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DETERMINANTS OF POVERTY AMONG ETHNIC MINORITIES IN THE NORTHWEST REGION, VIETNAM

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Abstract:

This paper is the first to investigate both community and household determinants of poverty among ethnic minorities in the Northwest region, Vietnam. Results of a fractional logit and a logit model show that some household factors such as fixed assets, education, land and off-farm employment have a reducing effect on both poverty intensity and incidence. Furthermore, some commune characteristics were found to be closely linked to poverty. Notably, the presence of means of transportation and post offices reduces both the poverty intensity and incidence. However, other commune and household factors affect only the poverty incidence or intensity, but not both. This suggests that previous studies that focused only on the determinants of poverty incidence using a logit/probit approach might not adequately evaluate or even ignored the impact of some factors on the poverty intensity. We draw both socio-economic household and commune level implications for poverty alleviation in the study area.

Keywords: shortfall, poverty incidence, poverty gap, poverty intensity, logit, fractional logit, national target program.

JEL classification codes: I 32, O12, J15

1. Introduction

Vietnam has achieved great progress in economic growth and poverty alleviation over the past two decades. According to a “basic needs” poverty line initially agreed in the early 1990s, the country’s poverty headcount dropped from 58 percent in the early 1990s to 14.5 percent by 2008, and by these standards was estimated to be well below 10 percent by 2010 (World Bank [WB], 2012). Despite remarkable progress, Vietnam’s mission of poverty reduction is not accomplished, and in some aspects it has been more difficult. One

of these is that the poverty is extremely high and persistent among ethnic minorities. Using the 2010 GSO-WB [General Statistical Office – World Bank] poverty line¹, WB (2012) estimated that there were still 66.3 percent of ethnic minorities being the poor and 37.4 percent being the extreme poor in 2010. By contrast, the corresponding figures for the Kinh Majority population were only 12.9 percent and 2.9 percent. Especially, there is a large proportion of ethnic minorities living in the Northwest Mountains with a very low income and limited access to infrastructure, education, health services and non-farm opportunities (Cuong, 2012). About 73 percent of the ethnic minorities in this region still lived below the poverty line and 45.5 percent lived below the extreme poverty line in 2010 (WB, 2012).

Perhaps due to the big gap in the living standards between ethnic minority and majority groups in Vietnam, there have been a growing number of studies examining the difference in wellbeing between the two groups (e.g, Baulch, Chuyen, Haughton, & Haughton, 2007; Baulch, Hoa, Phuong, & Hung, 2011; Cuong, 2012; Minot, 2000; Van de Walle & Gunewardena, 2001). However, to the best of our knowledge, little evidence exists on the determinants of poverty incidence among the ethnic minorities in Vietnam and furthermore, no econometric evidence determines factors affecting both the incidence and intensity of poverty among the ethnic minorities in the Northwest mountains. A thorough understanding of what factors contribute to the poverty of ethnic minorities in this poorest region is much of importance, when designing policy interventions to meet their needs and improve their welfare. For this reason, the current study was conducted to fill in this gap in the literature.

The main objective of the current study is to examine the determinants of poverty intensity and incidence among ethnic minority households in the Northwest Mountains, Vietnam. This study differs from previous studies on poverty in Vietnam in two important respects. *Firstly*, it is the first study to investigate the determinants of poverty among ethnic minority households in the Northwest Mountains – the poorest region of Vietnam by using a unique dataset from a recent survey of Northern Mountain Baseline Surveys. The survey was conducted in 2010 by GSO with the focus on the ethnic minorities in the Northwest Mountains (hereafter called “the Northwest region”). *Secondly*, the approach in previous studies have often focused only on the determinants of poverty incidence (the headcount index) using a logit or probit model (e.g, Kang, 2009; Minot, 2000; Tuyen &

¹ The 2010 GSO-WB poverty line is based on the consumption expenditure per capita per month of VND 653,000 in 2010.

Huong, 2013; Imai, Gaiha, & Kang, 2011). This approach, however, has a limitation as it might be unable to identify or even ignored factors affecting the intensity of poverty. This is because the incidence of poverty only implies a “jump” or discontinuity in the distribution of welfare at about the poverty line, and it does not indicate how poor the poor are (Ravallion, 1996). To deal with this limitation, in this study, a fractional logit model was added to examine factors affecting the poverty intensity. Therefore, the study made a significant contribution to the literature by providing the first econometric evidence for factors affecting the poverty intensity and incidence among the ethnic minorities in the Northwest region.

The paper is structured into four sections. The next section describes data source and econometric models used in this study. The third section presents the determinants of poverty incidence and intensity. Finally, the conclusions and policy implications are presented in the fourth section.

