

THE IMPACT OF LAND LOSS ON HOUSEHOLD INCOME: THE CASE OF HANOI'S SUB-URBAN AREAS, VIETNAM

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ABSTRACT

Using a novel dataset from a 2010 household survey, this study has provided the first econometric evidence of the impacts of farmland loss (due to urbanization and industrialization) on total household income and its sources in Hanoi's sub-urban areas, Vietnam. It was found that the loss of farmland had a positive impact on nonfarm income and other income but a negative impact on farm income. More importantly, the results showed that farmland loss had no negative effect on total household income. The above findings suggest that under the impacts of land loss, households have actively participated in nonfarm activities in order to supplement their income with nonfarm incomes, which in turn might have compensated for the loss of farm income due to land loss. Therefore, the loss of farmland should not be considered as an absolutely negative factor as it can help households improve their income by motivating them to change their livelihoods towards nonfarm activities.

Keywords: Farmland Loss; Land Acquisition; Land-Losing Households; Nonfarm Income; Hanoi.

1. INTRODUCTION

In Vietnam over the past two decades, escalated industrialization and urbanization have encroached on a huge area of agricultural land. It was estimated that, from 1990 to 2003, 697,417 hectares of land were compulsorily acquired by the State for the construction of industrial zones, urban areas and infrastructure and other national use purposes (Le, 2007). Between 2000 and 2007, about half a million hectares of farmland were converted for non-farm use purposes, accounting for 5 percent of the country's farmland (VietNamNet/TN,

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¹ Compulsory land acquisition is applied to cases in which land is acquired for national or public projects; for projects with 100 percent contribution from foreign funds (including FDI (Foreign Direct Investment) and ODA (Official Development Assistance)); and for the implementation of projects with special economic investment such as building infrastructure for industrial and services zones, hi-tech parks, urban and residential areas and projects in the highest investment fund group (WB, 2011a).

2009). In recent years, annually about 70,000 and 10,000 hectares of farmland have been acquired for the development of industrial zones and urban areas, respectively. Especially, in some localities such as Hanoi, Hung Yen and Vinh Phuc, more than half of their agricultural land has been acquired by 2011 for the construction of industrial parks, urban infrastructures and other nonfarm uses (Doan, 2011).

By 2009, Vietnam had a total area of around 33 million hectares and a population of 86 million. With less than 0.3 hectares of land per capita, Vietnam is one of the countries with the lowest land endowment per person (the World Bank [WB], 2011b). Nevertheless, the combination of fertile land, favourable weather conditions and an abundant labour force enables the country to assure national food security and succeed in exporting a number of crucial agricultural products such as rice, rubber, cashews, coffee and pepper. As a result, in Vietnam's rural areas, which represent three-quarters of the total population and most of the poor, agricultural production is the main living for more than half of the total workforce (WB, 2011b). Therefore, the State's farmland acquisition has a major effect on households in Vietnam's rural and peri-urban areas. From 2003-2008, it was estimated that the acquisition of agricultural land considerably affected the livelihood of 950,000 farmers in 627,000 farm households. About 25-30 percent of these farmers became jobless or had unstable jobs and 53 percent of the households suffered from a decline in income (VietNamNet/TN, 2009).

Land acquisition directly and indirectly affects household livelihoods by creating new non-farm employment opportunities and livelihood asset changes, respectively. However, apart from a number of rural households who attain benefits from this process because such households have enough resources or take full advantage of urbanization to obtain better livelihoods, many other households have become jobless, vulnerable and have precarious livelihoods even after receiving a significant amount of money as compensation for their land loss. Some case studies in peri-urban areas of Hanoi reveal mixed impacts of farmland acquisition on local people's livelihoods. When investigating a case study in a peri-urban village of Hanoi where two thirds of agricultural land was lost due to urbanization between 1998 and 2007, Nguyen (2009) found that many households benefited from their proximity to universities and urban centres. Income from renting out boarding houses to students and migrant workers emerged as the most important income source for the majority of households. However, a number of households faced insecure livelihoods because they did not have rooms for renting out and many landless farmers became jobless, particularly elderly and poorly educated farmers. In another case study in a peri-urban village of Hanoi, Do (2006) found that while farmland acquisition caused a loss of farm jobs, food supply and agricultural income sources, many households actively adapted to the new circumstance by diversifying their labour in manual labour jobs. Consequently, a high but unstable income from casual wage work became the main income source for many households.

Using secondary data gathered from various published documents in Vietnam, Nguyen, McGrath, and Pamela (2006) found that over the previous decade, Vietnam had experienced rapid urbanization and industrialization in peri-urban areas. One outcome of this process was that a large number of rural households had lost their farmland for the development of industrial zones and urban areas, and many among them had fallen in poverty. Moreover,

the results from a large-scale survey in eight developed cities and provinces with the highest level of farmland loss provided a quite detailed picture of both positive and negative effects of farmland acquisition on household income (Le, 2007). On average, while almost half of households suffered from a significant decline in farm income, more than half reported that their nonfarm income sources increased considerably after losing land. Regarding the total income that households earned after land loss, 25 percent obtained a higher level, while 44.5 percent maintained the same level and 30.5 percent experienced a decline (Le, 2007). In a case study in urbanizing areas of Hung Yen Province, Nguyen, Nguyen, and Ho (2013) found that although a large proportion of households have changed their livelihoods towards nonfarm activities and had a much higher level of income than before losing land, there have been many other households whose income was unchanged or declined after losing land.

