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The influence of contextual and household factors on multidimensional poverty in rural Vietnam: A multilevel regression analysis

Tuyen Quang Tran [a,*], Hoai Thu Thi Nguyen [b], Quang Ngoc Hoang [b], Dinh Van Nguyen [a]

[a] International School, Vietnam National University, Hanoi, Viet Nam
[b] University of Economics and Business, Vietnam National University, Hanoi, Viet Nam

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ABSTRACT

Using a multilevel regression modeling technique, this paper examines the influence of contextual and household factors on multidimensional poverty in rural Vietnam. We find that unobservable characteristics at the province, district and commune levels account for about 28% and 25%, respectively, of the variation in multidimensional and income poverty risk. In addition, the study shows that several micro-factors, such as ethnicity, better education, social capital, nonfarm activities and public employment, play a key role in reducing both the likelihood of falling into poverty and the number of dimensions of deprivation. The risk of poverty is higher for households in remote communes and lower for those in communes with access to transportation and nonfarm jobs. At the macro-level, it was found that living in provinces with a higher level of economic development, greater population density, and more international integration increases the chances of households to escape both multidimensional and income poverty.

1. Introduction

Vietnam has attained remarkable progress in poverty alleviation over the past three decades, with a huge drop in the poverty rate (measured in expenditure on consumption) from 57% in the early 1990s to only 9.8% in 2016 (Ministry of Labour, War Invalids and Social Affairs [MOLISA], 2018) and 6.8% in 2018 (General Statistical Office [GSO], 2018). However, recognizing that quality of life involves many more factors than income or consumption, since 2016 the Vietnamese Government has officially adopted a multidimensional approach to poverty to eradicate it in all its dimensions (MOLISA, 2018). To provide policy implications for reducing multidimensional poverty, one must understand the macro and micro factors that affect people's poverty status in the specific location where they live, and what factors enable them to improve their well-being. This suggests that identifying and quantifying factors contributing to multidimensional poverty are crucial to both academic researchers and policy makers in Vietnam.

A large number of studies have examined the dynamics and determinants of income or expenditure poverty in Vietnam, whereas to the best of our knowledge there are few similar studies so far for multidimensional poverty. More importantly, most previous studies often ignore the role of unobservable and observable regional factors in poverty alleviation. The gap in the literature and the

* Corresponding author. International School, Vietnam National University, Building G7 &G8, No. 144, Xuan Thuy Street, Cau Giay District, Hanoi, Viet Nam.
E-mail address: tuyentranquang@isvnu.vn (T.Q. Tran).

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significance of the research topic for policy making motivated us to conduct this research. Our study focuses only on rural areas because both monetary and multidimensional poverty have remained much higher among rural households (GSO & GSO, 2018; MOLISA, 2018). We utilize secondary data from the Household Living Standard Surveys (VHLSS) in 2016 and 2018, combined with secondary data at the provincial level. Specifically, we first employ the Alkire and Foster (2011) multidimensional poverty measurement methodology (AF method) to estimate multidimensional poverty and decompose the multidimensional poverty index (MPI) by dimensions and regions. We then use a multilevel regression modeling technique to quantify micro and macro factors affecting multidimensional poverty among rural households. In particular, our study controls for several important characteristics at the commune and provincial levels. This approach allows us to identify the contribution of both observable and unobservable contextual factors to the poverty status of rural households. Finally, we propose some policy implications for policies to combat poverty.

We find that multidimensional poverty rates and the contribution of each dimension to the MPI varies greatly according to region. Notably, we find that unobservable characteristics at province, district and commune levels account for about 28% of the variation in multidimensional poverty in rural Vietnam. It was found that several micro-factors, such as ethnicity, better education, social capital, nonfarm business and public employment, play a key role in reducing both the likelihood of falling into multidimensional poverty and the number of dimensions of deprivation. The risk of being poor is higher for households in remote communes and lower for those in communes with access to transportation and nonfarm jobs. At the macro-level, it was found that living in a province with a higher level of economic development, greater population density and more international integration (measured as the share of workers in foreign investment companies) increases the chance of households escaping both multidimensional and income poverty. Also, households in provinces with good public governance are more likely to experience a lower number of dimensions of deprivation.

The rest of the paper is structured as follows. A literature review on factors associated with multidimensional poverty is provided in Section 2, followed by an explanation of data and analytical methods in Section 3. Section 4 presents the empirical results and discussion while Section 5 concludes with some policy implications.

2. Theoretical and empirical review

Multidimensional poverty has emerged as a major concern among researchers as well as policy makers, partly in view of the persuasive analysis by Amartya Sen (Sen, 1976) and the unprecedented availability of relevant data (Alkire & Foster, 2011). Given the multidimensional framework, a growing number of studies over the last two decades have focused on the identification, aggregation, and decomposition of multidimensional poverty (Alkire, Roche, & Vaz, 2017; Alkire & Santos, 2013; Betti & Verma, 2008; Dotter & Klasen, 2017; Leu, Chen, & Chen, 2016; Levine, Muwonge, & Batana, 2014; Yu, 2013). Identification and aggregation provide an accurate profile of multidimensional poverty, whereas decomposition can be used to understand a subgroup's multidimensional poverty and the contribution of the subgroup to the overall poverty rate (Alkire et al., 2015, 2015). These, in turn, facilitate the formation of targeted policies (Alkire & Foster, 2011).

Applying Alkire and Foster's [AF] method (2011), an increasing number of studies have used three key deprivation indicators for measuring multidimensional poverty, namely education, standard of living and health (Alkire & Santos, 2013; Bader, Bieri, Wiesmann, & Heinimann, 2016; Batana, 2013; Chen, Leu, & Wang, 2019; Mitra, Posarac, & Vick, 2013; Yu, 2013). Many have employed the AF method to calculate changes in multidimensional poverty over time, for example in Uganda (Levine et al., 2014), China (Qi & Wu, 2015) and Vietnam (MOLISA, 2018). Also, several studies have found that the most appropriate deprivation indicators and findings of multidimensional poverty vary across nations, regions, and cities (Batana, 2013; Battiston, Cruces, Lopez-Calva, Lugo, & Santos, 2013; MOLISA, 2018; Yu, 2013).

While there is a large body of research into measuring and decomposing multidimensional poverty, few studies have examined the impact of individual or household factors on multidimensional poverty or why people fall into multidimensional poverty (Chen et al., 2019). Micro econometric evidence shows that age, socio-economic condition, marital status, and household income are closely linked with levels of multidimensional poverty in Taiwan (Chen et al., 2019) and India (Roy, Ray, & Haldar, 2019). Among rural households in South Africa (Megbowon, 2018), a better education and occupation, as well as an adequate number of assets, were found to reduce the risk of being multidimensionally poor. Poor health, low-paid employment and living in rural areas emerged as key drivers of multidimensional poverty in Nigeria (Ataguba, Fonta, & Ichoku, 2011). In several European countries, similarly, households characterized by low levels of education, low social class, unemployment, and disadvantaged marital status, are more likely to be multidimensionally poor (Whelan, Nolan, & Maitre, 2014). A recent study by Dhongde (2020) in the USA also reveals that individuals with better income and education have fewer indicators of economic deprivation.