2. Data and methods

2.1. Data source

The dataset from The Northern Mountains Baseline Survey (NMBS) 2010 was used for the current study. The 2010 NMBS was conducted by GSO from July to September in 2010 to gather baseline data for the Second Northern Mountains Poverty Reduction Project (Cuong, 2012). The overall objective of this project is to aim at alleviating poverty in the Northern Mountains, Vietnam. The project has invested in productive infrastructure in poor areas in this region and also has provided supports for the poor to foster agricultural and off-farm activities. The project covers six provinces in the Northwest region, including Hoa Binh, Lai Chau, Lao Cai, Son La, Dien Bien and Yen Bai (Cuong, 2012).

A multi-stage sampling procedure was used for the survey. Firstly, 120 communes from six provinces mentioned above were randomly selected following probability proportional to the population size of the provinces. Secondly, from each of selected communes, three villages are randomly selected and then five households in each village are randomly chosen for the interview, producing a total sample size of 1,800 households. The survey covered a large number of households from various ethnicities such as Tay, Thai, Muong, H’Mong and Dao.

The survey gathered both household and commune data. The household data contain characteristics of household members, education and employment, healthcare,

income, housing, durables and participation of households into targeted programs. The commune data include information about the characteristics of communities such as demography, population, infrastructure, off-farm job opportunities, natural calamities, domestic animal diseases, and targeted programs in the communes. The commune data can be merged with the household data.

2.2. Method of data analysis

2.2.1. Measures of poverty

This study adopted the class of poverty measures developed by Foster, Greer, and Thorbecke (FGT) (1984) that was most commonly used for measuring poverty (Coudouel, Hentschel, & Wodon, 2002). The FGT class of poverty measures is denoted as:

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

Where N is the size of the total population (or sample); Y_i is income per capita of the i th household; Z is the poverty line; q is the number of households with income per capita below Z (the number of poor households); α is Poverty Aversion Parameter Index which takes on the values of 0, 1 and 2 representing the incidence of poverty, gap of poverty and severity of poverty (Foster et al., 1984).

If $\alpha=0$, then FGT is reduced to $P_0 = \frac{q}{N}$, which is the *headcount index* (incidence of poverty) measuring the proportion of the population that is classified as poor. By far, this measure is most popular used because it is straightforward and easy to calculate (WB, 2005). However, as already noted, this measure does not indicate the intensity of poverty.

If $\alpha=1$, then The FGT class of poverty measure (P_1) is defined as: $P_1 = \frac{1}{N} \sum_{i=1}^q \left(\frac{Z - Y_i}{Z} \right)^1$, which is the *poverty gap index* or the depth of poverty. This measures the extent to which individuals fall below the poverty line (the poverty gaps) as a percentage of the poverty line. It should be noted that this measure is the mean proportionate poverty gap in the population (where the non-poor have zero poverty gap). This provides information regarding how far off the poor are from the poverty line. Thus, the poverty gap index has a virtue because it measures the intensity of poverty (WB, 2005).

If $\alpha=2$, the FGT class of poverty measure (P_2) becomes: $P_2 = \frac{1}{N} \sum_{i=1}^q \left(\frac{Z - Y_i}{Z} \right)^2$, which is the the squared *poverty gap* (“*poverty severity*”) *index*. This averages the squares of the

poverty gaps relative to the poverty line. This measure takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among them. That is, a larger weight is placed on poor households who are further away from the poverty line (Coudouel et al., 2002).

2.2.2. Specification of econometric models

First, we grouped households into poor and poor households. The 2010 NMBS did not collect expenditure data, so we classified poor households by per capita income using the national poverty line for the period 2011-2015. Because the survey focused on households living in mountainous areas, the poverty line for rural (400 thousand VND/person/month) was used to identify poor and non-poor households. Once households were split into the poor and non-poor groups, statistical analyses were then used to compare the means of household characteristics and assets between the two groups. As noted by Gujarati and Porter (2009), there are various statistical techniques for examining the differences in two or more mean values, which commonly have the name of analysis of variance. However, a similar objective can be attained by using the framework of regression analysis. Therefore, regression analysis using Analysis of Variance (ANOVA) model was used to compare the mean of household characteristics and assets between the two groups. In addition, a chi-square test was applied to examine whether a statistically significant association existed between two categorical variables such as the type of households (poor and non-poor households) and their participation in off-farm activities.

To model the determinants of poverty incidence, we used a logit model with the dependent variable being a binary variable that has a value of one if a household was counted as poor and a value of zero otherwise. The logit model takes form (Gujarati & Porter, 2009) as follow:

$$\Pr(Y = 1|X) = \frac{\text{Exp}(\beta'_s X'_s)}{1 + \text{Exp}(\beta'_s X'_s)}$$

, where the coefficients β'_s are the parameters need be estimated in the model and X'_s are the explanatory variables. This model estimates the probability that some event occurs, which is in this case the probability of a household falling into poverty ($Y=1$). Since the maximum likelihood estimation (MLE) of Logit model is based on the distribution of Y

given \mathbf{X} , the heteroscedasticity in $Var(\mathbf{Y}|\mathbf{X})$ is automatically accounted for (Wooldridge, 2013).

