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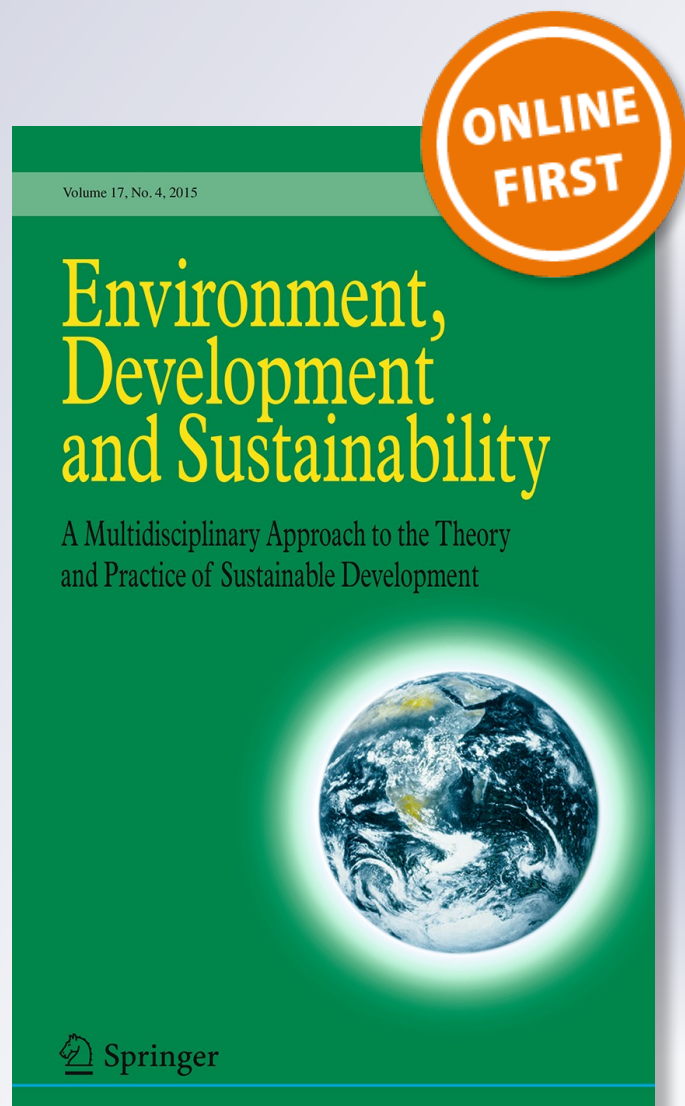
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Tran Quang Tuyen[1]

Abstract   This study analyzes the sources of income inequality among ethnic minorities in the Northwest region—the poorest and highest inequality region of Vietnam. Using an analysis of Gini decomposition by income source, the results show that while agricultural income, notably crop income, considerably decreases income inequality, off-farm income sources (wage and non-farm self-employment incomes) are found to increase inequality. This can be explained that in comparison with other income sources, agricultural income is more equally distributed and the main income source for most poor households. However, off-farm income sources are more unequally distributed and flow disproportionately toward the better-off. The findings support the hypothesis that income diversification in non-farm activities results in either greater inequality if opportunities for these activities are skewed toward to the better-off or less inequality if such opportunities are accessible to the poorer part of the population.

Keywords   Gini decomposition · Off-farm income · Inequality · Ethnic minorities · Northwest region · Vietnam

JEL Classification   I 32 · O12 · J15

1 Introduction

Vietnam has made remarkable achievements in economic growth and poverty reduction over the past decades. The economy has on average reached a high growth rate of about 6.7 % in the period 1986–2013 (Son and Tuyen 2014). The poverty rate reduced from 58

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percent in 1993 to about 30 % in 2001(World Bank [WB] 2012), 20 % in 2010 and 17 % in 2012 (General Statistical Office [GSO] 2013). Unlike other rapidly growing economies, such as China and Indonesia, previous empirical studies suggest that Vietnam's extraordinary economic transformation has been one of the growth without a considerable rise in inequality, a path similar to that of the Republic of Korea and Taiwan during their early stages of development (Hoang, et al. 2010; Kanbur and Zhuang 2012; McCaig et al. 2009; Vietnam Academy of Social Sciences [VASS] 2011; World Bank 2009a, b). Commonly used measures of inequality indicate that inequality increased modestly during the 1990s and stabilized during the 2000s (Hoang et al. 2010; VASS 2011).

Although inequality has remained stable for the whole population, it has risen among both subpopulations. The income Gini index among the Kinh majority group slightly increased from 0.334 in 2002 to 0.349 in 2012. Nevertheless, the income Gini index among minorities has risen most significantly, from 0.294 to 0.362 during the same period (McCaig et al. 2015); especially, the data show that both poverty and inequality remain highest in the Northwest region (GSO 2013) where the overwhelming majority of population is ethnic minorities (Cuong 2012). For instance, in 2012, the poverty rate and income Gini index for the Northwest region are 59 and 0.391 %, respectively. However, the corresponding figures for the Red River Delta are only 7.4 % and 0.346 and those for the Mekong River Delta are only 16.2 % and 0.332 in 2012 (GSO 2013).