It is also evident that not only individual and household characteristics, but also contextual factors play a key role in explaining the status of multidimensional poverty. Access to public infrastructure lowers the likelihood of households being multidimensionally poor in rural India (Roy et al., 2019) and South Africa (Megbowon, 2018). Chen et al. (2019) investigated both micro and macro factors determining multidimensional poverty in Taiwan. Their study showed that the risk of falling into poverty is higher for households in urban cities and lower for those in cities with a greater service-to-manufacturing ratio. Notably, using a multilevel modeling technique, Chen et al. (2019) showed that cities and counties explain about 30% of the variation of multidimensional poverty. Another micro- and macro-level study by Jindra and Vaz (2019) examined the role of good governance in multidimensional poverty, using hierarchical models and household survey data for 71 countries. They found that while good governance had a direct effect on reducing multidimensional poverty in middle-income countries, a similar effect was not observed in low-income countries. When examining multidimensional poverty in European Union (EU) countries and within-country areas, Weziak-Bialowolska (2016) found that the likelihood of being multidimensionally poor is higher in the rural areas of most countries, but lower in the rural areas of Greece, Italy, and Portugal.

In Vietnam, numerous studies have attempted to measure the multidimensional poverty index (MPI) and decompose it by dimensions, indicators and sub-groups (Haugton, 2010; Le, Nguyen, & Phung, 2015; MOLISA, 2018; Tran, Alkire, & Klasen, 2015). Recently, however, there is new research into the macro and micro determinants of the risk of multidimensional poverty. For example, Pham, Mukhopadhaya, and Vu (2020) examined factors affecting the likelihood of households experiencing deprivation in each of six dimensions, namely education, health, housing, durable assets, basic services, and economic status. The authors found that the likelihood of deprivation in most dimensions is higher for ethnic minority households and less educated households. The level of deprivation in most dimensions is much lower for households with more members engaging in nonfarm activities and those with older household heads. More importantly, using a multilevel regression model enables the authors to clarify the fact that while the household level accounts for the largest proportion of the total variability in dimensions of deprivation, the province, district and commune level makes a significant clustering contribution to the variation in deprivation in all dimensions.

In the aforementioned literature, no study examines both household and contextual factors influencing multidimensional poverty in rural Vietnam. The literature gap and importance of the research topic motivated us to conduct the current study. Using the Vietnamese government's official MPI measurements for the period 2016–2020, our study is the first to investigate both micro and macro factors affecting the incidence of multidimensional poverty and the number of dimensions of deprivation among households in rural Vietnam. Notably, we employ a multilevel regression technique to account for the contribution of unobservable contextual factors to both the income and multidimensional poverty of rural households in 2016 and 2018.

3. Data and methods

3.1. Data sources

Our study utilized secondary data from the VHLSS in 2016 and 2018. The survey was conducted by the GSO and was implemented nationwide with a sample size of 46995 households in 3133 communes/wards. The survey covered 63 provinces, which were representative at the national, regional, urban and rural, and provincial levels. It gathered information over four periods through face-to-face interviews with household heads, their household members and key commune officials. The survey contains detailed information about household and commune socio-economic characteristics, such as demography, education, economic activities and income sources, land and durable assets, job opportunities and access to public infrastructure, etc. Our study combined both household and commune data. After excluding cases with missing values for any of the relevant variables, our effective sample includes 50432 households, with 26764 households in 2016 and 23668 households in 2018. We also use certain provincial variables from the GSO in order to examine the role of some provincial factors in the poverty status of rural households.

3.2. Indicators

3.2.1. Multidimensional poverty

In 2015, the Vietnamese government officially adopted multidimensional poverty (MDP) measurements for the 2016–2020 period, marking a crucial step in the country's transition from an income-based to an MDP approach (MOLISA, 2018). Table 1 provides detailed information about five dimensions and their corresponding indicators, with equal weights. Our study adopts Alkire and Foster's (2011) (AF) method for measuring multidimensional poverty (MDP). Using the 2016–2018 VHLSS data, we estimate the proportion of households experiencing each dimension of deprivation in Table 1. Notably, we estimate and decompose the MPI index by dimensions and regions, and the results are given in Table 2, Figs. 1–3.

3.2.2. Household characteristics

We select several household characteristics that are found to be closely associated with poverty status and household welfare in rural Vietnam and several other countries. Specifically, we include the ethnicity, gender, age, marital status, occupation, and education of household heads (Dreze & Srinivasan, 1997; Hoang, Pham, & Ulubaşoğlu, 2014; Jindra & Vaz, 2019; Nguyen, Nguyen, & Grote, 2020; Rahman, 2013; Tran, Nguyen, Vu, & Nguyen, 2015); household size and dependency ratio (Gregory & Meng, 2007; Lipton & Ravallion, 1995; Van Hoang, Tran, Nguyen, & Nguyen, 2019); social capital (Dinh, Dufhues, & Buchenrieder, 2012; Hassan & Birungi, 2011); migration (Du, Park, & Wang, 2005; Lokshin, Bontch-Osmolovski, & Glinskaya, 2010); ownership of various types of land (Fazal, 2001; Glewwe, 1991; Heger, Zens, & Bangalore, 2020; Tran, Alkire, & Klasen, 2015) and the lagged income poverty status of households (Buddelmeyer & Cai, 2009).

3.2.3. Commune and provincial characteristics

Guided by previous studies on rural Vietnam (Tran, Alkire, & Klasen, 2015; Van Hoang et al., 2019) and other developing countries (Megbowon, 2018; Roy et al., 2019), our study also includes some commune variables correlated with the poverty status of rural households, including (i) nonfarm job opportunities, (ii) transportation availability and (iii) remoteness of region. In addition, empirical evidence from several studies (Ashley, 2008; Chao, Nabin, Nguyen, & Sgro, 2016; Chen et al., 2019; Chen & Wang, 2015; Giang, Nguyen, & Tran, 2017; Jindra & Vaz, 2019) suggests that at the city or country level, monetary and multidimensional poverty is

Table 1
Dimensions and indicators of multidimensional poverty according to Decision No. 59/2015/QD-TTg.