The main objective of this study is to answer the key research question: how, and to what extent, has farmland loss affected household income and its components in Hanoi' sub-urban areas, Vietnam. Our motivation to pursue this topic stems from two main reasons. First, although there have been many studies examining the impacts of land loss on household income and its sources, their findings are mixed. Second, all above studies used qualitative methods or descriptive statistics for investigating these impacts and this clearly restricts our understanding. Using a unique dataset from a 2010 household survey and econometric tools, this paper has made a significant contribution to the literature by providing the first econometric evidence of the impacts of land loss on household income and its components. Our results showed that while the loss of farmland in both years (2008 and 2009) had no impact on total household income, it had a positive effect on nonfarm income and other income but a negative effect on farm income. These findings suggest that the effects of land loss on different income components might balance each other.

2. DATA AND METHODS

2.1. *Research site*

Hoai Duc sub-urban district of Hanoi was selected for this study. This is because among the districts of Hanoi, Hoai Duc holds the biggest number of land acquisition projects with a huge area of farmland having been converted for nonfarm uses in recent years (Huu Hoa, 2011). Hoai Duc is located on the northwest side of Hanoi City, about 20 km from the Central Business District (see Appendix 1). The district is situated in a very prime location, surrounded by a number of important roads, namely Thang Long highway (the country's biggest and most modern highway) and National Way 32, and is in close proximity to new industrial zones, new urban areas and Bao Son Paradise Park (the biggest entertainment and tourism complex in North Vietnam). In the period 2006-2010, around 1,560 hectares of agricultural land were compulsorily acquired by the State for 85 projects in the district (LH, 2010), leading to a significant decrease in the size of farmland per households in Hoai Duc. The average size of farmland per household in the district was about 840 m² in 2009 (Hoai Duc District People's Committee, 2010a) which was much lower than that in Ha Tay Province (1,975m²) and that of other provinces (7,600 m²) in 2008 (Central Institute for Economic Management [CIEM], 2009). Prior to being merged into Hanoi on 1st August 2008, Hoai Duc was a district of Ha Tay

Province, a neighbouring province of Hanoi Capital. The district is covered with 8,247 hectares of land, of which farmland accounts for 4,272 hectares, 91 percent of which is used by households and individuals (Hoai Duc District People's Committee, 2010a). There are 20 administrative units in the district, consisting of 19 communes and one town. Hoai Duc has around 50,400 households with a population of 193,600 people. Prior to its transfer to Hanoi, Hoai Duc was the richest district in Ha Tay Province (Nguyen, 2007). In 2009, Hoai Duc GDP per capita reached 15 million Vietnam dong (VND) per year (Hoai Duc District People's Committee, 2010b), which was less than half of Hanoi's average (32 million VND per year) (Vietnam Government Web Portal, 2010).²

2.2. Data collection

Adapted from General Statistical Office [GSO] (2006), we designed a household questionnaire to collect quantitative data on household characteristics, assets and income sources. A sample of 480 households from 6 communes, including 80 households (40 with land loss and 40 without land loss) from each commune, was randomly chosen.³ To achieve the target sample size of 480 households, therefore, 600 households were selected, including 120 reserves. A disproportionate stratified sampling method was implemented with two stages: first, 12 communes that had farmland acquisition were clustered into three groups based on their employment structure. The first group was three agricultural communes; the second one included five communes that had a combination of both agricultural and non-agricultural production while the third one was characterized by four non-agricultural communes. From each group, two communes were randomly selected. Then, from each of these communes, 100 households (50 with land loss and 50 without land loss) including 20 reserves (10 with land loss and 10 without land loss) were randomly chosen using Circular Systematic Sampling (Groves, Fowler, Couper, Lepkowski, & Singer, 2009).

The data were collected between the beginning of April and the end of June 2010 by means of face-to-face interviews with the head of a household in the presence of other household members. In total, 477 households were successfully interviewed, among which 237 households lost their farmland at different levels. Some lost little, some lost part and others lost most or all of their land.⁴ Their farmland was compulsorily acquired by the government for a number of projects relating to the enlargement and improvement of Thang Long highway, the construction of industrial clusters, new urban areas and other non-farm use purposes (Ha Tay Province People's Committee, 2008). Due to some delays in the implementation of land acquisition, of the 237 households, 124 households had farmland acquired in the first half of 2008 and 113 households had farmland acquired in early 2009. In the remainder of this paper, households whose farmland was lost partly or totally by the State's compulsory land acquisition will be referred to as "land-losing households".

