# Education and the livelihood of households in the Northwest Region, Vietnam

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# in the Northwest Region, Vietnam

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**Abstract**

Using the updated data from the 2016 Vietnam Household Living Standard Survey, this study examines the role of education in the livelihood of households in the Northwest Region, the poorest region in Vietnam. Our micro-econometric analysis shows that education has a positive effect on choosing better livelihoods, on household income and poverty reduction, even after controlling for all other factors in the models. However, our quantile regression analysis reveals that the returns on education are substantially heterogeneous across percentiles of income distribution and tend to be higher for better-off households. This implies that education has an increasing effect on within-level income inequality. The finding suggests that a conventional approach employing only mean regression to study the effect of education on income could miss heterogeneity of interest to policymakers.

# 1. Introduction

Education has played a major role in making development a success in Vietnam (WB, 2015). Achieving rapid economic growth, by 2010 the country was transformed from one of the world's poorest nations into a lower middle-income country (World Bank & Ministry of

Planning and Investment of Vietnam, 2016) with one of the fastest poverty reduction rates (WB, 2015). Over the last decades, Vietnam's focused investments in developing primary education, combined with greater access to all levels, have paid off, and have enabled an increasing proportion of the population to exploit the advantages of expanding economic opportunities (WB, 2015). Numerous studies have found positive effects from education, among other factors, on poverty reduction and household income (Cloutier, Cockburn, & Decaluwé, 2008; Nguyen, Phung, & Westbrook, 2015) and wage income (Doan, Le, & Tran, 2018).

Vietnam's socio-economic achievements, however, have not been even across regions. While many regions have made significant improvements in household welfare and education, others have lagged behind (Oxfam, 2017; WB, 2013, 2015). An overwhelming majority of the country's ethnic minority population live in the Northwest region, which has much lower levels of income and education and higher levels of poverty and inequality than other regions (GSO, 2015). To the best of our knowledge, little evidence exists for the effect of education on the livelihood of rural households in the Northwest region. A thorough understanding of the role of education on choice of livelihoods, income, poverty and inequality is very important when designing policy interventions for the poor in this region. The current study was conducted to fill this gap in the literature.

Our study has several strong points. *First*, we provide the first econometric evidence for the role of education in the livelihoods of local households in terms of choice of occupation, household income and poverty reduction the Northwest Region - the poorest region of Vietnam. *Second*, previous studies (e.g., Lekobane & Seleka, 2017; Tran, 2015) often used a standard linear regression approach (e.g., ordinary least squares/fixed or random effects estimators) to investigate the mean effect of education on average household welfare (income or consumption expenditure). This approach, however, provides only a partial view of the relationship (Koenker & Hallock, 2001). In our study, we use a quantile regression approach to account for the heterogeneous effects of education on different percentiles of income distribution. This allows us to consider the role of education on the entire distribution of household welfare, not merely its conditional mean (Koenker, 2005). In particular, this approach enables us to evaluate whether education has an increasing effect on within-level income inequality.

Using the updated data from the 2016 Vietnam Household Living Standard Survey, combined with the use of micro-econometric analysis, we provide evidence that education has a positive effect on the choice of better livelihoods, and on household income and poverty reduction, even after controlling for all other factors in the models. Notably, our study shows

that education has a heterogeneous effect across percentiles of income distribution and the effect tends to be larger for better-off households. This implies that education has an increasing effect on within-level income inequality. Thus, the finding suggests that a conventional approach to studying the effect of income on education using only a mean regression approach could miss heterogeneity of interest to policymakers.

## 2. Data and Analytical methods

### 2.1. Data

In this study, household data were taken from the Vietnam Household Living Standard Survey (VHLSS) of 2016. The VHLSS were conducted by the General Statistics Office of Vietnam (GSO) with technical assistance from the World Bank. The 2016 survey covers around 46,000 households for the whole country and about 3,300 households for the Northwest Region. The survey is representative at the national and regional levels (Vietnam is divided into six geographic and eight economic regions). Data on households and individuals include basic demography, employment and labour force participation, education, health, income, housing, fixed assets and durable goods, and the participation of households in poverty alleviation programs. In this study we used data for the Northwest region, including about 3,300 households that were surveyed in six provinces, namely Hoa Binh, Lai Chau, Lao Cai, Son La, Dien Bien and Yen Bai.

### 2.2. Classifying household livelihoods

Empirical evidence indicates that Vietnamese rural households engage in a diverse range of income-generating activities (Tran, 2016; Tran, Lim, Cameron, & Van, 2014). In the current study, this requires us to employ the cluster analysis method to classify livelihood strategies at the household level. This is a technique that is used to identify meaningful, mutually exclusive subgroups of observations from a larger aggregate group (Hair, Black, Babin, Anderson, & Tatham, 1998).

Empirical studies have commonly used income contribution by source as the main criterion to classify household livelihood strategies (Nielsen, Rayamajhi, Uberhuaga, Meilby, & Smith-Hall, 2013; Tran et al., 2014). This approach is appropriate because incomes from various sources are the result of work and livelihood assets that are allocated to various economic activities. This suggests that livelihood strategy identification using an appropriate

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cluster technique is needed for the current study. The contributions of five income sources are used as input variables for clustering livelihoods, including agricultural income, nonfarm-self-employment income, wage income, rental and other incomes.

Following suggestions by Punj and Stewart (1983), a two-stage procedure was used for cluster analysis. First, data on contributions to income for each household were used to apply a hierarchical method, using the Duda-Hart stopping rule to identify the optimal numbers of clusters (Halpin, 2016). The results show that the largest Duda-Hart Je (2)/Je (1) stopping-rule value is 0.9916, corresponding to three groups. The cluster analysis was then rerun with the optimal cluster number which had been identified using k-mean clustering. Three livelihood strategies were identified, namely (i) farm work livelihoods (ii) wage-paying work livelihoods (wage-paying work in both private and public sectors); and (iii) non-farm self-employment livelihoods. Once households were partitioned into three groups, we employed a first-order stochastic dominant analysis and pairwise comparison, using the Bonferroni method to compare which household livelihood offered higher outcomes in terms of per capita income (Nielsen et al., 2013).

*2.3. Econometric models*

We used a multinomial logit model (MLM) to examine factors affecting the likelihood of a household choosing a given livelihood. The MLM is the most commonly used specification for nominal outcomes because of its simple estimation and straightforward interpretation (Cheng & Long, 2007; Tran, Tran, Pham, & Vu, 2018). As already explained, household livelihoods are distinct because they are clustered into three mutually exclusive groups. This implies the appropriateness of the choice of the MLM for identifying factors influencing the probability of a household head choosing a given livelihood. There have been numerous studies using the MLM to examine factors affecting livelihood or occupational choice (e.g., Hinks & Watson, 2001; Tran et al., 2014; Tran et al., 2018; Tsukahara, 2007).

Let $P_{ij}$ ($j$=1, 2, 3) denote the likelihood of a household head choosing a given livelihood $i$ with $j$=1 if the livelihood is farm work, $j$=2 if the livelihood is wage paying work, $j$=3 if the livelihood is from nonfarm self-employment. Then the ML model is:

$$P_{ij}(j = k|X_i) = \frac{\exp(\beta_k X_i)}{\sum_{j=1}^{3} \exp(\beta_j X_i)} (j = 1,2,3) \tag{1}$$

$$\beta_j$$

According to Cameron and Trivedi (2005), should be set to zero for one of the categories, and coefficients are then interpreted with respect to that category, called the reference category. Hence, set $\beta_j$ to zero for one livelihood group (say, a farm work livelihood), then the MLM for each group can be rewritten as:

$$P_{ij}(j = k|X_i) = \frac{\exp(\beta_k X_i)}{1+\sum_{j=1}^{3} \exp(\beta_j X_i)}\ (j = 2,3) \text{ and } P_{ij}(j = 1|X_i) = \frac{1}{1+\sum_{j=1}^{3} \exp(\beta_j X_i)} \tag{2}$$