Dimensions	Indicators	Definition and measurement: 1 = yes; 0 = not	Percentage of rural households whose indicator values are below the threshold.	
Education	Adult education	Households with at least one member aged between 15 and 30 years old who have not yet completed the lower secondary school and not attending school	14.79%	11.42%
	School attendance	Households with at least one school-age child (those between 5 and 15 years old) is not going to school	2.78%	2.50%
Health	Medical status	Household with at least one member seriously ill but lacking medical examination and treatment	1.09%	1.29%
	Health insurance	Households with at least one member aged 6 and above without health insurance	46.37%	27.39%
Housing	Housing quality	Households in temporary houses	7.99%	5.33%
	Housing area	Households with an average living area per person less than 8 m^2	8.79%	6.93%
Living conditions	Clean water	Households without access to clean water	8.36%	5.58%
	Hygienic latrine	Households without access to hygienic latrine/toilet	18.91%	14.86%
Information	Communication services	No household members use phone or internet	5.56%	3.34%
	Information access	Households without the means for information access or for listening to the commune/village loudspeaker system	2.33%	2.26%

Sources: Authors' calculation using rural household data from the 2016–2018 VHLSS. Estimates account for sampling weights and household size.

Table 2
Multidimensional poverty measurement for rural Vietnam, 2016 and 2018.

Year	MPI measurements	2016	2018
H	Multidimensional headcount	0.118	0.069
		(0.002)	(0.002)
M0 = H × A	Adjusted multidimensional headcount	0.042	0.024
		(0.001)	(0.001)
A	Average range of deprivations	0.357	0.348
		(0.002)	(0.002)
Income poverty	Income poverty headcount	0.079	0.061
		(0.270)	(0.240)
Dimensions	Indicators	Contribution of each indicator to M0 (%)	
Year		2016	2018
Education	Adult education	0.160	0.157
	School attendance	0.038	0.059
Health	Medical services	0.008	0.013
	Health insurance	0.156	0.146
Housing	Housing quality	0.117	0.102
	Housing area	0.101	0.117
Living conditions	Clean water	0.106	0.100
	Hygienic latrine	0.216	0.201
Information	Communication services	0.057	0.050
	Means for accessing information	0.041	0.055

Note: standard errors in parentheses. Income poverty measured using the Government poverty line for rural areas of 700,000 and 755,000 Vietnamese dong/person per month in 2016 and 2018, respectively.
Sources: Authors' calculation using rural household data from the 2016–2018 VHLSS. Estimates account for sampling weights and household size.

strongly affected by certain key contextual factors such as the level of economic development, inequality and the quality of public governance. Therefore, our study includes five provincial variables, namely (i) the provincial gross domestic product per capita, (ii) the quality of public governance as measured by the provincial governance and public administration performance index (PAPI),[1] (iii) the proportion of workers in foreign direct investment (FDI) companies as a percentage of the total labour force, (iv) the income Gini index, and (v) population density as measured by the number of people per square kilometer.

3.3. Econometric methods

Our research data consist of a four-level hierarchical structure with households at level one, nested within communes/wards at

[1] https://papi.org.vn/eng/.

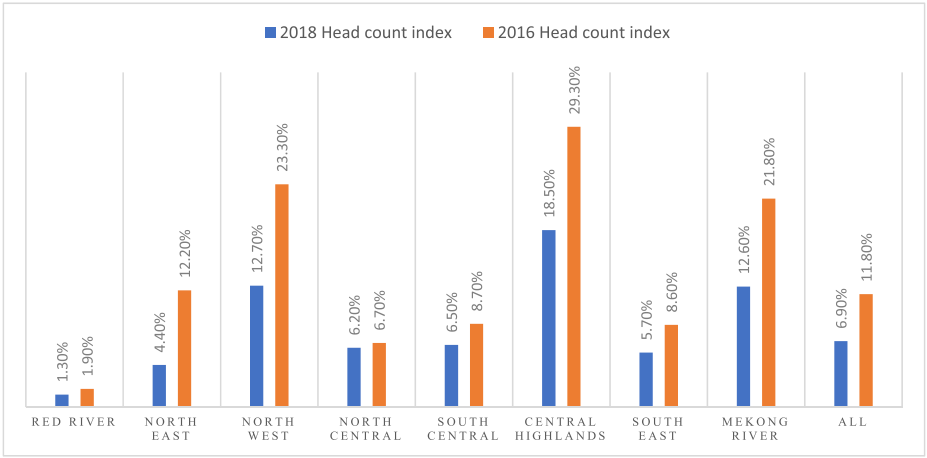

Fig. 1. Multidimensional poverty head count index in rural Vietnam by region, 2016 and 2018.
Sources: Authors' calculation using data from the 2016–2018 VHLSS. Estimates account for sampling weights and household size.

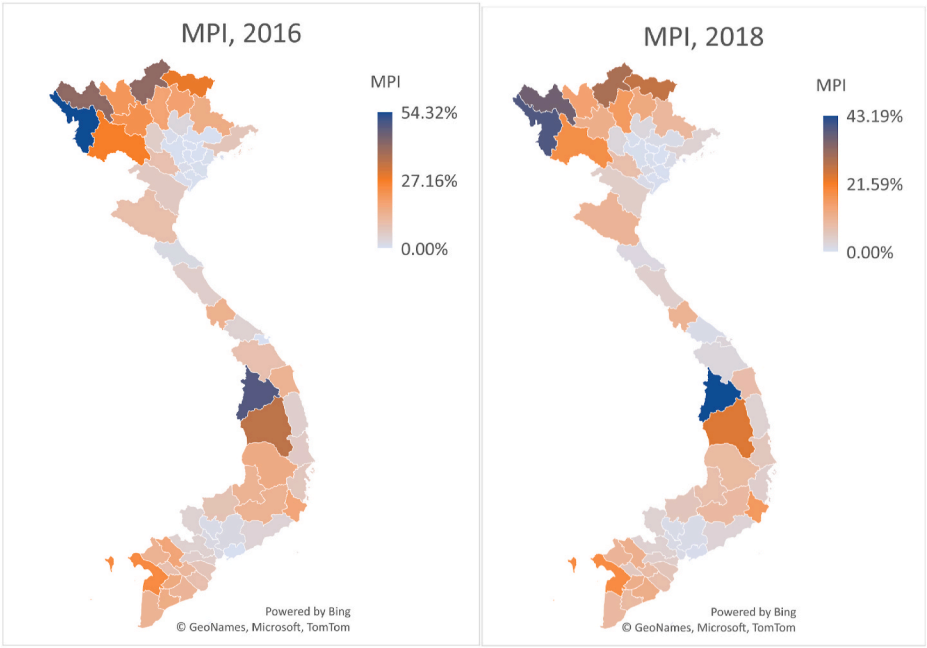

Fig. 2. Multidimensional poverty map of Vietnam's mainland provinces.
Sources: Authors' calculation using data from the 2016–2018 VHLSS.

level two, districts at level three, and provinces/cities at level four. This suggests that a multilevel regression technique is appropriate for such micro and macro hierarchical data (Guo & Zhao, 2000). Also, this method accounts for dependent observations and yields bias corrections for estimated parameters and standard errors (Guo & Zhao, 2000; Hox, Moerbeek, & Van de Schoot, 2017). Notably, this approach allows us to explain the variability in the poverty level by taking into account information at every level of the data. Multilevel models provide estimations of the random effects (or errors at provincial, district, commune and household levels), enabling us to quantify the contribution of unobservable contextual effects to the poverty status of rural households.