² 1 USD equated to about 18,000 VND in 2009.

³ Six selected communes are Song Phuong, Lai Yen, Kim Chung, An Thuong, Duc Thuong and Van Con.

⁴ Statistic summary of the area of acquired farmland is available in Appendix 2.

2.3. Analytical models

First, the household sample was split into two groups, namely land-losing and non-land-losing households. Statistical analyses were then used to compare the mean of household assets and household income between the two groups. According to Gujarati and Porter (2009), there is a variety of statistical techniques for investigating the differences in two or more mean values, which are referred to as analysis of variance. However, a similar objective can be achieved by using the framework of regression analysis. Therefore, regression analysis using Analysis of Variance (ANOVA) model was applied to explore the differences in the mean of household assets and income between the two groups of households. In addition, a chi-square test was employed to determine whether a statistically significant association existed between two categorical variables such as the type of households (land-losing and non-land-losing households) and their participation in nonfarm activities.

Because total household income is continuously distributed over positive values, ordinary least squares (OLS) regression was used to examine factors affecting total household income. However, other components of household income, including farm income, nonfarm income and other income, are continuous but censored at zero. In this case, the OLS estimator will give biased results and Tobit regression is usually used for such data (Atamanov & van den Berg, 2012). Therefore, Tobit regression was applied to examine the determinants of farm income, nonfarm income and other income. Household income and its components were assumed to be determined by household characteristics and assets. In addition, other factors, in this case the loss of farmland and the participation by households in nonfarm activities before farmland acquisition were included as regressors in the models. Finally, commune dummy variables were also included in the models to control for fixed commune effects. Thus, we have the following equations for the models:

$$Y_i = \varphi_0 + \varphi_1 X_i + \varphi_2 Z_i + \varphi_3 NP_i + \varphi_4 LL_i + \varphi_5 D_i + u_i$$

$$S_{ij} = \beta_0 + \beta_1 X_i + \beta_2 Z_i + \beta_3 NP_i + \beta_4 LL_i + \beta_5 D_i + \varepsilon_i$$

where Y_i is the total income of a household i and S_{ij} is the income source j of the household I that were assumed to be determined by the household's characteristics (X_i) and assets (Z_i), farmland loss (LL_i), past nonfarm participation (NP_i) and commune dummy (D_i) (the commune in which the household I lived). The definition and measurements of variables included in the models are displayed in Table 1.

The vectors of household characteristics (X_i) include household size, dependency ratio, age of and gender of household head, age and education of working age members. The justification of including these variables is as follow. Larger size households might be indicative of labour availability and therefore were expected to obtain a higher level of total income, farm and nonfarm income. However, households with a higher dependency ratio might be indicative of labour shortage and were hypothesized to earn a lower level of total income, farm and nonfarm income. Having more working members who are male might be an advantage, which in turn might allow households to earn more income, including both farm and nonfarm income.

Table 1: Definition and measurements of variables included in the models

	Definition	Measurement
<i>Independent variables</i>		
Total income	Total annual income from farm, nonfarm and other income	Natural log
Nonfarm income	Total annual income from wage and self-employment in nonfarm activities	1,000 VND
Farm income	Total annual income from planting and livestock production and other related activities	1,000 VND
Other income	Total annual income from other sources	1,000 VND
<i>Explanatory variables</i>		
<i>Farmland loss</i>		
Land loss 2009	The proportion of farmland that was compulsorily acquired by the State in 2008.	Ratio
Land loss 2008	The proportion of farmland that was compulsorily acquired by the State in 2008.	Ratio
<i>Household characteristics</i>		
Household size	Total household members.	Number
Dependency ratio	This ratio is calculated by the number of household members aged under 15 years and over 59 years, divided by the number of household members aged 15-59 years.	Ratio
Age of household head	Age of household head.	Years
Gender of household head	Whether or not the household head is male.	Male=1; Female=0
Age of working members	Average age of members aged 15 and over who were employed in the last 12 months	Years
Education of working age members	Average years of formal schooling of members aged 15 and over who were employed in the last 12 months	Years
<i>Household assets</i>		
Farmland per capita	The size of owned farmland per capita	100 m ²
House location	Whether or not households have a house or a plot of residential land in a prime location.	Dummy (=1 if yes)
Residential land size	The size of residential land owned by households	10 m ²
Productive assets	Total value of productive assets.	Natural log
Past nonfarm participation	Whether or not the household had participated in nonfarm activities before farmland acquisition.	Dummy variable
Commune variables	The commune in which the household resided (Lai Yen Commune is the base group)	Dummy variable

Households with working members that had more years of formal schooling were expected to earn a higher amount of nonfarm and total income. However, the income effect of the age of working members might be ambiguous. Younger working members might have more chances to take up nonfarm jobs, which in turn might generate more nonfarm income and therefore result in households having more total income. Nevertheless, older members tend to have more work experience and thus might have access to lucrative job opportunities, which allows them to earn a higher level of total income.