Equation (3) was used to estimate factors associated with livelihood choice among households, where $X_{ij}$ is a vector of household characteristics, such as household size, dependency ratio and age, education, gender and the ethnicity of household heads; $\lambda_{ij}$ represents some types of land; $D_j$ is the dummy variable of provinces and $\varepsilon_{ij}$ is an error term.

$$P_{ij}(j = k|X_i) = \beta_0 + X_{ij}\beta_1 + \lambda_{ij}\beta_2 + D_j\beta_3 + \varepsilon_{ij} \tag{3}$$

We assume that household per capita income is a reduced function of household characteristics and assets, as given in equation (4) where $\text{Ln}(y_{ij})$ is the natural logarithm of per capita income of household $i$ in province $j$. Thus, an ordinary least squares (OLS) estimator is used to examine factors affecting household income.

$$\text{Ln}(y_{ij}) = \beta_0 + X_{ij}\beta_1 + \lambda_{ij}\beta_2 + D_j\beta_3 + \varepsilon_{ij} \tag{4}$$

Factors associated with the incidence of poverty were modeled using a Probit model in equation (5), where the dependent variable $P_{ij}$ is a binary variable that has a value of one if a household was classified as poor and a value of zero otherwise.

$$P_{ij} = \beta_0 + X_{ij}\beta_1 + \lambda_{ij}\beta_2 + D_j\beta_3 + \varepsilon_{ij} \tag{5}$$

Standard linear regression techniques (e.g., ordinary least squares or fixed/random effects estimators) have been commonly used for considering the effect of education on household income or wage income (e.g., Doan et al., 2018; Lekobane & Seleka, 2017; Psacharopoulos & Patrinos, 2004; Tran, 2015). This mean approach looks at the average relationship between education and economic welfare based on the conditional mean of the outcome distribution. This gives us only a partial view of the relationship. However, a quantile regression (QR) estimator allows us to investigate the relationship at different points in the conditional distribution of household welfare (e.g., at the 25th and 75th percentiles) (Buchinsky,

1994). Also, the QR estimator is more robust to non-normal errors and outliers, whereas a linear regression estimator can produce inefficient estimates if the errors are highly abnormal (Koenker, 2005).

Thus, we use the QR estimator to investigate the possible effect of education and other independent variables on household income across various points in the conditional distribution of household income. As given in equation (6), the model specifies the $\theta^{th}$ – quantile ($0 < \theta < 1$) of conditional distribution of the dependent variable, given a set of covariates $X_{ij}$, and assuming that residual distributions of each quantile are normal.

$$Q_{\theta}\left(y_i \mid x_i\right) = \beta_0 + X_{ij}\beta_1 + \lambda_{ij}\beta_2 + D_j\beta_3 + \varepsilon_{ij} \tag{6}$$

Interestingly, the QR estimator enables us to evaluate whether education increases income inequality. If the returns on education increase by quantile, this suggests that education has an increasing effect on within-level income inequality (Alves, 2012). In contrast, when the returns on education are the same across the quantiles considered, education has no effect on within-level income inequality, as the income distribution depending on the different levels of education would vary only through their means and not through their dispersions (Buchinsky, 1994).

Empirical research on family or household welfare has found that the social and economic welfare of a household is often based on the characteristics of its household head, such as his or her age, race, education, in both developed (Alves, 2012; Biddlecom & Kramarow, 1998; Santi, 1990; Tsukahara, 2007) and developing countries (Gustafsson & Yue, 2006; Lekobane & Seleka, 2017; Maitra & Vahid, 2006; Nguyen & Tran, 2013; Tran, Nguyen, Vu, & Nguyen, 2015; Tran et al., 2018). Thus, the current study focuses on the characteristics of household heads as main factors affecting household livelihoods. Following the literature on education economics (Alves, 2012; Doan et al., 2018; Sakellariou, Patrinos, & Ridao-Cano, 2006), we measure the education levels of a household by the number of formal schooling years and the highest qualification attained by the head. Following Doan et al. (2018) and Psacharopoulos and Patrinos (2004), we do not include many other variables (e.g., occupation, sector, etc.) because they would deflect attention from the effect of education on income and poverty. Equations (4), (5) and (6) use the same explanatory variables as those in equation (3). Definitions and measurements of included variables are given in Table 1.

## 3. Results and discussion

### 3.1. Background on household livelihoods

Table 1 shows that there are substantial differences in the study area between poor and better off in the mean values of most household characteristics. The poor have a larger household size and much higher dependency ratio than the better off. The differences between the two groups in the age and education of heads of household were also statistically significant. On average, the heads of better-off households were about 3 years older and had about 3 years more formal schooling than those of poor households. Unsurprisingly, the percentage of households depending on wage or nonfarm self-employment is much higher for the better off (42% and 14%) than it is for the poor (12% and 0%).

The differences between the two groups in their use of some types of land are found to be statistically highly significant. The area of annual cropland owned by poor households was much larger than that owned by better-off households. However, better-off households had much more perennial cropland and forestland than did poor households. The poor earned a very low level of per capita income, equivalent to only a quarter of that earned by those better off. Also, Table 4 shows that the percentage of households with livelihood strategies based on nonfarm work (both wage paying or self-employed) was much higher for the better off than for the poor. Remarkable dissimilarities in household characteristics and assets between the two groups were expected to be closely linked with variations in household affluence.

*Table 1: Household Characteristics by Poverty Status*

| Variables | Non-poor | | Poor | | Whole sample | | P-value |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | |
| Gender (1=male; 0=female) | 0.79 | 0.41 | 0.88 | 0.32 | 0.81 | 0.39 | *** |
| Age (of household head) | 46.76 | 12.77 | 42.24 | 13.78 | 45.51 | 13.21 | *** |
| Marital status (1 if the household head is married; 0=otherwise) | 0.01 | 0.12 | 0.01 | 0.10 | 0.01 | 0.11 | |
| Schooling years (household head's years of formal schooling) | 8.76 | 4.20 | 5.94 | 2.99 | 8.16 | 4.14 | *** |
| Ethnicity (of the head: 1=Kinh & Hoa; 0=ethnic minorities) | 0.40 | 0.49 | 0.04 | 0.19 | 0.30 | 0.46 | *** |
| Urban/rural (1=urban; 0=rural) | 0.28 | 0.45 | 0.05 | 0.22 | 0.21 | 0.41 | *** |
| Dependency ratio [a] | 0.34 | 0.25 | 0.44 | 0.21 | 0.37 | 0.24 | *** |
| Household size (total household members) | 4.08 | 1.54 | 5.23 | 1.97 | 4.40 | 1.75 | *** |
| Farm work livelihood (1=yes; 0=other) | 0.44 | 0.50 | 0.88 | 0.33 | 0.55 | 0.50 | *** |
| Wage paying livelihood (1=yes; 0=other) | 0.42 | 0.50 | 0.12 | 0.32 | 0.35 | 0.49 | *** |
| Nonfarm self-employment livelihood (1=yes; 0=other) | 0.14 | 0.35 | 0.00 | 0.07 | 0.10 | 0.30 | *** |
| Annual cropland ($m^2$) | 5313 | 9013 | 9560 | 9079 | 6486 | 9227 | *** |
| Perennial cropland ($m^2$) | 876 | 3565 | 263 | 1103 | 707 | 3100 | *** |
| Forestland ($m^2$) | 3651 | 13275 | 2422 | 6970 | 3311 | 11885 | *** |
| Residential land ($m^2$) | 109 | 21 | 29 | 4 | 87 | 16 | ** |
| Monthly per capita household income [b] | 2,385 | 2,312 | 523 | 123 | 1,870 | 2,135 | *** |
| Observations | 2388 | | 911 | | 3299 | | |

Note: Authors' calculation from the 2016 VHLSS. SD: standard deviation. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] This ratio is calculated by the number of members aged under 15 and over 59, divided by the number of members aged 15-59. [b] Calculated in thousands of Vietnamese dong (VND).

As shown in Table 2, the average per capita income for the whole sample was estimated at about 1.87 million VND per month. However, the per capita income for the Kinh and Hoa is nearly three times that for ethnic minorities. In addition, the incidence and intensity of poverty remain much higher for ethnic minorities than for the Kinh and Hoa. The data also indicate that there are differences in living standards across provinces. Households in Lao Cai, Yen Bai and Hoa Binh attained a higher level of per capita income and had a lower poverty rate than those in other provinces.

