \beta\}$, and $\mathrm{Y}_i \in [0,1]$. Therefore, the model can be specified as follows:

$$\mathrm{E}(\mathrm{Y}_i|X_i) = \frac{\mathrm{Exp}\,(\beta'_{\mathrm{S}}\mathrm{X}'_{\mathrm{S}})}{1+\mathrm{Exp}\,(\beta'_{\mathrm{S}}\mathrm{X}'_{\mathrm{S}})} \tag{6}$$

With regards to the fractional outcome variable (poverty intensity), we chose not to use OLS and binomial logit regression because neither are suitable (Papke & Wooldridge, 2008). OLS estimation does not guarantee an accurate prediction with values lying between 0 and 1. The log-odds ratio approach requires that values are either 0 or 1. The fractional logit model

can deal with the shortcomings of OLS and log odds approaches and model a proportional outcome. This model can be distinguished from the binary logit model that defines Y with only two values: 0 and 1. The maximum likelihood method cannot yield robust estimates for $E(Y_i|X_i)$ since it cannot overcome the distributional failure (Papke & Wooldridge, 1996). Therefore, we use the quasi-likelihood method to estimate the parameters in the fractional logit model.

According to Bhaumik et al. (2006), the factors that determine the poverty intensity are similar to those that affect the probability of poverty. Therefore, we estimated two fractional logit models using both household and commune-level data.

4. Living Standards and Poverty in Rural Ethnic Minority Communities

The result shows that rural poverty is worse for the ethnic minorities than for the majority. These results are based on three measures of poverty. Table 1 shows that the 2012 poverty headcount ratio for the REM was 60.97%, substantially higher than their majority counterparts (who had a poverty headcount ratio of 12.85%). The poverty incidence decreased for both groups from 2012-2016 whereas the speed of poverty alleviation for the REM was slower than for the majority. From 2012-2016, the average poverty reduction rate was approximately 4.5% for the REM compared with 13% for the majority. The same patterns were identified for the depth and severity of poverty. The RPE exhibited a consistently higher poverty gap ratio than the majority poor. In 2016, the RPE's poverty gap was 14.28% compared with 0.72% for the poor majority.

Table 1. Rural Poverty Measures by Ethnicity in Vietnam (2012-2016)

Year	*2012*	*2014*	*2016*	*Average*
Rural Ethnic Majority				
Headcount Ratio	12.85	8.54	4.49	-13.0
Poverty Gap Ratio	2.52	1.65	0.72	-14.3
Poverty Severity	0.77	0.5	0.19	-15.1
Rural Ethnic Minority				
Headcount Ratio	60.97	60.47	47.12	-4.5
Poverty Gap Ratio	20.07	20.15	14.28	-5.8
Poverty Severity	8.67	8.84	6.02	-6.1

Note. Estimates were adjusted for cross-sectional weights. All figures are in percentage form
Source. Author's calculation based on the VHLSS data (2012- 2016)

Table 2 shows that the REM's living standards improved over the study period. However, the poor's living standards remained substantially lower than the non-poor. The RPE's average real expenditure per capita was only 40% of the RNPE. In 2016, the RPCE of the poor was VND 5,481.5 thousand compared with VND 13,813.1 thousand for the non-poor. Consistent expenditure gaps between the RPE and the RNPE (2.5 times) indicate limited improvement in the poor's living conditions.

Table 2. Rural Ethnic Minorities' Real Per Capita Income and Expenditure (2012-2016)

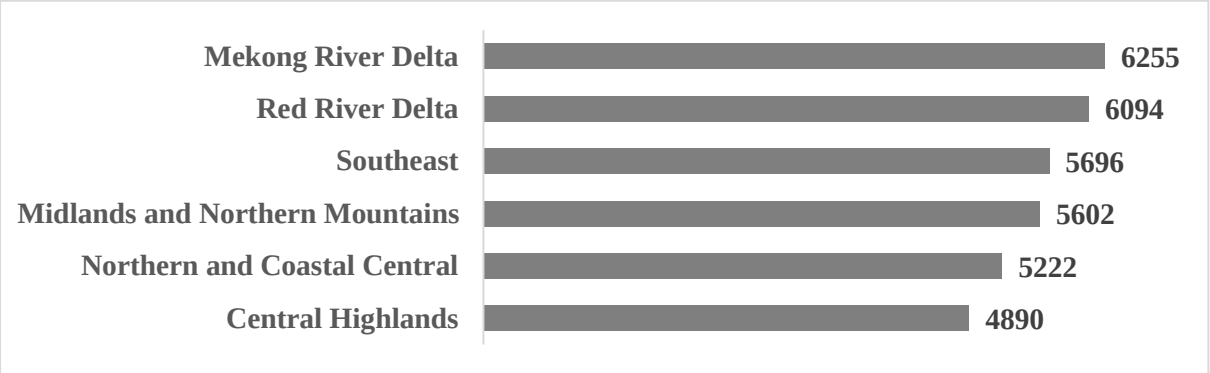
Year	*2012*	*2014*	*2016*	*Average Growth (%)*
Average Expenditure (VND 1,000)	8522.8	8440.8	9887.1	3.8
The Poor	5418.1	5367	5481.5	0.3
The Non-poor	13372.2	13142.5	13813.1	0.8
Average Income (VND 1,000)	8439.3	9094.8	10069	4.5
The Poor	5561.1	5708	5880.8	1.4
The Non-poor	12935	14275.2	13801.3	1.6
Gap between the Poor and the Non-poor				
Expenditure Gap	2.5	2.4	2.5	-
Income Gap	2.3	2.5	2.3	-

Note. Estimates were adjusted for cross-sectional weights
Source. Author's calculations based on data from the VHLSS (2012- 2016)

Figure 1 shows that among the six regions, the RPE in the CH region were the poorest households, with an average RPCE of VND 4,890 thousand during the study period. The RPE in the Mekong River Delta (MRD) had the highest RPCE (VND 6,255 thousand). The

Southeast was the most developed region in Vietnam (GSO, 2017); the RPE's RPCE was ranked third in the six regions.

