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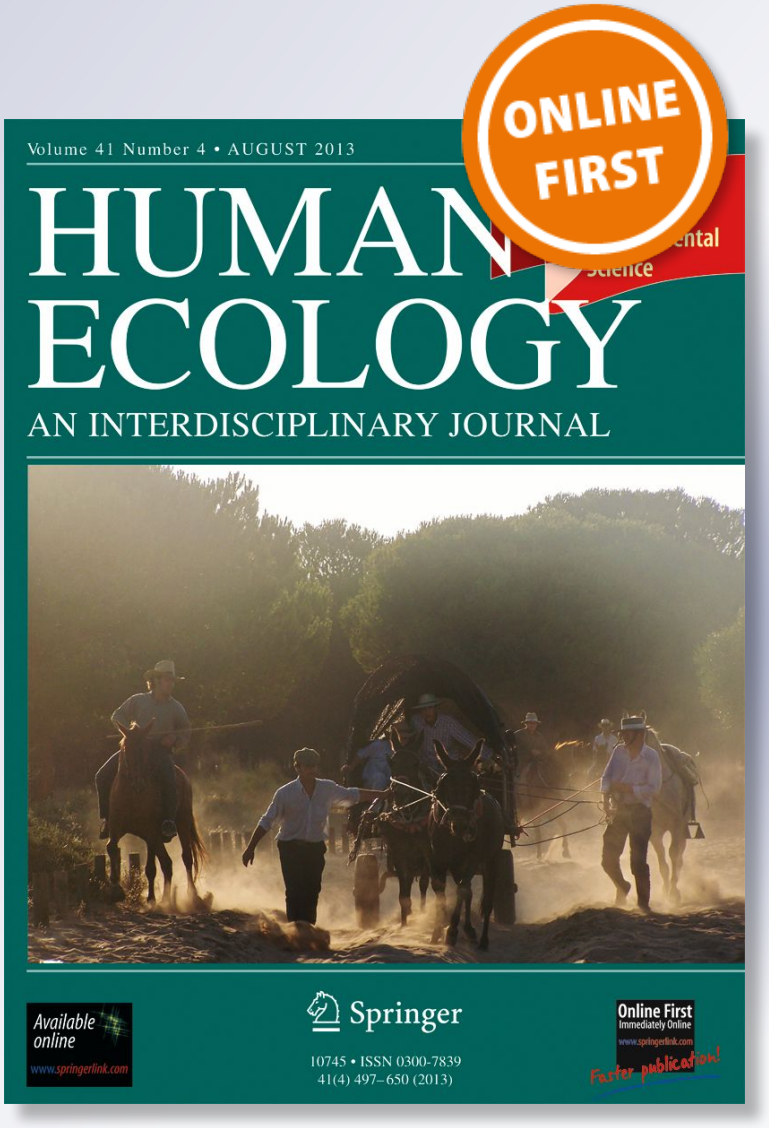

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Cuong Van Hoang [1] · Tuyen Quang Tran [2] · Yen Hai Thi Nguyen [1] · Kien Duc Nguyen [1]

Abstract
Our main objective in this research was to examine the role of land ownership in the choice of household livelihood in the rural Mekong Delta region, Vietnam. Using secondary data on rural households in the Mekong Delta region, we use cluster analysis techniques to classify livelihoods currently adopted by rural households. Using Bonferroni pairwise tests and quantile functions (Pen's parades), we then compare the income levels of identified livelihoods. Finally, we employ a multinomial logit model to examine different factors affecting the choice of livelihoods. We identify five livelihoods pursued by local households, and found that households engaged in farm work, formal wage-earning work and non-wage work livelihoods obtain higher levels of income than did those whose livelihoods depend on informal wage-earning work or non-labor income sources. We also found that several types of land are positively associated with the choice of high-return livelihoods, implying that lack of access to land is a potential obstacle to adopting a profitable livelihood. Also, we found education plays a major role in the pursuit of remunerative livelihoods, which suggests that better education would allow households to move from low- to high-return livelihoods.

Keywords Landholding · Livelihood strategies · Cluster analysis · Household incomes · Living conditions · Mekong Delta, Vietnam

Introduction

In 2016, arable land per capita in Vietnam was slightly less than 0.074 ha, which is much lower than the world average (0.192 ha) and than the average for lower- and middle-income countries (0.167 ha) (World Bank 2016a). However, Vietnam is endowed with fertile land and a climate favorable for agriculture, which has enabled the country's agricultural sector to make great progress over the past two decades (World Bank 2011, 2016a, b). Although in the past Vietnam has suffered famines, its per capita food yield now puts it in the top tier of middle-income countries. The country also now ranks among the top five global exporters of products such as rice, rubber, cashews, coffee, and pepper (World Bank 2016b).

Conditions for agricultural development vary substantially across the regions of Vietnam. The land is more fertile and the climate more favorable for agricultural production in the Central Highlands, Southeast, and Mekong Delta regions. Combined, these regions now contribute about 60% of the country's gross agricultural output and more than 80% of its agricultural exports (World Bank 2016a, b). In particular, the Mekong Delta region accounts for about one third of gross value-added agricultural income (World Bank 2016a, b). As a result, highly productive commercial rice growers are concentrated in this region, while subsistence farmers are mainly found in other regions (World Bank 2016a, b). This leads us to hypothesize that natural resources, especially land, may have varying effects on the livelihood of rural households depending on geographical region.