*Table 2: Household Economic Welfare by Ethnicity and Province*

| Livelihood outcomes | All | Ethnic minorities | Kinh & Hoa | Lao Cai | Dien Bien | Lai Chau | Son La | Yen Bai | Hoa Binh |
|---|---|---|---|---|---|---|---|---|---|
| Household income per capita[a] | 1,870 | 1,206 | 3,433 | 2132 | 1591 | 1553 | 1603 | 2139 | 2195 |
| (SD) | 2,135 | 2,897 | 1,208 | 2299 | 2352 | 1546 | 1933 | 2551 | 1873 |
| Poverty head count | 0.28 | 0.38 | 0.03 | 0.20 | 0.46 | 0.32 | 0.37 | 0.17 | 0.14 |
| Poverty gap | 0.07 | 0.10 | 0.00 | 0.05 | 0.12 | 0.07 | 0.11 | 0.04 | 0.04 |
| Observations | 3294 | 2313 | 981 | 510 | 510 | 509 | 628 | 569 | 568 |

Note: Authors' calculation from the 2016 VHLSS. [a] Monthly income in thousands of Vietnamese dong (VND). SD: standard deviation. Poverty head count and gap indexes are estimated using the updated poverty line for the period 2016-2020 (700,000 VND and 900,000 VND per person per month in rural and urban regions, respectively).
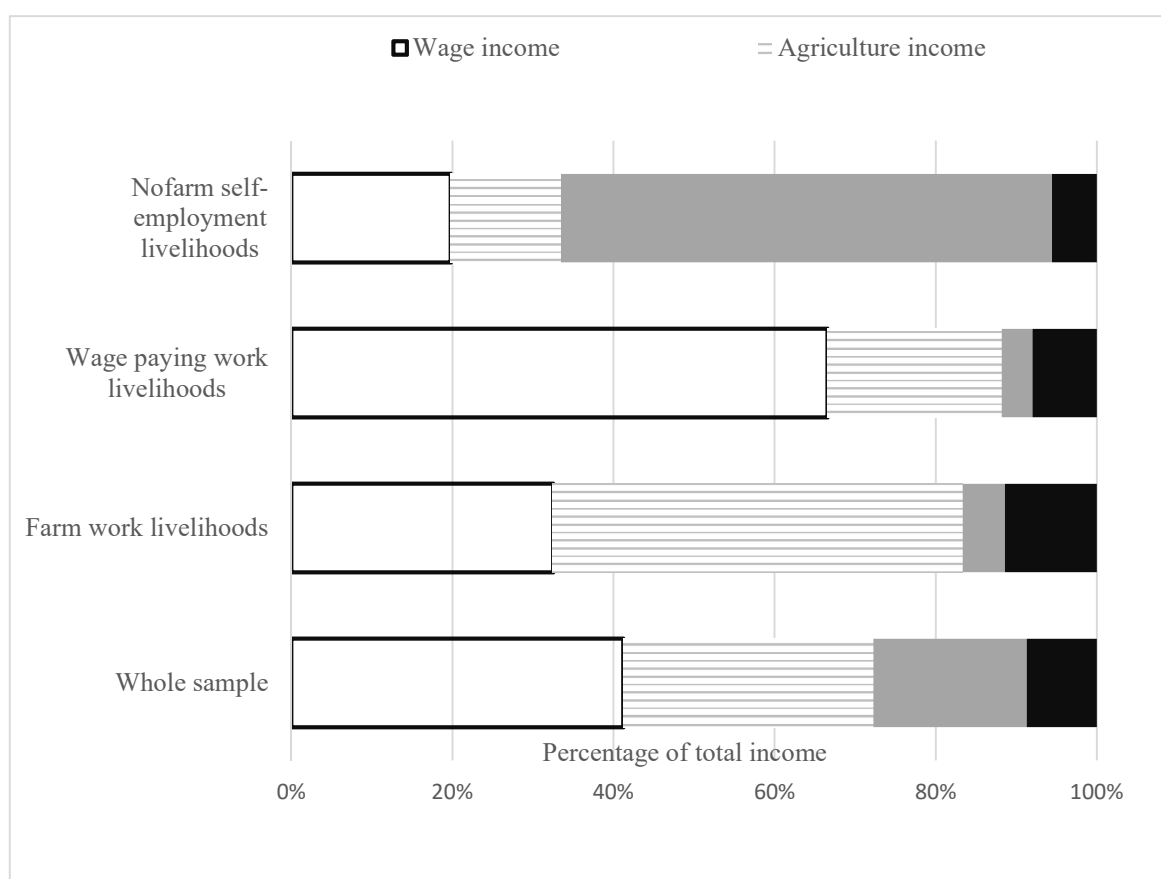


*Figure 1: Household income sources by livelihood.*
Source: Authors' calculation from the 2016 VHLSS.

Figure 1 reports the mean income contribution for the whole sample as well as for each livelihood group. For the whole sample, it indicates that wage income accounted for the largest proportion of total household income (41%), followed by agricultural income (31%), nonfarm self-employment income (19%) and other sources (9%). However, there are considerable

differences in the mean income contribution across livelihood groups. Income from agricultural activities contributed about 70% of total income for households with farm work livelihoods, while wage income made up about 78% of total income for those depending on wage paying work. Nonfarm self-employment accounted for about 78% of total income for those dependent on nonfarm self-employment.
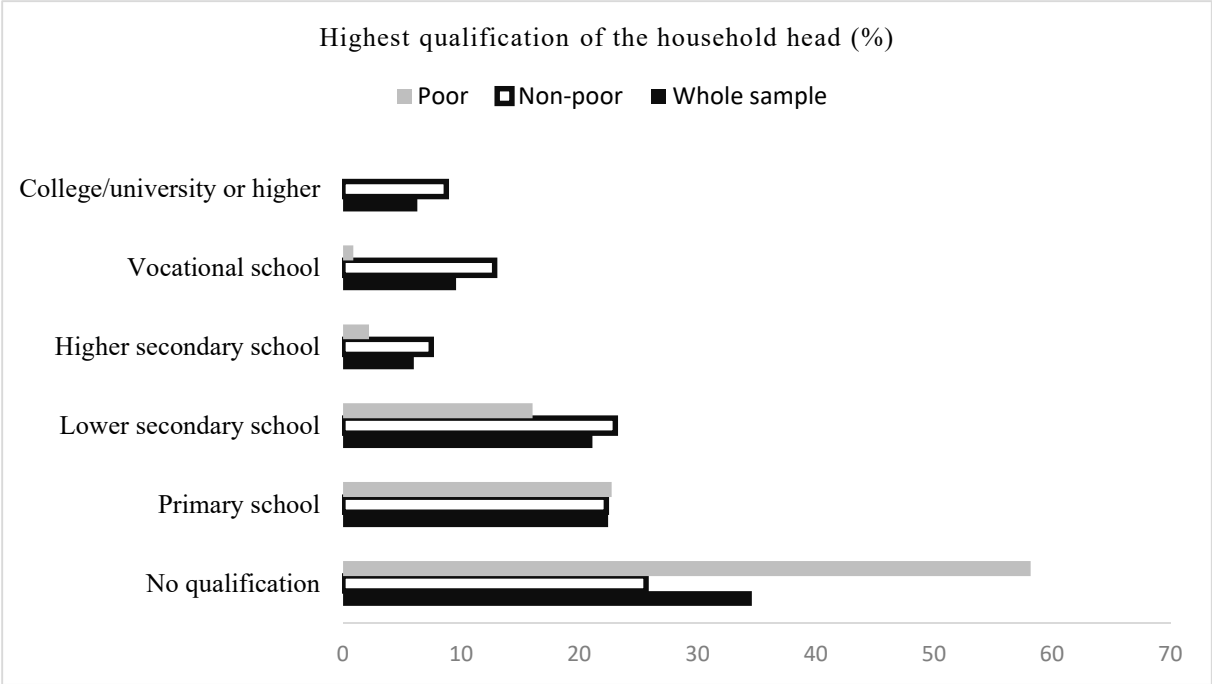


*Figure 2: Percentage of household heads according to level of qualifications.*
Source: Authors' calculation from the 2016 VHLSS.