Because the intensity of poverty, defined as shortfall, i.e., the poverty line minus income, is a fractional response variable taking the values from zero to 100 percent², the determinants of poverty intensity were modeled by using a fractional regression model proposed by Papke and Wooldridge (1996). This approach was developed to deal with models containing fractional dependent variables bounded between zero and 100 percent. Papke and Wooldridge (1996) noted that a fractional logit estimator is appropriate for this type of response variable with cross sectional data. As demonstrated by Wagner (2001), the fractional logit approach, is the most appropriate approach because this model overcomes a lot of difficulties related to other more commonly used estimators such as OLS (ordinary least square) and TOBIT³. There have been an increasing number of studies applying the fractional logit/probit model to handle models containing a fractional response variable being bounded between zero and one (e.g, Cardoso et al., 2010; Gallaway, Olsen, & Mitchell, 2010; Jonasson, 2011; McGuinness & Wooden, 2009; Tuyen, Lim, Cameron, & Huang, 2014). Hence, following this approach, we applied the so-called fractional logit model:

$$E(\mathbf{Y}|\mathbf{X}) = G(\mathbf{X}|\boldsymbol{\beta}\mathbf{X}) = \frac{Exp(\boldsymbol{\beta}'_s \mathbf{X}'_s)}{1 + Exp(\boldsymbol{\beta}'_s \mathbf{X}'_s)}$$

, where \mathbf{Y} is the poverty gap that takes the values in the interval $[0, 1]$, i.e. $0 \leq \mathbf{Y} \leq 1$; G is a function satisfying the predicted variables, \mathbf{Y} , will lie in the interval $[0, 1]$. The coefficients $\boldsymbol{\beta}'_s$ are the parameters need to be estimated in the model and \mathbf{X}'_s are the explanatory variables. The empirical model can be estimated by the quasi-maximum likelihood estimator, with heteroscedasticity-robust asymptotic variance.

² The intensity of poverty (poverty gap) is a percentage variable that is by definition limited between zero and 100 percent with a lot of households (36.6 % of observations) having the zero values of poverty gap because they were not poor.

³ One may argue that the two-limit variant of the Tobit estimator is suitable. Nonetheless, Wagner (2001, p. 231) noted that: "TOBIT is simply not made for a situation when the endogenous variable is bounded to be zero or positive by definition." It is appropriately applied to situations where the values of variable are outside of the limits because of censoring. In addition, Cardoso, Fontainha, and Monfardini (2010) indicate that the fractional logit model has a crucial advantage over the Tobit specification because it is based on a quasi-maximum likelihood estimator, which does not require an assumption of full normal distribution for consistent estimates.

Table 1: Definition and measurement of explanatory variables included in the models

Explanatory variables	Definition and measurement	Expected sign
Household size	Total household members (persons)	+
Dependency ratio ^b	Proportion of dependents in the households	+
Age	Age of household head (years).	+/-
Age squared	The squared age of household head (Year) ²	+/-
Gender ^a	Whether or not the household head is male (Male=1; female=0).	+/-
Primary education ^a	Whether or not the household head completed the primary school	-
Lower secondary ^a	Whether or not the household head completed the lower secondary school	-
Upper secondary and higher ^a	Whether or not the household head completed the upper secondary school or higher level	-
Annual crop land	The size of annual crop land per capita (100 m ² per person)	-
Perennial crop land	The size of perennial crop land per capita (100 m ² per person)	-
Forestry land	The size of forestry crop land per capita (100 m ² per person).	-
Water surface for aquaculture	The size of water surface for aquaculture per capita (100 m ² per person)	-
Resident land	The size of resident land per capita (10 m ² per person)	-
Fixed assets	Total value of all fixed per capita (Log of VND 1,000)	-
Credit	Total value of loans that the household borrowed during the last 24 months before the time of the survey (VND 1 million)	-
Group participation ^a	Whether or not the household participated in any production or farmer association	-
Wage employment ^a	Whether or not the household engaged in paid jobs	-
Nonfarm self-employment ^a	Whether or not the household took up nonfarm self-employment	-
Asphalt/concrete road ^a	Is there any asphalt or concrete road to the commune in which the household lived?	-
Means of Transportation ^a	Whether or not means of transportation such as minibuses; passenger cars, vans, three-wheel taxis or motorbike taxis that are available within the commune in which the household lived.	-
Irrigational work ^a	Is there any irrigational work within the commune in which the household lived?	-
Post office ^a	Is there any post office within the commune in which the household lived?	-
Off-farm opportunities ^a	Is there any production/services unit or trade village located within the distance that the people in the commune can go there to work and then go home every day?	-
Geographic location ^a	Whether or not the household lived in high mountain areas	-
Population density	Number of people per one square kilometer	+/-
Natural calamity ^a	Is there any natural calamity such fires, flood, storm landslides, earth quake that occurred in the commune in which the household lived in the last 3 years?	+
Disease ^a	Is there any disease of domestic animals or crop plants that occurred in the commune in which the household lived in the last 3 years?	+

Note: ^a indicates dummy variables (1=Yes; 0=otherwise). ^b dependents include young dependents (members under 15) and old dependents (male members above 59 and female members above 64).