While the urban–rural gap declined, the inequality between majority and minorities has risen during the past decade in Vietnam (McCaig et al. 2015). Over the period 2002–2012, average incomes of the Kinh households increased by 8.6 %, while minorities reached a respectable but lower growth rate of 6.1 %. Thus, the ratio of Kinh to minority incomes increased from 1.65 in 2002 to 2.07 by 2012 (McCaig et al. 2015). There have been an increasing number of studies examining the gap in living standards between minorities the majority Kinh population (Baulch et al. 2002; Baulch et al. 2011; Cuong 2012; Hoa et al. 2012; Hoang et al. 2007; Van de Walle and Gunewardena 2001; WB 2009a, b). In general, these studies find that differences in the endowments of and returns to household characteristics and assets are the main reason explaining why ethnic minorities continue to lag behind the majority Kinh population.

According to McCaig et al. (2015), the stability of income inequality at a national level in Vietnam over the past decade (2002–2012) can be explained by a reduction in inequality within urban areas, an increase within rural areas and a decline of the urban–rural income gap during the same time.[1] As noted by WB (2012), the rural sector has been the driving force behind the rise in income inequality in recent years. The rise in income inequality in Vietnam rural reflects changes in the component of household income, moving from agriculture to non-agricultural sources, and from low-skill to higher-skill work outside the agriculture sector (WB 2012). A number of studies in recent years have examined the contribution of different income sources to and their impact on income inequality in rural and urban Vietnam (McCaig et al. 2015; Cam and Akita 2008), peri-urban Vietnam (Tuyen et al. 2014) and Vietnam as a whole (Tuyen 2014; McCaig et al. 2015). When examining the role of income sources in overall inequality within rural and urban areas during the period 2002–2012, McCaig et al. (2015) found that wage income is an important contributor to overall inequality within both rural and urban areas because of its large and increasing share as it is still highly correlated with overall income. Most of increased

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[1] The Gini (income) for the whole country is 0.397 in 2002 and 0.391 in 2012. The corresponding figures for urban areas are 0.399 in 2002 and 0.365 in 2012, and those for rural areas are 0.358 and 0.383 (McCaig et al. 2015).

inequality within the rural area between 2002 and 2012 is due to wage inequality. Although the inequality of wage income actually reduced as more households received income from wage activities, the share of wage earnings increased among rural households. However, the decline in inequality within urban households during the same period is driven by a significant reduction in the inequality-increasing effect of business income, and especially, remittances (McCaig et al. 2015).

The aforementioned findings suggest that the role of each income source in the distribution of income might be different across regions. This implies that the research results in a particular region might not be true in other regions, which are dissimilar in socioeconomic and geographic characteristics. As already mentioned, there have been a number of studies examining the inequality between the ethnic groups as well as the inequality within Vietnam' rural, peri-urban or urban areas, to the best of my knowledge; however, no study investigates the sources of income inequality within ethnic minority areas of Vietnam. This gap in the literature motivated the author to conduct this study. The current study is the first to decompose income inequality by source among ethnic minority households in the Northwest region. The Northwest region is chosen for the current study because this is the poorest and highest inequality region of Vietnam (GSO 2013), with the overwhelming majority of population (95.6 %) being ethnic minorities (Table 1). This study utilized a unique dataset from a recent survey of Northern Mountain Baseline Surveys. The survey was conducted by GSO with a focus on the ethnic minorities in the Northwest region.

The study aims to achieve two objectives. First, it provides a descriptive analysis of the composition of household's income from different sources and estimates the overall income inequality. Second, it measures the contributions of each income source to and their effect on the total income inequality. A key rational for studying the Gini decomposition by income source is to learn how changes in a given income source will affect the overall inequality. The study contributes to the extant literature by offering the first evidence of the role of each income source in the overall inequality and attempting to explain why some income sources are inequality increasing, while others are inequality-decreasing. Using an analysis of Gini decomposition by income source, the study shows that while agricultural income, notably crop income, significantly decreases income inequality, off-farm income sources (wage and non-farm self-employment incomes) are found to increase

Table 1 Descriptive statistics of the sample by ethnicity

Ethnic groups	Kinh/Hoa	Tay	Thai	Muong	Hmong (Meo)	Dao	Others
Income per capita	7738 (7424)	5990 (6241)	5424 (4372)	5450 (3592)	3688 (2730)	5157 (4159)	4011 (3027)
Poor (%)	7.78	25.35	23.70	24.76	26.54	25.50	28.32
Extremely poor (%)	22.50	31.30	31.75	23.40	50.40	37.07	45.14
Number of households	86	129	323	205	618	196	243
Percentage	4.78	7.17	17.94	11.39	34.33	10.89	15.30
Number of individuals	327	555	1712	841	3733	1051	1205
Percentage	3.47	5.89	18.17	8.92	39.62	11.15	12.79

Standard deviations in parentheses. Estimates in Row 1 are adjusted for sampling weights and household size. Estimates in other rows are estimated based on the household data and adjusted for sampling weights. Income measured in thousand Vietnam Dongs (VND). 1 USD was equal about 19 thousand VND in 2010

inequality. Remittances also cause inequality to rise, albeit at small level. This can be explained that in comparison with other income sources, agricultural income is more equally distributed and tends to target the poor. However, off-farm income sources are more unequally distributed and flow disproportionately toward the better-off.