Figure 2 shows that about 35% of all household heads lacked formal schooling. However, the percentage of those without formal schooling was much higher for ethnic minorities (58%) than for Kinh and Hoa (26%). The difference between the two groups in primary education was negligible but much greater at higher levels of education. For instance, the proportion of household heads with lower secondary education was about 16% for the poor compared with 23% for the better off. However, the percentage of household heads who completed vocational education was about 1% and 13% for the poor and the better off, respectively. Figure 3 suggests that the better educated a household head, the more likely it is that the household will earn higher income. It shows that households whose head has a college or university degree would achieve the highest per capita income, while those whose head lacks formal schooling would earn the lowest per capita income. The findings imply that the level of education of household heads plays an important role in household affluence in the study area.

The estimates in Figure 4 also reveal the importance of livelihood strategies for household affluence. The highest per capita income was observed for households choosing

nonfarm self-employment livelihoods, followed by those with wage paying occupations, and finally by those depending on farm work. Table 4 shows that on average, households with nonfarm self-employment would earn monthly per capita income 2.6 million VND and 1.276 million VND higher, respectively, than the income earned by those whose livelihoods consisted of farm and wage paying work. In addition, the estimates in Table 4 indicate that households living from wage paying work would obtain a level of monthly per capita income about 1.324 million VND higher than those whose livelihoods depended on farm work. Once again, the findings confirm the important role of the type of livelihood in the economic wellbeing of households.
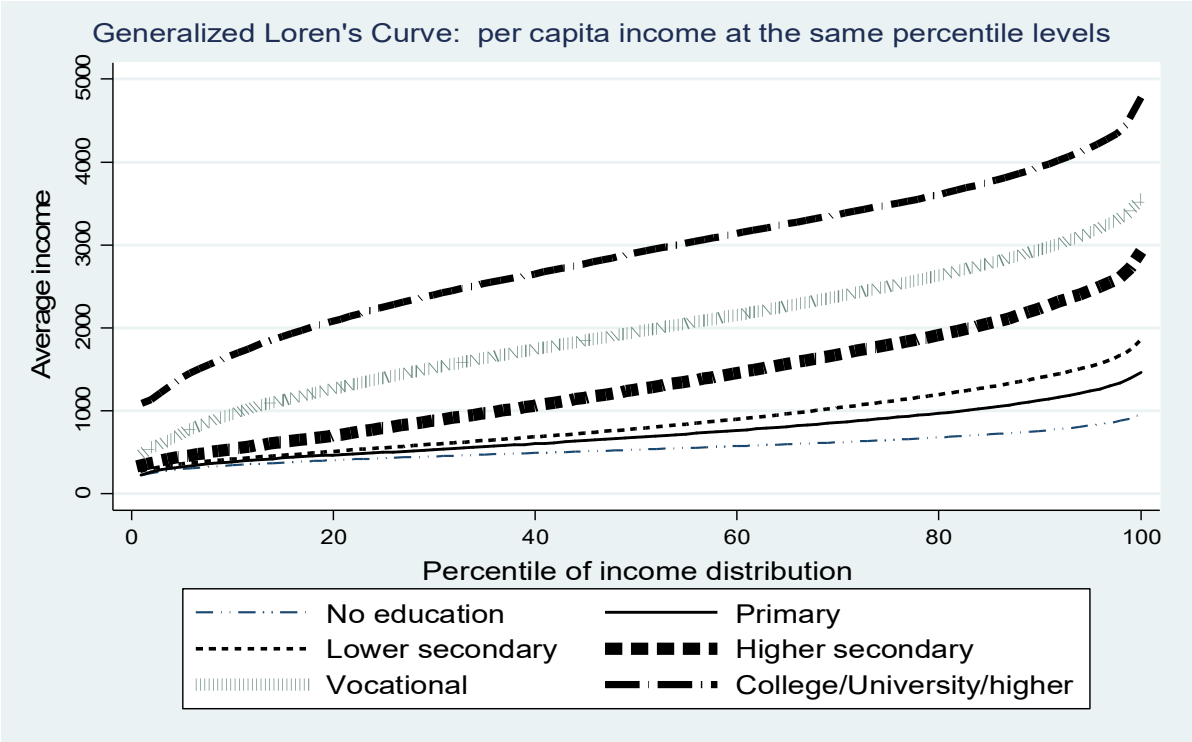


*Figure 3: Comparing per capita income according to level of qualifications.*
Source: Authors' calculation from the 2016 VHLSS.
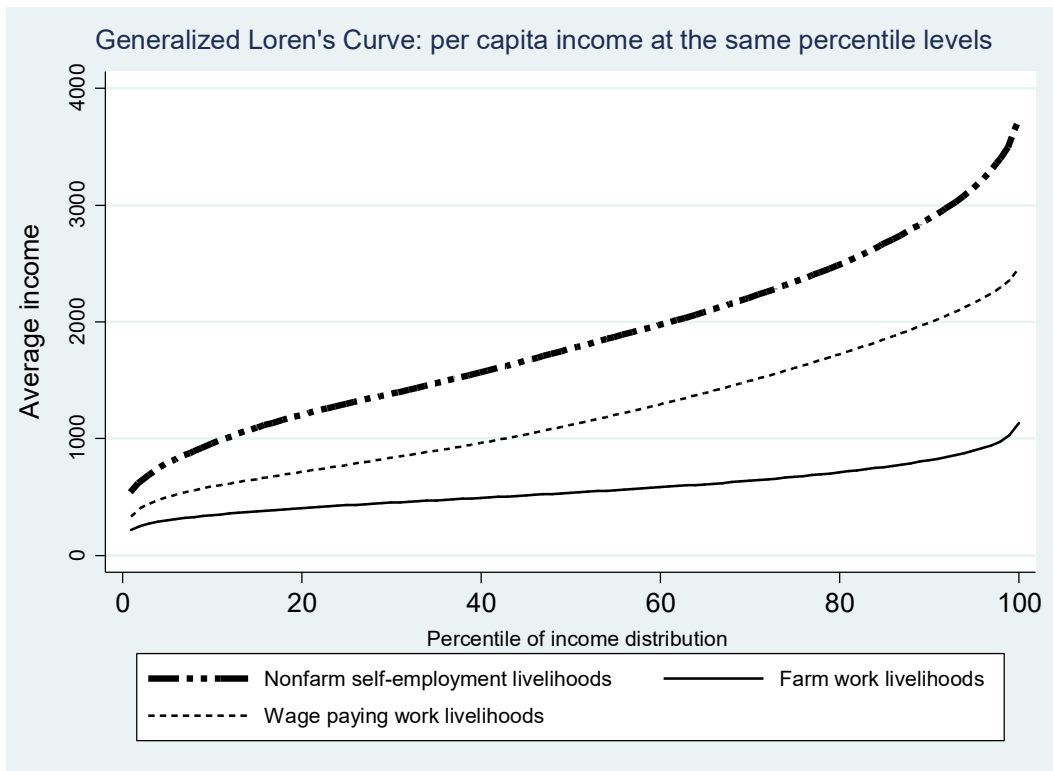
*Figure 4: Comparison of per capita income across livelihood groups.*
Source: Authors' calculation from the 2016 VHLSS.

*Table 3: Pairwise Comparison of Household Income Across Livelihood Groups Using the Bonferroni Method*

| | Group | | | |
|---|---|---|---|---|
| | Whole sample | Farm work livelihood | Wage paying work livelihood | Non-farm self-employment livelihood |
| Observations | 3294 | 1789 | 1164 | 341 |
| Monthly per capita income | | | | |
| Mean | 1870 | 1,132 | 2,457 | 3,733 |
| Standard deviation | 2134 | 1,492 | 1,978 | 3,397 |
| Comparing income across groups | | | Wage paying work livelihood | Non-farm self-employment livelihood |
| | | Farm work livelihood | 1,324 (0.00) | 2,601 (0.00) |
| | | Wage paying work livelihood | | 1,276 (0.00) |

*Note*: Results reported are mean differences in monthly per capita household income and *P*-values are in parentheses. Unit: 1,000 VND and 1 USD equated to about 22,000 VND in 2016.