Because the poverty status of a household is measured by a binary variable, we use a multilevel logistic regression model to examine household and contextual factors affecting the likelihood of a household falling into multidimensional poverty (Guo & Zhao, 2000).

$$P_{thcdp} = \beta_0 + \beta_1 X_{thcdp} + \beta_2 C_{tc} + \beta_3 P_{tcp} + \beta_4 Year_t + (U_{thcdp} + V_{tcdp} + \alpha_{tdp} + e_{tp}) \quad (1)$$

In equation (1), let P_{thcdp} be the measurement of the poverty status of a household$_h$ in a year$_t$ that is nested within a commune$_c$, a district$_d$, and a province$_p$. X_{thcdp}, C_{tc} and P_{tp} denote vectors of explanatory variables measured at the household, commune and

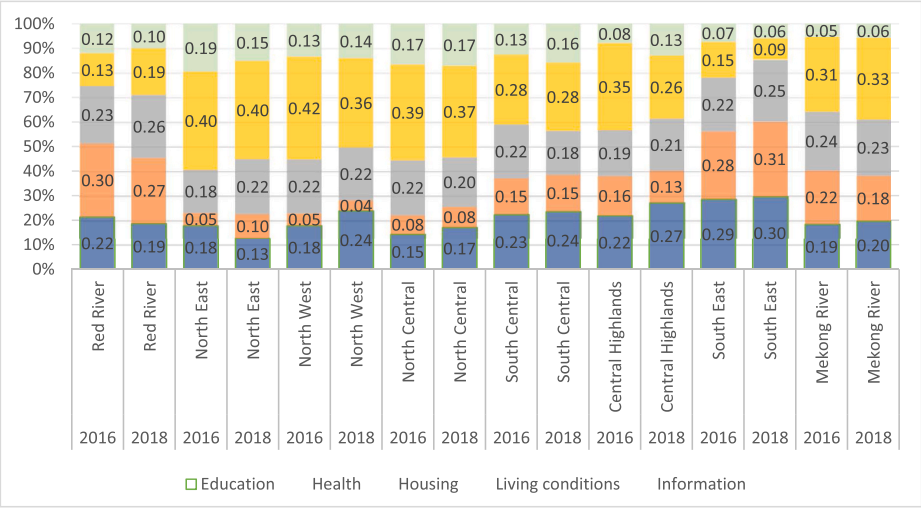

Fig. 3. Contribution of each dimension to the adjusted multidimensional poverty index in rural Vietnam by region, 2016–2018. Authors' calculation using rural household data from the 2016–2018 VHLSS.

provincial levels, respectively. β_0, β_1, β_2, β_3, β_4, are the parameters to be estimated. In particular, the residual is split into four components corresponding to the four-level hierarchical data, namely $U_{thcdp} + V_{tcdp} + \alpha_{tdp} + e_{tp}$. This approach enables researchers to investigate the nature of inter-level differences which cannot be examined within the framework of a single-level regression (Guo & Zhao, 2000; Hox et al., 2017).

Using a multilevel Tobit regression model, Equation (2) is also used to examine factors affecting the number of dimensions of deprivation, because the dependent variable is censored with many zero values[2] (StataCorp, 2019). D_{thcdp} is the number of dimensions of deprivation of a household$_h$ in a year$_t$ that is nested within a commune$_c$, a district$_d$, and a province$_p$. Equation (2) uses the same covariates as those in Equation (1).

$$D_{thcdp} = \beta_0 + \beta_1 X_{thcdp} + \beta_2 C_{tc} + \beta_3 P_{tcp} + \beta_4 Year_t + (U_{thcdp} + V_{tcdp} + \alpha_{tdp} + e_{tp}) \quad (2)$$

The total variation in a poverty measure for a household is equal to the total of the four independent variance components. Therefore, we can calculate variance partition coefficients (VPCs) or intraclass correlation coefficients (ICC) based on random effect variance estimates, which describe the percentage of variance in P_{thcdp} or D_{thcdp} that is attributable to each level. The ICC for each level is estimated as the ratio of that level's variance to the total variance (Goldstein, 2011).

In a mixed-effects linear, probit and ordered probit model, errors are assumed to follow a normal distribution with a mean of zero and a variance of Υ (StataCorp, 2019). In a mixed-effects logistic and ordered logistic model, errors are assumed to have a logistic distribution with a mean of zero and a variance of Υ. Random intercepts are supposed to be normally distributed with a mean of zero and a variance of δ_l, and to be independent of error terms (StataCorp, 2019). In general, for a K-level nested random-intercept model, the k-level intraclass correlation is denoted as:

$$\rho(k) = \frac{\sum_{l=k}^{K} \delta_l^2}{\gamma + \sum_{l=2}^{K} \delta_l^2}$$

where $\gamma = \frac{\pi^2}{3}$ for a mixed-effects logistic and ordered logistic regression , $\Upsilon = \delta_1^2$ for a mixed-effects linear regression and $\Upsilon = 1$ for a mixed-effects probit and ordered probit model (StataCorp, 2019).

4. Empirical results and discussion

4.1. Measurements and decomposition of multidimensional poverty

Table 1 reports the percentage of households who experienced deprivation in each of ten indicator areas. It shows that in 2016, lack of access to health insurance accounted for about 46.40% of total households, followed by those without access to a hygienic latrine/toilet (about 19%) and households with a deprivation in adult education (about 14.80%). The corresponding figures declined in 2018, with a huge reduction for the proportion of households with deprivation in health insurance (27.40%). This suggests that Vietnam achieved remarkable progress in health insurance coverage in 2018. The proportion of households with deprivation in school

[2] Sixty percent of the household sample were not deprived in any dimension.

attendance, access to medical services, and the means for accessing information is quite small in both years.

As mentioned in Section 3.1.1, we employed Alkire and Foster's (2011) method to estimate the MPI index. The overall deprivation cut-off for our study is the same as the cut-off level in Decision No. 59/2015/QD-TTg (The Prime Minister, 2015). That is, a household is considered poor in multiple dimensions if the household is deprived in at least three indicator areas (or k = 3/10 = 0.33). Table 2 shows that 11.8% and 6.9% of total households were defined as multidimensionally poor in 2016 and 2018, respectively. The corresponding figures for income poverty are 7.9% and 6.1% over the same period. The average range of deprivations dropped slightly from 0.357 to 0.348 between the two years. Also, the adjusted multidimensional headcount index declined from 4.2% to 2.4% during the same period. The decomposition results in Table 2 reveal that deprivation in access to hygienic latrine, adult education and health insurance made the largest contribution to the level of multidimensional poverty.