The remaining parts of the paper are organized as follows. Section 2 provides a brief description of the source of data and measurement of income sources and income inequality. Section 3 discusses the empirical results, while Section 4 concludes with policy implications.

2 Data and method

2.1 Data source

The data from the Northern Mountains Baseline Survey (NMBS) 2010 were utilized for the current study. The 2010 NMBS was conducted by GSO from July to September in 2010 to collect baseline data for the Second Northern Mountains Poverty Reduction Project. The main objective of this project is to aim at reducing poverty in the Northern region (Northwest and Northeast regions), Vietnam. The project has invested in productive infrastructure and provided supports for the poor in this region. The project covered six provinces in the Northwest region (see the map in Appendix 1), namely Hoa Binh, Lai Chau, Lao Cai, Son La, Dien Bien and Yen Bai (Cuong 2012).

A multistage sampling method was used for the survey. Firstly, 120 communes from six aforementioned provinces were randomly selected following probability proportional to the population size of the provinces. Secondly, from each of these selected communes, three villages were randomly chosen, and then five households in each village were randomly selected for the interview, yielding a total sample size of 1800 households. The survey covered a large number of households from various minor ethnicities such as Tay, Thai, Muong, H'Mong and Dao. Ethnic minorities account for 95.22 % of the total sample.

Both household and commune data were gathered for the survey. The household data contain characteristics of household members, education and employment, health care, income, housing, land, access to credit, fixed assets and durables. The commune data include information about the characteristics of communities such as demography, population, infrastructure and off-farm job opportunities.

2.2 Measures of income sources

Vietnam rural households often earn income from multiple sources. To better focus on the most important income sources in the study area, I divide annual household income into seven sub-aggregates:

1. *Wage income* This source includes salary or wage payments plus additional payments such as bonuses and allowances for all jobs worked by household members during the past 12 months.
2. *Non-farm self-employment* This source comes from all economic activities outside agricultural activities (crop, livestock, aquaculture and forestry) undertaken by households.
3. *Crops* This source is received from crop-based farm income, including incomes from annual crops (e.g., rice, other starchy crops, vegetables, medicine and industrial crops)

and perennial crops (industrial crops, fruit and nuts, etc.), and crops by-products for the last 12 months.

4. *Livestock and aquaculture* This consists of income from household raising or owning cattle, poultry and pets, and income from rearing fish, shrimp and other aquaculture products for the last 12 months.

5. *Forestry* Forestry income earned from forestry activities, including planting/managing/ protecting/maintaining forests, germinating forestry seedlings and collecting products from forests, and from hunting, trapping and domesticating wild animals for last 12 months.

6. *Remittances and Gifts* Gifts and remittance payments (including in-kind) comprise both domestic and overseas sources from people who are not household members.

7. *"Other" sources of income* This includes government transfers (pension, sickness, one-time job allowance, and social insurance allowance); income from other social welfare allowances (invalids, relatives of revolutionary martyr, policy households…); allowance from recovery from disasters and income from various types of insurance; income from interest of savings, shares, bonds and loans; income from leasing workshops, machines, assets, equipment that is not yet counted in trade and business production parts; income and support from charity organizations, associations or firms; and others.

Note that income is measured accounting for own consumption of products produced by households. This is because most ethnic minority households are producers as well as consumers in the study area. This is also the case for rural households in developing countries (Deaton 1997).

2.3 Gini coefficient and its decomposition

Income inequality can be measured in various ways. Among the different types of inequality measurement, the Gini index is popularly used to measure the disparity in the distribution of income, consumption and other welfare indicators (López-Feldman 2006). The Gini coefficient was proposed by Gini, 1912, which is strictly linked to the representation of income inequality via the Lorenz curve (Bellù and Liberati 2006). However, this index can be directly expressed in terms of the covariance between income levels and the cumulative distribution of income as follows (Bellù and Liberati 2006):

$$G = 2 \frac{\text{Cov}\left(y, F_{(y)}\right)}{\bar{y}} \qquad (1)$$

where G is the Gini index, Cov is the covariance between income levels y and the cumulative distribution of the same income ($F_{(y)}$) and $\bar{y}$ is the average income. On this basis, the Gini coefficient of the income source k (G_k) can be written as:

$$G_k = 2 \frac{\text{Cov}\left(yk, F_{(yk)}\right)}{\bar{y}k}, \qquad (2)$$

where G_k is the Gini coefficient of the income source k, Cov is the covariance between income levels yk and the cumulative distribution of the same income ($F_{(yk)}$) and $\bar{y}k$ is the average income of source k (Adams 1991).