Source: Authors' calculation from the 2016 VHLSS.

## 3.2. The impact of education on household livelihoods

*Table 4: MNL Estimates for the Effect of Education on Livelihood Choice*

| Explanatory variables | Model 1: Schooling years | | Model 2: Highest qualification | |
|---|---|---|---|---|
| | Group 2 | Group 3 | Group 2 | Group 3 |
| Gender | 1.576** | 0.797 | 1.645** | 0.944 |
| | (0.302) | (0.119) | (0.344) | (0.136) |
| Age | 0.986 | 0.977 | 0.973 | 0.966 |
| | (0.065) | (0.027) | (0.042) | (0.022) |
| Age squared | 1.000 | 1.000 | 1.000 | 1.000 |
| | (0.001) | (0.000) | (0.000) | (0.000) |
| Marital status | 0.425 | 1.282 | 0.477 | 1.147 |
| | (0.356) | (0.647) | (0.395) | (0.452) |
| Urban/rural | 3.170*** | 2.853*** | 3.263*** | 3.263*** |
| | (0.934) | (0.654) | (0.547) | (0.547) |
| Ethnicity | 5.000*** | 1.150 | 1.429** | 1.429** |
| | (1.234) | (0.214) | (0.201) | (0.201) |
| Dependency ratio | 0.210*** | 0.336*** | 0.305*** | 0.305*** |
| | (0.094) | (0.084) | (0.072) | (0.072) |
| Household size | 1.240*** | 1.165*** | 1.137*** | 1.137*** |
| | (0.060) | (0.038) | (0.035) | (0.035) |
| Annual cropland | 0.646*** | 0.733*** | 0.711*** | 0.711*** |
| | (0.030) | (0.028) | (0.018) | (0.018) |
| Perennial cropland | 0.905*** | 0.916*** | 0.918*** | 0.918*** |
| | (0.034) | (0.022) | (0.016) | (0.016) |
| Forestland | 0.912*** | 0.966* | 0.966*** | 0.966*** |
| | (0.028) | (0.017) | (0.013) | (0.013) |
| Residential land | 1.065 | 0.962 | 0.981 | 0.981 |
| | (0.042) | (0.025) | (0.023) | (0.023) |
| Dien Bien | 0.450** | 0.496** | 0.497*** | 0.497*** |
| | (0.171) | (0.155) | (0.088) | (0.088) |
| Lai Chau | 0.774 | 0.627 | 0.601*** | 0.601*** |
| | (0.307) | (0.187) | (0.102) | (0.102) |
| Son La | 0.329*** | 0.332*** | 0.365*** | 0.365*** |
| | (0.127) | (0.094) | (0.065) | (0.065) |
| Yen Bai | 0.791 | 0.914 | 0.975 | 0.975 |
| | (0.276) | (0.256) | (0.158) | (0.158) |
| Hoa Binh | 1.059 | 0.926 | 1.211 | 1.211 |
| | (0.389) | (0.286) | (0.198) | (0.198) |
| Years of schooling | 1.035 | 1.156*** | | |
| | (0.025) | (0.020) | | |
| Primary education | | | 3.222*** | 1.202 |
| | | | (0.746) | (0.147) |
| Lower secondary education | | | 3.802*** | 1.429*** |
| | | | (0.865) | (0.185) |
| Higher secondary education | | | 7.056*** | 1.199 |
| | | | (2.125) | (0.288) |
| Vocational education | | | 9.436*** | 4.900*** |
| | | | (2.842) | (1.127) |
| College/university or higher | | | 24.279*** | 38.906*** |
| | | | (28.806) | (41.994) |
| Constant | 2.822 | 5.556** | 1.498 | 17.124*** |
| | (4.578) | (4.648) | (1.683) | (10.948) |
| Pseudo R2 | 0.29 | | 0.29 | |
| Observations | 3,294 | | 3,294 | |

Note: Estimates are relative risk ratio (RRR) and robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Group 1: the farm work livelihood forms the base group; Group 2: nonfarm self-employment livelihood; Group 3: wage paying work livelihood. The omitted categories in the dummy variable analyses are: female sex; unmarried; rural; ethnic minorities; Lao Cai; no education.

Table 4 presents the estimation results from the multinomial logit model, in which education was measured by the household head's highest qualification in Model 1 and the number of formal schooling years in Model 2. Both models show that many explanatory variables are statistically significant at the 5% level or lower, with their signs as expected. Finally, the Pseudo-$R^2$ = 0.29 and is highly significant, indicating that this model has strong explanatory power.[1]

With respect to the role of education in livelihood choice, the results indicate that better education of household heads has a positive association with adopting a livelihood strategy based on wage employment. Keeping all other variables constant, the results from Model 2 in Table 4 show that an additional year of formal schooling increases the likelihood of a household choosing a livelihood from wage paying work by about 15.6%. Model 1 in Table 4 reveals that a household whose head has achieved higher levels of qualification is much more likely to have a better livelihood. For instance, the likelihood of choosing nonfarm self-employment is 3.22 times higher for a household whose head has primary education than for a household whose head has no education. Similar but much larger effects are observed with higher secondary education (7.05 times), vocational education (9.40) and college/university or higher (24.30 times). The findings imply that education plays an important role in pursuing lucrative livelihoods and that households with low educational levels may be hindered from adopting better livelihoods. Our findings are consistent with previous studies in Vietnam's peri-urban areas (Tran et al., 2014) and rural Vietnam (Pham, Anh Tuan, & Thanh, 2010; Van de Walle & Cratty, 2004).

We also find that other household characteristics have a close link with livelihood choice. The gender evidence suggests that the probability of adopting a wage paying livelihood is about 1.6 times higher for a household with a male head than for a household whose head is female, assuming that the remaining variables in the model are held constant. In addition, Kinh and Hoa households are more likely than ethnic minority households to choose nonfarm self-employment livelihoods. We find evidence that the only type of land associated with livelihood choice is annual cropland. In accordance with other findings in several developing countries (Rigg, 2006; Winters et al., 2009), our research shows that cropland is negatively associated with the choice of both wage paying work and nonfarm self-employment livelihoods. The

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[1] An extremely good fit for the model is confirmed if the value of the Pseudo-$R^2$ ranges from 0.2 to 0.4 (Louviere, Hensher, & Swait, 2000).

results show that the likelihood of choosing various livelihoods varies significantly across provinces. For instance, holding all other variables constant, households in Dien Bien and Son Lan are less likely to adopt a strategy based on nonfarm activities, including both wage paying and self-employment, than households in Lao Cai. However, households in Lai Chau are more likely to choose wage paying and nonfarm self-employment livelihoods than those in Lao Cai.

*Table 5: OLS Estimates for the Effect of Education on Household per Capita Income*

| | Model 1 Highest qualification | | | Model 2 Years of schooling | | |
|---|---|---|---|---|---|---|
| Explanatory variables | Coefficient | SE | P-value | Coefficient | SE | P-value |
| Gender | 0.069 | 0.030 | ** | 0.046 | 0.031 | |
| Age | 0.023 | 0.006 | *** | 0.026 | 0.006 | *** |
| Age squared | 0.000 | 0.000 | *** | 0.000 | 0.000 | *** |
| Marital status | 0.039 | 0.107 | | 0.047 | 0.107 | |
| Urban/rural | 0.302 | 0.077 | *** | 0.322 | 0.075 | *** |
| Ethnicity | 0.342 | 0.047 | *** | 0.319 | 0.048 | *** |
| Dependency ratio | -0.518 | 0.056 | *** | -0.513 | 0.056 | *** |
| Household size | -0.064 | 0.006 | *** | -0.057 | 0.007 | *** |
| Annual cropland | -0.036 | 0.007 | *** | -0.041 | 0.007 | *** |
| Perennial cropland | 0.019 | 0.006 | *** | 0.016 | 0.007 | ** |
| Forestland | 0.004 | 0.004 | | 0.004 | 0.004 | |
| Residential land | 0.020 | 0.006 | *** | 0.018 | 0.006 | *** |
| Dien Bien | -0.128 | 0.063 | ** | -0.126 | 0.063 | ** |
| Lai Chau | -0.029 | 0.057 | | -0.019 | 0.059 | |
| Son La | -0.171 | 0.061 | *** | -0.181 | 0.062 | *** |
| Yen Bai | -0.079 | 0.056 | | -0.094 | 0.058 | |
| Hoa Binh | 0.020 | 0.066 | | -0.030 | 0.067 | |
| Primary education | 0.157 | 0.031 | *** | | | |
| Lower secondary education | 0.249 | 0.035 | *** | | | |
| Higher secondary education | 0.429 | 0.054 | *** | | | |
| Vocational education | 0.621 | 0.045 | *** | | | |
| College/university or higher | 0.869 | 0.057 | *** | | | |
| Years of schooling | | | | 0.049 | 0.003 | *** |
| Constant | 6.750 | 0.163 | *** | 6.615 | 0.164 | *** |
| Observations | 3,294 | | | 3,294 | | |
| R-squared | 0.53 | | | 0.53 | | |