At the household level, land ownership may determine wellbeing in various ways. As a productive asset, the ownership of more land allows households to expand their scale of production, which in turn helps them create more jobs, and increase productivity and income for family members (Finan *et al.* 2005). Households with landholdings are also more likely to obtain ready access to both formal and informal credit (Finan *et al.* 2005; Lipton 1985). Land ownership has

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additional functions, including serving as an asset, providing insurance for unemployed farmers, and reducing economic risks or shocks (Tran 2014). Several studies have confirmed the importance of land and land reforms for poverty reduction in many countries (Nguyen and Tran 2013). It is evident that steady advances in the productivity of smallholders and their intensification of agricultural activities through the 1990s have played an important role in Vietnam's remarkable achievements in poverty alleviation, national food security, and social stability (World Bank 2016a, b).

A number of studies have examined the role of land in household wellbeing in rural Vietnam. Ravallion and Van de Walle (2008) find that rising landlessness does not increase rural poverty in the aggregate. Tran *et al.* (2014a, b) indicate that land loss (due to urbanization) does not have a negative impact on either income or consumption among households in Vietnam's peri-urban areas. Nguyen and Tran (2013) analyzed the effect of land ownership on household welfare during the period of rapid economic transformation in rural Vietnam. They found a U-shaped relationship between land ownership and household welfare, which suggests that both acquiring cropland and moving out of farming are associated with higher levels of income and expenditure. Notably, their study reveals that the relationship is stronger in less developed communities, implying that the benefits of structural transformation may decline at higher levels of development. Other studies confirm the positive effect of cropland ownership on poverty reduction and household income in the Northwest region (Tran 2015; Tran *et al.* 2015), the North Central region (Nguyen and Tran 2018) and the Central Highlands (Chi 2018).

While most existing studies concentrate on the way the availability of farmland directly affects household welfare, very few attempt to answer the question whether limited landholdings may present a potential obstacle to pursuing high return livelihoods in rural Vietnam. In particular, few studies focus on the Mekong Delta region where the land is fertile and the weather favorable for agricultural production. In addition, landlessness and land inequality tend to be more widespread in this region. This gap in the literature motivated us to conduct the current study to address three questions: (i) What types of livelihood are pursued by local households; (ii) which livelihood strategies offer higher returns; and (iii) whether land ownership is a factor in determining the adoption of a profitable livelihood.

Using cluster analysis, we identified five types of livelihood adopted by local households and found that those based on farm work, formal wage-earning work, and non-wage work offered higher returns than did those based on informal wage-earning work or non-labor income sources. Notably, our econometric analysis reveals that landholding is positively associated with the choice of high-return livelihoods. This suggests that the lack of access to land is a potential barrier to the pursuit of remunerative strategies. The fact that we found education plays a major role in the pursuit of gainful livelihoods suggests that improved educational opportunities would allow households move from low- to high-return livelihood strategies. We also find that households living in communities where roads and transport vehicles are available have greater opportunities to pursue high-return livelihoods.

Background

Historically, landlessness and landholding disparity was a longstanding feature of rural society in the South of Vietnam before the reunification with the North in 1975. Prior to 1975, land was privately owned in the South. A large share of cropland was held by a small number of wealthy landlords and over 80% of cultivated area was rented out to tenants (Callison 1983). In the South's Mekong Delta, land distribution was highly inequitable, with a Gini coefficient of 0.8 in 1966 (Tuan 2011). Land distribution and tenancy issues in the South led to the exploitation of tenants by landlords, a situation cited as the cause of discontent and rebellion of peasants in the region (Bui and Preechametta 2016). Consequently, high inequality in land ownership was a serious socioeconomic issue confronting the Saigon government of the Republic of Vietnam, often referred to as South Vietnam prior to 1975 (Bui and Preechametta 2016).

After reunification in 1975, the Vietnamese Communist Party (VCP) attempted to collectivize agriculture in the South but met resistance from farmers. For instance, by the time of the 1988 Land Law, fewer than 10% of farmers had been organized into farming co-operatives in the Mekong Delta region, whereas in the North after 1975, nearly all cropland had been collectivized as part of the government's reconstruction efforts (Ravallion and Walle 2008). Southern farmers had participated in collective farms for a much shorter period compared to those in the North, and many never fully participated, especially in the Mekong Delta region (Ravallion and Walle 2008). In the North and Central region of Vietnam, instead of participating in collective production (Raymond 2008) farmers focused their labor on private land plots producing for their own households,[1] which offered higher economic rewards. In general, agricultural collectivization failed because it was unable to generate economic incentives for farmers. Despite adjustments to collectivization policies, the government did not succeed in agricultural collectivization and finally abandoned the policy (Bui and Preechametta 2016; Raymond 2008).

[1] "Private land plots—in theory equal to 5% of the cooperative's cultivable land per capita, though often more—was allocated to members at the beginning of collectivization for growing vegetables and other produce not available through the cooperatives"(Ravallion and Walle 2008: 28).

The decollectivization of Vietnam's rural economy began in 1981, when farmers were permitted to sell their agricultural products after contributing a required amount to the state (World Bank 2016a, b). In 1988, to further promote agricultural production the government adopted Resolution 10, which abolished most features of collective production. Regulation 10 enabled farmers to lease land from the government for up to 20 years, thus providing security of tenure. According to Resolution 10, the most important principle in the decollectivization process was that land must be distributed on an equal basis (World Bank 2016a, b). Land was allocated from collective farms to households and individuals subject to two main criteria: (i) the number of household members, and (ii) land quality in terms of irrigation, distance among plots, and other farming conditions (Nguyen 2014). In addition, the Land Law of 1993 and Decree 64 (1993) allocated agricultural land to farmers with a record of stable land use and gave them the rights of transfer, exchange, lease, inheritance, and mortgage (Van Hung *et al.* 2007).