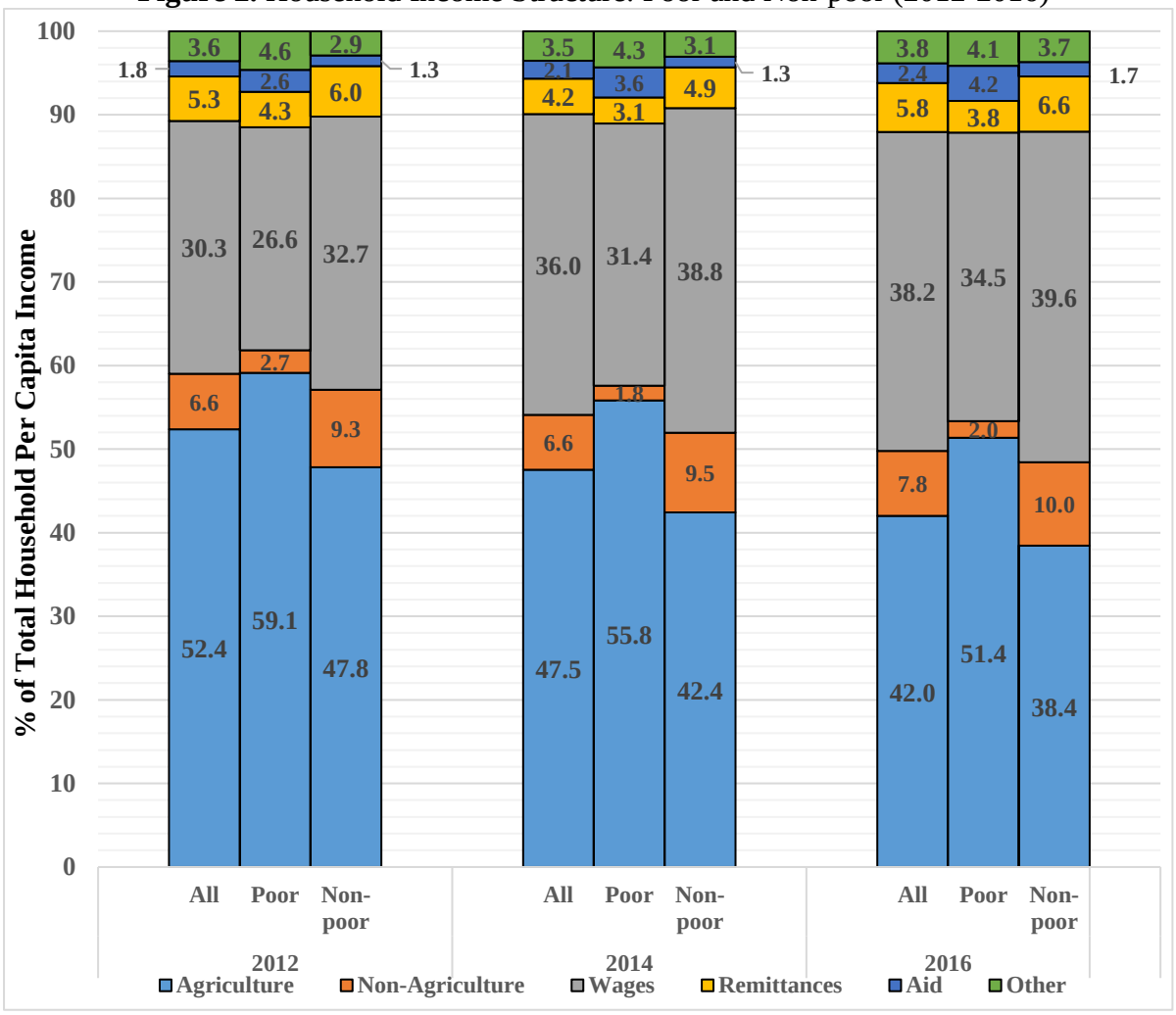
Figure 1. Real Per Capita Expenditure of the RPE in Six Regions in Vietnam (2012-2016)



Note. Per capita expenditure refers to the average per capita expenditure from 2012-2016 at January 2010 prices. All figures are in VND thousand. Estimates were adjusted for cross-sectional weights.
Source. Author's calculations using data from the VHLSS (2012-2016)

Differences in the RPCE between the two household groups are associated with variations between the two groups was approximately 2.3 to 2.5 times between 2012 and 2016. Household income was generated from six main sources (see Figure 2). The analysis reveals that the RPE depend more on agricultural income than the RNPE. Wages and non-agricultural income occupied smaller shares in the RPE's total household income than for the RNPE. Likewise, income from remittances contributed a smaller share to the RPE's total household per capita income (3.8% in 2016) than that of the non-poor (6.6% in 2016). Although the RPE's share of aid for education and healthcare was higher (4.2% in 2016) than the RNPE (1.7%), the value of aid for the RPE (VND 246 thousand in 2016) was not much higher than the RNPE (VND 236.6 thousand).[6]

Figure 2. Household Income Structure: Poor and Non-poor (2012-2016)



Source. Authors'calculations using data from the VHLSS (2012-2016)

in per capita income and income sources (Gallup, 2004). Table 2 shows that the income gap

5. Results and Discussion

For brevity, descriptive statistics for the explanatory variables in the empirical models are presented in Appendix A, Tables A4 and A5.

5.1. Impact of Household-level Factors on the REM Poverty and Intensity

The results for the model estimates in equations (2), and (6), without public assistance and remittances,[7] are similar to the full models. These results indicate that public assistance and remittances are weakly correlated with other covariates in the empirical models when using

household-level data. For this reason, we focuses on the interpretation of full model results.

5.1.1. Impact of Household-level Factors on Poverty

Table 3 shows the binary logit model results for the REM's poverty at the household level. The Wald chi-square (653.6) with a statistical significance of 0.01, shows that at least one of the explanatory variables affected the likelihood of falling into poverty. The pseudo R-squared (0.39) indicates that the binary logit model explains variations in the outcome variable (poor or non-poor households) (McFadden, 1977).[8] Specifically, the logit model was 81% successful in predicting the likelihood that a household is poor.[9] This result shows that the signs and significance levels of parameters in the logit model are identified as expected, except for employment, water sources, farm size, the free health insurance rate, and pension.

a) Household Head Characteristics. Table 3 shows that marital status had no impact on the likelihood of poverty for the REM during the study period. Similarly, our study found no evidence that female-headed households are more likely to live under the poverty line in REM communes in Vietnam. The household head's education level and age had positive effects on poverty reduction. Higher education levels and age significantly reduced the likelihood of poverty. Only wage-paying employment significantly affected the odds that the REM would be poor. Although it had a positive sign, the non-farm self-employment coefficient was statistically insignificant.

b) Household Characteristics. For demographic characteristics, the results show that household size and the number of working members were strong determinants of poverty in rural ethnic minority communes. In particular, an additional family member increased the risk of falling into poverty by 1.7%, holding other variables constant. In contrast, the proportion of working members in a household had a positive effect on poverty reduction; a 1% increase in the

Table 3. Binary and Fractional Logit Regression Model Estimations at the Household Level