Regarding to assets (Z_i), owning more productive assets was expected to increase total household income as well as its components. Within the context of urban and sub-urban areas in Vietnam, a house or a plot of residential land has become an important resource, as households use them as productive assets. An area of several tens of square meters of residential land can be enough for a household to build a house for rent (Nguyen, 2009). In addition, a house or a residential land plot in a prime location such as the main road of a village can be used for opening a shop (Nguyen, Vu, and Lebailly, 2011; Nguyen, 2009).⁵ Therefore, we included the size of residential land and the location of houses (or of residential land plots) as explanatory variables in the models. Households with larger size of residential land or a house in prime location were expected to earn a higher amount of nonfarm income and total income.

Nonfarm participation (NP_i) was found to be a determinant of household welfare in Vietnam rural (Pham, Bui, and Dao, 2010; Van de Walle and Cratty, 2004). Nevertheless, the inclusion of nonfarm participation as an explanatory variable in the model is likely to suffer from the potential endogeneity (Van de Walle and Cratty, 2004). This is because nonfarm participation was determined by household characteristics, assets and other exogenous factors. However, in our case study, the households' nonfarm participation in the past (before farmland acquisition) was predetermined and treated as an exogenous variable.⁶ Therefore, we included a dummy variable of past nonfarm participation in the models as an explanatory variable. Households with past nonfarm participation were hypothesized to earn a higher amount of nonfarm income and total income than those without past nonfarm participation.

In the present study, the loss of farmland (LL_i) is an exogenous variable, resulting from the State's compulsory farmland acquisition.⁷ The State conducted the farmland acquisition at two different times; therefore, land-losing households were divided into two groups: (i) those that had farmland acquired in 2008 and (ii) those did in 2009. The rationale for this division was that difference in lengths of time since farmland acquisition was expected to have different effects on household income and its components. In addition, the level of farmland loss, as noted, was quite different among households. Therefore, this factor, as measured by the proportion of farmland acquired by the State in 2008 and in 2009, was used as the variable of interest. Households with more land loss were expected to earn more nonfarm income because the loss of farmland might induce households to intensively participate in nonfarm activities. However, households with more land loss were expected to earn a lower amount of farm income due to land shortage. The discussion suggests that the impact of land loss on total income might be positive if the extra income earned from nonfarm activities is greater than the amount of lost farm income. Conversely, the impact might be negative if the amount of

⁵ A prime location is defined as: the location of house or the location of a plot of residential land situated on the main road of a village or at the crossroads or very close to local markets or to industrial zones, and to a high way or new urban areas. Such locations enable households to use their house for opening a shop, or a workshop or for renting zones, hi-tech parks, urban and residential areas and projects in the highest investment fund group (WB, 2011a).

⁶ According to Kennedy (2003), lagged values of endogenous variables are predetermined and treated as exogenous variables, because they are given constants for determination of the current time period's values of the endogenous variables.

⁷ As noted by Wooldridge (2013), an exogenous event is often a change in the State's policy that affects the environment in which individuals and households operate.

additional nonfarm income cannot compensate for the loss of farm income. Another possibility is that land loss might have virtually no impact on total income at all if its effects on farm income and nonfarm income balance each other.

3. RESULTS AND DISCUSSION

3.1. Background on household assets and income

Table 2 provides some information about household characteristics, assets and income for the household sample. There were no statistical significant differences in the size of households, dependency ratio, gender of household heads and number of male working members between the two groups. On average, the age of the household heads for all the surveyed households was 51 and the corresponding age among the land-losing households was approximately 4 years older than that among the non-land-losing households. The average age of working members among the group of land-losing households was about 3 years older than that in the group of non-land-losing households, while the disparity in average years of schooling was negligible between the two groups.

Table 2: Summary statistics of household characteristics, assets and income

Variables	All households		Land-losing households		Non-land-losing households		t-value/ Pearson chi2 ^a
	Mean	SD	Mean	SD	Mean	SD	
<i>Household characteristics/assets</i>							
Household size	4.49	1.61	4.46	1.73	4.50	1.55	-0.25
Dependency ratio (%)	60.58	66.78	54.54	68.68	64.00	65.60	-1.27
Gender of household head (1=male)	0.77	0.42	0.77	0.42	0.77	0.42	0.022
Age of household head	51.21	12.34	53.95	12.04	49.60	12.24	3.44***
Male working members	1.25	0.70	1.23	0.72	1.26	0.70	-0.40
Average age of working members	40.46	8.25	42.24	8.51	39.48	7.95	3.88***
Average schooling years of working members	8.37	2.90	8.24	2.58	8.44	3.07	-1.87*
Farmland size per capita (m ²)	266.20	230.37	155.40	129.71	330.85	251.01	-8.12***
Residential land per household (m ²)	218.76	146.16	230.34	151.52	211.94	142.71	1.19
Proportion of houses in a prime location	0.32	0.47	0.25	0.44	0.36	0.48	1.723
Total value of productive assets	22,081	20,089	18,397	17,377	24,252	21,261	-2.87***
Past nonfarm participation	0.78	0.41	0.73	0.44	0.81	0.40	4.367**