Arguably, the same factors that affect the probability of a household falling into poverty also affect the intensity of poverty (or the size of its shortfall) (Bhaumik, Gang, & Yun, 2006). Thus, we used the same specification to explain variations in the likelihood of being poor (logit) and those in the shortfall (fractional logit). Household socio-economic

factors, among others, have been recognized by development practitioners in developing countries as variables that are strongly associated with poverty (Akerele, Momoh, Adewuyi, Phillip, & Ashaolu, 2012). In addition, community socio-economic factors such as the presence of road, irrigational works and electricity were found to help the poor promote agricultural and non-agricultural productivity and diversify their livelihoods, which in turn enable them escape poverty (Ali & Pernia, 2003). Therefore, in this study, the incidence and intensity of poverty were hypothesized to be determined by a vector of both household and commune socio-economic variables.

The definition, measurement and expected sign of explanatory variables are given in Table 1. Specifically our specification included household size, dependency ratio, the age, education and gender of household heads. Some other socio-economic characteristics, namely households' participation in production/farmer associations and off-farm activities, and access to credit were also included in the models. It also takes into account some productive assets of households such as the size of various types of land, the area of water surface for aquaculture and the value of fixed assets. In addition, we controlled for some commune characteristics such as the presence of asphalt/concrete roads, post offices, irrigational works, off-farm opportunities, and means of transportation. Finally, controls were added to account for natural calamities and animal diseases at the commune level.

3. Results and discussion

3.1. Background on household characteristics and assets

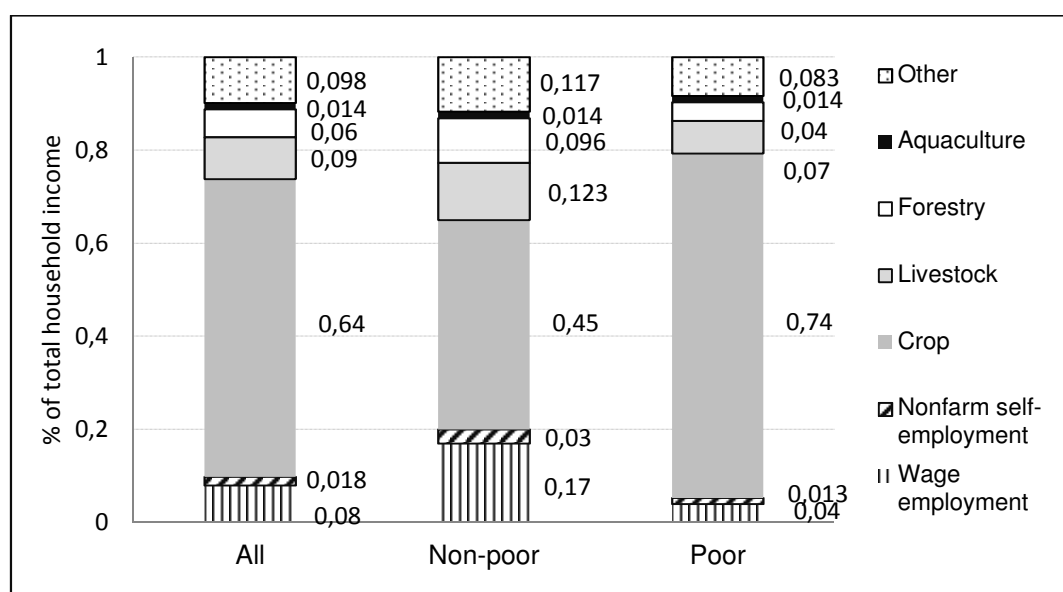
Table 2 reports poverty measures by ethnic group in Vietnam in 2010. Nearly two thirds of the ethnic population in the region lived below the poverty line and about 42 percent lived below the extreme poverty line. The poor in this region were also much poorer than the ethnic minority poor in other regions. Their shortfall (poverty gap) nearly tripled that of the other ethnic minority poor and was about ten times the King/Hoa poor. Thus, the results confirm that the ethnic minority poor in the Northwest region are the poorest by any measures of poverty. The poverty gap is 27 percent for the Northwest Ethnic Minorities, indicating that on average, a poor ethnic minority household would have to mobilize financial resources up to VND 108 thousand per month (27 percent of VND 400 thousand) for each household member to be able to move out of poverty. However, the corresponding figures for the King/Hoa population and the ethnic minorities in other regions were only VND 10.8 thousand and VND 38.8 thousand.