Variables	*Binary Logit Model*			*Fractional Logit Model*	
	Coef.	*OR*	*AME*	*Coef.*	*AME*
Household Head Characteristics					
Age	-0.014***	0.986	-0.002	-0.008***	-0.001
Gender	-0.178	0.837	-0.024	-0.134	-0.016
Schooling Years	-0.069***	0.933	-0.009	-0.034***	-0.004
Never Married	-0.533	0.587	-0.072	-0.143	-0.018
Widowed	-0.162	0.851	-0.022	0.076	0.009
Divorced/Separated	-0.443	0.642	-0.060	0.071	0.009
Non-Farm Self-Employment	-0.231	0.794	-0.031	-0.471***	-0.058
Wage-Paying Employment	-0.564***	0.569	-0.076	-0.540***	-0.066
Household Characteristics					
Language Barrier	0.171	1.187	0.023	0.127***	0.016
Household Size	0.127***	1.135	0.017	0.128***	0.016
Working Rate	-0.013***	0.987	-0.002	-0.011***	-0.001
Living Area	-1.082***	0.339	-0.146	-0.521***	-0.064
Durable Goods	-0.931***	0.394	-0.125	-0.277***	-0.034
Tap Water	-0.296	0.744	-0.040	-0.249	-0.030
Other Water	0.727**	1.539	0.058	0.262***	0.032
Toilet_Not Flush	0.807***	2.242	0.109	0.597***	0.073
Toilet_No	0.941***	2.562	0.127	0.830***	0.101
Domestic Remittances	-0.038*	0.963	-0.005	-0.020*	-0.002
Overseas Remittances	-0.098	0.906	-0.013	-0.128***	-0.016
No Farmland	-0.401	0.670	-0.054	-0.194	-0.024
0.5 Ha <=Farm Size<1 Ha	0.115	1.122	0.016	0.007	0.001
1 Ha <=Farm Size<1.5 Ha	-0.225	0.799	-0.030	-0.134*	-0.016
Farm Size >=1.5 Ha	-0.151	0.860	-0.020	-0.184***	-0.023
Health Insurance Premiums	-0.007***	0.993	-0.001	-0.008***	-0.001
Development Programmes					
Free Health Insurance Rate	0.000	1.000	0.000	-0.003	0.000
Scholarship	-0.140**	0.869	-0.019	-0.028	-0.003
Pension	-0.068	0.934	-0.009	-0.063*	-0.008
Borrowing	-0.295***	0.745	-0.040	-0.140***	-0.017
Regional Characteristics					
Red River Delta	-1.176***	0.309	-0.158	-0.578***	-0.071
Northern and Coastal Central	0.122	1.130	0.017	0.092	0.011
Central Highlands	-0.204	0.816	-0.028	0.1431**	0.018
Southeast	-1.609***	0.200	-0.217	-0.705**	-0.086
Mekong River Delta	-1.370***	0.254	-0.185	-0.835***	-0.102
Year 2014	0.284**	1.329	0.038	0.156***	0.019
Year 2016	-0.452***	0.637	-0.061	-0.306***	-0.037
Constant	9.619***	15052.5		1.596***	
Observations	4080			4080	
Pseudo R-Squared	0.394			0.179	
Wald Chi-Square	653.56***			2359.4***	

Note. Model estimations were adjusted for cross-sectional weights. Coef.: Estimated coefficient**.** OR: Odds ratio. AME: Average marginal effects. Reference groups: Agricultural employment; Married; Water Source_Cleaned; Toilet_flush; 0 ha<Farm Size <0.5 ha; Midlands and Northern Mountains.

*** p<0.01, ** p<0.05, * p<0.1

Source. Authors' calculations based on data from the VHLSS (2012- 2016)

percentage of working members led to a 0.2% decrease in the probability of poverty. Although it had a positive sign, the language barrier had an insignificant effect on the likelihood of poverty.

REM household's poverty was related to the residential area and durable assets; they reduced the likelihood of poverty for REM. Durable assets strongly affected the probability of the REM being poor. Hygiene conditions were associated with poverty. The likelihood of living in poverty for the REM using simple toilets was 124% higher than that for the REM using flush toilets.[10] Similarly, other water variable is significant among the three water source variables. Households that used untreated or purchased water (in bottles, jars, or small vehicles) were more likely to be poor than those who had access to clean, protected water from streams or dug wells.

Our study shows that although the farm size variables had the expected signs, none significantly affected poverty. These results indicate that the RPE may use farmland ineffectively or are unable to fully utilise the land to escape poverty; though more land area is associated with greater output and income, it also requires higher levels of expenditure. Low quality of the farmland may constrain the RPE's agricultural production.[11] We found lower percentages of irrigated annual and perennial cropland in communes where the RPE resided than in the RNPE's communes (see Table A5). We found a positive link between health insurance premiums and poverty reduction. Similarly, domestic remittances significantly decreased the odds of the REM being poor; this was not true for overseas remittances.

We found that the impact of free health insurance and pension were not statistically significant in reducing the likelihood of poverty. These findings are consistent with Abrams et al., (2016) who have provided evidence that in northern Vietnam the ethnic minorities with mental health issues who live far away from commune health centres seek help from traditional shamans[12] before obtaining medical treatment. Similarly, Van de Walle Dominique and

Gunewardena (2001), found that free healthcare for the REM is ineffective because they tend to visit shamans for treatment instead of the local healthcare centre. The authors also argued that the funds are allocated to development programmes that are not appropriate for ethnic minorities. In particular, they identified the national educational curriculum as ineffective in meeting the needs of the local people. However, this logit results indicate that scholarships have a positive impact on the REM's poverty rates. Credit programmes also have a strong impact on the REM's poverty rates. Holding other variables constant, the odds that a REM household is poor was reduced by 25%.

c) Regional Characteristics. Poverty studies have identified the spatial effects on the likelihood that a household is poor (Epprecht et al., 2011; Mukherjee & Benson, 2003; Ravallion, 1998). Similarly, we show that the probability of poverty depends on where REM reside. Our results show that during the study period very few poor ethnic minority people resided in the most developed region, Southeast Vietnam (0.8%) (see Table A4). In contrast, 94.4% of the RPE lived in upland and coastal areas. The difficult geographic terrain and limited access to socio-economic centres partially explain why ethnic minority poverty is concentrated and persists in specific areas of Vietnam, i.e., the CH region or Northwest Vietnam. The logit results show that REM in the MNM region had a higher likelihood of living poverty than people in the RRD, MRD or southeast Vietnam. The Northern and Coastal Central and Central Highlands coefficients were insignificant, meaning that there was no difference in the probability that REM would be poor between the two regions and the MNM region.

5.1.2. Impact of Household-level Factors on Poverty Intensity

a) Household Head Characteristics. Table 3 shows the fractional logit estimation results for REM at the household level. The result reveals that education and age were strong predictors

of a poverty gap ($p<0.01$). Although it was positive in the REM fractional model, gender was not significant. These findings show that female-headed households do not have a wider poverty gap than male-headed households, holding other variables constant. For REM, marital status was not associated with a poverty gap.

Both non-farm and wage-paying employment significant decreased the poverty gap. However, the poverty gap-reducing effect of wage-paying employment was larger than non-farm employment. In particular, the poverty gap was reduced by 6.6% for households whose heads have wage-paying employment compared with farming employment, holding other variables constant. Similarly, non-farm self-employment reduced the poverty gap by 5.8% compared with farming.

b) Household Characteristics. Larger households have a greater poverty gap. If REM households have one additional member, the poverty gap increases by 1.6%. Likewise, the language barrier negatively affects the poverty gap ($p<0.01$). Regarding the AME, the result shows that the poverty gap increases by 1.4% for individuals who cannot speak Vietnamese (they can speak only their ethnic minority language) compared with native-Vietnamese speakers, holding other variables constant.

The ratio between the RPCE and the poverty line is decreased for REM who use clean water and flush toilets. Likewise, the poverty gap is reduced for REM who have a larger residential area and durable consumption expenditure. In the binary logit model, the impact of farmland area on the probability of poverty was not significant. However, a large farm holding (from 1 ha) reduced REM's poverty gap by 0.3 to 5.5% compared with a small farm holding (less than 0.5 ha). The study found a poverty intensity-decreasing effect for domestic and overseas remittances and health insurance premiums.