Table 2: Summary statistics of household characteristics, assets and income (*cont*)

Variables	All households		Land-losing households		Non-land-losing households		t-value/ Pearson chi2 ^a
	Mean	SD	Mean	SD	Mean	SD	
<i>Household income</i>							
Total annual household income	60,642	30,034	54,154	25,725	60,465	36,171	-3.22***
Monthly household income per capita	1,126	591	1,012	487	1,193	635	-2.88***
Total annual farm income	14,432	16,169	11,564	15,452	16,121	16,368	-2.79***
Total annual nonfarm income	46,211	35,391	42,590	26,938	48,344	39,431	-1.69*
Total annual other income	3,409	8,676	3,454	7,461	3,382	9,331	0.09
<i>Number of households</i>	477		237		240		

Notes: ^a applied to dummy variables. Productive assets, household income and its components measured in VND. 1 USD equated to about 18,000 VND in 2009. Means and standard deviations (SD) are adjusted for sampling weights. *, **, *** mean statistically significant at 10%, 5 % and 1 %, respectively.

The data in Table 2 indicate that the distribution of farmland was quite unequal between the two groups of households. On average, non-land-losing households owned approximately twice as much farmland per capita as land-losing households did. However, there were no statistically significant differences between the two groups in the size of residential land and proportion of households with a house in a prime location. The non-land-losing households possessed a higher total value of productive assets than their counterpart and this difference is statistically significant. The results show that a statistically significant association existed between the type of households and their past nonfarm participation; while 81 percent of the non-land-losing households had participated in nonfarm activities before the farmland acquisition, the corresponding figures for the land-losing households were 73 percent.

Non-land-losing households earned a higher amount of farm income, nonfarm income and total income than land-losing households. Possibly this suggests that land loss might have had a negative effect on total income and its components. However, the dummy variable of land loss simply indicates the difference in the total income and its sources, if it exists, but it does not suggest the causes of this difference. Differences in households' educational levels, productive assets, the size of residential land, the prime location of house and past nonfarm participation may all have a considerable effect on the income difference. Therefore, other variables that potentially affect household income had been taken into account in multiple regression models, which will be presented in the subsequent section.

3.2. Determinants of total household income and its sources

Table 3 reports the results from Tobit estimates for determinants of household income components. It is evident that many explanatory variables are highly statistically significant, with their signs as expected. The results indicate that land loss has a positive effect on nonfarm income but a negative effect on farm income. A 10 percentage point-increase in the land loss in 2009 corresponds with an increase of around 1.2 million VND in nonfarm income, holding

all other variables constant. A similar increase in the land loss in 2009 resulted in a decrease of about 1.4 million VND in farm income. In addition, the land loss in 2009 had a positive effect on other income. These results indicate that the loss of farmland had different effects on household income components. Also, this suggests that the loss of farmland had motivated households to participate intensively in nonfarm activities as a way to supplement their income with nonfarm income sources. In overall, the findings support the previous survey findings obtained by Le (2007), who found that after losing land, households' farm income considerably decreased but their nonfarm incomes significantly increased.

The result reveals that having more family members increased the amount of farm income. This indicates that farming is a more labour-intensive strategy than nonfarm activities. Possibly, this reflects the fact that having more family labour allowed many households to intensively cultivate vegetables that are more profitable than rice but also require a greater labour input.⁸ A similar picture was also observed in Thanh Tri, a sub-urban district of Hanoi (van den Berg, Van Wijk, and Van Hoi, 2003), and on the peripheries of Ho Chi Minh City (Jansen, Midmore, Binh, Valasayya, and Tru, 1996). Having more male working members also allowed households to earn more nonfarm income but less other income. Female headed households were more likely to earn more farm income than male headed households, suggesting that farming was more suitable for women than men. Younger working members tended to earn more nonfarm income but less farm income. Higher levels of education of working members enabled households to earn a higher amount of nonfarm income and a lower amount of farm income. This suggests that better education might shift households away from farming. In general, these findings are similar to those in Shandong Province, China where working members with younger age and better education were more likely to participate in off-farm activities (Huang, Wu, and Rozelle, 2009).

Regarding the role of household assets in income-generation, the results show that households with a house in a prime location were more likely to earn a much higher amount of nonfarm income as compared to those without this advantage. This is because households have utilized their houses for nonfarm activities such as opening a shop, a workshop or a small restaurant. This finding suggests that a house (or a plot of residential land) in a prime location was important to the livelihoods of peri-urban households. Holding a higher value of productive assets is positively associated with a higher amount of both nonfarm and farm income. Finally, households' past nonfarm participation is closely linked to their current income sources. Households with past nonfarm participation earned a much higher amount of nonfarm income (about 26 billion VND) and a much lower amount of farm income (about 11 billion VND) as compared to those without past nonfarm participation, holding all other variables constant.

