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A note on poverty among ethnic minorities in the Northwest region of Vietnam

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This article is the first to investigate both community and household determinants of poverty among ethnic minorities in the Northwest region of Vietnam. Results of a fractional logit and a logit model show that fixed assets, education and off-farm employment, among other household factors, have a strongly reducing effect on both the intensity and incidence of poverty. Furthermore, some commune characteristics were found to be closely linked to poverty. Notably, the presence of means of transport and post offices significantly reduces both poverty intensity and incidence. However, other commune and household factors affect only poverty incidence or intensity but not both. Hence, a typical approach using a logit/probit model that only examined the determinants of poverty incidence did not adequately evaluate or even ignored important impacts of some factors on poverty intensity. We draw both socio-economic household and commune level implications for poverty alleviation in the study area.

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% in the early 1990s to 14.5% by 2008, and by these standards was calculated to be well below 10% by 2010 (World Bank 2012). Despite remarkable progress, Vietnam’s mission of poverty reduction is not accomplished, and in some respects it has become more challenging. One of these is that poverty is extremely high and persistent among ethnic minorities. Using the 2010 General Statistical Office–World Bank poverty line,¹ the World Bank (2012) estimated that 66.3% of ethnic minorities were still poor and 37.4% extremely poor in 2010. By contrast, the corresponding figures for the Kinh majority population were only 12.9% and 2.9%. In particular, 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% of the ethnic minorities in this region still lived below the poverty line and 45.5% below the extreme poverty line in 2010 (World Bank 2012).

Perhaps owing to the big gap in 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 *et al.* 2007, Minot 2000, Van de Walle and Gunewardena 2001, Baulch *et al.* 2011, Cuong 2012). However, to the best of our knowledge, little evidence exists on the determinants of poverty incidence among the ethnic minorities in Vietnam and, furthermore, there is no econometric evidence determining factors affecting both the incidence and the intensity of poverty among the

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ethnic minorities in the Northwest Mountains. A thorough understanding of what factors contribute to the poverty of ethnic minorities in this poorest region is of great importance for designing policy interventions to meet their needs and improve their welfare. For this reason, the current study was conducted to fill 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 of Vietnam. This study differs from previous studies on poverty in Vietnam in two important respects. First, it investigates the determinants of poverty among ethnic minority households in the Northwest Mountains – the poorest region of Vietnam – using a unique dataset from a recent Northern Mountains Baseline Survey. The survey was conducted in 2010 by the General Statistical Office of Vietnam with the focus on the ethnic minorities in the Northwest Mountains (hereafter the Northwest region). Second, the approach in previous studies has often focused only on the determinants of poverty incidence (the headcount index) using a logit or probit model (e.g. Minot 2000, Kang 2009, Imai *et al.* 2011, Tuyen and Huong 2013). This approach, however, has a limitation, as it might be unable to identify or even might ignore factors affecting the intensity of poverty. This is because the incidence of poverty implies only a ‘jump’ or discontinuity in the distribution of welfare at about the poverty line, and 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 makes a significant contribution to the literature by providing the first econometric evidence for factors affecting poverty intensity and incidence among the ethnic minorities in the Northwest region.

The article is structured in four sections. The first describes the data source and econometric models used. The next presents the determinants of poverty incidence and intensity. Finally, the conclusions and policy implications are presented.

Data and methods

Data source

The dataset from the Northern Mountains Baseline Survey (NMBS) 2010 was used for the current study. The 2010 NMBS was conducted by the General Statistical Office of Vietnam from July to September 2010 to gather baseline data for the Second Northern Mountains Poverty Reduction Project (Cuong 2012). The overall objective of this project is to alleviate poverty in the Northern Mountains. The project has invested in productive infrastructure in poor areas in this region and has also provided support for the poor to foster farm and off-farm activities. The project covers six provinces in the Northwest region: 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. First, 120 communes from the six provinces were randomly selected following probability proportional to the population size of the provinces. Second, from each of the selected communes, three villages were randomly selected and then five households in each village randomly chosen for interview, producing a total sample size of 1800 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 in targeted programmes. The commune data include information about the characteristics of communities such as demography,

population, infrastructure, off-farm job opportunities, natural calamities, diseases of domestic animals and diseases and targeted programmes in the communes. The commune data can be merged with the household data.