As noted by Ravallion and Walle (2008), heterogeneous effects of decollectivization can be expected due to historical differences between Vietnam's North and South. The collectivization of agricultural production in the North over several decades allowed for a more equitable allocation by the time of decollectivization. By contrast, Resolution 10 allowed farmers in the South to recover land owned prior to 1975. This issue, combined with farmers' resistance to participating in collective farming in the South, initially resulted in a less equitable distribution of land at the time of decollectivization (notably in the Mekong Delta) (Ravallion and Walle 2008), a situation that persists to this day. Using data from the 2016 VHLSS, for instance, our own calculation shows that the Gini index of annual cropland in the Mekong Delta is 0.796, which is much higher than that in the South Central Coast region (0.650), the North Central Coast (0.570), the West Northern Mountains (0.557), the East Northern Mountains (0.562), and the Red River Delta (0.524). In addition, landless rates tend to be higher among poor farmers in the Mekong Delta (Garschagen *et al.* 2012). This suggests that landlessness and land inequality among the rural population may be a major barrier to inclusive development in the Mekong Delta.

Materials and Methods

Data Sources

We utilize data taken from the 2016 Vietnam Household Living Standard Survey (VHLSS) for this study. The survey was implemented by the General Statistics Office of Vietnam (GSO) with technical help from the World Bank. Covering around 46,000 households for the whole country, the survey is representative at the national and regional levels. The data on households and individuals contain detailed information about basic demography, employment and economic activities, education, health, economic activities, housing, durable goods, and various types of land. The household and individual data were combined with community data recording the natural and socioeconomic characteristics of the communities in which households reside. We used a sub-sample of about 7000 households living in the rural Mekong Delta region.

Methods

Classifying Livelihood Strategies

The classification of household livelihood choices is of great importance to both academics and policymakers (Tran *et al.* 2018, 2014a, b). Researchers can more readily predict the behaviour of households on the basis of their membership in groups where they have certain properties in common (Serneels *et al.* 2009). One of the statistical techniques available for classification purposes is cluster analysis. From a larger aggregate group, this technique classifies a set of observations into two or more mutually exclusive, meaningful subgroups of observations (Punj and Stewart 1983). The objective of cluster analysis is to divide a system of organizing observations, in this case relating to households, into various groups where group members share similar characteristics (Serneels *et al.* 2009). The method has been widely used in many studies on household livelihoods (Jansen *et al.* 2006; Serneels *et al.* 2009; Tran *et al.* 2014a, b; Van den Berg 2010).

Empirical studies have often used income components by source as main input variables for classifying household livelihoods (Tran *et al.* 2018). The rationale is that income from different sources is the result of work time and livelihood assets distributed among various economic activities. Thus, we employed cluster analysis techniques to identify livelihoods pursued by local households using income data from various sources. Following Punj and Stewart (1983), we applied a two-stage procedure for cluster analysis. First, we employed a hierarchical method, using the Calinski stopping rule to seek the optimal number of clusters (Halpin 2016). Cluster analysis was then performed with the optimal number of clusters, using k-mean clustering.

Measuring Livelihood Outcomes

Based on the classification into five livelihoods adopted by local households, we carried out a descriptive analysis of household characteristics according to their choice of livelihood. We compared household per capita income across livelihood groups using Bonferroni pairwise tests and quantile functions (Pen's parades). We adopted this approach because household income is one of the standard measures of household economic welfare (Deaton 1997). Per capita income was

expected to highlight the expected result of the livelihood chosen. The estimate of per capita income also indicated that a household's choice of low-return livelihood, or minimal chance of earning higher income, may reflect the fact that these households face obstacles limiting or preventing the pursuit of more remunerative jobs (Nielsen *et al.* 2013). Using Dunn's multiple-comparison test for stochastic dominance with a Bonferroni correction, we also examined the link between the proportion of households whose living conditions are improving (GSO 2016) and the choice of livelihood.

Econometric Specification for the Choice of Household Livelihood

Since the choice of livelihood was a polychotomous variable, a multinomial logit model (MLM) was utilized to examine the determinants of a household's choice for income generation. Let P_{ij} ($j = 1, 2, 3, 4, 5$) denote the probability of a household choosing a given livelihood *i,* with $j = 1$ if the household adopted a non-labor source of income, $j = 2$ if the household took up a formal wage-earning job, $j = 3$ if the household chose a non-wage paying livelihood, $j = 4$ if the household took up a livelihood in farm work, and $j = 5$ if the household had an informal wage-earning livelihood. The multinomial logit model was then obtained by:

$$P_{ij}(j = k|X_i) = \frac{\exp(\beta_k X_i)}{\sum_{j=1}^{5}\exp(\beta_j X_i)} (j = 1, 2, 3, 4, 5) \quad (1)$$

In order to construct the model identified β_j should be set to zero for one of the categories, and coefficients were then interpreted with respect to that category, called the reference or base category (Cameron and Trivedi 2005). Thus, set β_j to zero for one livelihood group (say, the informal wage-earning group), then the MLM for each group can be rewritten as:

$$P_{ij}(j = k|X_i) = \frac{\exp(\beta_k X_i)}{1 + \sum_{j=1}^{5}\exp(\beta_j X_i)} (j = 1, 2, 3, 4) \text{ and } P_{ij}(j = 1|X_i) = \frac{1}{1 + \sum_{j=1}^{5}\exp(\beta_j X_i)} \quad (2)$$

Equation (3) was used to estimate factors associated with livelihood choice among households, where β_i is the parameter that needs to be estimated; X_{ij} is a vector of household characteristics; Z_{ij} represents various types of land; Cj is the commune-related variable and ε_{ij} is an error term.

$$P_{ij}(j = k|X_i) = \beta_0 + \beta_1 X_{ij} + \beta_2 Z_{ij} + \beta_3 C_j + \epsilon_i \quad (3)$$

The estimated parameters in Eq. (3) are reported in the forms of relative risk ratios (RRRs). The RRR of a coefficient shows how the probability of the outcome being in the comparison group rather than in the referent group changes with the variable in question. If an RRR is larger than 1, then the probability of the outcome belonging to the comparison group rather than to the referent group increases as the variable increases. If a RRR is smaller than 1, then the probability of the outcome belonging to the comparison group rather than to the referent group decreases as the variable increases (Scott Long 1997).