Following Van Den Berg and Kumbi (2006) and Tuyen et al. (2014), the current study examined the relationship between income sources and income inequality using Gini

decomposition analysis by income source (Lerman and Yitzhaki 1985; Shorrocks 1982). Lerman and Yitzhaki (1985) extended the results of Shorrocks (1982) and showed that the Gini coefficient of total income inequality (G) can be denoted as:

$$G = \sum_{k=1}^{K} S_k G_k R_k \qquad (3)$$

where S_k represents the share of income source k in total income, G_k is the Gini coefficient of the income distribution from source k and R_k is the correlation coefficient between income from source k and the distribution of total income Y $(R_k = \text{Cov}\{y_k, F_{(y)}\}/\text{Cov}\{y_k, F_{(yk)}\})$, where $\text{Cov}\{y_k, F_{(y)}\}$ is the covariance between the amount of income source k and the income rank of total income Y, and $\text{Cov}\{y_k, F_{(yk)}\}$ is the covariance between the amount of income source k and the income rank of income source k (Adams 1991).

$C_k = G_k R_k$ is known as the concentration ratio of income source k, while W_k is the contribution share of income source k to the overall inequality *(G),* which is denoted as:

$$W_k = (S_k G_k R_k)/G \qquad (4)$$

According to Adams (1991), the relative concentration coefficient of income source k in the total inequality is calculated as:

$$g_k = \frac{G_k R_k}{G} = \frac{C_k}{G} \qquad (5)$$

An income source can be defined as increasing or decreasing inequality, depending on whether the relative concentration coefficient (g_k) is greater or smaller than unity. The income source k increases inequality if $g_k > 1$, decreases inequality if $g_k < 1$ and does not affect inequality if $g_k = 1$ (Adams 1991).

Lerman and Yitzhaki (1985) noted that by using the method of Gini decomposition, one can calculate the impact of small changes in a given income source on inequality, keeping income from other sources constant. Consider a small change in income from source k equal to ey_k, where e is close to 1 and y_k is the income from source k. Stark et al. showed (1986) that the partial derivative of the Gini coefficient with respect to a percent change e in source k is expressed as:

$$\frac{\partial_G}{\partial_e} = S_k(G_k R_k - G) \qquad (6)$$

where G is the overall Gini coefficient prior to the income change. The percent change in inequality resulting from a small percent change in income from source k equals the share contribution of income source k to the overall Gini coefficient minus its share in the total income:

$$\frac{\partial_G/\partial_e}{G} = \frac{S_k G_k R_k}{G} - S_k \qquad (7)$$

It should be noted that if all the income sources changed by the same percentages, the overall Gini coefficient (G) would remained unchanged.

As indicated by Stark et al. (1986), the effect of an income source upon the total income inequality depends on: (1) the share of that income source in the total income (S_k); (2) the distribution of that income source(G_k); and (3) the correlation between that income source

and the distribution of total income. Specifically, López-Feldman (2006) elaborated that if an income source accounts for a significant share of total income, it may potentially have a significant effect on inequality. Nevertheless, if the income source is equally distributed ($G_k = 0$), it cannot affect inequality, even if its magnitude is large. On the other hand, if that income source is large and unequally distributed (S_k and G_k are large), it may either increase or decrease inequality, depending on which households (individuals), at which points in the income distribution, earn it. If the income source is unequally distributed and skewed toward those at the top of the income distribution (R_k is positive and large), it may increase inequality. However, if the income source is unequally distributed but flows disproportionately toward the poor, it may reduce inequality.

3 Result and discussion

3.1 Background on household income and economic activities

Table 1 provides background information about the sample. As shown in Table 1, the overwhelming majority of population is ethnic minorities. The sample includes 1800 households (9422 individuals), of which there are 1714 ethnic minority households (9096 individuals), accounting for nearly 95 % of the household sample and 96.5 % of total population. Using the poverty line for rural areas of 400 thousand Vietnam Dongs (VND) per person per month (WB 2012) and the extreme poverty line of 267 thousand VND per person per month (Tuyen et al. 2015), I divided the sample of ethnic minorities into three groups. The first group includes non-poor households with monthly per capita income equal or more than 400 thousand VND. The second one consists of poor households whose monthly per capita income equal or more than 267 thousand VND and less than 400 thousand VND. The third one represented by extremely poor households who earn monthly per capita income less than 267 thousand VND. Accordingly, 671 (39 %) households, 445 (26 %) households and 598 households (35 %) are identified as non-poor, poor and extremely poor, respectively (Table 2).