Method of data analysis

Measures of poverty

This study adopts the class of poverty measures developed by Foster, Greer and Thorbecke (FGT) (Foster *et al.* 1984) that has been most commonly used for measuring poverty (Coudouel *et al.* 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) and α is the Poverty Aversion Parameter Index, which takes the values of 0, 1 and 2 representing the incidence of poverty, poverty gap and severity of poverty (Foster *et al.* 1984).

If $\alpha = 0$, then the FGT measure 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. This measure is by far the most popular one used because it is straightforward and easy to calculate (World Bank 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 $P_1 = \frac{1}{N} \sum_{i=1}^q \left(\frac{Z - Y_i}{Z} \right)$, 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 the poor are from the poverty line. Thus the poverty gap index has the virtue of measuring the intensity of poverty (World Bank 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).

Specification of econometric models

First, we grouped households into poor and non-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 2011–15. Because the survey focused on households living in mountainous areas, the poverty line for the rural population (400,000 Vietnamese dong (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 is commonly called analysis

of variance. However, a similar objective can be attained by using the framework of regression analysis. Thus, regression analysis using the Analysis of Variance (ANOVA) models was used to compare the mean of household characteristics and assets between the two groups. In addition, a chi-square test was applied to investigate whether a statistically significant relationship 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 the value of one if a household was counted as poor and zero otherwise. The logit model takes the form (Gujarati and Porter 2009)

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

where the coefficients β'_s are the parameters to be estimated in the model and X'_s are the explanatory variables. This model estimates the probability that some event occurs, in this case the probability of a household falling into poverty ($Y = 1$). Since the maximum likelihood estimation (MLE) of a logit model is based on the distribution of Y given X , the heteroscedasticity in $\text{Var}(Y|X)$ is automatically accounted for (Wooldridge 2013).

Because the intensity of poverty, defined as the shortfall, i.e. the poverty line minus income, is a fractional response variable taking the values from zero to 100%², the determinants of poverty intensity were modeled 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%. As demonstrated by Wagner (2001), the fractional logit approach is the most appropriate because this model overcomes a lot of difficulties related to other more commonly used estimators such as OLS (ordinary least squares) and TOBIT³. There have been an increasing number of studies applying the fractional logit/probit model to handle models containing a fractional response variable bounded between zero and one (e.g McGuinness and Wooden 2009, Cardoso *et al.* 2010, Gallaway *et al.* 2010, Jonasson 2011, Tuyen *et al.* 2014). Hence, following this approach, we applied the so-called fractional logit model

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

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

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 *et al.* 2006). Thus we used the same specification to explain variations in the likelihood of being poor (logit) and in the shortfall (fractional logit). Household socio-economic factors, among others, have been recognised by development practitioners in developing countries as variables that are strongly associated with poverty (Akerle *et al.* 2012). In addition, community socio-economic factors such as the presence of roads, irrigation works and electricity were found to help the poor promote agricultural and non-agricultural productivity and diversify their livelihoods, which in turn enables them to escape poverty

(Ali and Pernia 2003). Therefore, in this study, the incidence and intensity of poverty were hypothesised 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. Our specification included household size, dependency ratio and the age,