Of public assistance programmes, the credit programme had a strong impact on the intensity of poverty ($p<0.01$). Holding other variables constant, households that had access to

the credit programme for the poor had a 4.8% narrower poverty gap than those who could not access such programmes. Having a pension also significantly reduced the poverty gap ($p<0.1$); a 1% increase in the pension was associated with a 0.8% reduction of poverty intensity. Scholarships and free health insurance both had no effect on REM's poverty gap.

c) Regional Characteristics. REM's poverty gap depends heavily on differences in geographic and socio-economic conditions among the six regions in Vietnam. The poverty gap was smaller for households that were in RRD and MRD and southeast, compared with those who lived in the MNM regions in which the poverty gap reducing-effect of residence in the MRD was the largest at 10.2% ($p<0.01$). The Northern and Coastal Central coefficient was positive but insignificant; this means that living in the NCC region did not increase the poverty intensity when compared with living in the MNM region. In contrast, living in the CH region led to a wider poverty gap (1.8%), compared with living the MNM region, holding other variables constant. These findings show that, during the study period, the CH was home to the poorest ethnic minority households. Similarly, the data in Figure 1 show that the RPE living in the CH region had the lowest expenditure.

5.2. Impact of Commune-level Factors on the REM Poverty and Intensity

5.2.1. Impact of Commune-level Factors on Poverty

a) General Commune Characteristics. We found that the REM's poverty depends on commune characteristics. Geographical conditions were the most strongly linked to ethnic minority poverty (see Table 4). Of the three geographical factors, two variables, midlands and mountains were significant at 1%. The midlands coefficient was approximately 2.92, larger than the 1.98 for mountains. The coasts variable had a negative sign but was insignificant in the REM logit model. Our finding is consistent with Tran et al. (2015), who found that ethnic minority

Table 4. Estimation Results of the Binary and Fractional Logit Models at the Commune Level

Variables	*Binary Logit Model*			*Fractional Logit Model*	
	Coef.	*OR*	*AME*	*Coef.*	*AME*
General Commune Characteristics					
Coasts	-1.067	0.344	-0.223	-2.247**	-0.331
Midlands	2.918***	18.503	0.609	2.268***	0.334
Mountains	1.984***	7.274	0.414	1.605***	0.237
Christian	0.520	1.683	0.109	0.484***	0.071
Other Religions	0.119	1.126	0.025	0.066	0.010
No Religion	-0.165	0.848	-0.034	-0.210	-0.031
Natural Calamity	0.247	1.281	0.052	0.161*	0.024
Population Density	0.000	1.000	0.000	0.000	0.000
Commune Infrastructure					
Paved Roads	-0.584***	0.558	-0.122	-0.427***	-0.063
Daily Market	-0.741***	0.477	-0.155	-0.325	-0.048
High Schools	-0.428***	0.652	-0.089	-0.338***	-0.050
Agriculture and Fishing Extension Centre	-0.888***	0.412	-0.185	-0.604***	-0.089
District Hospital	0.001	1.001	0.000	0.0006*	0.000
Post-Office	0.001	1.001	0.000	0.001**	0.000
Land and Non-agricultural Employment Opportunities					
Irrigated Annual Cropland Rate	-0.003***	0.997	-0.001	-0.003**	-0.001
Irrigated Perennial Cropland Rate	0.001	1.001	0.000	0.0004**	0.000
Housing Land Use Right Rate	-0.001	0.999	0.000	0.000	0.000
Production Units	-0.441***	0.643	-0.092	-0.372***	-0.055
Year 2014	-0.038	0.963	-0.008	0.053	0.008
Year 2016	-0.545***	0.580	-0.114	-0.266***	-0.039
Constant	-0.406	0.667		-2.243***	
Observations	2202			2202	
Pseudo R-Squared	0.111			0.0513	
Wald Chi-Square	188.84***			286.97***	

Note. Estimates were adjusted for the cross-sectional weights. Reference categories: Deltas; Buddha

*** p<0.01, ** p<0.05, * p<0.1

Source. Authors' calculations based on data from the VHLSS (2012 – 2016)

families residing in high mountains have a lower poverty gap than those in low mountains in Northwest Vietnam. The effects of natural calamity, religion and population density on poverty were statistically insignificant.

b) Commune Infrastructure. For access to public infrastructure, our results show that an agriculture and fishing extension centre had the greatest impact on the likelihood of poverty. The odds ratio of poverty between households who can and cannot access agricultural and fishing extensions was 41.17%, holding other variables constant. In other words, the likelihood of poverty was approximately 59% lower for families who had access to agricultural and fishing extension services than those without access. The second largest impact on ethnic minority poverty reduction was the daily market. The odds of poverty was almost 52% lower for families living in a commune with a daily market than those who could not access a daily market. Access to paved roads and a high school mitigated the likelihood of poverty by 45% and 35%, respectively, holding other variables constant. The distance from the commune centre to a post-office and a district hospital had an insignificant impact on REM's probability of living in poverty.

c) Land and Non-agricultural Employment Opportunities. The negative, significant sign of irrigated annual cropland rate indicates that farmers who had access to irrigation had lower odds of falling into poverty during the study period. A 1% increase in the irrigated annual cropland rate resulted in a 0.1% reduction in the probability of living in poverty. In contrast, the percentage of irrigated perennial cropland was uncorrelated with the REM's risk of poverty. Production units, a measure of off-farm earning opportunities, also contributed to a reduction in ethnic poverty. The odds ratio was 0.643, suggesting that the probability of poverty was reduced by almost 36% for households with access to off-farm opportunities.

5.2.2. Impact of Commune-level Factors on the Poverty Intensity

Table 4 shows REM fractional logit model results at the commune level. We found that eight commune-level factors affecting the risk of poverty were also predictors of poverty intensity. These were: midlands, mountains, paved roads, high schools, off-farm opportunities, irrigated

annual cropland rate, and access to an agriculture and fishing extension centre. However, six other commune characteristics and infrastructure, natural calamity, coastal areas, religion, irrigated perennial cropland, access to a post-offices and a hospital, affected only the poverty intensity.

a) General Commune Characteristics. All three commune geography variables were statistically significant in the fractional logit model in equation 6. The results show that disadvantaged geographical characteristics had a negative impact on the poverty gap. For the AME, midlands had a 33.4% poverty intensity higher than the deltas, holding other variables constant. REM in mountainous areas had a 23.7% poverty intensity higher than those in the deltas. Therefore, the poverty intensity-increasing effect of midlands was more significant than that of mountains. This finding is consistent with Tran et al. (2015), who found that ethnic minority families residing in high mountains had less severe poverty intensity than those in low mountains in Northwest Vietnam. Families residing in the coastal regions experienced a lower poverty intensity (33%) than those living in the deltas. Vietnam has narrow flat coastal lowlands extending from the south of the RRD to the MRD. The coastal stretch is fertile (Adger et al., 2002; University of Michigan. Department of Geography, 1962). Farming in fertile soil in the coastal areas increases ethnic minorities' agricultural productivity that, in turn, improves their living standards and reduces their poverty intensity. Natural calamity had a detrimental impact on the poverty intensity ($p<0.1$). The REM who had experienced a natural disaster/s had a 2.4% larger poverty gap than those who had not experienced any natural disasters. Similarly, a wider poverty gap was observed for REM who were practising Christians compared with those who were Buddhists.