⁸ In some places of Hoai Duc District, the mean net return per year per hectare for fresh vegetable production is between 3-4 times higher than for rice. The vegetable cultivation has short durations; about 40-60 days (depending on types of vegetables), which allows farmers to harvest 5-6 crops per year (Tùng, 2010). Therefore, vegetable production requires a higher labour input than rice.

Table 3: Tobit estimates for determinants of income sources

Explanatory variables	Nonfarm income	Farm income	Other income
Land loss 2008	10,441.15* (5,423.7205)	-21,624.70*** (3,441.04)	3,920.98 (4,189.36)
Land loss 2009	12,185.3725** (5,635.6445)	-14,278.28*** (3,428.76)	7,537.46** (3,454.07)
Household size	-75.477 (1,317.321)	2,868.171*** (678.652)	-1,045.828 (958.648)
Dependency ratio	-1,288.11 (2,478.79)	-3,645.62** (1,604.75)	3,197.16** (1,534.23)
Number of male working members	6,040.34** (2,870.24)	254.81 (1,114.45)	-6,415.86*** (1,974.43)
Household head's gender	-5,594.95 (4,014.55)	3,614.78* (1,981.74)	-544.84 (2,469.71)
Household head's age	313.05* (174.01)	-145.98* (80.66)	360.79*** (101.35)
Age of working members	-522.81** (224.97)	447.94*** (127.17)	107.00 (147.22)
Education of working members	4,857.78*** (855.42)	-1,055.13*** (345.67)	1,819.48*** (493.68)
House location	9,968.5845** (4,077.67)	-5,710.58*** (1,878.57)	-460.66 (2,141.84)
Residential land	118.23 (115.84)	106.31 (65.20)	9.71 (69.06)
Productive assets	5,306.54*** (1,406.09)	2,693.17*** (750.22)	447.21 (853.73)
Past nonfarm participation	26,200.82*** (4,494.29)	-10,908.62*** (2,091.46)	3,633.90 (2,938.39)
Song Phuong	8,630.80* (4,868.83)	4,801.55* (2,697.27)	-1,640.71 (3,311.82)
Kim Chung	17,889.23*** (4,482.76)	-8,267.667*** (2,408.11)	4,648.17 (3,081.16)
An Thuong	-445.2056 (5,032.8506)	4,618.09* (2,554.68)	-2,234.55 (3,356.18)
Duc Thuong	-119.9856 (4,097.97)	5,293.68** (2,643.05)	-569.89 (3,092.35)
Van Con	5,985.84 (5,178.62)	1,201.24 (3,142.83)	2,839.32 (3,341.50)
Constant	-77,008.11*** (17,992.37)	-18,027.53* (9,185.15)	-44,664.88*** (12,306.96)
Sigma	27,805.24*** (1,865.10)	14,245.70*** (905.21)	14,388.68*** (1,077.47)
Pseudo R2	0.0276	0.0260	0.0336
Observations	460	460	460

Notes: Robust standard errors in parentheses. Estimates are adjusted for sampling weights. *, **, *** mean statistically significant at 10%, 5%, and 1%, respectively.

Table 4 reports the results from OLS estimates for determinants of total household income. Surprisingly, the coefficients on the land loss variables in both years are not statistically significant; indicating that land loss had no impact on total household income. As expected, the different effects of land loss on various income sources might have balanced each other. The estimation results from Tobit model suggest that the amount of farm income lost due to farmland loss might have been compensated by the additional income earned from nonfarm activities. These results, therefore, can help explain why the loss of farmland had no negative effect on household income in the short-term. In addition, they suggest that farmland loss

Table 4: Ordinary least squares estimates for determinants of total household income
(Log of annual total household income)

Explanatory variables	Coefficient	SE
<i>Farmland loss</i>		
Land loss 2008	-0.05	(0.071)
Land loss 2009	0.03	(0.081)
<i>Household characteristics</i>		
Household size	0.05***	(0.017)
Dependency ratio	-0.05	(0.035)
Number of male working members	0.05	(0.032)
Household head's gender	0.04	(0.052)
Household head's age	0.00	(0.002)
Age of working members	-0.00	(0.003)
Education of working members	0.05***	(0.010)
<i>Household assets</i>		
House location	0.04	(0.045)
Residential land size	0.00	(0.002)
Productive assets	0.14***	(0.020)
Past nonfarm participation	0.17***	(0.051)
<i>Commune dummy</i>		
Song Phuong	0.15**	(0.071)
Kim Chung	0.19***	(0.065)
An Thuong	0.07	(0.063)
Duc Thuong	0.09	(0.060)
Van Con	0.14*	(0.075)
Constant	8.56***	(0.257)
Prob> F	0.0000	
R-squared	0.4789	
Observations	460	

Notes: Robust standard errors (SE) are in parentheses. Estimates are adjusted for sampling weights. *, **, *** mean statistically significant at 10%, 5%, and 1%, respectively.