We assumed that a household's choice of livelihood was determined by fixed or slowly changing factors, including the household's natural and human capital and commune-related variables (Jansen *et al.* 2006; Tran *et al.* 2014a, b; Van den Berg 2010). Other livelihood assets, however, such as social and physical assets or financial capital, were more likely to be jointly determined with, or even determined by, the choice of livelihood (Jansen *et al.* 2006). Thus, we can minimize potential endogeneity issues, such as potentially spurious or collinear variables, by not including such livelihood capital in the regression model.

Natural capital included the size of various types of land (owning more land encourages farming activity). Human capital was represented by household size and its dependency ratio (this ratio is calculated by the number of household members aged under 15 and over 59, divided by the total members aged 15–59). Both household size and dependency ratio reflect labor endowment, i.e., the amount of labor that could be employed for livelihood activities. We also included ethnicity, age, and gender of the household head, and the average years of formal schooling of the household head (requirements for formal wage-earning work) as explanatory variables. We also included in the model other commune-related factors, such as susceptibility to natural disasters, geographical region (e.g., coastal vs. inland areas), road access and the availability of transport vehicles (essential for nonfarm job opportunities in the communes) (Table 2).

Results

Descriptive Statistics for Household Livelihoods

Table 1 describes five income sources that were used for cluster analysis. The first stage in the cluster analysis shows that the largest value of Calinski/Harabaz pseudo-F was 0.4781, corresponding to the optimal number of five livelihood groups (Table 1). We then performed cluster analysis with the five groups, using k-mean clustering. Finally, five livelihood

Table 1 Description of income from five sources

Categories	Definitions
1. Farm work	Self-employment in household agriculture, including crops, livestock, and other related activities.
2. Non-wage work	Self-employment in non-farm activities (non-farm household businesses).
3. Informal wage-earning work	Wage-earning work that is often casual, low-paid and usually requires little or no education. Informal wage earners are often manual laborers who work for other individuals or households without a formal labor contract.
4. Formal wage-earning work	Regular, relatively stable wage-paying work with a formal labor contract, in factories, enterprises, state offices and other organizations, often requiring skills and higher levels of education.
5. Non-labor sources	Income from remittances, interest, rentals, subsidies, scholarships, and other income.

groups were identified. Their corresponding household income structures include (i) non-labor income; (ii) formal wage-earning work; (iii) non-wage work; (iv) farm work; and (v) informal wage-earning work (Fig. 1).

Specializing in farming activities emerges as the most common livelihood, with about one third of total households (Table 2). Next were those whose livelihoods are based on informal wage employment (23%). The proportion of households with livelihoods based on formal wage-earning work is about 16%, a proportion similar to those in non-wage livelihoods, while about 13% depend for their living on non-labor income sources.

On average, non-labor income sources contribute about 77% of the total income of households in non-labor livelihoods (Fig.1). The average contribution of formal wage income is about 66% of total income among those whose livelihoods depend on formal wage-earning work, while the average share of informal wage income accounts for about 71% of total income among those whose livelihoods are based on informal wage-earning work. On average, income from non-wage work and farm work contributes about 73% and 77%, respectively, of total income among those whose livelihood depends on non-wage work and those who specialize in farm work.

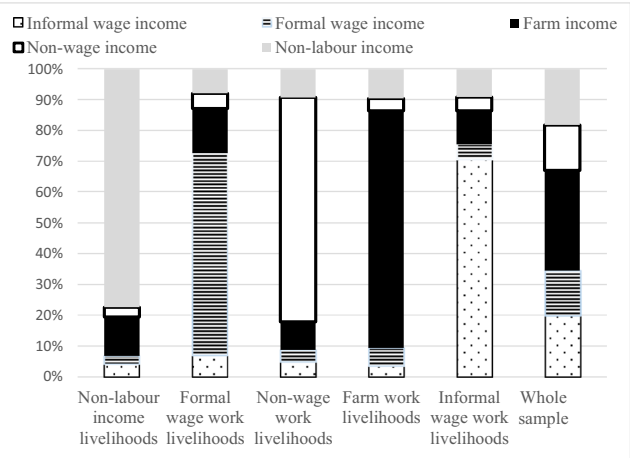

Fig. 1 Household income structure by livelihood group. Estimates are the authors' calculation from the VHLSS 2016 data

Average annual cropland per household is 4929 m^2 (Table 2). The corresponding figures for perennial, forest, and aquaculture land are approximately 1026 m^2, 162 m^2, and 1629 m^2, respectively. The data show that on average, households engaged in farm-work own larger land holdings of all three types than other livelihood groups.

We measured inequality in land ownership using the Lorenz curve, developed by Max Otto Lorenz in 1905 (Jones 2002). We constructed the Lorenz curve by ranking households in the rural Mekong Delta region in ascending order, from the land poorest (those with the smallest landholdings) to the land richest (those with the largest landholdings) (Jones 2002). We then plotted the cumulative percentage of household landholdings on the vertical axis, above the cumulative percentage of households (Fig. 2). The line at the 45° angle indicates perfectly equal land distribution, while the other line shows the actual distribution of landholdings; the further away from the diagonal, the more unequal the distribution of land. Inequality in land ownership is extreme: the 20% of land-rich households own about 80% of total annual cropland, while 20% of total annual cropland is held by the remaining households. About 55% of the sample has no annual cropland and about 77% has no perennial cropland.