   Among ethnic groups, the Hmong (Meo) is the most populous one, contributing the largest share of the household sample (34 %). This group is also the poorest, with about two-thirds living below the poverty line and half being extremely poor. Unsurprisingly, the ethnic majority group (Kinh/Hoa) has higher income per capita and less poor than ethic minority groups. The data also indicate that Tay, Thai and Muong are ethnic minority groups that are better-off than Hmong, Dao and other groups. A detailed look at the income structure of three groups in Table 2 reveals that the crop income share of the extreme poor is larger than that of the non-poor. This is not because the extremely poor have higher participation rates or earn more crop income than the non-poor.[2] Actually, this reflects the fact that crop income contributes much more to the total income relative to other sources among the extremely poor. The proportion of income earned from wage employment is much larger for the non-poor than for their counterparts. This difference is due to the difference in the rates of participation as well as the amount of wage income. These data imply that differences in income sources between three groups might explain the disparity in their income per capita.

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[2] The mean value of crop income (both unconditional and conditional on participation) earned by the poor and extremely poor is smaller than that received by the non-poor (Table 2).

Table 2 Household income by source and participation in activities

	Kinh/Hoa		All ethnic minorities		Extremely poor		Poor		Non-poor	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Mean incomes										
Crop	1520	(1611)	2277	(1836)	1308	(549)	2191	(891)	3640	(2532)
Livestock and aquaculture	746	(1343)	616	(1039)	256	(221)	492	(402)	1195	(1635)
Forestry	595	(1337)	512	(781)	324	(241)	480	(386)	783	(61)
Non-farm self-employment	1513	(5902)	129	(801)	22	(88)	58	(240)	329	(1377)
Wages	2470	(4833)	684	(2406)	122	(321)	320	(678)	1723	(4004)
Gifts and remittances	283	(896)	243	(814)	203	(631)	300	(829)	250	(996)
Other income	611	(2202)	243	(1036)	210	(1272)	201	(596)	320	(956)
Total	7738	(7424)	4703	(3929)	2448	(1572)	4042	(1184)	8239	(4932)
Income share (%)										
Crop	32.00		52.60		57.70		55.50		45.20	
Livestock and aquaculture	9.80		12.50		11.10		12.60		15.00	
Forestry	10.20		12.60		15.50		12.60		9.60	
Non-farm self-employment	13.00		1.90		1.20		1.40		3.00	
Wages	24.00		10.06		6.00		8.50		16.80	
Gifts and remittances	3.70		5.40		6.60		6.00		5.00	
Other income	7.50		5.10		5.90		4.50		5.00	
Participation in activities (%)										
Crop	83.00		99.13		99.70		99.67		98.20	
Livestock and aquaculture	78.80		92.42		90.24		93.83		94.00	
Forestry	78.83		96.63		98.52		97.72		94.00	
Non-farm self-employment	21.65		11.55		11.45		8.84		13.60	
Wages	37.00		32.30		22.00		29.42		45.10	

Table 2 continued

	Kinh/Hoa		All ethnic minorities		Extremely poor		Poor		Non-poor	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gifts and remittances	87.00		77.70		75.54		81.60		77.20	
Other income	75.25		73.17		77.43		72.80		69.00	
Mean incomes, conditional on participation										
Crop	1836	(1598)	2285	(1834)	1130	(547)	2195	(887)	3661	(2524)
Livestock and aquaculture	974	(1461)	652	(1058)	276	(217)	520	(395)	1238	(1648)
Forestry	741	(1457)	524	(787)	328	(240)	493	(382)	818	(1280)
Non-farm self-employment	6537	(11,032)	1014	(2037)	177	(185)	586	(521)	2168	(2931)
Wages	6444	(5479)	2203	(3915)	582	(474)	1113	(849)	3730	(5223)
Gifts and remittances	324	(953)	316	(915)	273	(719)	366	(903)	328	(1130)
Other income	797	(2489)	324	(1185)	267	(1430)	273	(680)	450	(1108)
N of households	86		1714		598		445		671	

This table reports mean per capita household income by source, measured in thousand VND in 2010. 1 USD was equal about 19 thousand VND in 2010. Standard deviations are in parentheses. Each panel indicates a different dimension of the results: (1) The top panel reports the unconditional means; (2) the second panel reports income share by source; (3) the third panel reports the percentage of households with positive earnings for that source (i.e., the participation rate); and (4) the bottom panel reports average income by source, conditional on participation

Table 3 Pairwise comparison of income per capita between groups using Bonferroni method

Group	Agricultural employment 1 (N = 1064)	Wage employment 2 (N = 495)	Non-farm self-employment 3 (N = 175)	Mixed: both wage and non-farm self-employment 4 (N = 66)
Mean	4232	6535	5776	7039
SD	3550	6006	6620	5949

Group		2	3	4
	3	−759		
		(0.430)		
	4	504	1263	
		(1.000)	(0.408)	
	1	−2304	−1544	−2807
		(0.000)	(0.000)	(0.000)

Results reported are mean differences, and *P* values are in parentheses. SD: standard deviation. Estimates based on annual per capita income. Income measured in thousand VND and 1 USD was equal about 19 thousand VND in 2010

Table 2 provides background information about household income by source and participation rates in activities. This also indicates the extent to which various income sources contribute to total household income. The results show that all ethnic minority households (99 %) derive income from crops, which account for about 53 % of total income on average. This suggests that crop production plays a very important role in the livelihoods of ethnic minorities in the study area. As revealed by the surveyed data, 100 % of households plant rice as a source of food supply, while around half and one-third of them cultivate fruit and industrial trees, respectively. The overwhelming majority of households engages in livestock and aquaculture, and forestry activities. Each of these activities contributes around 12 % and 13 % to total income, respectively. This might indicate that the type of livestock activities is small scale, mostly extensive free range backyard type.