Table 2: Poverty measures by ethnicity in 2010

Poverty measures (%)	Headcount	Poverty gap	Poverty severity
Poor	$\alpha=0$	$\alpha=1$	$\alpha=2$
Northwest Ethnic Minorities ^a	66.40	27.10	14.00
Ethnic Minorities in other regions ^b	34.90	9.70	4.00
Kinh/Hoa ^c	12.90	2.70	0.90
Extreme poor			
Northwest Ethnic Minorities ^a	41.7	13.0	5.7
All Ethnic Minorities ^c	37.4	9.7	3.7
Kinh/Hoa ^c	2.9	0.5	0.1

Source: ^a authors' own calculation from the 2010 NMBS using the poverty line which is based on the income per person per month of 400 thousand VND and the extreme poverty line being calculated as two thirds of the poverty line. ^b Estimation from Nguyen (2012) using the 2010 VHLSS (Vietnam Household Living Standard Survey in 2010) and ^c WB (2012)'s estimation from the 2010 VHLSS using the 2010 GSO-WB poverty line. Kinh/Hoa called the ethnic majority population.

Figure 1: Household income structure by the poor and the non-poor



Source: Authors' own calculation from the 2010 NMBS

Figure 1 reveals that crop income accounts for the largest proportion of total household income for the whole sample as well as for each group of households. This suggests that agriculture plays a crucial role in the livelihood of the ethnic minorities in the Northwest region. Looking at the income structure of each group, the crop income share of the poor is, on average, much larger than that of the non-poor. However, the non-poor earned more income from forestry and livestock production than the poor. The share of total income contributed by aquaculture is similar between the two groups. The non-poor derived much more income from off-farm activities, including both wage and nonfarm self-employment than the poor. Furthermore, the non-poor received more income from other sources than the poor. The figures indicate that the poor seem to depend much more

on crop production than the non-poor. Also, it implies that the differences in income per capita between the two groups might stem from the differences in income sources.

Table 3: Descriptive statistics of household and commune characteristics and assets

Explanatory variables	All ethnic minority households		Non-poor ethnic minority households		Poor ethnic minority households		t-value or Pearson chi2
	Mean	SD	Mean	SD	Mean	SD	
<i>Household characteristics</i>							
Household size	6.01	(2.32)	5.22	(1.80)	6.40	(2.50)	***
Dependency ratio	0.83	(0.69)	0.58	(0.60)	0.97	(0.70)	***
Age of household head	41.46	(12.82)	43.23	(12.06)	40.44	(13.13)	***
Gender of household head ^a	0.92	(0.26)	0.92	(0.27)	0.93	(0.26)	
Credit participation ^a	0.40	(0.49)	0.41	(0.49)	0.39	(0.49)	
Wage employment ^a	0.32	(0.47)	0.45	(0.50)	0.25	(0.43)	***
Nonfarm self-employment ^a	0.11	(0.32)	0.14	(0.34)	0.10	(0.30)	*
Group participation ^a	0.31	(0.46)	0.40	(0.49)	0.26	(0.44)	***
<i>Education</i>							
Primary education ^a	0.23	(0.42)	0.25	(0.43)	0.21	(0.41)	***
Lower secondary ^a	0.18	(0.38)	0.25	(0.43)	0.14	(0.34)	***
Upper secondary and higher ^a	0.05	(0.21)	0.09	(0.29)	0.02	(0.14)	***
<i>Assets/Wealth</i>							
Annual crop land	1,851	(1,736)	2,432	(2,197)	1,574	(1,312)	***
Perennial land	95.7	(506)	178	(755)	48.6	(267)	***
Forestry land	1,517	(8,557)	1,262	(5,032)	1,661	(1,003)	***
Water surface for aquaculture	16.17	(190)	24.74	(130)	11.30	(219)	
Value of fixed assets	23.60	(28.82)	35.00	(40.40)	16.72	(15.05)	***
Monthly income per capita ^b	390	(336)	712	(432)	238	(84)	***
<i>Commune characteristics</i>							
Asphalt or concrete road ^a	0.22	(0.42)	0.22	(0.42)	0.23	(0.42)	*
Transportation ^a	0.33	(0.47)	0.40	(0.49)	0.29	(0.46)	***
Irrigation ^a	0.77	(0.42)	0.78	(0.41)	0.77	(0.42)	
Post office ^a	0.93	(0.25)	0.96	(0.19)	0.91	(0.28)	***
Job opportunities ^a	0.23	(0.42)	0.30	(0.46)	0.19	(0.39)	***
Population density	156	(379)	196	(425)	133	(349)	*
Geographic location ^a	0.23	(0.42)	0.27	(0.44)	0.20	(0.42)	*
Domestic animal diseases ^a	0.17	(0.38)	0.13	(0.33)	0.19	(0.39)	***
Natural calamities ^a	0.58	(0.49)	0.58	(0.49)	0.58	(0.49)	

Note: estimates are adjusted for sampling weights. *, **, *** mean statistically significant at 10%, 5 % and 1 %, respectively. ^a means dummy variables. ^b measured in VND 1,000. USD 1 equated to about VND 19 thousand in 2010.