b) Commune Infrastructure. Access to paved roads, a high school and agricultural extension strongly affected the poverty gap. Additionally, limited access to a district hospital or a post-

office widened the poverty gap. For AME, a one-kilometre increase in the distance from the commune centre to a district hospital or a post-office led to a 0.01% increase in the poverty intensity. A daily market insignificantly reduced the poverty intensity but diminished the odds that REM are poor.

c) Land and Non-agricultural Employment Opportunities in the Commune. Irrigated annual cropland rate was associated with a decreased poverty gap for REM. Surprisingly, the irrigated perennial cropland rate increased the poverty intensity of REM. One possible reason is that REM had limited investment in their perennial crops. These households cannot produce more output to improve their living standards (see Table 6). The insignificant sign of borrowing indicates the ineffectiveness of the credit policy on the REM's poverty gap. Access to non-farm opportunities reduced the poverty gap by 5.5%, holding other variables constant.

In summary, the binary and fractional logit regression models' results are relatively consistent in determining the probability and intensity of poverty. The results confirm previous studies (Bhaumik et al., 2006; Tran et al., 2015) that demonstrated that many factors affect both the prevalence and intensity of poverty. Our results show that some covariates reduced the poverty intensity, but did not affect the likelihood of falling into poverty: (1) seven household-level covariates (non-farm employment, language barrier, overseas remittances, two types of large farms (no less than 1 ha), pension, and Central Highlands); and (2) six commune-level covariates (natural calamity, coasts, religion, irrigated perennial cropland, access to the post-offices and hospitals). Scholarship and daily market significantly affected the likelihood of poverty but not the poverty intensity.

6. Conclusions and Policy Recommendations

Using household and commune-level data from three recent national surveys, we have provided

improved empirical evidence about the causes of persistent poverty and poverty intensity of ethnic minorities in rural Vietnam from 2012-2016. We applied a binary logistic regression model, a method commonly used in empirical studies, to estimate the probability that households is poor. Additionally, the study employed a fractional logit regression model that is more appropriate than the OLS and logit estimations to determine the poverty intensity, because it provides a fractional outcome variable bounded between 0 and 1.

Results from both models show that among the household-level factors, low education levels, a large household size, poor sanitary conditions and a lack of healthcare or wage-paying employment strongly limit REM's capability to escape poverty. For example, the likelihood and intensity of poverty were reduced by 43% and 6.6% for household heads with salaried employment compared with those who worked in agricultural jobs, respectively. However, only 3% of the RPE had wage-paying employment. Education has a moderately positive effect on poverty: a one-year increase in education reduces the poverty gap by 0.4%. Given that the mean of RPE's schooling years was five years (most only graduated from primary schools), if the RPE were to complete nine years of school (or graduate from secondary school), the poverty gap would be decreased by 1.6% (0.4% multiplied by four years). Using the 2016 figures, this number is equivalent to VND 186 thousand/person (1.6% of the 2016 poverty line). Similarly, domestic remittances and durable assets reduce poverty and its intensity. At the commune-level, the availability of a high school, paved roads, and production units, helped to reduce REM's poverty rates and the depth of poverty. Access to agricultural extension services significantly reduced the probability and intensity of poverty. As most of the REM work in the agricultural sector, access to irrigation significantly improved REM's incidence and intensity of poverty.

Our results show that the majority of the REM reside in the most difficult geographic locations, such as in the upland or high mountains. Our results further reveal that living in

remote and sparsely populated areas contributes to poor living standards and the severity of ethnic minority poverty in rural Vietnam. We supports the conceptual and theoretical model of the spatial effect of locations on poverty (Ravallion, 1998). Specifically, the Southeast, RRD and MRD regions have a lower likelihood and intensity of poverty compared with other areas. The CH region have the lowest living standard and the largest poverty gap. Therefore, to lift the poorest segment of the Vietnamese population out of poverty, the state budget allocation needs to target this region.

Our results show that the fractional logit models overcome limitations associated with the binary logit models that ignore some important determinants related to the depth of poverty. At the household level, we found seven variables that affect only the poverty intensity, not the probability of poverty: non-farm self-employment, language barrier, overseas remittances, farm sizes no less than 1 ha, pension, and Central Highlands. Similarly, at the commune level, six variables affect only the poverty gap: natural calamity, coasts, Christian, irrigated perennial cropland rate, distance to a post-office or a district hospital. The binary logit model results show that scholarship and daily market help to reduce the probability of poverty. However, these factors appear to be insignificant in the fractional logit model. Using the linear regression models, the study proves that scholarship and the daily market do not significantly improve the RPE's expenditure.[13] This finding is consistent with the results of the fractional logit models.

Previous authors argued that the anti-poverty policies have failed to tackle poverty in ethnic minority communes (Nguyen et al., 2017; Van de Walle & Gunewardena, 2001). Our study supports this view. Our results show that free health insurance for the poor is ineffective in reducing REM's poverty; the free health insurance estimates were insignificant in both the binary and fractional logit models. However, we found that scholarship, pension and credit programmes had positive effects on poverty. Whereas the scholarship programme affects only the probability of poverty, the pension scheme affects only the poverty intensity. In contrast,

the credit programme for the poor is highly effective because credit significantly decreases both the likelihood (25%) and intensity (10%) of poverty for participating households.

We provides policy planners with solutions to elevate REM's living standards and reduce their severe poverty. The study proposes solutions that build REM's human and physical capital, especially for the most marginalised people, such as people who speak only ethnic minority languages or those facing the detrimental impact of natural calamities. Improving education is one solution that has a long-term impact on poverty reduction. It helps with building human resources, creates employment, and raises awareness about the importance of family planning. As lessons are taught in Vietnamese, removing language barriers would improve RPE's participation rates and, in turn, their futures. This would require the incorporation of Vietnamese classes and/or introducing bilingual school curriculums for those RPE who speak only ethnic minority languages. Moreover, government agencies/services such as healthcare and agricultural extension services should also provide information in ethnic minority languages. This would enable greater use of public services.

In addition, solutions that mitigate the negative impact of natural calamities help to reduce poverty levels and the poverty intensity. Rural diversification through increasing non-farm employment opportunities would raise the RPE's income and expenditure. Another solution involves increasing access to development programmes, especially credit programmes. The RPE's economic activities depend heavily on agriculture; improving access to irrigation and agricultural extension services that are suitable for the specific geographical conditions and local farming practices would contribute to more efficient use of farmland and greater agricultural output. The Program 135[14] focusses on strengthening the infrastructure system for the poorest ethnic minority communes. However, this programme should include greater provision for access to clean water, paved roads, non-farm employment and migration supports for the RPE.