On average, household heads engaged in non-wage work and formal wage-earning livelihoods have more years of formal schooling than did those of households with non-labor, farm work, and informal wage-earning livelihoods. Household heads engaged in non-labor livelihoods are much older, on average, than those choosing other livelihoods and also have larger households and higher dependency ratios.

On average, households engaged in farm work, formal wage-earning work and non-wage work have higher levels of per capita income than those with livelihoods based on non-labor income and informal wage-earning work (Fig. 3). The highest poverty rate was observed in households with non-labor livelihoods (12%), followed by those living from farm work (7%) (Table 2). The corresponding figures for those whose livelihoods depend on formal wage-earning work, non-wage work and informal wage-earning work are only 2%, 2% and 5%, respectively.

Table 2 Household and commune characteristics by livelihood, Mekong Delta region, Vietnam

Livelihood strategies	Non-labor income		Formal wage work		Non-wage work		Farm work		Informal wage work		All households	
Household characteristics	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Household head gender: 1 = male; 0 = female	0.57	0.49	0.76	0.43	0.75	0.43	0.85	0.35	0.73	0.44	0.76	0.43
Age of household head (years)	62.20	13.90	50.66	12.37	50.39	12.56	52.94	12.65	50.34	12.53	52.81	13.30
Education: years of formal schooling of household head	4.32	3.48	7.68	4.85	6.56	3.78	5.77	3.42	4.67	3.36	5.76	3.90
Ethnicity of household head: 1 = majority; 0 = minority	0.91	0.29	0.94	0.24	0.94	0.25	0.94	0.24	0.90	0.30	0.92	0.26
Marital status of household head: 1 = married; 0 = single	0.05	0.21	0.02	0.15	0.02	0.16	0.01	0.12	0.03	0.16	0.02	0.15
Dependency ratio [a]	0.59	0.37	0.30	0.23	0.34	0.26	0.35	0.28	0.31	0.24	0.36	0.29
Household size: total number of family members	2.65	1.48	4.07	1.46	3.81	1.48	3.88	1.52	3.85	1.43	3.73	1.54
Annual cropland: m^2	2824	7325	3572	6337	2414	5769	10,294	18,301	1355	3178	4929	11,919
Perennial cropland: m^2	821	2235	1007	2565	666	2162	1700	4158	465	1467	1026	2952
Forestland: m^2	46	833	60	916	116	1773	381	3724	28	576	162	2290
Aquaculture land: m^2	628	2881	612	4012	744	4730	3894	10,193	380	2772	1629	6673
Residential land and gardens: m^2	129	412	183	614	100	387	277	805	86	276	171	581
Monthly household per capita income (in thousands of VND)	2272	4344	2857	1729	3086	5036	2778	3481	1877	1057	2564	3351
Living conditions improved [b]: 1 = yes; 0 = no	0.59	0.49	0.85	0.36	0.80	0.40	0.83	0.37	0.69	0.46	0.77	0.42
Poverty status: 1 = yes; 0 = no [c]	0.12	0.32	0.02	0.15	0.02	0.14	0.07	0.25	0.05	0.22	0.06	0.23
Community characteristics												
Natural disasters in the last three years: 1 = yes; 0 = no	0.49	0.50	0.49	0.50	0.47	0.50	0.49	0.50	0.45	0.50	0.48	0.50
Coastal area: 1 = yes; 0 = inland delta area	0.09	0.28	0.05	0.23	0.09	0.28	0.13	0.33	0.10	0.30	0.10	0.30
Transport vehicles: 1 = yes; 0 = no	0.59	0.49	0.54	0.50	0.60	0.49	0.53	0.50	0.56	0.50	0.56	0.50
Road access: 1 = yes; 0 = no	0.84	0.37	0.88	0.33	0.89	0.32	0.75	0.44	0.85	0.36	0.83	0.38
Observation	941		1149		1091		2255		1626		7062	

[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. SD: standard deviation. [b] This is question 17 in Section 8 which asks the household head, "Have living conditions in your household improved, compared with 5 years ago (2010)?". [c] The poverty line was 630,000 dong per capita per month for rural areas (GSO 2016)

Estimates are the authors' calculation from the VHLSS 2016 data. US $1 = about 22,000 VND in 2016

About 77% of all households said that their living conditions had improved compared with five years ago (Fig. 4). However, this figure encompassed substantial differences, depending on type of livelihood. Specifically, the proportion of households that had secured better living conditions is only 59% of those with non-labor livelihoods, followed by those who earn a living from informal wage-paying work (69%). The corresponding figures are markedly higher for those in formal wage-earning work (85%), non-wage work (83%), and farm work (80%).

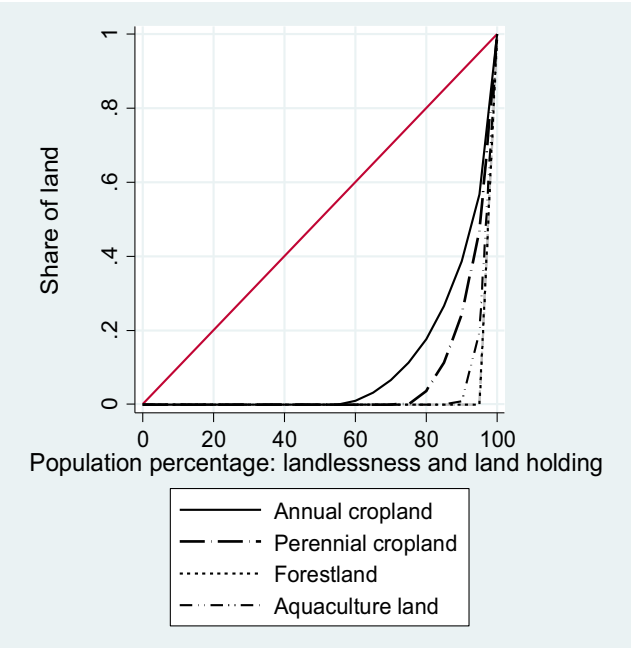

Fig. 2 Lorenz curves for various types of land. Estimates are the authors' calculation from the VHLSS 2016 data