A further look at Fig. 1 reveals that the multidimensional poverty rate varies substantially across regions. The highest figure is found for the Central Highland region, followed by the North West and Mekong Delta regions, while the lowest figure was observed in the Red River Delta region. However, the data in Fig. 1 indicate that between 2016 and 2018, there was a decrease in the multidimensional poverty rate in all regions, with the biggest drop in the North East, North West, Mekong River and Central Highland regions. Fig. 2 shows the poverty rate at the provincial level and indicates that the highest multidimensional poverty headcount index for 2016 was in Dien Bien province, while the corresponding figure for 2018 was in Kon Tum province.

It is instructive to decompose the MPI by dimensions and regions. Specifically, the decomposition result in Fig. 2 shows that living

Table 3
Definition, measurements, and descriptive statistics of included variables.

Explanatory variables	2016		2018		chi2(1) *t*-test/
	Mean	Sd	Mean	Sd	
Household-level variables					
Gender (1 = male; 0 = female)	0.78	0.42	0.77	0.42	*
Ethnicity (1 = Kinh/Hoa;0 = minorities)	0.85	0.36	0.86	0.34	***
Age (years)	52.15	13.94	52.98	13.61	
Unmarried (1 = yes; 0 = no)	0.02	0.14	0.02	0.15	
Married (1 = yes; 0 = no)	0.80	0.40	0.80	0.40	
Widowed (1 = yes; 0 = no)	0.15	0.36	0.15	0.36	
Divorced/separated (1 = yes; 0 = no)	0.03	0.17	0.03	0.17	*
Household size (total household members)	3.71	1.59	3.65	1.60	
Dependency ratio (number of dependents[a]/household size)	0.38	0.31	0.40	0.32	***
No education (1 = yes; 0 = no)	0.26	0.44	0.23	0.42	***
Primary education (1 = yes; 0 = no)	0.28	0.45	0.28	0.45	
Lower secondary education (1 = yes; 0 = no)	0.32	0.47	0.32	0.47	*
Upper secondary education (1 = yes; 0 = no)	0.11	0.32	0.13	0.33	***
Post-secondary education (1 = yes; 0 = no)	0.03	0.18	0.04	0.19	***
No vocational (1 = yes; 0 = no)	0.93	0.26	0.92	0.27	**
Elementary vocational (1 = yes; 0 = no)	0.03	0.18	0.03	0.18	
Intermediate and college vocational (1 = yes; 0 = no)	0.02	0.13	0.02	0.14	***
Professional secondary (1 = yes; 0 = no)	0.02	0.16	0.02	0.16	
Public employment (1 = yes; 0 = no)	0.03	0.18	0.03	0.18	
Nonfarm household business (1 = yes; 0 = no)	0.17	0.38	0.18	0.39	***
Migration (1 = yes;0 = no)	0.12	0.33	0.13	0.34	***
Farmers' union (1 = yes; 0 = no)	0.35	0.48	0.33	0.47	***
Women's union (1 = yes; 0 = no)	0.09	0.28	0.09	0.28	
Communist Party (1 = yes; 0 = no)	0.07	0.26	0.07	0.26	
Annual cropland (m^2)	3008	7689	2673	18647	***
Perennial cropland (m^2)	1531	7599	1602	9309	***
Forestland (m^2)	1340	7970	1548	11093	***
Aquaculture land (m^2)	436	3457	494	4473	***
Horticultural land (m^2)	190	857	196	927	***
Income-poor household in the previous year (1 = yes; 0 = no)	0.10	0.30	0.08	0.28	***
Commune-level variables					
Remote commune (1 = yes; 0 = no)	0.19	0.39	0.16	0.36	***
Job opportunities (1 = yes[b]; 0 = no)	0.89	0.31	0.91	0.29	***
Transportation availability (1 = yes[c]; 0 = no)	0.47	0.50	0.50	0.50	***
Province-level variable					
Gross domestic product per capita (billion Vietnamese dong)	36.22	26.32	40.85	22.31	***
Quality of public governance (PAPI)	36.03	1.57	43.86	2.08	****
Inequality (Income Gini)	0.38	0.07	0.36	0.04	***
Population density (person/km^2)	570	603	631	662	***
Proportion of FDI[d] workers as percentage of the total labour force	0.26	0.21	0.30	0.22	***
Observations	26764		23668		

[a] Those aged below 15 years and above 60 years.
[b] If there are production/service units or trade villages located in the commune.
[c] If there are bus or boat routes through the village.
[d] Those who work for foreign direct investment (FDI) companies. ***p < 0.01, **p < 0.05, *p < 0.1.

conditions made the largest contribution to the MPI in most regions, except for the Red River and South East regions. Housing and health contributed the biggest share of the MPI in the Red River Delta region, while housing and living conditions emerged as the two major contributors to the MPI in the Mekong Delta region. Information access made the smallest contribution to the MPI in the Red River, Central Highlands, South East and Mekong River Delta regions. Health, however, made the smallest contribution to the MPI in the North West, North East and North Central regions.

4.2. Descriptive statistics of household and contextual characteristics

Table 3 provides the definition, measurement and descriptive statistics of dependent and independent variables. The proportion of male household heads is about 77% and 78% of total households in 2016 and 2018, respectively. Household heads from the Kinh/Hoa (the majority population group) account for 85%–86% of the total household sample. Within the two-year period, the average age of household heads increased slightly from 52.15 years to 52.98 years. The marital status of household heads, on average, remained unchanged over the same period. Each household, on average, has 3.70 members and a dependency ratio of about 0.40 for both years. Between 2016 and 2018, the proportion of household heads without formal education declined from 26% to 23%, while the percentage of those with upper secondary education increased from 11% to 13%. However, the proportion of household heads with some vocational training appears unchanged over the same period. About 3% of total households had at least one member in the public sector and 17%–18% were engaged in nonfarm economic activities. The proportion of households with a membership in the Vietnamese Women's Union and the Vietnamese Communist Party was about 9% and 7%, while the percentage of those with a membership in the Vietnamese Farmers' Union increased from 33% to 35% within the two-year period.

Regarding household assets, the data in Table 3 show that on average, each household held about 3008 m^2 and 2673 m^2 of annual cropland in 2016 and 2018, respectively. The average size of perennial cropland per household increased slightly from around 1530 m^2–1600 m^2 within the two-year period. The data also show an increase in the average size of forestland and aquacultural land over the same period. The percentage of households defined as income poor in the previous year also declined from 10% in 2016 to 8% in 2018. Regarding the contextual variables, 19% of total households were found to live in remote communes in 2016; the corresponding figure is 16% for 2018. The percentage of households with job opportunities rose from 89% to 91% between 2016 and 2018. Similarly, the proportion of households with access to transportation was on the rise, from 47% to 50% over the same years.