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 household	+
Age	Age of household head (years).	±
Age squared	Squared age of household head (years) ²	±
Gender ^a	Whether or not household head is male (male = 1; female = 0).	±
Primary education ^a	Whether or not household head completed primary school	-
Lower secondary ^a	Whether or not household head completed lower secondary school	-
Upper secondary and higher ^a	Whether or not household head completed upper secondary school or higher level	-
Annual crop land	Area of annual crop land per capita (100 m ² per person)	-
Perennial crop land	Area of perennial crop land per capita (100 m ² per person)	-
Forestry land	Area of forestry land per capita (100 m ² per person).	-
Water surface for aquaculture	Area of water surface for aquaculture per capita (100 m ² per person)	-
Residential land	Area of residential land per capita (10 m ² per person)	-
Fixed assets	Total value of all fixed assets per capita (log of thousand VND)	-
Credit	Total value of loans the household borrowed during last 24 months before the survey (million VND)	-
Group participation ^a	Whether or not household participated in any production or farmer association	-
Wage employment ^a	Whether or not household engaged in paid jobs	-
Non-farm self-employment ^a	Whether or not household took up non-farm self-employment	-
Asphalt/concrete road ^a	Is there any paved road to the commune in which the household lived?	-
Means of transport ^a	Whether or not means of transport such as minibuses, passenger cars, vans, three-wheel taxis or motorbike taxis are available in the commune in which household lived.	-
Irrigation work ^a	Is there any irrigation work in the commune in which household lived?	-
Post office ^a	Is there any post office within the commune in which household lived?	-
Off-farm opportunities ^a	Is there any production/services unit or trade village located in the distance that the people in the commune can go to work and then go home every day?	-
Geographical location ^a	Whether or not household lived in high mountain areas (1 = high/ 0 = low)	-
Population density	Number of people per square kilometre	±
Natural calamities ^a	Is there any natural calamity such as fire, flood, storm, landslide, or earthquake that occurred in the commune in which household lived in last three years?	+
Diseases ^a	Is there any disease of domestic animals or crop plants that occurred in the commune in which household lived in last three years?	+

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

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 model. It also takes into account some productive assets of households such as the area 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 paved roads, post offices, irrigation works, off-farm opportunities and means of transport. Finally, controls were also added to take account of natural calamities and diseases of domestic animals and crop plants at the commune level.

Results and discussion

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 Northwest region lived below the poverty line and about 42% 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) was nearly triple that of the other ethnic minority poor and was about 10 times that of the Kinh/Hoa poor. Thus the results confirm that the ethnic minority poor in the Northwest region are the poorest by any measure of poverty. The poverty gap is 27% for the Northwest ethnic minorities, indicating that, on average, a poor ethnic minority household would have to mobilise financial resources up to VND 108,000 per month (27% of VND 400,000) for each household member to be able to move out of poverty. However, the corresponding figures for the Kinh/Hoa population and the ethnic minorities in other regions were only VND 10,800 and VND 38,800.

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, livestock and aquaculture than the poor. The non-poor derived much more income from off-farm activities, including both wage and non-farm 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

Table 2. Poverty measures by ethnicity, 2010, %.

Poverty measures	Headcount	Poverty gap	Poverty severity
Poor			
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: ^aauthors' own calculation from 2010 NMBS using poverty line based on income per person per month of VND 400,000 and extreme poverty line calculated as two-thirds of poverty line. ^bEstimation from Cuong (2012) using 2010 VHLSS (Vietnam Household Living Standard Survey in 2010) and ^cWorld Bank (2012) estimation from 2010 VHLSS using 2010 GSO-WB poverty line. The Kinh/Hoa are the ethnic majority population.