Household Wellbeing Compared Across Livelihoods

We ranked the outcomes for each livelihood in terms of household income per capita, using Bonferroni pairwise tests across five livelihood groups. The results show that the income gap is large and statistically highly significant (p value <0.05) across groups. For instance, on average, households adopting livelihoods in informal wage-earning work earn monthly per capita income 980,000 VND, 1,209,000 VND, and 900,000 VND less than those who earn their living from formal wage-earning work, non-wage work, and farm work, respectively (Table 3). Similarly, lower income levels are observed for those whose living derives from non-labor income sources. In general, the findings confirm that households with livelihoods in farm work, formal wage-earning work and non-wage work tend to earn higher incomes than those who rely on non-labor income sources or informal wage-earning work.

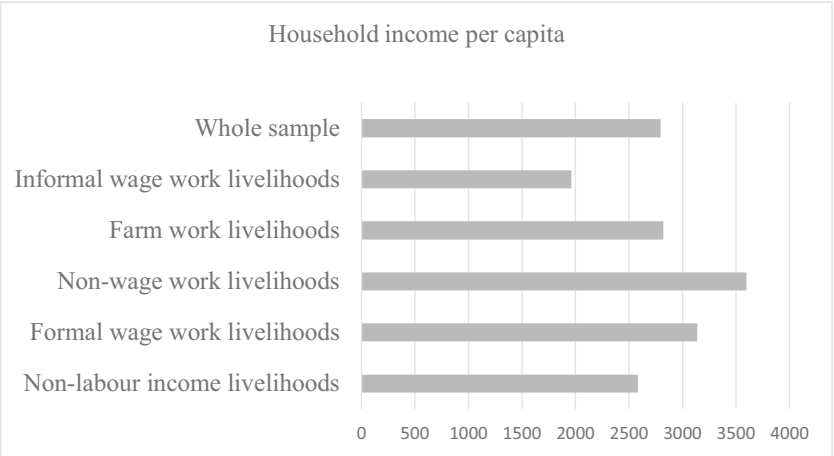

Fig. 3 Household income per capita by livelihood. Estimates are the authors' calculation from the VHLSS 2016 data. Income measured in thousands of Vietnamese dong

We also rank livelihood strategy outcomes using a Pen's parade graph or quantile functions. It can be seen that many observations for high return livelihoods overlap. Consequently, it is unclear which choice of livelihood in this group brings the highest return and which the lowest (Fig. 5). This is also the case for the low return livelihood group. However, three livelihoods in the high-return group achieved higher income levels than did those in the low-return group in almost the same percentiles, suggesting that these three livelihoods are more likely to yield higher incomes compared to the latter. The quantile functions, therefore, confirm the Bonferroni test results and combined, show that the former are superior to the latter, assuming that households try to maximize their income.

The result from the multiple comparison Dunn's test confirms that there is a close link between the livelihood strategy pursued by a household and improvement in their living conditions over the past five years (Table 4). Overall, the finding implies that households engaged in formal wage-earning work, farm work, and non-wage work livelihood strategies are more likely to achieve better living conditions than are those undertaking informal wage-earning work or non-labor livelihood strategies.

Econometric Results

The results of the multinomial logit regression reported in the form of relative risk ratios (RRRs) (Table 5) show that the larger the household, the more likely it is to specialize in informal wage-earning work as its main source of income. Also, households with a higher dependency ratio have a lower probability of choosing high-return livelihoods. Male-led households are less likely to pursue a formal wage-earning livelihood strategy but are more likely to engage in farm work than their female-led counterparts. We find that the level of education of household heads is positively associated with the choice of two profitable livelihood strategies. Specifically, with one additional year in a household head's formal schooling, the relative probability of choosing a formal wage-earning livelihood increases by 22%, and the relative probability of choosing a non-wage work livelihood increases by 15%. Similar results are found in several studies in rural

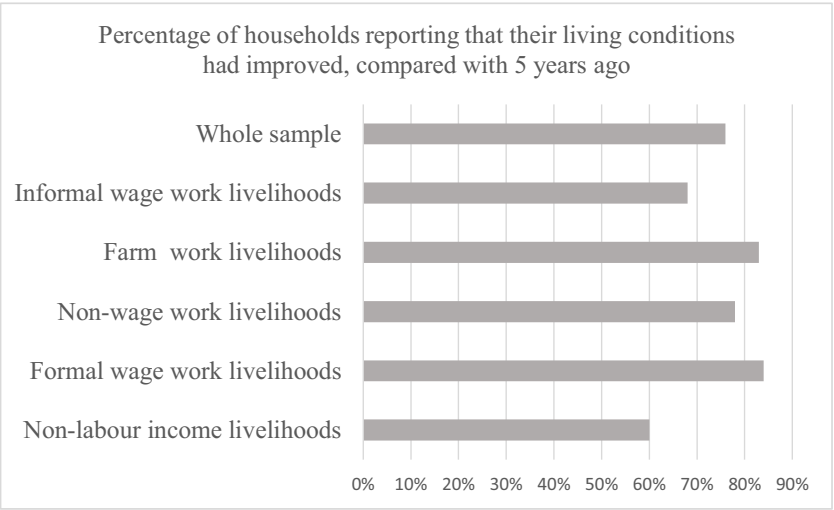

Fig. 4 The percentage of households with improved living conditions, by livelihood. Estimates are the authors' calculation from the VHLSS 2016 data