might have a positive effect on household income in the long-term as households have more time to change their livelihoods towards lucrative nonfarm activities. This explanation is well supported by the recent survey findings obtained by Nguyen et al. (2013), who found that ten years after losing land, the majority of households with higher levels of land loss had higher rates of job change and their income per capita was approximately seven times higher as compared to before losing land. The above finding simply that farmland has been gradually lost its crucial role in peri-urban livelihoods and its role has been gradually replaced by nonfarm employment.⁹

Holding all other variables constant, an additional family member is associated with five percent greater total income. In addition, a one year increase in formal education of working member corresponds with five percent greater total income. Among various types of household assets, only productive assets have a positive association with total income. The elasticity of total income to higher values of productive assets is 0.14. In overall, the above findings are in line with the previous findings in Vietnam rural obtained by Nguyen, Kant, and MacLaren (2004) who found that having more family members, better education and more productive assets all had a positive effect on household income. Finally, households with past participation in nonfarm activities earned an amount of total income 18.5 percent higher than those without past nonfarm participation.¹⁰ This finding is partly in accordance with that of Do et al. (2001) who found that nonfarm households were much more likely to belong to the high income groups than farm households in rural Vietnam.

4. CONCLUSION AND POLICY IMPLICATIONS

The impacts of farmland loss (due to urbanization and industrialization) on household income and its sources were investigated in previous studies using qualitative analysis or descriptive statistics. Going beyond the literature, we have quantified this relationship by using a novel dataset from a 2010 household survey and econometric methods. Although land-losing households earned a lower level of total income than non-land-losing households, the results of multiple regression analyses show that the one and two-year effects of farmland loss on total household income are not statistically significant. These results confirm that the loss of farmland had no negative effect on household income in Hanoi's peri-urban areas in the short-term. This can be explained by the fact that the loss of farm income might have been offset by the amount of income earned from nonfarm activities. These arguments are well supported by our econometric findings which indicate that land loss has a positive effect on nonfarm income and other income but a negative effect on farm income. Therefore, a possible policy implication here is that the loss of farm land should be seen as a positive factor since it can make rural household livelihoods more diversified and secure by motivating households to participate intensively in nonfarm activities. The econometric findings in Vietnam and several

⁹ We also examined the impact of farmland on household income sources and the regression results in Appendix 3 show that farmland has a negative effect on nonfarm income, suggesting that land-limited households tend to participate intensively in nonfarm activities.

¹⁰ Because the dependent variable (total household income) is in logarithmic form, households with past nonfarm participation are predicted to have total income that is higher about 18.5% [$\exp(0.17) - 1 = 0.1853$] than those without past nonfarm participation.

developing countries also showed that land limited households were more likely to engage in nonfarm activities and thus leads rural households to pursue this way of enhancing their wellbeing (Winters et al., 2009).

The results show that some asset-related variables, including education, productive assets and a house with a prime location, all had a positive effect on nonfarm income. This implies that governmental support for households' access to formal credit can help them have more financial resources and accumulate more productive assets, these, in turn, allow them to participate in nonfarm activities. Encouraging parental investment in their children's education should be considered a way to move out of farming and to seize lucrative nonfarm job opportunities for the next generation.

This study confirms the important role of nonfarm participation in improving household income in peri-urban areas. This suggests that government policies aiming at improving household income should focus on promoting rural nonfarm activities and improving households' access to these activities. Nevertheless, access to nonfarm employment in Hanoi's sub-urban areas has been found to be determined by a number of factors such as education, access to formal credit, a prime location for doing nonfarm businesses (Tuyen and Huang, 2013; Tuyen and Lim, 2011), access to local markets (Ngoc, 2004) and the development of local infrastructure (Nguyen, 2009). As a result, policy intervention in these factors can help peri-urban households increase their income by providing them with favourable conditions to participate intensively in nonfarm activities.