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Appendix A

Table A1. Definitions of Binary and Fractional Logit Model Variables at the Household Level

Independent Variables	*Description*	*Expected sign*
Household Head Characteristics		
Age	Age of household heads (years)	+/-
Gender	Gender of household head, where female=1, male=0	+/-
Education	Household head's years of school attendance (number of years)	-
Marital Status	Marital status of household head: single/never married=1, married=2 (base group), widowed=3, divorced/separated=4	+/-
Occupation	The employment sector in which household heads work as their main job. agriculture=1 (base group), non-farm self-employment =2, wage-paying employment =3	-
Household Characteristics		
Poverty Status	Is the household poor or non-poor? Poor=1, non-poor=0.	+
Rural Areas	The place where households live. Rural=1, urban=0.	+
Ethnicity	The religion of households, divided into the ethnic majority (Kinh/Chinese) or minority (the remaining 52 ethnicities in Vietnam), where minority=1, majority=0.	+
Language Barriers	Whether or not a household needs an interpreter during an interview session. Yes=1, no=0.	-
Household Size	Number of family members in the household.	-
Working Rate	The percentage of working members in relation to total family size (in %).	-
Living Area	Per capita land area (m^2).	-
Durable Goods	The logarithm of real per capita spending on durable goods (in 1,000 VND).	-
Water Sources	The main water sources a household uses, where tap water =1 (base group), clean and protected water=2, other=3.	+
Toilets	The type of toilet a household has, where flush toilets=1, other toilets=2, no toilet=0. Other toilets include non-flush toilets such as a suilabh, barrel/pot, and/or fishing bridge.	-
Domestic Remittances	The logarithm of real per capita domestic remittances a household receives (in 1,000 VND).	-
Overseas Remittances	The logarithm of real per capita overseas remittances a household receives (in 1,000 VND).	-
Farm Size	The size of farmland (area) that a household manages or uses, where Farm Size=1 if farmland =0 ha, 2 if 0 ha < farmland area < =0.5 ha, 3 if 0.5 ha < farmland area <=1 ha, 4 if 1 ha < farmland area <= 1.5 ha, 5 if farmland area > 1.5 ha.	-
Health Insurance Premiums	The percentage of family members who have purchased health insurance (%).	-
Development Programmes		
Free Health Insurance Rate	The percentage of family members who have free health insurance (%).	-
Scholarship	The logarithm of real per capita scholarship a household receives (in 1,000 VND).	-
Pension	The logarithm of real per capita pension a household receives (in 1,000 VND).	-
Borrowing	Whether or not a household borrows money from the preferred credit programmes implemented by the Social Policy Bank and other organisations such as the Farmer's Association and the Women's Association, where yes=1, no=0.	-
Regional Characteristics		
Region1	Households live in Midlands and Northern Mountains (base group for REM models), where yes=1, no=0.	+
Region2	Households live in Red River Delta (base group for TH, TRH models), where yes=1, no=0.	-
Region3	Households live in Northern and Coastal Central,[1] where yes=1, no=0.	-
Region4	Households live in Central Highlands, where yes=1, no=0.	-
Region5	Households live in Southeast, where yes=1, no=0.	+/-
Region6	Households live in Mekong River Delta, where yes=1, no=0.	+/-
Survey Year		
Interview year	The year in which the survey was conducted. Year 2012=1 (base year), year 2014=2, year 2016=3.	-

Table A2. Definitions of Binary and Fractional Logit Model Variables at the Commune Level

Independent Variables	*Description*	*Expected Sign*
General Commune Characteristics		
Commune Geography	Where the commune is located (the geographical area). Coastal=1 (base group), delta=2, midlands=3, mountains=4.	+/-
Religion	The main religion in the commune, Buddhism=1 (base group), Christian=2, other=3, none=4.	+/-
Natural Calamity	Have any natural calamities (wildfires, floods, storms, landslides, or earthquakes) occurred in the commune in which households live in the past three years? Yes=1, no=0.	+
Population Density	Number of people per km^2.	-
Commune Infrastructrure		
Paved Roads	Are there any paved roads in the commune in which households live? Yes=1, no=0.	-
Daily Market	Is there a daily market in the commune where households live? Yes=1, no=0.	-
High School	Is there a high school in the commune where the children can go to study? Yes=1, no=0.	-
Agriculture and Fishery Extension Center	Is there an Agriculture and Fishery Extension Centre in the commune where the households live? Yes=1, no=0.	-
Kilometres to the District Hospital	The distance from the commune center to the nearest hospital (km).	+
Kilometres to the Post-Office	The distance from the commune center to the post-office (km).	+
Land and Non-agricultural Employment Opportunities		
Irrigated Annual Cropland Rate	Percentage of irrigated annual crop land in the commune (%).	-
Irrigated Perennial Cropland Rate	Percentage of irrigated perennial crop land in of the commune (%).	-
Housing Land Use Right Rate	The percentage of residential land with land use right certificates in the commune (%).	-
Production Units	Is there a production/service unit or trade village where the local people in the commune can go to work and return home every day? Yes=1, no=0.	-
Survey Year		
Interview Year	The year the survey was conducted. Year 2012=1 (base year), year 2014=2, year 2016=3.	-

Table A3. Structure of Annual Real per Capita Income of Rural Ethnic Minorities, 2012-2016 (VND 1,000)

	2012						*2014*						*2016*					
	All		***Poor***		***Non-Poor***		***All***		***Poor***		***Non-Poor***		***All***		***Poor***		***Non-Poor***	
Income Sources	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***	***Mean***	***%***
Agriculture	**4419.5**	**52.4**	**3288.0**	**59.1**	**6186.9**	**47.8**	**4321.6**	**47.5**	**3186.3**	**55.8**	**6058.2**	**42.4**	**4229.1**	**42.0**	**3020.5**	**51.4**	**5306.2**	**38.4**
Non-Agriculture	**559.5**	**6.6**	**151.3**	**2.7**	**1197.1**	**9.3**	**597.4**	**6.6**	**100.4**	**1.8**	**1357.5**	**9.5**	**783.3**	**7.8**	**117.6**	**2.0**	**1376.5**	**10.0**
Wages	**2555.2**	**30.3**	**1481.9**	**26.6**	**4231.8**	**32.7**	**3274.2**	**36.0**	**1790.4**	**31.4**	**5543.9**	**38.8**	**3842.6**	**38.2**	**2028.7**	**34.5**	**5459.1**	**39.6**
Remittances	**448.3**	**5.3**	**237.1**	**4.3**	**778.1**	**6.0**	**384.4**	**4.2**	**178.0**	**3.1**	**700.0**	**4.9**	**588.0**	**5.8**	**224.5**	**3.8**	**911.9**	**6.6**
From Domestic	322.0	3.8	228.1	4.1	468.7	3.6	339.8	3.7	168.4	2.9	602.0	4.2	512.6	5.1	208.2	3.5	783.9	5.7
From Overseas	126.3	1.5	9.0	0.2	309.5	2.4	44.6	0.5	9.6	0.2	98.1	0.7	75.4	0.7	16.3	0.3	128.0	0.9
Aids	**154.0**	**1.8**	**145.2**	**2.6**	**167.6**	**1.3**	**194.8**	**2.1**	**205.2**	**3.6**	**178.7**	**1.3**	**241.1**	**2.4**	**246.1**	**4.2**	**236.6**	**1.7**
For Education	108.5	1.3	117.5	2.1	94.5	0.7	147.7	1.6	178.6	3.1	100.3	0.7	174.3	1.7	224.5	3.8	129.5	0.9
For Healthcare	45.4	0.5	27.7	0.5	73.1	0.6	47.1	0.5	26.6	0.5	78.4	0.5	66.8	0.7	21.6	0.4	107.1	0.8
Other	**302.9**	**3.6**	**257.6**	**4.6**	**373.6**	**2.9**	**322.5**	**3.5**	**247.7**	**4.3**	**436.8**	**3.1**	**385.0**	**3.8**	**243.4**	**4.1**	**511.1**	**3.7**
Total	**8439.3**	**100**	**5561.1**	**100**	**12935.0**	**100**	**9094.8**	**100**	**5708.0**	**100**	**14275.2**	**100**	**10069.0**	**100**	**5880.8**	**100**	**13801.3**	**100**