An examination of provincial variables reveals that the level of local economic development as measured by the value of gross domestic product per capita, was about 36.20 million Vietnamese Dong (VND) in 2016 and 40.85 million VND in 2018. The quality of provincial public governance is proxied by the PAPI score, which increased on average from about 36 to 44 points. Also, population density significantly increased from 570 person/km^2 to 631 person/km^2 between 2016 and 2018. There was a slight decrease in income inequality because the income Gini declined from 0.38 to 0.36 over the same period. Finally, the data show that the international integration level, as measured by the number of workers in foreign direct investment enterprises, grew from 26% in 2016 to 30% in 2018.

4.3. Econometric results

4.3.1. The effect of unobservable contextual factors

Table 4 reports the results from multilevel logit regression estimates for household and contextual factors influencing the incidence of both the income and multidimensional poverty status of rural households in Vietnam for 2016–2018. Random intercepts are present at the province, district and commune levels. Notably, we report three intraclass correlations for this four-level nested model. Specifically, the first is the level-4 intraclass correlation at the provincial level, the correlation between poverty status in the same province. The second is the level-3 intraclass correlation at the district-within-province level, the poverty status correlation in the same province and district. The third is the level-2 intraclass correlation at the commune-within-district-within-province level, the poverty status correlation in the same province, district and commune.

The intraclass correlation coefficient (ICC) indicates the amount of variance in the poverty status unexplained by any covariates in the model that can be attributed to interregional variance, as compared to the total unexplained variance (within and between variances) (Luke, 2004). Conditional on the fixed-effects covariates, we find that poverty status seems to be only slightly correlated within the same province or the same province and district, but it is highly correlated within the same province, district and commune. However, even with the ICC so low (0.025) at the provincial level, the Type I error rate might be high (Huang, 2018)[3] and thus our study still accounts for the clustering effect at the provincial level. The best advice is to not simply ignore the clustering effect, but to address it using a multilevel modeling technique (Huang, 2016).

Our results in Table 4 show that province, district and commune random effects compose 27.6% of the total residual variance. In other words, our research indicates that about 28% of the multidimensional poverty risk variance is explained by inter-provincial, district and commune differences (and conversely that about 72% is explained by intra-provincial, district and commune differences). A similar effect was also found for income poverty (Table 4) and the number of dimensions of deprivation (Table 5), with the corresponding ICC at the province, district and commune levels being 25.4% and 16.3%. This indicates the need to use a multilevel modeling approach to analyze the hierarchically nested data (Luke, 2004). The same but smaller effect was also found in Taiwan,

[3] As noted by Musca et al. (2011), "even with ICCs as low as 0.01, the type I error rate may be as high as 0.20, four times higher than the conventionally used alpha of .05."

Table 4
Multilevel logit estimates for factors associated with multidimensional and income poverty.

Explanatory variables	Multidimensional poverty		Income poverty	
	Coef	Se	Coef	Se
Gender	0.04	(0.081)	−0.06	(0.090)
Ethnicity	−1.05***	(0.093)	−0.66***	(0.099)
Age	−0.02***	(0.002)	0.00	(0.002)
Married	−0.57***	(0.147)	−0.70***	(0.144)
Widowed	−0.11	(0.149)	−0.68***	(0.136)
Divorced/separated	−0.19	(0.176)	−0.43**	(0.179)
Household size	0.14***	(0.015)	0.07***	(0.015)
Dependency ratio	0.26***	(0.089)	1.68***	(0.088)
Primary education	−0.52***	(0.056)	−0.28***	(0.060)
Lower secondary education	−1.12***	(0.077)	−0.58***	(0.070)
Upper secondary education	−1.34***	(0.141)	−0.74***	(0.119)
Post-secondary education	−2.28***	(0.426)	−2.89***	(0.602)
Elementary vocational	−0.63***	(0.240)	−0.96***	(0.246)
Intermediate and college vocational	−0.44	(0.414)	−1.18***	(0.396)
Professional secondary	−0.59	(0.376)	−1.59***	(0.389)
Public employment	−1.12**	(0.436)	−1.36**	(0.609)
Nonfarm household business	−0.49***	(0.078)	−0.91***	(0.096)
Migration	−0.26***	(0.077)	−0.87***	(0.091)
Farmers' union	−0.23***	(0.067)	0.12**	(0.057)
Women's union	−0.26**	(0.109)	−0.16*	(0.095)
Communist Party	−0.41**	(0.179)	−0.77***	(0.144)
Annual cropland (log)	−0.06***	(0.007)	−0.00	(0.008)
Perennial cropland (log)	−0.05***	(0.009)	−0.05***	(0.010)
Forestland (log)	−0.01	(0.011)	−0.02	(0.010)
Aquaculture land (log)	−0.07***	(0.015)	−0.04***	(0.015)
Horticultural land	−0.04***	(0.011)	−0.02	(0.010)
Income-poor household in the previous year	1.42***	(0.060)	1.64***	(0.056)
Remote commune	0.39***	(0.086)	0.41***	(0.088)
Job opportunities	−0.37***	(0.107)	−0.35***	(0.095)
Transportation availability	−0.14**	(0.068)	−0.04	(0.064)
Gross domestic product per capita (log)	−0.53***	(0.194)	−0.33*	(0.175)
Quality of public governance (PAPI) (log)	−0.63	(0.579)	−0.82	(0.716)
Inequality (Gini)	0.24	(1.004)	2.37**	(1.048)
Population density (log)	−0.36***	(0.128)	−0.53***	(0.132)
Number of FDI workers	−1.25***	(0.403)	0.09	(0.380)
North East	0.44	(0.366)	−0.41	(0.333)
North West	0.64	(0.425)	−0.68*	(0.409)
North Central Coast	0.26	(0.356)	−0.10	(0.321)
South Central Coast	0.45	(0.334)	−0.82***	(0.302)
Central Highlands	1.14***	(0.410)	−1.26***	(0.398)
South East	1.06***	(0.349)	−2.09***	(0.365)
Mekong River Delta	2.00***	(0.267)	−0.71***	(0.238)
Year 2018	−0.27**	(0.125)	−0.49***	(0.155)
Var (cons[province])	0.11**	(0.050)	0.11**	(0.044)
Var (cons[province>district])	0.43***	(0.088)	0.41***	(0.073)
Var (cons[province>district>commune])	0.71***	(0.077)	0.61***	(0.071)
Constant	4.99**	(2.334)	4.84*	(2.769)
Observations	50,432		50,432	
LR test vs. logistic model: chi2(3) | Prob > chi2	1025.72	0.000	874.52	0.000
Intraclass correlation coefficient (ICC)	ICC	Se	ICC	Se
Province	0.025	0.011	0.025	0.010
Province| district	0.120	0.018	0.115	0.017
Province| district | commune	0.276	0.017	0.254	0.016

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

where the regional level accounted for about 13% of the variation in the multidimensional poverty level (Chen & Wang, 2015).