Table 3 Multiple comparison of household per capita income across livelihood groups

Livelihood group	Non-labor income (1)	Formal wage work (2)	Non-wage work (3)	Farm work (4)
Formal wage work (2)	(2) minus (1) 585 [0.00]			
Non-wage work (3)	(3) minus (1) 814 [0.00]	(3) minus (2) 229 [1.00]		
Farm work (4)	(4) minus (1) 505 [0.00]	(4)–(2) −79 [1.00]	(4) minus (3) −309 [0.12]	
Informal wage work (5)	(5) minus (1) −395 [0.04]	(5) minus (2) −980 [0.00]	(5) minus (3) −1209 [0.00]	(5) minus (4) −900 [0.00]

Monthly household per capita income measured in thousands of Vietnamese dong (VND). US $1 = about 22,000 VND in 2016. Results reported are mean differences in monthly per capita household income between households with livelihoods in rows and those with livelihoods in columns; *P*-values are given in brackets

Estimates are the authors' calculation from the VHLSS 2016 data

Vietnam (Tran *et al.* 2018, 2014a, b) and other developing countries (Rigg 2006).

The coefficients (RRRs) for some types of land are greater than one and statistically highly significant, confirming that households with land holdings are more likely to specialize in high-return livelihoods (rather than informal wage-earning work). For example, all things being equal, a 10% increase in the size of annual cropland increases the likelihood of a household choosing farm work, formal wage-earning work, or a non-wage livelihood by 20%, 12%, and 10%, respectively. Similar effects are apparent in the case of perennial cropland and aquaculture land.[2] We also found that owning more forestland allows households to specialize in farming activities that are more profitable than pursuing an informal wage-earning livelihood.

With respect to the role of community-related factors in the choice of livelihood, holding all other variables constant, we find that in communes that are accessible by road, households are more likely to pursue high-return livelihood strategies. For example, the relative probability ratio of choosing a formal wage-earning livelihood (compared to an informal wage-earning livelihood) is 1.27 times higher for those living in communities accessible by road. The relative probability ratio of adopting a non-laboring livelihood (compared to informal wage work) is 1.24 times higher for those living in communes where there are transport vehicles. A similar effect is found for those living in communities that have experienced at least one natural disaster in the past year.

Discussion

With regard to household per capita income, the results from comparing livelihood outcomes across livelihood strategies confirms that there are two groups of households — those with high-return livelihoods and those with low-return livelihoods. The former are represented by those with livelihoods in farm work, formal wage-earning work, and non-wage work while the latter consist of those whose living relies on non-labor income sources or informal wage-earning work. We also found that households in the former group were more likely to achieve better living conditions (over the past five years) than those in the latter group.

The extensive empirical literature estimating the contribution of land to household welfare disregards the question whether landholding is in fact a potential obstacle to choosing a profitable livelihood in rural Vietnam. Our study examines the role of landholding in the choice of livelihood in the rural Mekong Delta, a fertile region favorable to agriculture with a high level of landholding inequality. Our study provides evidence that landlessness or land shortage is actually a potential barrier to households in choosing remunerative jobs in the rural Mekong delta region. In particular, we find that households owning less cropland are more likely to accept an informal wage work livelihood, offering much lower income than farm work and other non-farm livelihoods.

Our research results suggest that land-limited households have been pushed into low-return activities to compensate for the adverse impacts of land scarcity. Therefore, the absence of land ownership among poor households may have become a

[2] Given a 10% increase in the size of annual cropland, the corresponding difference in logarithm for the size of annual cropland is log (1.01) = 0.09531, and the relative likelihood of choosing farm work rather than an informal wage work livelihood can be expressed in terms of the exponential function, exp. (1.93*0.09531) ≈ 1.20. The corresponding relative likelihood of choosing formal wage work and non-wage work livelihoods (rather than informal wage work) is 1.12 and 1.10, respectively.

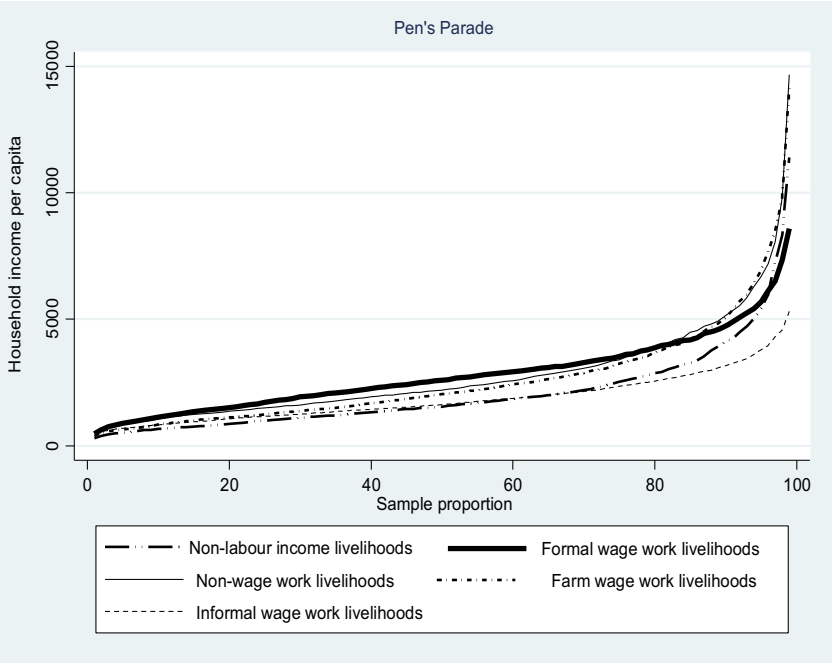

Fig. 5 Pen's Parade comparing per capita income across livelihoods. Estimates are the authors' calculation from the VHLSS 2016 data. Monthly household per capita income is measured in thousands of Vietnamese dong