Note. Means are calculated at the constant prices of January 2010. Estimates are accounted for the sampling weights.

Source. Author's calculation from the VHLSS 2012- 2016

Table A4. Characteristics of Rural Ethnic Minorities at the Household Level

Continuous/Discrete Variables	*All*		*Rural Poor Ethnic Minorities*		*Rural Non-poor Ethnic Minorities*		*t-value/ Pearson Chi²*
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	
Age	44.53	12.59	43.11	12.92	46.32	11.93	***
Education	5.01	3.81	4.11	3.59	6.14	3.78	***
Household Size	5.04	1.77	5.44	1.80	4.54	1.60	***
Proportion of Working Member	61.76	21.87	57.36	19.69	67.33	23.19	***
Living Area/Residential	14.77	10.06	11.72	6.44	18.62	12.25	***
Durable Goods (logarit)	5.91	1.52	5.27	1.55	6.72	1.01	***
Durable Goods (VND 1,000)	779.40	1682.72	362.36	324.37	1305.70	2403.56	***
Domestic Remittances (logarit)	3.55	2.48	3.22	2.30	3.95	2.64	***
Domestic Remittances (VND 1,000)	398.59	1770.04	201.10	805.27	647.82	2481.73	***
Overseas Remittances (logarit)	0.07	0.74	0.02	0.43	0.12	1.01	***
Overseas Remittances (VND 1,000)	81.72	1668.76	11.45	300.74	170.41	2484.46	**
Farm Land Area Per Capita	3177.02	4812.72	2914.20	4691.05	3508.84	4943.37	***
Health Insurance Premiums	18.37	34.51	9.40	25.75	29.68	40.35	***
Free Health Insurance	90.15	24.81	93.94	20.12	85.36	28.99	***
Scholarship (logarit)	0.23	0.96	0.21	0.95	0.26	0.98	
Scholarship (VND 1,000)	9.71	100.04	8.97	78.87	10.63	121.63	
Pension (logarit)	0.14	1.09	0.05	0.64	0.26	1.47	***
Pension (VND 1,000)	103.86	1092.33	21.21	322.95	208.17	1596.42	***
Dummy/Categorical Variables							
Female	0.12	0.32	0.11	0.31	0.13	0.33	***
Never Married	0.01	0.10	0.01	0.10	0.01	0.11	***
Married	0.90	0.29	0.91	0.28	0.89	0.31	***
Widowed	0.07	0.26	0.07	0.25	0.08	0.28	***
Divorced/Separated	0.01	0.10	0.01	0.10	0.01	0.10	***
Agriculture	0.87	0.34	0.93	0.26	0.79	0.41	***
Non-farm Self-Employment	0.06	0.24	0.04	0.19	0.10	0.29	***
Wage-Paying Employment	0.07	0.25	0.03	0.17	0.11	0.32	***
Language Barriers	0.28	0.45	0.39	0.49	0.15	0.36	***
Tap Water	0.05	0.21	0.03	0.16	0.07	0.26	***
Clean Water	0.39	0.49	0.29	0.45	0.52	0.50	***
Other Water	0.56	0.50	0.68	0.47	0.41	0.49	***
Toilet_Flush	0.16	0.37	0.06	0.24	0.29	0.46	***
Toilet_Not Flush	0.62	0.49	0.62	0.49	0.62	0.49	***
Toilet_No	0.22	0.41	0.32	0.47	0.09	0.29	***
No-Farmland	0.05	0.21	0.03	0.16	0.07	0.26	***
0 ha <=Farm Size <0.5 ha	0.27	0.44	0.26	0.44	0.27	0.45	***
0.5 ha <=Farm Size <1 ha	0.19	0.39	0.20	0.40	0.17	0.37	***
1 ha <=Farm Size <1.5 ha	0.16	0.37	0.17	0.37	0.15	0.36	***
Farm Size >=1.5 ha	0.34	0.47	0.34	0.47	0.34	0.47	***
Borrowing/Credit	0.32	0.47	0.31	0.46	0.33	0.47	***
Red River Delta	0.02	0.16	0.01	0.12	0.04	0.19	***
Midlands and Northern Mountains	0.52	0.50	0.54	0.50	0.49	0.50	***
Northern and Coastal Central	0.20	0.40	0.22	0.42	0.16	0.37	***
Central Highlands	0.15	0.36	0.18	0.38	0.12	0.32	***
Southeast	0.02	0.16	0.01	0.09	0.05	0.21	***
Mekong River Delta	0.08	0.28	0.03	0.18	0.14	0.35	***

Note. Means and Standard Deviations (SD) accounted for the sampling weights. Differences between means/proportions of the poor and the non-poor are statistically significant at 1%, except for overseas remittances(p-value <0.05) and scholarship (p-value>0.1).

Source. Authors' calculations using the VHLSS data (2012-2016)

Table A5. Descriptive Statistics of the Rural Ethnic Minorities Models at the Commune Level

Continuous/Discrete Variables	*All*		*Rural Poor Ethnic Minorities*		*Rural Non-Poor Ethnic Minorities*	
	Mean	***SD***	***Mean***	***SD***	***Mean***	***SD***
Irrigrated Annual Cropland rate (%)	54.7	46.8	48.6	43.9	62.4	49.2
Irrigrated Perennial Cropland Rate (%)	29.5	71.4	25.7	88.6	34.3	39.3
Housing Land Use Right Certificate Rate (%)	76.1	33.1	72.5	35.9	80.8	28.6
Distance to District Hospital (km)	82.3	128.7	97.4	142.1	62.9	106.1
Distance to Post-office (km)	33.7	69.4	41.6	79.4	23.5	52.1
Population Density (persons/km^2)	185.2	294.5	146.2	284.8	234.8	299.2
Dummy/Categorical Variables						
Paved Roads	0.90	0.30	0.88	0.33	0.92	0.27
Daily Markets	0.10	0.30	0.07	0.25	0.14	0.35
High Schools	0.17	0.38	0.14	0.34	0.21	0.41
Agriculture and Fishery Extension Centre	0.05	0.21	0.03	0.18	0.07	0.25
Production Units	0.52	0.50	0.43	0.50	0.64	0.48
Natural Calamity	0.87	0.33	0.87	0.34	0.88	0.33
Coasts	0.01	0.10	0.00	0.06	0.02	0.13
Deltas	0.08	0.26	0.03	0.16	0.14	0.34
Midlands	0.01	0.10	0.01	0.09	0.01	0.11
Mountains	0.90	0.29	0.96	0.19	0.83	0.37
Buddhism	0.16	0.36	0.11	0.31	0.23	0.42
Christian	0.07	0.24	0.07	0.26	0.05	0.22
Other Religion	0.11	0.31	0.13	0.33	0.09	0.28
No Religion	0.66	0.47	0.69	0.46	0.63	0.48

Note. Means and standard deviations (SD) are the average means and SD for three years of 2012, 2014, and 2016 at the constant prices of January 2010. Estimates are accounted for the sampling weights. Differences between means/proportions of the poor and the non-poor are statistically significant at 1%.