As seen in Table 2, approximately 32 % and 11.5 % of households participate in wage and non-farm self-employment activities, respectively. The corresponding share of wage and non-farm self-employment in total income is about 10 % and 1.9 %. By contrast, about 37 % and 21.6 % of the ethnic majority population (Kinh/Hoa) receives income from wage and non-farm self-employment activities and these activities contribute about 24 % and 13 % of total income, respectively. Also, the ethnic majority group receives much more wage and non-farm self-employment incomes (conditional on participation) than ethnic minorities. The results suggest that access to off-farm activities appears to be more limited for ethnic minorities than for the Kinh/Hoa group in the study area. Table 2 shows that the percentage of households receiving income from gifts and remittances is higher for the Kinh/Hoa group, and the mean of income sources (conditional on participation) and the share of this source are approximately similar to that of ethnic minorities. However, while the proportion of households having other income is approximately same between the two groups, Kinh/Hoa households earn much higher other income (conditional on participation) than ethnic minority households.

Four groups of households were identified by their participation in various economic activities in Table 3. The first group includes households that receive income from

Table 4 Gini decomposition by income source

Income source	Location	Income share	Relative concentration coefficient	Gini	Correlation with the distribution of total income	Share to total income inequality	Relative marginal effect
		S_k	$(G_kR_k)/G$	G_k	R_k	$\frac{(S_kG_kR_k)}{G}$	$\frac{(S_kG_kR_k)}{G} - S_k$
Crop	All	0.471	0.728	0.368	0.742	0.343	−0.128
	High	0.373	0.750	0.433	0.686	0.279	−0.093
	Low	0.497	0.741	0.352	0.775	0.368	−0.129
Livestock and Aquaculture	All	0.122	0.987	0.562	0.658	0.120	−0.002
	High	0.112	0.928	0.596	0.616	0.104	−0.008
	Low	0.124	1.006	0.554	0.668	0.125	0.001
Forestry	All	0.113	0.692	0.520	0.499	0.078	−0.035
	High	0.118	0.613	0.554	0.438	0.073	−0.046
	Low	0.112	0.703	0.509	0.508	0.079	−0.033
Non-farm self-employment	All	0.031	1.798	0.964	0.699	0.056	0.025
	High	0.039	1.654	0.959	0.682	0.064	0.025
	Low	0.029	1.823	0.963	0.696	0.053	0.024
Wage	All	0.154	1.789	0.890	0.754	0.276	0.122
	High	0.266	1.428	0.778	0.727	0.380	0.114
	Low	0.125	1.927	0.915	0.775	0.240	0.115
Gifts and Remittances	All	0.056	1.226	0.872	0.527	0.068	0.013
	High	0.028	0.642	0.768	0.331	0.018	−0.010
	Low	0.063	1.339	0.882	0.559	0.084	0.021
Other income	All	0.054	1.093	0.815	0.503	0.059	0.005
	High	0.064	1.282	0.868	0.585	0.082	0.018
	Low	0.051	1.010	0.794	0.468	0.051	0.001
Total	All	1.000	1.000	0.375	1.000	1.000	0.000
	High	1.000	1.000	0.396	1.000	1.000	0.000
	Low	1.000	1.000	0.368	1.000	1.000	0.000

Estimates based on annual income per capita. All—1714 households; high—319 households; and low—1395 households

agriculture and possibly other sources but not from wage or non-farm self-employment. The second group derives income from wage work and possibly other sources but not non-farm self-employment. The third group is represented by those with income earned from non-farm self-employment and possibly other sources except for wage employment. The fourth group consists of households that receive income from both wage work and non-farm self-employment and possibly other sources. Table 3 shows the mean income per capita for each group of households. According to the data, the average income per person for the sample households is about 390 thousand VND per month, which is even lower than the poverty line for rural areas in 2010. In order to rank the outcomes of each group in terms of total mean income per capita, Bonferroni pairwise tests were conducted across the four groups of households. While all off-farm groups have much higher levels of welfare (income per capita) than the agricultural group, there is no difference in income per capita across off-farm groups. On average, the wage group earns income per capita that is 2300

thousand VND higher than that earned by the agricultural group. The corresponding figures for the non-farm self-employment group and the mixed group are 1544 thousand VND and 2800 thousand VND. This suggests that moving from a pure agriculture household to an off-farm household (either wage or non-farm self-employment or both) can help households improve their welfare in the study area. Also this implies that income inequality might stem from difference in off-farm income sources.