social issue preventing inclusive development in the Mekong Delta. However, this conclusion does not accord with findings for Vietnam's peri-urban areas (Tran *et al.* 2014a, b) and Northwest region (Tran *et al.* 2018), where it has been discovered that owning more cropland increases the likelihood of households engaging in work less profitable than other livelihood options. Such differences may result from differences in livelihood opportunities and farming conditions across geographical regions in Vietnam.

Our study confirms that education increases the likelihood of households seeking high-return livelihoods in the Mekong Delta region. This supports the argument made by Haggblade *et al.* (2010) that better education enables households to move out of low-return activities and that the most profitable opportunities often require higher levels of education. This finding implies that land is not the sole factor determining the choice of remunerative livelihoods and its role may be replaced by other factors in the region, such as education and skills. Since land is in limited supply, a land distribution policy should not be considered the main approach to improving household welfare in the rural Mekong delta region. Instead, government investment in education should constitute a central, high priority measure for improving the living standards of households with limited land and education in this region.

Table 4 Multiple comparison of the improvement in living conditions over 5 years across livelihood groups

Livelihood strategy group	Non-labor income (1)	Formal wage work (2)	Non-wage work (3)	Farm work (4)
Formal wage work (2)	(2) minus (1) −0.26 [0.00]			
Non-wage work (3)	(3) minus (1) −0.21 [0.00]	(3) minus (2) 0.05 [0.02]		
Farm work (4)	(4) minus (1) −0.24 [0.00]	(4) minus (2) 0.02 [1.00]	(4) minus (3) 0.03 [0.19]	
Informal wage work (5)	(5) minus (1) −0.11 [0.00]	(5) minus (2) 0.15 [0.00]	(5) minus (3) 0.10 [0.00]	(5) minus (4) 0.14 [0.00]

Results reported are mean differences in the percentage of households who reported that their living conditions had improved compared to 5 years ago; *P*-values are given in brackets

Estimates are the authors' calculation from the VHLSS 2016 data

Table 5 Factors affecting the choice of livelihood in the rural Mekong delta region (multinomial logit model)

Explanatory variables	Non-labor income	Formal wage-earning work	Non-wage-earning work	Farm work
Gender	0.93	0.74**	0.93	1.58***
	(0.102)	(0.088)	(0.102)	(0.169)
Age	1.07***	0.96	1.03*	1.04*
	(0.027)	(0.045)	(0.019)	(0.023)
Age squared	1.00	1.00	1.00	1.00
	(0.000)	(0.000)	(0.000)	(0.000)
Education	1.05***	1.22***	1.15***	1.03**
	(0.016)	(0.018)	(0.014)	(0.014)
Ethnicity	0.91	1.01	1.12	1.30
	(0.180)	(0.227)	(0.223)	(0.232)
Marital status	1.31	0.99	0.82	0.79
	(0.385)	(0.285)	(0.215)	(0.224)
Dependency ratio	9.70***	0.79	2.04***	3.29***
	(1.782)	(0.178)	(0.378)	(0.563)
Household size	0.55***	1.06*	0.94**	0.76***
	(0.023)	(0.034)	(0.028)	(0.024)
Annual cropland (log)	1.30***	1.21***	1.06***	1.93***
	(0.038)	(0.030)	(0.025)	(0.056)
Perennial cropland (log)	1.25***	1.18***	1.02	1.75***
	(0.047)	(0.042)	(0.035)	(0.062)
Forestland (log)	1.28*	1.22	1.18	1.26**
	(0.165)	(0.184)	(0.150)	(0.121)
Aquaculture land (log)	1.33***	1.16***	1.12**	2.11***
	(0.058)	(0.048)	(0.051)	(0.088)
Prone to natural disaster	1.24**	1.18	1.09	0.97
	(0.134)	(0.148)	(0.117)	(0.099)
Coastal area	0.94	0.61**	0.95	1.21
	(0.163)	(0.128)	(0.162)	(0.219)
Road access	0.97	1.27*	1.37**	0.79*
	(0.145)	(0.174)	(0.187)	(0.106)
Transport vehicles	1.24*	1.02	1.17	0.99
	(0.138)	(0.129)	(0.120)	(0.102)
Constant	0.93	0.74**	0.93	1.58***
	(0.102)	(0.088)	(0.102)	(0.169)
Observations	7062	7062	7062	7062
Wald chi2(68)	2497.48			
Pseudo R2	0.1857			

Estimates are relative risk ratios (RRRs) adjusted for sampling weights and clustered at the commune level. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Informal wage-earning livelihoods are the base or reference group. The area of all land types was divided by 100 and converted into the natural logarithm. The omitted categories in the dummy variable analyses are female sex, unmarried, ethnic minorities, no liability to natural disasters, inland delta area, no roads, no transport vehicles

Estimates are the authors' calculation from the VHLSS 2016 data

Our study also finds that certain commune characteristics play an important role in enabling the pursuit of profitable livelihoods in the rural Mekong Delta region. A commune accessible by road increases the likelihood that households living in that commune will choose formal wage-earning work or non-wage work. A policy implication here is that by improving local infrastructure (e.g., road access to communes), local governments can create opportunities for local households, especially those with limited land and education, to specialize or develop high-return activities to earn their livelihoods.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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