Source. Author's calculation from VHLSS 2012-2016

Table A6. Binary Logit Estimation without Sampling Weight for RHE at the Household Level

Variables	*Coef.*	*SD*	*z*	*P>z*	*95% Confidence Interval*	
Age	-0.017	0.004	-4.350	0.000	-0.025	-0.010
Gender	-0.128	0.187	-0.680	0.495	-0.495	0.239
Schooling Years	-0.063	0.013	-4.910	0.000	-0.088	-0.038
Never Married	-0.448	0.344	-1.300	0.193	-1.122	0.227
Widowed	-0.115	0.243	-0.470	0.636	-0.592	0.362
Divorced/Separated	0.355	0.407	0.870	0.383	-0.443	1.154
Non-Farm Self-Employment	-0.328	0.173	-1.900	0.057	-0.667	0.010
Wage-Paying Employment	-0.535	0.190	-2.810	0.005	-0.908	-0.162
Language Barrier	0.236	0.114	2.080	0.038	0.013	0.458
Household Size	0.251	0.041	6.100	0.000	0.171	0.332
Working Rate	-0.014	0.002	-7.170	0.000	-0.018	-0.010
Living Area	-1.043	0.120	-8.720	0.000	-1.277	-0.809
Durable Goods	-0.860	0.066	-13.040	0.000	-0.990	-0.731
Tap Water	-0.225	0.293	-0.770	0.444	-0.799	0.350
Other Water	0.381	0.099	3.840	0.000	0.186	0.575
Toilet_Not Flush	0.936	0.151	6.180	0.000	0.639	1.232
Toilet_No	1.047	0.182	5.760	0.000	0.691	1.403
Domestic Remittances	-0.020	0.018	-1.100	0.272	-0.056	0.016
Overseas Remittances	-0.183	0.096	-1.900	0.058	-0.371	0.006
No Farmland	-0.383	0.288	-1.330	0.183	-0.947	0.181
0.5 Ha <=Farm Size<1 Ha	0.065	0.127	0.510	0.608	-0.183	0.313
1 Ha <=Farm Size<1.5 Ha	-0.188	0.139	-1.350	0.177	-0.460	0.085
Farm Size >=1.5 Ha	-0.218	0.120	-1.810	0.070	-0.453	0.017
Health Insurance Premiums	-0.009	0.002	-3.480	0.001	-0.013	-0.004
Free Health Insurance Rate	0.001	0.003	0.350	0.728	-0.005	0.008
Scholarship	-0.131	0.049	-2.650	0.008	-0.228	-0.034
Pension	-0.103	0.048	-2.150	0.031	-0.196	-0.009
Borrowing	-0.310	0.094	-3.290	0.001	-0.494	-0.125
Red River Delta	-0.953	0.336	-2.840	0.005	-1.611	-0.295
Northern and Coastal Central	0.203	0.146	1.390	0.165	-0.084	0.490
Central Highlands	-0.045	0.142	-0.320	0.748	-0.323	0.232
Southeast	-1.557	0.416	-3.740	0.000	-2.372	-0.741
Mekong River Delta	-1.258	0.253	-4.980	0.000	-1.753	-0.762
Year 2014	0.260	0.106	2.460	0.014	0.053	0.467
Year 2016	-0.421	0.108	-3.910	0.000	-0.632	-0.210
Constant	8.425	0.727	11.590	0.000	7.000	9.850
Classification Accuracy						0.804

Source. Authors' calculations using the VHLSS data (2012-2016)

Table A7. Beneficiaries of Development Programs by Groups of Households

Supports/Assistances	*Rural Poor Ethnic Minorities*			*Rural Non-Poor Ethnic Minorities*		
	No of HH	***%***	***Mean***	***No of HH***	***%***	***Mean***
Free health insurance (%)	2195.00	97.77	96.16	1931.00	94.70	89.74
Scholarship (VND 1,000)	126	5.61	150.94	167	8.19	121.32
Pension (VND 1,000)	13	0.58	3184.10	66	3.24	6842.48
Borrowing (Yes)	701	31.23		670	32.85	

Source. Author's calculation from VHLSS 2012-2016

Notes

1 Poverty intensity is measured using the poverty gap ratio. This ratio shows how far the poor's consumption is under the poverty line (Foster et al., 1984). See section 3.1 for further details.

2 Data calculated by the author.

3 The WB (2018) figures show that in 2016, 95% of poor ethnic minority households resided in rural areas.

4 The regional CPIs collected in the VHLSSs before 2010 were inaccurate because of problems in the data collection of these indexes: 1) the good and services were not spatially representative; 2) changes in the price index were included with changes in the quality of goods.

5 The nominal poverty threshold was VND 10,456 or 11,563 thousand per year a person in 2012 and 2014, respectively. In 2016, the poverty line was VND 11,630 thousand per person annually.

6 See Table A3 for more details.

7 The results for the model estimates without public assistance and remittances are unreported but available on request.

8 McFadden (1977) suggests that the binomial logistic regression model is appropriate if the Pseudo R-square value falls in the range of 0.2 to 0.4.

9 See Appendix A, Table A6 for the prediction success of the poor and non-poor binomial logit regression model for the REM. We calculated the precision of the logit estimation without fitting the sample weights; in Stata, the command "lstat" (used to estimate the precision of logit model) is not available after estimation due adjustments made to account for sample weights. The results of the sampling unweighted logit model changed very little.

10 We consider whether or not the types of toilets used by a household are associated with poverty. The type of toilet that a household uses is an indication of poverty (not able to afford a flush toilet is associated with poverty). The type of toilet a household uses is not the cause of poverty.

11 Information about land quality is included only in the 2014 VHLSS, not in the 2012 and 2016 surveys. As suggested by Markussen (2017), we use irrigated land in communes as a measure of land quality.

12 A shaman is a religious specialist who is believed to have the ability to communicate with a non-human world (Pharo, 2011). In some ethnic minority communes in Vietnam, a shaman is considered to be an illness healer because s/he has the ability to search for the lost, wandering, or attacked soul and bring it back to the body in the human world (Pinson-Perez et al., 2005).

[13] The OLS results are available on request.

14 This is a socio-economic programme that targets communes with extreme difficulties in mountainous and remote areas.