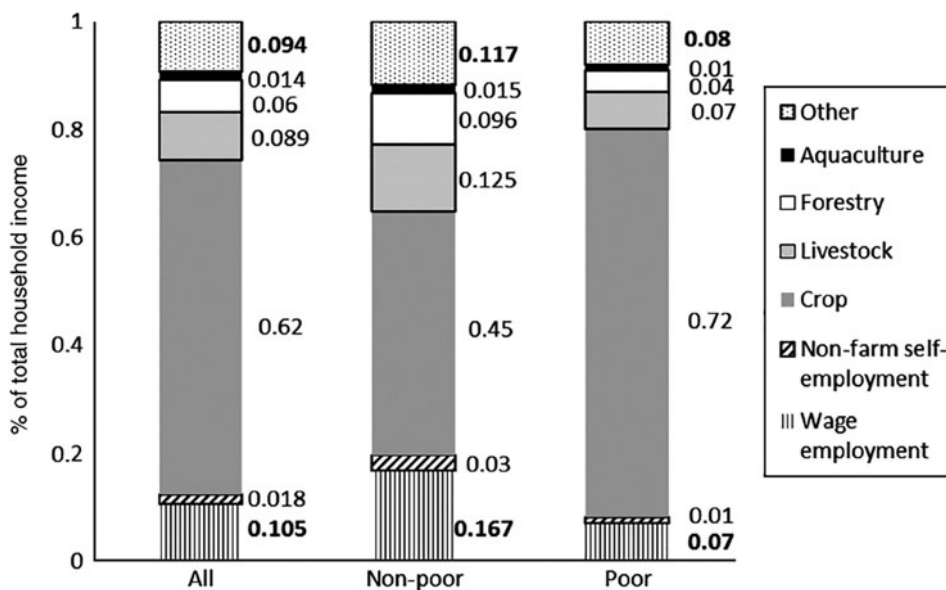


Figure 1. Household income structure, poor and non-poor. *Source:* authors' own calculation from the 2010 NMBS.

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

Table 3 indicates that there are significant differences in the mean values of most household characteristics between poor and non-poor households. Poor households had a larger size and a much higher dependency ratio than those of the non-poor. Statistically significant differences 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 approximately 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 non-farm 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 lower than the poverty line. In addition, the poor had an extremely low level of per capita income, equivalent to just 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 the two groups are statistically highly significant. The area of annual crop land per capita owned by poor households was considerably smaller than that owned by non-poor households. In addition, the non-poor households owned approximately three times as much perennial land per capita as the poor households. Nevertheless, the poor had a somewhat larger area of forestry land per capita than the non-poor. This can be explained by the various programmes and policies that allocated forestry land to the ethnic minority poor in this region (Cuong 2012). The difference in the water area for aquaculture per capita between the two groups was not statistically significant. The non-poor households also owned a

Table 3. Descriptive statistics of household and commune characteristics.

Explanatory variables	All ethnic minority households		Non-poor ethnic minority households		Poor ethnic minority households		t-value or Pearson chi ²
	Mean	SD	Mean	SD	Mean	SD	
Household characteristics							
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)	***
Non-farm 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)	***
Education							
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)	***
Assets/Wealth							
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 area 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)	***
Commune characteristics							
Asphalt or concrete road ^a	0.22	(0.42)	0.22	(0.42)	0.23	(0.42)	*
Transport ^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)	***
Off-farm job opportunities ^a	0.23	(0.42)	0.30	(0.46)	0.19	(0.39)	***
Population density	156	(379)	196	(425)	133	(349)	*
Geographical location ^a	0.23	(0.42)	0.27	(0.44)	0.20	(0.42)	*
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. SD: standard deviations. *, **, *** mean statistically significant at 10%, 5% and 1%, respectively. ^aDummy variables. ^bMeasured in VND 1000. USD 1 was equal to about VND 19,000 in 2010.

total value of fixed assets that was nearly double 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 shortfall and the probability of being poor.

It is evident from 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 households who lived in a commune with means of transport, post offices and off-farm job opportunities was higher for the non-poor group than for the poor group. However, there is no relationship between the poverty rate and the availability of irrigation works. 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 a commune suffering from diseases among domestic animals and crop plants was higher for the poor than for the non-

poor but a similar relationship was not found for natural calamities. The above findings suggest that the intensity and incidence of poverty were expected to be closely associated with some characteristics of the commune in which they lived.

Determinants of incidence and intensity of poverty

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

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)
Non-farm 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 area 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)
Transport	-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)
Geographical 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 $\chi^2(26)$			264.83	
Prob > χ^2			0.0000	
Pseudo R^2			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
Household characteristics				
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)
Non-farm self-employment	-0.2662**	(0.122)	-0.0384**	(0.016)
Group participation	-0.0905	(0.090)	-0.0138	(0.014)
Education				
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)
Assets/wealth				
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 area 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)
Commune characteristics				
Asphalt or concrete road	-0.0458	(0.083)	-0.0070	(0.013)
Transport	-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)
Geographical 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			1570	

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.