Table 3 indicates that there are significant differences in the mean values of most household characteristics between the two groups of households. Poor households had a larger size and much higher dependency ratio than that of non-poor. The statistically significant difference in the age and education of household heads between the two groups were also recorded. On average, the household heads of non-poor households were nearly three years older than those of poor households. In addition, the household heads of the non-poor group had a higher rate of school completion (at all levels) than those of the poor group. The non-poor group also had a higher proportion of households participating in farmer or production groups. Unsurprisingly, the participation rates in both wage and nonfarm self-employment were found to be higher for the non-poor than the poor. However there was no difference in credit participation between the two groups.

As shown in Table 3, the average income per capita for the whole sample is even lower than the poverty line. In addition, the poor had an extremely low level of per capita income, which is just equivalent to one third of the income per capita earned by the non-poor. The disparities in all types of land and the total value of fixed assets per capita between two the groups are highly statistically significant. The size of annual crop land per capita owned by poor households was quite smaller than that owned by non-poor households. In addition, the poor-households owned approximately three times as much the size of perennial land crop per capita as that of the poor-households. Nevertheless, the poor had a much larger size of forestry land per capita than that of the non-poor. This can be explained that there are several programs and policies that allocated forestry lands for the ethnic minority poor in this region (Cuong, 2012). The difference in the water surface for aquaculture per capita between the two groups was not statistically significant. The non-poor households also owned a total value of fixed assets that nearly doubled that of the poor-households. Noticeable differences in some household characteristics and assets between the two groups were expected to be closely linked with the probability of households reducing their poverty intensity and moving out of poverty.

It is evident in Table 3 that a statistically significant association existed between the type of households and some characteristics of the commune in which they lived. The percentage of households who lived in the commune with presence of means of transportation, post offices and off-farm job opportunities was higher for the non-poor group than that of the poor group. However, there is no relationship between the poverty rate and the availability of irrigational works. The population density was found to be lower for the poor than the non-poor. Surprisingly, the proportion of the non-poor living in high mountain areas was higher than that of the poor. The percentage of households who lived in the commune suffering from diseases of domestic animal was higher for the poor than the non-poor but a similar relationship was not found for the case of natural calamities. The above findings suggest that the likelihood of households falling into poverty and its poverty gap was expected to be closely associated with some characteristics of the commune in which they lived.

3.2. Determinants of incidence and intensity of poverty

Table 4 and 5 report the estimation results from the logit model and fractional logit model. It is evident that many explanatory variables are statistically significant at 10 percent or lower level, with their signs as expected. In addition, many coefficients in both models

have same sign and statistical significance. This suggests that some factors that have effects on the incidence of poverty also have the same effects on the intensity of poverty (shortfall). However, some other factors affect only the likelihood of falling into poverty or the poverty intensity, but not both. This reflects the fact that although some factors do not help the poor escape poverty, they make the poor less poor. Therefore, the finding suggests that previous studies that examined only the determinants of poverty incidence might not identify or even ignored the impact of some factors on the intensity of poverty.

Table 4: Logit estimates for the determinants of poverty incidence among ethnic minorities in the Northwest region, Vietnam

Explanatory variables	Coefficients	SE	Marginal effects	SE
<i>Household characteristics</i>				
Household size	0.2973***	(0.051)	0.0650***	(0.011)
Dependency ratio	0.2751*	(0.154)	0.0601*	(0.034)
Age	-0.1341***	(0.041)	-0.0293***	(0.009)
Age squared	0.0012***	(0.000)	0.0003***	(0.000)
Gender	-0.0346	(0.308)	-0.0075	(0.067)
Credit	-0.0019*	(0.001)	-0.0004*	(0.000)
Wage employment	-1.3811***	(0.186)	-0.3133***	(0.042)
Nonfarm self-employment	-0.7011***	(0.246)	-0.1642***	(0.060)
Group participation	-0.3732**	(0.172)	-0.0832**	(0.039)
<i>Education</i>				
Primary	-0.1907	(0.213)	-0.0424	(0.048)
Lower secondary	-0.7730***	(0.231)	-0.1798***	(0.056)
Upper Secondary and higher	-1.5447***	(0.386)	-0.3679***	(0.085)
<i>Assets/wealth</i>				
Annual crop land	-0.0566***	(0.008)	-0.0124***	(0.002)
Perennial crop land	-0.0769***	(0.022)	-0.0168***	(0.005)
Forestry land	0.0010	(0.001)	0.0002	(0.000)
Water surface for aquaculture	-0.0656***	(0.023)	-0.0143***	(0.005)
Residential land	-0.0039**	(0.002)	-0.0009**	(0.000)
Fixed assets	-0.5189***	(0.067)	-0.1134***	(0.013)
<i>Commune characteristics</i>				
Asphalt or concrete road	0.0518	(0.193)	0.0113	(0.042)
Transportation	-0.6544***	(0.178)	-0.1473***	(0.041)
Irrigation	-0.1923	(0.190)	-0.0412	(0.040)
Post office	-0.7586*	(0.398)	-0.1432**	(0.062)
Off-farm job opportunities	-0.6278***	(0.220)	-0.1435***	(0.052)
Population density	0.0004**	(0.000)	0.0001**	(0.000)
Geographic location	-0.0301	(0.249)	-0.0066	(0.055)
Natural calamities	0.4055**	(0.202)	0.0896**	(0.045)
Diseases	0.4184	(0.276)	0.0864	(0.054)
Constant	7.5982***	(1.194)		
Wald chi2(26)		264.83		
Prob > chi2		0.0000		
Pseudo R2		0.3325		
Observations		1,570		

Note: estimates are adjusted for sampling weights. Marginal effects calculated at the means. Robust standard errors are in parentheses. *, **, *** mean statistically significant at 10%, 5 % and 1 %, respectively.