4.3.2. The effect of household factors

We find that several micro-factors are closely linked with the poverty status of rural households. The likelihood of falling into both multidimensional and income poverty is lower for Kinh/Hoa households than for ethnic minority households. Specifically, households whose heads belong to the ethnic majority group (Kinh/Hoa households) are 65% less likely to suffer from multidimensional poverty

Table 5
Multilevel Tobit estimates for factors associated with the number of dimensions of deprivation.

Explanatory variables	Coef	Se
Gender	0.04	(0.030)
Ethnicity	−0.72***	(0.040)
Age	−0.01***	(0.001)
Married	−0.54***	(0.056)
Widowed	−0.22***	(0.056)
Divorced/separated	−0.27***	(0.068)
Household size	0.05***	(0.006)
Dependency ratio	0.45***	(0.030)
Primary education	−0.36***	(0.022)
Lower secondary education	−0.82***	(0.025)
Upper secondary education	−1.04***	(0.038)
Post-secondary education	−1.55***	(0.075)
Elementary vocational	−0.43***	(0.055)
Intermediate and college vocational	−0.47***	(0.081)
Professional secondary	−0.30***	(0.072)
Public employment	−0.49***	(0.077)
Nonfarm household business	−0.44***	(0.024)
Migration	−0.21***	(0.026)
Farmers' union	−0.06***	(0.022)
Women's union	−0.02	(0.036)
Communist Party	−0.26***	(0.042)
Annual cropland (log)	−0.03***	(0.003)
Perennial cropland (log)	−0.03***	(0.003)
Forestland (log)	0.00	(0.004)
Aquaculture land (log)	−0.02***	(0.005)
Horticultural land (log)	−0.02***	(0.004)
Income-poor household in the previous year	0.93***	(0.028)
Remote commune	0.28***	(0.038)
Job opportunities	−0.16***	(0.043)
Transportation availability	−0.08***	(0.025)
Gross domestic product per capita (log)	−0.09	(0.090)
Quality of public governance (PAPI)	−0.69***	(0.246)
Inequality (Gini)	−0.05	(0.375)
Population density (log)	−0.15**	(0.060)
Proportion of FDI workers	−0.62***	(0.161)
North East	0.25	(0.164)
North West	0.28	(0.203)
North Central Coast	0.05	(0.162)
South Central Coast	0.01	(0.153)
Central Highlands	0.49**	(0.196)
South East	0.29*	(0.150)
Mekong River Delta	1.05***	(0.118)
Year 2018	−0.08	(0.053)
Var (cons[province])	0.03***	(0.012)
Var (cons[province>district])	0.14***	(0.019)
Var (cons[province>district>commune])	0.25***	(0.015)
Var (dimensions)	2.13***	(0.024)
Constant	5.41***	(1.005)
Observations	50,432	
LR test vs. logistic model: chi2(3) | Prob > chi2	3158.16	0.000
Intraclass correlation coefficient (ICC)	ICC	Se
Province	0.013	0.005
Province| district	0.066	0.008
Province| district | commune	0.163	0.007

Note: Standard errors in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. Uncensored: 19723; Left-censored: 30709; Right-censored: 0.

than those whose heads belong to ethnic minorities.[4] The well-being gap between ethnic minorities and majorities may result from the differences in asset endowments and their returns, as documented in previous studies (Nguyen, Tran, & Van Vu, 2017). Furthermore, households headed by those who are married are less likely to be poor in both multidimensional and income measurements. As in previous findings, our study shows that more family members and more dependents increase the risk of multidimensional poverty

[4] The odds ratio is calculated as exp (−1.05*1) = 0.350 which means that the odds of experiencing multidimensional poverty are (−0.650), about 65% lower for Kinh/Hoa households than for ethnic minority households.

(Chen et al., 2019; Chen & Wang, 2015; Roy et al., 2019) and income poverty (Tran, Alkire, & Klasen, 2015). The educational level of household heads plays a major role in determining poverty status. For instance, holding all other factors in the model constant, the odd of experiencing multidimensional poverty is 40.5% lower for households whose heads complete primary education than it is for those headed by individuals without formal education.[5] Similar but larger effects on both multidimensional and income poverty were found for higher levels of education.

In Table 5, we find that not only attaining higher levels of general education but holding some level of vocational training or professional secondary education reduces the number of dimensions of deprivation. For instance, the number of dimensions of deprivation would be 0.43 lower for a household whose head had completed an elementary vocational course. Households with public employment or nonfarm activities were less likely to be poor according to both multidimensional and income measurements (Table 4) and also tended to have lower levels of dimensions of deprivation (Table 5). For instance, the odds of being multidimensionally poor were about 67% lower for households with public employment and about 38% lower for those with nonfarm activities. In general, our research findings are consistent with those in several other studies which showed that better education and occupation lower the risk of households falling into multidimensional poverty in South Africa (Megbowon, 2018), Nigeria (Ataguba et al., 2011) and several European countries (Whelan et al., 2014).

Regarding the role of social capital in determining poverty status, the results in Tables 4 and 5 confirm that holding a membership in certain political or social groups is closely linked with a lower risk of multidimensional and income poverty and lower levels of dimensions of deprivation. For example, the odds of falling into multidimensional and income poverty were 33% and 53% lower, respectively, for households holding a membership in the Vietnam Communist Party. We also find that owning land has a small effect on reducing the likelihood of being poor. As expected, lagged poverty status has a strong effect on current poverty status. For instance, for households that were income poor in the previous year, the odds of being multidimensionally poor in the current year is 4.14 times greater than for those who were poor in the previous year. Similarly, the lagged poverty status also increases the number of dimensions of deprivation by 0.94 in Table 5. The results in Tables 4 and 5 also reveal that migration is positively associated with a lower likelihood of households being in both multidimensional and income poverty and lower levels of deprivation. The finding is partly consistent with that in China (Du et al., 2005) and Nepal (Lokshin, Bontch-Osmolovski, & Glinskaya, 2010), where migration enables rural households to move out of poverty.

4.3.3. The effect of observable contextual factors

We find that some commune and provincial characteristics emerged as key determinants of poverty status in rural Vietnam. Households in communes with access to transportation and the availability of nonfarm jobs were less likely to be poor in both income and multidimensional measurements. Also, living in these communes reduces the number of dimensions of deprivation for households. However, households residing in remote communes are at greater risk of becoming poor. For example, the odds of falling into multidimensional poverty are about 37% lower for those living in communes with access to nonfarm jobs and about 48% higher for those living in remote communes. Similar results are also found in some other countries (Megbowon, 2018; Roy et al., 2019), indicating that households living in urban areas or with access to public infrastructure are at less risk of falling into multidimensional poverty.