3.2 Income inequality by Gini Decomposition

Table 4 presents the Gini decomposition of income inequality by income source. The overall Gini coefficient for ethnic minority households is 0.375, which is higher than the Gini coefficient of 0.356 for rural areas and that of 0.334 for the ethnic majority population in Vietnam as a whole (GSO 2013). In previous studies on the decomposition of income inequality among all households (both ethnic minority and majority) in Vietnam, household income has been often disaggregated into various sources, including wage income, non-farm self-employment income, agricultural income and other income (Adger 1999; Cam and Akita 2008; Gallup 2002; Tuyen et al. 2014; McCaig et al. 2015). The current study is the first to further break down agricultural income into three sub-categories, namely crop income, livestock and aquaculture income, and forestry income. The estimates in column 4, Table 4, show that crop income is the most equally distributed source (the lowest value of Gini index), followed by forestry income, and livestock and aquaculture income. The off-farm income sources have an extremely unequally distribution, with Gini index of about 0.9 and higher. Incomes from crop, livestock and aquaculture, and forestry activities are more equally distributed as the overwhelming majority of households participating in these activities. By contrast, the off-farm income sources are very unevenly distributed because of a much smaller proportion of households undertaking wage work or non-farm self-employment. About 32 % report having income from wage work and only about 12 % receiving income from non-farm self-employment.

The results reveal that crop income and wage income are the major contributors to the overall income inequality among the sample households. Taken together, they account for about 60 % of the total income inequality, while the remaining income sources contribute about 40 % of the total inequality. Surprisingly, wage income contributes the second largest share of total inequality, while its share in total income is just about one-third of that of crop income. This can be explained that although the share of wage income in total income is not so large, this income source is very unequally distributed and most correlated with the distribution of total income. In contrast, crop income accounts for the largest share of total income, but it is the most evenly distributed source (G_k has lowest value).

The value of relative concentration coefficients in Column 3 of Table 4 shows which income is inequality increasing and which income is inequality reducing. The magnitude of these coefficients is smaller than one for crop and forestry income sources indicating that these sources reduce income inequality. Conversely, the relative concentration coefficient for wage income, non-farm self-employment income, and gifts and remittances are larger than one confirming that these sources increase income inequality. As can be seen in Column 7, Table 4, the relative marginal effect of crop income is −0.128 and that of forestry income is −0.035, meaning that a 10 % increase in these sources is associated with a 1.28 % decline and a 0.35 % decline in the overall income inequality, respectively. In contrast, the same increase in wage income, non-farm self-employment, and gifts and remittances corresponds with a 1.22 %, 0.25 % and 0.13 % increase in the overall income inequality. This finding is partly in accordance with Gallup (2002), Cam and Akita (2008)

and McCaig et al. (2015) who found that while agricultural income actually reduced the inequality of income distribution, non-farm self-employment income and remittances increase inequality in Vietnam rural.

However, the other finding of the current study is inconsistent with Cam and Akita (2008). While income from wage work significantly increase inequality in the Northwest region, this income source is found to lower inequality in Vietnam's rural areas (Cam and Akita 2008). This can be explained that in comparison with other income sources, wage income is more equally distributed ($G_k = 0.7$) and least correlated ($R_k = 0.45$) with the income distribution in Vietnam rural (Cam and Akita 2008). Nevertheless, Table 3 shows that wage income has the second most unequal distribution ($G_k = 0.89$) in the Northwest region. In addition, this source is most associated with the distribution of total income ($R_k = 0.753$). The results of the current study imply that wage income is very unequally distributed and also follows disproportionately toward the better-off in the Northwest region. Conversely, Cam and Akita (2008) found that wage income was quite evenly distributed and was not skewed to the rich in Vietnam rural. However, it should be noted that the different findings might be driven by using different datasets, different location coverage and different survey times. The findings of the current study suggest that access to wage employment is much more limited for ethnic minority households in the Northwest region than for households in Vietnam's rural areas. This refects the fact that ethnic minorities have a very limited access to wage employment in the study area. This is also the case of non-farm self-employment.

Table 4 also reveals some interesting information about income distribution by location. The Gini coefficient is higher for ethnic minorities in high mountains (0.396) than for those in low mountains (0.368). In comparison with ethnic minority households in low mountains, those living in high mountains seem to depend less on crop cultivation and remittances, but they tend to rely more on wage income. While wage income is more equally distributed in high mountains than in low mountains, the distribution of crop income is more unevenly in high mountains. The role of most income sources in income distribution is quite similar between the two areas except for the case of gifts and remittances. Gifts and remittances are found to increase inequality in low mountains, but they reduce inequality in high mountains. Possibly, this is due to the fact that these sources tend to be the main income source for the poor and more equally distributed in high mountains than in low mountains.

4 Conclusion and policy implication

The current study uses a unique dataset from the Northern Mountains Baseline Survey (NMBS) 2010, to analyze the sources of inequality among ethnic minorities in the Northwest region—the poorest and highest inequality region in Vietnam. Using an analysis of Gini decomposition by source, the study has quantified the contribution of each income source to and their effect on the overall inequality. In addition, this approach allowed the author to explain why some income sources serve to increase inequality, while others serve to reduce inequality. The analysis indicates that the overall Gini coefficient of income inequality in the Northwest region is 0.376, which is higher than that in Vietnam's rural areas.