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted categories in the dummy variable analyses are female sex, unmarried, rural, ethnic minorities, Lao Cai, no education.

Table 5 reports the results from the household income model with Model 1 using the highest qualification and Model 2 using the number of formal schooling years. Both models explain roughly 50% of the variation in household income. In addition, many coefficients are statistically highly significant (p<0.05), with their signs as expected. As shown in Model 2, the coefficient of schooling years indicates that on average and holding all other variables constant, an additional year of formal schooling would increase household per capita income by about 5%. Model 2 in Table 5 indicates that a higher level of qualifications would have an increasing effect on household per capita income and the effect significantly increases with the level of education. For instance, per capita income would be about 16% and 87% higher, respectively,

for a household whose head had a primary diploma and one with a college/university or higher degree. Similar findings were also found in previous studies in peri-urban Vietnam (Tuyen et al., 2014) and rural Vietnam (Nguyen & Tran, 2013).

*Table 6: QR Estimates for the Effect of Education on Household per Capita Income*

| Explanatory Variables | Simultaneous Quantile Regression Estimator | | | | |
| --- | --- | --- | --- | --- | --- |
| | 10th Quantile | 25th Quantile | 50th Quantile | 75th Quantile | 90th Quantile |
| Years of schooling | 28.862*** | 37.736*** | 55.940*** | 76.068*** | 109.387*** |
| | (3.636) | (3.878) | (3.855) | (5.514) | (10.753) |
| Gender | -14.528 | -9.518 | -16.412 | 63.403 | 123.742 |
| | (41.461) | (45.253) | (35.733) | (61.748) | (117.812) |
| Age | 13.718** | 27.693*** | 41.829*** | 35.419*** | 43.667*** |
| | (6.461) | (6.508) | (7.392) | (8.195) | (13.627) |
| Age squared | -0.119 | -0.246*** | -0.353*** | -0.261*** | -0.339*** |
| | (0.072) | (0.070) | (0.078) | (0.081) | (0.129) |
| Marital status | 69.679 | 4.566 | 18.477 | 130.787 | 382.728 |
| | (183.509) | (114.201) | (174.791) | (270.385) | (3,080.414) |
| Urban/rural | 410.517*** | 567.857*** | 673.950*** | 961.327*** | 862.607*** |
| | (61.187) | (56.341) | (106.078) | (156.924) | (289.073) |
| Ethnicity | 348.192*** | 486.490*** | 579.928*** | 905.169*** | 1,408.618*** |
| | (45.890) | (57.372) | (63.905) | (143.736) | (225.062) |
| Dependency ratio | -284.350*** | -316.573*** | -627.089*** | -1,006.560*** | -1,804.555*** |
| | (56.288) | (75.200) | (61.341) | (110.922) | (159.876) |
| Household size | -6.509 | -15.821** | -35.729*** | -61.672*** | -73.702*** |
| | (7.114) | (7.750) | (9.444) | (10.628) | (16.341) |
| Annual cropland | -37.457*** | -53.374*** | -88.293*** | -101.828*** | -161.100*** |
| | (7.642) | (7.820) | (10.686) | (15.626) | (26.370) |
| Perennial cropland | -8.030* | -7.190 | 7.820 | 27.641*** | 69.884*** |
| | (4.511) | (4.914) | (5.737) | (9.359) | (14.672) |
| Forestland | 1.743 | 2.514 | 6.745** | 7.348 | 9.516 |
| | (3.386) | (2.666) | (3.322) | (5.282) | (9.970) |
| Residential land | 13.749*** | 9.471* | 9.831 | 26.837** | 8.481 |
| | (4.354) | (5.110) | (6.684) | (10.629) | (22.810) |
| Dien Bien | -111.050*** | -127.555*** | -48.070 | -144.958** | -138.984 |
| | (31.909) | (40.094) | (53.332) | (73.512) | (107.527) |
| Lai Chau | -22.492 | -11.078 | 59.714 | -52.558 | -134.998 |
| | (34.360) | (38.844) | (41.275) | (56.977) | (88.318) |
| Son La | -154.188*** | -141.098*** | -69.971 | -202.521*** | -365.567*** |
| | (43.959) | (49.008) | (58.642) | (72.718) | (94.154) |
| Yen Bai | -142.684*** | -163.706*** | -155.240*** | -226.419*** | -170.503 |
| | (50.199) | (41.602) | (47.548) | (71.681) | (132.016) |
| Hoa Binh | -126.195*** | -111.935** | -1.624 | -11.434 | -214.302 |
| | (47.708) | (56.250) | (55.110) | (81.992) | (136.588) |
| Constant | 515.401*** | 496.057*** | 747.555*** | 1,496.651*** | 2,605.122*** |
| | (140.827) | (168.450) | (199.374) | (251.971) | (436.752) |
| Pseudo R2 | 0.15 | 0.22 | 0.32 | 0.37 | 0.38 |
| Observations | 3,294 | 3,294 | 3,294 | 3,294 | 3,294 |

*Note:* * significant at 10%; ** significant at 5%; *** significant at 1%. Bootstrapped standard errors (1000 replications) in parentheses. The omitted categories in the dummy variable analyses are female sex, unmarried, rural, ethnic minorities, Lao Cai.

Table 6 provides the estimation results from the quantile regression analysis. It shows that education has a positive and statistically significant effect on household per capita income for

all quantiles. Interestingly, the results in Table 6 and Figure 5 indicate that the effect is substantially heterogeneous across the quantiles considered, and increases when moving up the conditional income distribution. For instance, holding all other factors constant, an additional year of formal schooling would lead to an increase of about 29,000 VND in monthly per capita income for those in the 10th quantile. However, the corresponding figures for those in the 50th, 75th and 90th quantiles are about 56,000 VND, 76,000 VND and 110,000 VND, respectively. This finding shows education to be more profitable at the top of the distribution, which implies that education increases within-level income inequality in absolute terms[2]. Similar results were also found when education is measured by the highest qualification (see Appendix 2).
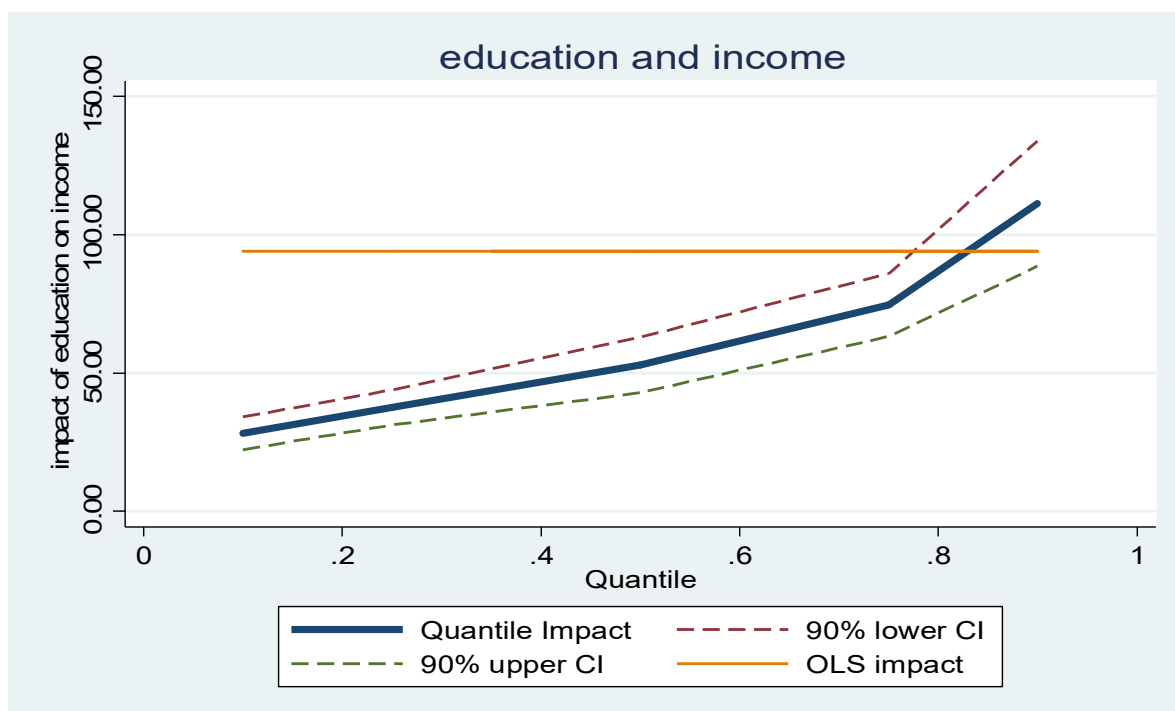