At the macro level, our study shows that certain provincial characteristics have a substantial effect on both income and the multidimensional poverty status of rural households. The level of economic development has a positive effect on reducing the likelihood of being poor according to both income and multidimensional measurements. A 10% increase in the level of gross domestic product (GDP) per capita lowers the odds of households falling into multidimensional poverty by about 5%,[6] holding all other factors in the model constant. In Table 5, we also find that the quality of public governance has the effect of reducing the number of dimensions of deprivation. The finding is partially congruent with that in some other countries (Jindra & Vaz, 2019). Income inequality was found to increase the risk of income poverty but not multidimensional poverty. Living in more crowded provinces reduces the odds of being multidimensionally poor and also lowers the number of dimensions of deprivation. The same effect was also observed for those living in provinces with higher levels of international integration. Specifically, the odds of being multidimensionally poor would be reduced by about 12%,[7] given a 10-percentage point increase in the proportion of workers in the FDI sector.

5. Conclusion and policy implications

This is the first study to look into the influence of contextual and household characteristics on multidimensional poverty in rural Vietnam, combining micro and macro data on the household, commune and provincial levels between 2016 and 2018. We employed a multilevel modeling technique to account for the multilevel nature of the data. One of the main advantages of this method is that we

[5] The odds ratio is calculated as exp (−0.52*1) = 0.595, which means that the odds of experiencing multidimensional poverty are (−0.405), about 40.5% lower for those with primary education than those without formal education.

[6] We can obtain the odds ratio by exponentiating the coefficient for a variable, for instance, the gross domestic product per capita (log) in Table 4. For a 10% increase in the level of (GDP) per capita, the corresponding logarithm difference for the provincial GDP per capita is log (1.01) = 0.09531. The odds of being multidimensionally poor would decline by about 5%. This can be calculated in terms of exponential function as: exp (−0.53*0.09531)-1 = -.04925967≈−5%.

[7] Similarly, we can obtain the odds ratio by exponentiating the coefficient for the variable of the share of FDI workers in Table 4. This can be calculated as: exp (−1.24*0.1)-1 = -.11662016≈−0.12.

can examine the contribution of unobservable contextual factors to a household's poverty status. We provide fresh evidence that unobservable characteristics at the province, district and commune levels account for about 28% and 25% of the variation in multidimensional and income poverty risk, respectively. Specifically, the finding implies that heterogeneity in poverty status exists across regions and therefore regional factors should be simultaneously accounted for when investigating the influence of micro-level factors on the poverty status of rural households. Our finding also suggests that a common approach using a single-level regression method to investigate determinants of poverty may conceal the unobservable contextual effects that might be of interest to policy makers. While the nature of the study implies that our results are correlational, the main findings suggest a number of policy implications for poverty reduction, as follows.

Some of our findings concerning household-level factors accord with previous studies. For instance, educational attainment, social capital, occupation and nonfarm activities, ethnicity and household structure are closely linked with poverty status. Educational attainment, including general education, post-secondary education and vocational training, among other factors, could lift rural households out of poverty or at least reduce their level of dimensions of deprivation. Poorly educated households today could be the result of limited access to education in the past or poorly educated parents, in turn leading to poor education for offspring in the future, resulting in a generational transmission of poverty. Considering the importance of education as confirmed by our study, government policies aimed at improving the access of poor households to education should be further promoted, especially in remote and mountainous areas, such as the North West and Central Highlands regions, where there is a higher incidence of poverty and lower levels of education (MOLISA, 2018).

Our econometric finding indicates that ethnic minorities are much more likely to fall into poverty. The data in Appendix 1 in particular reveal that they experience much higher levels of deprivation in several dimensions, especially adult education, housing size and quality, access to hygienic latrines and clean water, communication services and the means for accessing information. This suggests that more resources should be provided for this disadvantaged group and effective policies should be designed for them. As made clear in our study, households with more social capital, as measured by membership in political and social groups, are less likely to be multidimensionally poor. This may be a reflection of the fact that participating in such groups can provide households with easier access to information and resources, which in turn enable them to improve their living standard. Our research findings offer some useful policy implications by providing insight into the positive role of migration in reducing multidimensional poverty in rural Vietnam. This implies that to support migrants by eliminating the barriers they encounter, central and local authorities should design and implement specific policies, such as integration and social protection policies for migrants.

Our study confirms that several observable contextual factors emerge as key drivers of multidimensional poverty in rural areas. The possibility of moving out of poverty is higher for households in communes with access to transportation and nonfarm jobs, but lower for those in remote areas. This suggests that at the commune level, policies should aim at promoting nonfarm activities and improving the access of local people to transportation. At the macro level, findings from the positive effects of some provincial-level factors suggest that increasing the level of provincial GDP per capita and the number of workers in the FDI sector can help reduce the likelihood of households falling into both multidimensional and income poverty. Finally, in light of the findings concerning inequality and provincial public governance established by our study, a useful policy implication for provincial authorities is that maintaining economic equality can help lower the risk of households falling into income poverty. At the same time, bolstering the quality of public governance is expected to lower the number of dimensions of deprivation.

We acknowledge that our study has limitations. First, while the AF method has numerous practical and technical advantages (Alkire et al., 2015, 2015), the AF indexes do not clearly show whether a reduction in poverty has an impact on the poorest people (Bérenger, 2019). Second, using pooled cross-sectional data, our research was unable to control for unobserved household heterogeneity that may affect both monetary and multidimensional poverty. This implies that when longitudinal data become available, future studies should take this issue into account.

Declaration of competing interest

The author agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare absence of conflicting interests with the funders.

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Appendix 1. The proportion of households with dimensions of deprivation, by ethnicity

Dimensions	Indicators	Percentage of rural households whose indicator values are below the threshold.	
		Kinh/Hoa	Ethnic minorities
Education	Adult education	10.84%	26.81%

(*continued on next page*)

(*continued*)

Dimensions	Indicators	Percentage of rural households whose indicator values are below the threshold.	
		Kinh/Hoa	Ethnic minorities
	School attendance	2.13%	5.62%
Health	Access to medical services	1.17%	1.23%
	Health insurance	41.16%	16.59%
Housing	Housing quality	5.81%	12.14%
	Housing area	6.14%	18.09%
Living conditions	Clean water	4.39%	22.29%
	Hygienic latrine	11.87%	46.47%
Information	Communication services	3.29%	11.57%
	Means for accessing information	1.22%	8.45%

Sources: Authors' calculations using rural household data from the 2016–2018 VHLSS. Estimates account for sampling weights and household size.

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