It is found in the current study that although crop income accounts for the second largest share of total inequality, this source has a significantly reducing effect on the total

inequality. This is because crop income is the most equally distributed source and tends to target the poor. Agricultural income is very equally distributed possibly because land is quite equally distributed in Vietnam (WB 2012). Wage income contributes the largest share of total inequality and significantly increases inequality, while its share in total income is not so large. This finding is not in line with Cam and Akita (2008) who found that wage income did not increase inequality in Vietnam's urban and rural areas. The study also finds that non-farm self-employment is highly unequally distributed and inequality increasing. The findings suggest that access to off-farm activities appears to be very limited for the poor in the Northwest region. Possibly, job opportunities are scarce in the study area because this is the most difficult geographic region where the market labor is absent or very thin (Tung 2012).

The findings of the current study support the hypothesis stated by Adger (1999) that income diversification into non-farm activities results in either greater income inequality if opportunities for these activities are skewed toward the better-off or less income inequality if such opportunities are accessible to the poorer parts of the population. Hence, a policy implication here is that, for the off-farm sector to contribute more equally to income growth of ethnic minority households, there is need to remove entry barriers faced by poor households in participating in off-farm activities. This is because, by eliminating the entry barriers, all households would be able to engage and the non-farm sector would have a reducing effect on inequality, as labor is more evenly distributed among households than land.[3] Nevertheless, Tuyen et al. (forthcoming, 2016) noted that removing the entry barriers to off-farm employment in the Northwest region would require, among others, the provision of education programs and physical infrastructure such as paved roads, and the expansion of local enterprises. These in turn would increase overall employment opportunities for all households, and this could result in income growth among the poor and inequality reduction. Unfortunately, the policy implications raise some challenging questions. When we think of investment in education and physical infrastructure, we should consider that the return on investment to those investments might be low, while this requires huge investments in such a remote and mountainous area. Also, the expansion of local enterprises might not be successful as expected because there might be not sufficient potential for sustainable markets in goods and services in the study area.

Another useful implication of this paper is that promotion of crop productivity might increase income for those at the bottom of the distribution in the study area. This is because, apart from being an inequality-reducing source, this remains a major income source for many households, especially for poor and extremely poor households. Despite the concern that agricultural growth might not offer an effective way of moving out of poverty, the result of the current study might suggest that by promoting agricultural productivity, the poor and extremely poor can improve their income, which in turn might help reduce poverty as well as inequality in the study area.

However, there is also some caveat in this study. As noted by McCaig et al. (2015), non-farm self-employment incomes, or even agricultural income, are subject to a significant level of measurement error. Unusually, high income from this source will result in a high estimate of overall income. If genuine, the Shorrocks decomposition will correctly find this as an inequality-increasing income source. However, if affected by measurement error, the role of this income source will be magnified, while the role of the other sources will be downplayed. Using a regression framework allows us to focus on the potential role of

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[3] Author's own calculation form NMBS shows that the Gini index for agricultural land is 0.59 while that for labor (working age members) is only 0.24.

measurement error in skewing the estimated contribution of an income source to overall inequality. A natural way to address the measurement error is to employ the method of instrumental variables (McCaig et al. 2015). However, it is often not easy to find a valid instrumental variable in most empirical studies (Wooldridge 2013), and this is also the case of this study. Hence, this suggests a potential venue for future researches that the instrumental variable method should be used to account for measurement errors.

Appendix 1: Map of the Northwest region, Vietnam
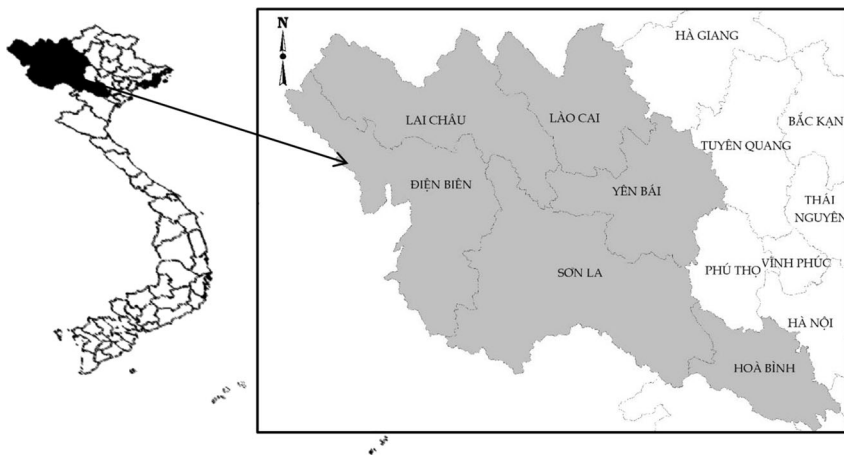
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