*Figure 5: Heterogeneous Effects of Education on Income Across Percentiles*
*Note:* Figure 2 reflects the varying effects of years of schooling on per capita income across different points in the income distribution and also indicates that the effect is greater for better-off households.

Source: Authors' calculation from the 2016 VHLSS.

The greater influence of education on higher quantiles may be explained by the fact that better-off households have more resources or a better ability to use their human capital more efficiently, which in turn can lead to higher income levels. Another possible reason is that for the same number of years of schooling, the better off received better quality education than

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[2] the absolute gap between "rich" and "poor" rather than the proportionate gap.

those worse off. These results suggest that a mean regression approach has obscured the role of education in improving household welfare at different points of outcome distribution.

The results from probit regression analysis are given in Table 7, which indicates that better education is strongly associated with a lower likelihood of a household remaining in poverty. Model 2 in Table 7 reveals that an additional year of formal schooling would have a marginal effect of -2% on the probability of a household falling into poverty, holding all other variables constant in the model. Similarly, the results from Model 1 in Table 7 confirm that a household whose head had no college/university or higher degree would, on average, be more likely to be poor than would a household whose head had such a qualification. Specifically, Model 1 predicts a marginal effect of 95%, 116%, 118%, 122% and 128% in the case of vocational education, higher secondary, lower secondary, primary and no education, respectively.[3] The results from both models in Table 7 confirm that better education helps reduce poverty in the study area. The findings are congruent with those from several studies in Vietnam (Tran et al., 2015) and other developing countries (Biddlecom & Kramarow, 1998; Lekobane & Seleka, 2017; Rigg, 2006).

With respect to the role of other household characteristics in household affluence, we find that both household size and dependency ratio reduce per capita income and increase the likelihood of being poor. Similar findings are also reported in several developing countries (Jansen, Pender, Damon, Wielemaker, & Schipper, 2006; Lekobane & Seleka, 2017; Winters et al., 2009) and rural Vietnam (Tran, 2015; Tran et al., 2015). The current study also shows that households headed by men, are Kinh or Hoa, and live in urban areas, would, on average, have higher per capita income and be at lower risk of falling into poverty. However, the results from the quantile regression suggest that the effect of the aforementioned factors is quite heterogeneous at various points of income distribution. For instance, the negative effect of the household size and dependency ratio on household income tends to be larger for better-off households, while the regional (urban) and ethnicity (Kinh and Hoa) factors bring greater benefits for richer households.

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[3] We use the highest qualification (those with college/university/higher qualifications) as the reference group in Model 1 instead of using the group with no education, because there are no poor households in the group with the highest qualification. Consequently, the education variable "highest qualification" predicted failure and had to be dropped, leaving 208 observations unused.

*Table 7: Probit Estimates for the Effect of Education on the Incidence of Poverty*

| Explanatory variables | Model 1 Highest qualification | | | Model 2 Years of schooling | | |
|---|---|---|---|---|---|---|
| | Marginal effect | SE | P-value | Marginal effect | SE | P-value |
| Gender | -0.046 | 0.021 | ** | -0.032 | 0.021 | |
| Age | -0.014 | 0.003 | *** | -0.016 | 0.003 | *** |
| Age squared | 0.000 | 0.000 | *** | 0.000 | 0.000 | *** |
| Marital status | -0.056 | 0.062 | | -0.060 | 0.060 | |
| Urban/rural | -0.078 | 0.048 | | -0.075 | 0.046 | |
| Ethnicity | -0.191 | 0.039 | *** | -0.178 | 0.038 | *** |
| Dependency ratio | 0.224 | 0.035 | *** | 0.226 | 0.035 | *** |
| Household size | 0.033 | 0.004 | *** | 0.031 | 0.004 | *** |
| Annual cropland | 0.008 | 0.005 | * | 0.010 | 0.004 | ** |
| Perennial cropland | -0.007 | 0.003 | ** | -0.006 | 0.003 | |
| Forestland | -0.002 | 0.002 | | -0.002 | 0.002 | |
| Residential land | -0.016 | 0.004 | *** | -0.015 | 0.004 | *** |
| Dien Bien | 0.148 | 0.046 | *** | 0.144 | 0.045 | *** |
| Lai Chau | 0.021 | 0.041 | | 0.016 | 0.041 | |
| Son La | 0.136 | 0.038 | *** | 0.138 | 0.038 | *** |
| Yen Bai | 0.051 | 0.041 | | 0.058 | 0.041 | |
| Hoa Binh | 0.017 | 0.044 | | 0.041 | 0.045 | |
| No education | 1.282 | 0.045 | *** | | | |
| Primary education | 1.222 | 0.047 | *** | | | |
| Lower secondary education | 1.182 | 0.048 | *** | | | |
| Higher secondary education | 1.116 | 0.055 | *** | | | |
| Vocational education | 0.955 | 0.056 | *** | | | |
| Years of schooling | | | | -0.019 | 0.002 | *** |
| Observations | 3,294 | | | 3,294 | | |
| Pseudo R2 | 0.30 | | | 0.29 | | |

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted categories in the dummy variable analyses are female sex, unmarried, rural, ethnic minorities, Lao Cai, college/university or higher degree.

Regarding the role of assets in household welfare, the study found that not all types of land are positively associated with household affluence. While both residential and perennial croplands have a positive effect on household income and poverty reduction, this effect is negative for annual cropland and not statistically significant in the case of forestland (Tables 5 and 7). An increase of 1% in perennial cropland would increase per capita income by about 0.02% and reduce the probability of falling into poverty by 0.007%. Interestingly, using a quantile regression analysis, our study provides the first evidence that the income effect of land is substantially heterogeneous at different points of income distribution (Table 6). The negative effect of annual cropland tends to be greater for richer households. Notably, the effect of perennial cropland is statistically significant and positive only for households with per capita income above the median, but is negative for those in the 10th quantile. Also, it is found that forestland is positively associated with per capita income for those at the median. This suggests that such findings would be hidden if we only reported the results from a mean regression analysis.

Finally, Table 5 shows that some coefficients of province dummy variables are negative and statistically significant, suggesting that on average, households with equal lands, education and other characteristics would have per capita income levels lower in Dien Bien and Son La than in Lao Cai. The disparities in per capita income across provinces suggest that livelihood outcomes are also affected by provincial factors.