(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 have identified or even ignored the impact of some factors on the intensity of poverty.

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% and its poverty gap by 1.8 percentage points. A similar finding, that household size and dependents increase the risk of falling into poverty in Vietnam, was also reported by Imai

et al. (2011). The positive sign of the age of the household head and the negative sign of its square imply that the age of the household head has a diminishing effect on the incidence and intensity of poverty. Not all levels of education have a reducing effect on poverty incidence and 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) increases the likelihood of escaping poverty and closes the poverty gap. The intensity and incidence of poverty would be around 5 percentage points and 18% lower, respectively, for households with heads who had completed lower secondary school than those whose heads had not attained this education level. A similar but much stronger effect on the shortfall and the poverty incidence was also detected for household heads with an upper secondary diploma or higher. The same finding was also reported for rural Vietnam by Kinh *et al.* (2001) and for Vietnam's peri-urban areas by Tuyen (2014): households with better education are more likely to escape poverty and join the middle class.

Some other socio-economic characteristics of households were also found to reduce both the risk of being poor and 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 non-farm self-employment. For example, holding all else constant, the incidence and intensity of poverty would be around 31% and 10 percentage points lower, respectively, for a household taking up wage work than another household without such work. A similar but smaller impact was also recorded for the case of non-farm self-employment. These are partly consistent with the findings by Kinh *et al.* (2001) and Tuyen (2014) that households with non-farm 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 reported for Armenia by Bezemer and Lerman (2004): membership of a co-operative reduced the risk of falling into poverty. The impact of credit on the probability of being poor is statistically significant but very 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 area 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 this finding is similar to that by Nghiem *et al.* (2012), who found that households' farmland size and ownership of assets all had a positive effect on poverty reduction in Vietnam.

As expected, we found that some commune characteristics such as the presence of means of transport and a post office have a reducing effect on both the incidence and intensity of poverty. For example, living in a commune with a post office decreases the risk of a household falling into poverty by 14.3% and reduces the shortfall by 8.25 percentage points. Some other characteristics, however, affect poverty incidence but do not affect poverty intensity and *vice versa*. For instance, while the presence of off-farm opportunities significantly diminishes the probability of living below the poverty line, it does not close the poverty gap. By contrast, irrigation 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 geographical variable. Although natural calamities were found to raise the chance of falling into poverty, they do not affect the shortfall. Finally, not at all as

expected, neither poverty incidence nor the shortfall is affected by the occurrence of diseases among domestic animals or crop plants.

Conclusion and policy implications

This study examined 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 in the country by any measure of poverty. In this study both household and community-related factors affecting 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 the intensity of poverty. We found that some factors determined both the incidence of poverty and the poverty gap. Some other factors, however, affected only either the poverty incidence or the shortfall. This suggests that previous poverty studies using only a logit/probit approach might not adequately evaluate or even ignored the possible impact of some factors on the intensity of poverty.

This study found that some household characteristics were 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. 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 2006). Hence, improving the National Target Programme on Population and Family Planning is likely to be an effective way of reducing poverty in the Northwest region. Furthermore, the National Target Programme 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.

While 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 stronger effect in reducing both the incidence and the intensity of poverty. The risk of being poor would also be considerably 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 the region (Cuong 2012). This suggests that expansion of off-farm activities, coupled with improving the access of the poor to such activities, should be considered one of the leading priorities of the National Target Programme on Employment in this region.

We found evidence that some community level factors, such as the availability of means of transport and a post office, played an important role in reducing both poverty incidence and poverty intensity. In addition, it is evident that the presence of irrigation 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 post offices and irrigation works, and promoting the presence of means of transport. Finally, the occurrence of natural calamities was 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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Notes

1. The 2010 GSO–WB (General Statistical Office – World Bank) poverty line is based on consumption expenditure per capita per month of VND 653,000 in 2010.
2. The intensity of poverty (poverty gap) is a percentage variable that is by definition limited between zero and 100% with a lot of households (36.6% of observations) having zero values for 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 a variable are outside the limits because of censoring. In addition, Cardoso *et al.* (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.

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