Table 5: Fractional logit estimates for the determinants of poverty intensity (shortfall) among ethnic minorities in the Northwest region, Vietnam

Explanatory variables	Coefficients	SE	Marginal effects	SE
<i>Household characteristics</i>				
Household size	0.1185***	(0.018)	0.0182***	(0.003)
Dependency ratio	0.1901***	(0.053)	0.0292***	(0.008)
Age	-0.0565***	(0.018)	-0.0087***	(0.003)
Age squared	0.0005***	(0.000)	0.0001***	(0.000)
Gender	0.1344	(0.154)	0.0199	(0.022)
Credit	-0.0004	(0.001)	-0.0001	(0.000)
Wage employment	-0.6880***	(0.096)	-0.0986***	(0.013)
Nonfarm self-employment	-0.2662**	(0.122)	-0.0384**	(0.016)
Group participation	-0.0905	(0.090)	-0.0138	(0.014)
<i>Education</i>				
Primary	-0.0963	(0.095)	-0.0145	(0.014)
Lower secondary	-0.3454***	(0.124)	-0.0495***	(0.016)
Upper Secondary and higher	-1.0632***	(0.264)	-0.1191***	(0.020)
<i>Assets/wealth</i>				
Annual crop land	-0.0499***	(0.004)	-0.0077***	(0.001)
Perennial crop land	-0.0584***	(0.018)	-0.0090***	(0.003)
Forestry land	0.0003	(0.000)	0.0000	(0.000)
Water surface for aquaculture	-0.0110	(0.008)	-0.0017	(0.001)
Residential land	-0.0032**	(0.002)	-0.0005**	(0.000)
Fixed assets	-0.2243***	(0.027)	-0.0344***	(0.004)
<i>Commune characteristics</i>				
Asphalt or concrete road	-0.0458	(0.083)	-0.0070	(0.013)
Transportation	-0.2794***	(0.080)	-0.0417***	(0.012)
Irrigation	-0.1773**	(0.088)	-0.0280**	(0.014)
Post office	-0.4748***	(0.156)	-0.0825***	(0.030)
Off-farm job opportunities	-0.1111	(0.115)	-0.0168	(0.017)
Population density	-0.0000	(0.000)	-0.0000	(0.000)
Geographic location	-0.3311***	(0.126)	-0.0481***	(0.017)
Natural calamities	0.0057	(0.094)	0.0009	(0.014)
Diseases	0.0713	(0.119)	0.0111	(0.019)
Constant	2.3580***	(0.503)		
Log pseudolikelihood		-24596.29747		
AIC		31.36726		
BIC		5282.268		
Observations		1,570		

Note: estimates are adjusted for sampling weights. Marginal effects calculated at the means. Robust standard errors are in parentheses. *, **, *** mean statistically significant at 10%, 5 % and 1 %, respectively.

As expected, household size and dependency ratio are positively associated with the incidence of poverty and the shortfall (poverty gap). Holding all other things constant, an additional member increases the probability of a household being poor by around 6.5 percent and its poverty gap by 1.8 percentage points. A similar finding was also found by Imai, Gaiha, & Kang (2011) that household size and dependents increase with the risk of falling into poverty in Vietnam. The positive sign of the age of household head and the negative sign of its squared term imply that the age of household head has a diminishing effect on the incidence and intensity of poverty. Not all levels of education have a reducing effect on the poverty incidence and the shortfall. While having a primary diploma does not decrease the shortfall and poverty incidence, attaining a lower secondary diploma or an upper secondary diploma (or higher level) increase the likelihood of escaping poverty and

close the poverty gap. The intensity and incidence of poverty would be around 5 percentage points and 18 percent lower, respectively, for households with the heads completed the lower secondary school than those whose heads did not attained this education level. A similar but much stronger effect on the shortfall and the poverty incidence were also detected for having an upper secondary diploma or higher. The same finding was also found in Vietnam rural by Kinh et al. (2001) and in Vietnam's peri-urban areas by Tuyen (2014) that households with better education are more likely to escape poverty and become the middle class.