## 4. Policy implication and conclusion

For the first time, this study considers the role of education on livelihood choice, household income, poverty and inequality in the Northwest Region, the poorest region in Vietnam. The extensive empirical literature, which estimates the influence of education on household income using a mean regression approach, disregards variation in the effect for households with the same levels of education. Going beyond the current literature, our study is the first to employ a quantile regression (QR) estimator to investigate the returns on education for the entire distribution of household income, not merely its conditional mean. This approach enables us to measure inequality within groups, since quantile returns represent the income differential between households in the same education group but in different income quantiles.

In the current study, education is measured by the number of years of formal schooling and the highest qualification attained by household heads. We find that the poor have much lower levels of education than do the better off. The results from a multinomial logit model show that education plays a significant role in securing well-paying livelihoods, even after controlling for other factors in the models. In addition, the findings from OLS and probit models confirm that households with better education would, on average, have higher per capita income and a greater chance of escaping poverty. Given that the poor have much lower levels of education than those better off, our research finding suggests that increasing the access of the poor to education, combined with improvements in its quality, could have a substantial effect on livelihood choice, income and poverty in the study area.

Notably, we provide the first evidence that there is a significant variation in the returns on education across income distribution, with higher returns for households with higher levels of per capita income. This implies that education has an increasing effect on within-level income inequality in absolute terms and raises challenges for the conventional view of investment in education, in which education improves income equality in the long run, other things being equal (Sakellariou et al., 2006). Higher returns on education for better-off households can be explained by the fact that they have more resources or a better ability to

use their human capital more efficiently, which in turn can lead to higher income levels. Another possible reason is that for the same number of schooling years, richer households receive better quality education than do those worse off. These results suggest that a mean regression approach that looks only at the effect of education on mean household affluence and does not investigate differences in the distribution of household wealth, may miss heterogeneity that is of interest to policymakers.

We find a number of other factors affecting household income, poverty status, and the choice of better livelihoods. Households with male heads, or of Kinh and Hoa ethnicity, were more likely to have lucrative livelihoods. These households and those living in urban areas also have higher per capita income and a lower likelihood of falling into poverty. The study shows that not all types of land are positively associated with income and poverty alleviation. Both income and poverty reduction are positively linked with perennial cropland and residential land, but are negatively associated with annual cropland. However, the results from the QR estimator show that these factors have heterogeneous effects across points of income distribution. The negative effects of household size and dependency ratios tend to be smaller for poorer households, whereas the positive effects of gender, ethnicity, and regional variables tend to increase for richer households. This suggests that a mean regression approach has obscured the role of household characteristics in improving household welfare at different points of outcome distribution.

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# Appendix 1

**Household Characteristics by Ethnicity**

| Variables | Ethnic minorities | | Kinh & Hoa | | Whole sample | |
|---|---|---|---|---|---|---|
| | Mean | Sd | Mean | Sd | Mean | Sd |
| Gender | 0.88 | 0.32 | 0.65 | 0.48 | 0.81 | 0.39 |
| Age | 43.54 | 12.75 | 50.16 | 13.12 | 45.51 | 13.21 |
| Marital status | 0.01 | 0.11 | 0.01 | 0.11 | 0.01 | 0.11 |
| Schooling years | 5.12 | 4.33 | 10.40 | 4.00 | 6.70 | 4.90 |
| Dependency ratio | 0.37 | 0.23 | 0.36 | 0.28 | 0.37 | 0.24 |
| Household size | 4.74 | 1.79 | 3.60 | 1.34 | 4.40 | 1.75 |
| Wage employment | 0.56 | 0.50 | 0.74 | 0.44 | 0.61 | 0.49 |
| Nonfarm self-employment | 0.23 | 0.42 | 0.42 | 0.49 | 0.29 | 0.45 |
| Annual cropland | 86.62 | 97.44 | 13.51 | 49.53 | 64.86 | 92.27 |
| Perennial cropland | 5.81 | 24.49 | 10.03 | 42.45 | 7.07 | 31.00 |
| Forestland | 37.48 | 127.45 | 22.82 | 94.79 | 33.11 | 118.85 |
| Residential land | 0.65 | 3.10 | 1.38 | 15.66 | 0.87 | 8.94 |
| Urban/rural | 0.08 | 0.27 | 0.53 | 0.50 | 0.21 | 0.41 |
| Per capita income | 1,207 | 1,208 | 3,432 | 2,895 | 1,870 | 2,134 |
| Poverty head count | 0.38 | 0.48 | 0.034 | 0.018 | 0.27 | 0.45 |
| Observations | 2313 | | 981 | | 3294 | |
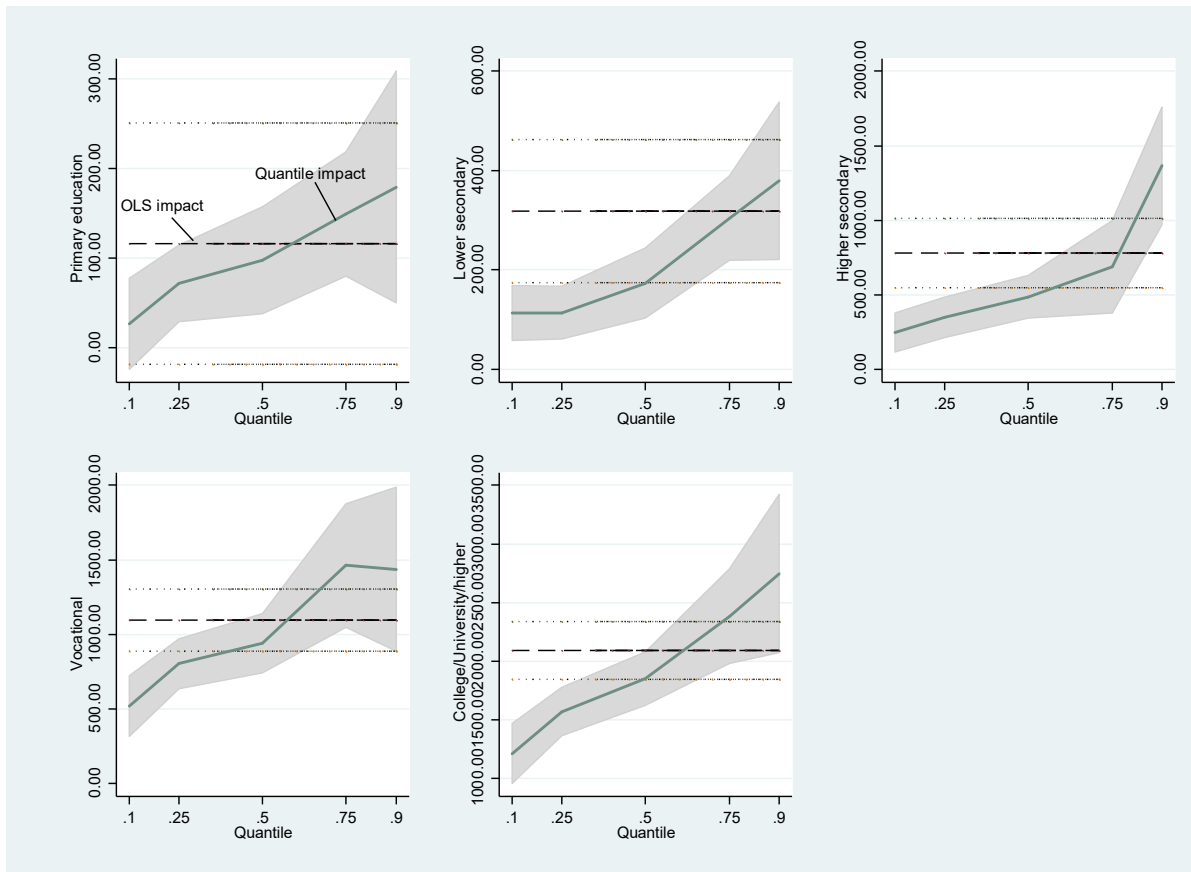
*Appendix 2: Heterogeneous Impacts of the Highest Qualification on Income Across Percentiles*

*Note:* Appendix 2 shows the varying effects of the highest qualification on per capita income across different points in the distribution of income and also indicates that the effect is greater for better-off households. No education is the reference group.

Sources: Authors' calculation from the 2016 VHLSS.