It was found that some other socio-economic characteristics of households also reduce both the risk of being poor, as well as the distance of a poor household from the poverty line. The shortfall and the probability of falling into poverty would be decreased if a household participated in off-farm activities, either wage work or nonfarm self-employment. For example, holding all else constant, the incidence and intensity of poverty would be around 31 percent and 10 percentage points lower, respectively, for a household taking up wage work than another household without doing this work. A similar but smaller impact on the incidence and intensity of poverty were also recorded for the case of nonfarm self-employment. These are partly consistent with the finding by Tuyen (2014) and Kinh et al. (2001) that households with nonfarm participation have more chance of moving out of poverty in Vietnam's peri-urban and rural areas. Participation in groups is positively associated with the likelihood of escaping poverty. A similar finding was found in Amernia by Bezemer and Lerman (2004) that holding a membership of co-operation reduced the risk of falling into poverty. The impact of credit on the probability of being poor is statistically significant but the impact is too small. This variable also has no impact on the poverty gap.

Regarding the role of household assets in poverty reduction, the results show that the intensity and incidence of poverty decrease with holding more annual crop land, perennial crop land and residential land. However, this is not the case for forestry land. Having a larger size of water surface for aquaculture reduces the likelihood of remaining in poverty but does not diminish the shortfall. The incidence of poverty and the shortfall also decline with households owning a higher value of fixed assets. In part the finding is similar to that by Nghiem et al. (2012), who found households' farmland size and ownership of assets all have a positive effect on poverty reduction in Vietnam.

As expected, we found that some commune characteristics such as the presence of means of transportation and post offices have a reducing effect on both the incidence and

intensity of poverty. For example, living in a commune with the availability of post offices decreases the risk of a household falling into poverty by 14.3 percent and reduces the shortfall by 8.25 percentage points. Some other characteristics, however, affect the poverty incidence but do not affect the poverty intensity and vice versa. For example, while the presence of off-farm opportunities significantly diminishes the probability of living below the poverty line, it does not close the poverty gap. Irrigational works diminish the shortfall but do not mitigate the risk of being poor. Surprisingly, households living in high mountains had a lower intensity of poverty than those in low mountains. Nevertheless, the incidence of poverty is not affected by this geographic variable. Although natural calamities were found to raise the chance of falling into poverty, they do not affect the shortfall. Finally, not as expected at all, neither one of the poverty incidence and the shortfall is affected by the occurrence of diseases of domestic animals or crop plants.

4. Conclusion and policy implications

This study examined the poverty and its correlates among the ethnic minorities in the Northwest region of Vietnam. It was evident that the poor in this region are the poorest by any measure of poverty. In this study, both household and community-related factors affecting the poverty were identified using appropriate econometric models. The logit model was applied to explore factors affecting the risk of falling into poverty while the fractional logit model was added to identify factors determining the poverty gap. This combined approach allowed us to investigate factors affecting both the incidence and intensity of poverty. It was found that some factors determine both the incidence of poverty and poverty gap. Some other factors, however, affect only either the poverty incidence or the shortfall. This suggests that previous poverty studies using only a logit/probit approach would not adequately evaluate or even ignored possible impacts of some factors on the intensity of poverty.

This study found that some household characteristics are closely linked to the incidence and intensity of poverty in the Northwest region. For example, having more family members increases both the shortfall and likelihood of being poor. Education was found to have a significantly reducing effect on both the incidence and depth of poverty, and the effect increases with the level of education. The data also revealed that poor ethnic minorities have a larger household size and a much lower level of education than non-poor ethnic minorities. This suggests that reducing larger family sizes would help alleviate poverty in this region. Family planning measures, among others, have been proved to be a

powerful tool in combating poverty in many developing countries (United Nations Population Fund [UNFPA], 2006). Hence, improving the National Target Program on Population and Family Planning is likely to be an effective way of reducing poverty in the Northwest region. Furthermore, the National Target Program on Education and Training should aim at ensuring sustained and improved access for the poor ethnic minorities to education and training. This will go a long way to alleviate the poverty rate as well as close the poverty gap in the study area.

Although having more land (annual crop land, perennial crop land and residential land) reduces the shortfall and increases the probability of escaping poverty; participation in off-farm activities, notably wage employment was found to have a strongly decreasing effect on both the incidence and intensity of poverty. The risk of being poor would be also quite lower for a household living in a commune with the presence of off-farm opportunities. Unfortunately, access to off-farm jobs was very limited for the poor in this region (Cuong, 2012). This suggests that expansion of off-farm activities, coupled with improving the access of the poor to these, should be considered one of the leading priorities of the National Target Program on Employment in the Northwest region.

We found evidence that some community level factors such as the availability of means of transportation and post offices play an important role in reducing both the poverty incidence and poverty intensity. In addition, the current study found that the presence of irrigational works diminishes the poverty gap, although it does not reduce the risk of falling into poverty. This implies that the likelihood of being poor and or the shortfall might be reduced by investing in local physical (hard) infrastructure in the form of building up post offices and irrigational works, and promoting the presence of means of transportation. Finally, the occurrences of natural calamities were found to increase the incidence of poverty. So it is possible to suggest that negative effects of natural calamities might be mitigated through improving preparedness and mitigation measures for various natural disasters.

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