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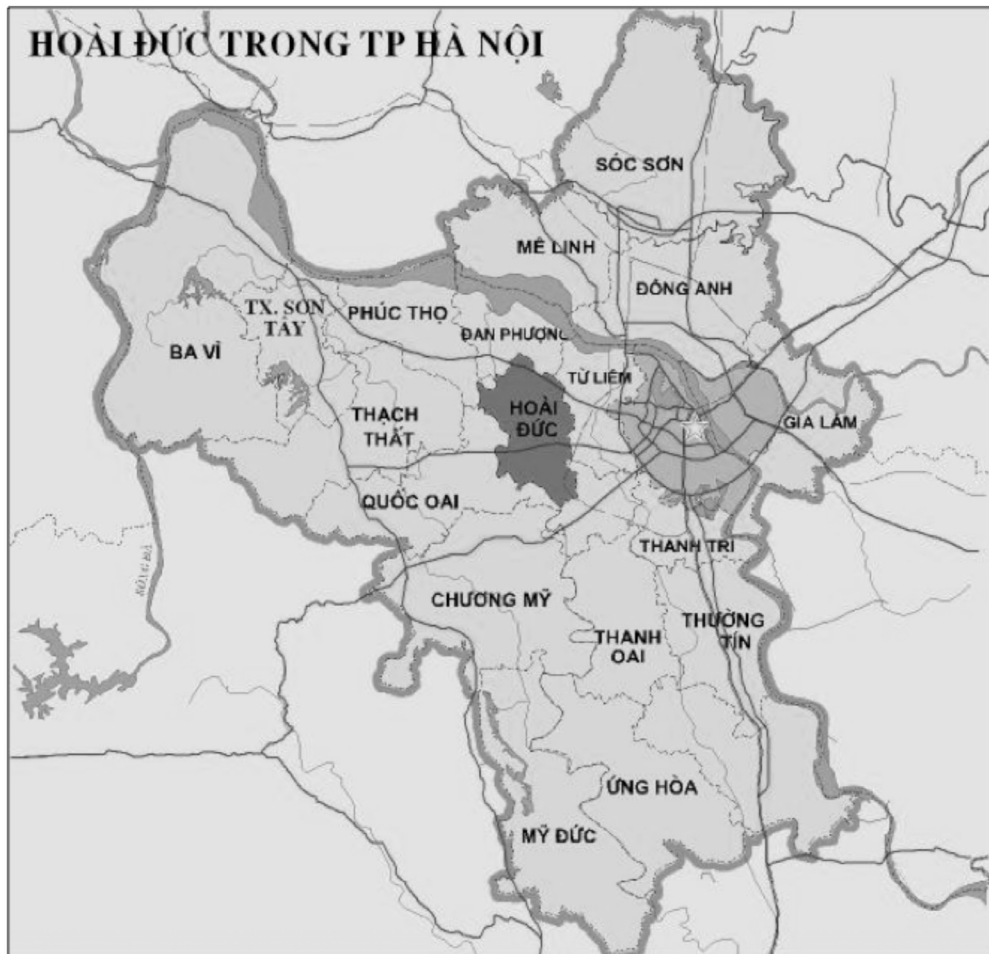
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APPENDICES**Appendix 1:** Location of Hoai Duc peri-urban district

Appendix 2: Loss of and decline in farmland size among land-losing households

	Mean	SD	Min	Max	Mean	SD
The area of acquired farmland in 2009 (m ² /household). N =113	744	389	24	1,880	767	394
Proportion of farmland loss (%/household). N =113	56.50	25.40	1.96	100	58.00	25.00
The area of acquired farmland in 2008 (m ² /household). N=124	765	435	120	2,520	709	390
Proportion of farmland loss (%/household). N=124	54.00	24.00	12.20	100	54.23	24.40
Farmland size before losing land (m ² /household). N =237	1,484	706	280	4,860	1,430	658
Current farmland size (m ² /household). N=237	729	599	0	3,600	693	556

Note: SD: standard deviation. Estimates in the last two columns are adjusted for sampling weights.

Appendix 3: Tobit estimates of the impact of farmland on household income sources

Nonfarm income	Farm income	Other income	
Household size	-608.71 (1,376.62)	3,930.97*** (688.48)	-955.48 (934.34)
Dependency ratio	-1,955.87 (2,503.93)	-2,161.58 (1,565.65)	3,004.78* (1,555.39)
Number of male working members	6,134.04** (2,859.12)	64.54 (1,031.84)	-6,498.44*** (1,962.66)
Household head's gender	-5,257.48 (3,936.83)	2,793.42 (1,729.67)	-450.85 (2,462.27)
Household head's age	380.47** (174.39)	-254.00*** (75.29)	374.47*** (101.78)
Age of working members	-438.45* (236.93)	313.60** (132.29)	129.32 (151.10)
Education of working members	4,813.47*** (863.00)	-941.61*** (324.26)	1,799.40*** (493.37)
Farmland per capita	-1,614.11* (908.95)	3,081.19*** (571.44)	-78.93 (710.75)
House location	9,692.19** (4,125.24)	-4,650.85*** (1,743.23)	-271.74 (2,126.57)
Residential land	167.90 (116.37)	27.17 (56.59)	21.78 (65.80)
Log of total value of productive assets	5,477.82*** (1,426.77)	2,327.93*** (735.77)	358.10 (873.06)
Past nonfarm participation	24,623.74*** (4,598.04)	-8,029.98*** (2,302.19)	3,516.82 (2,987.75)
Song Phuong	7,748.70* (4,684.16)	4,883.98** (2,406.22)	-2,641.68 (3,202.51)
Kim Chung	15,365.70*** (4,447.74)	-4,698.87** (2,342.06)	3,402.52 (3,131.73)
An Thuong	1,424.47 (4,759.405)	-1,378.34 (2,334.47)	-3,426.75 (3,415.71)
Duc Thuong	-473.88 (4,122.17)	5,833.99** (2,543.59)	-61.45 (3,112.17)
Van Con	4,357.01 (5,141.19)	2,156.65 (2,903.22)	898.13 (3,395.30)
Constant	-75,038.08*** (18,071.49)	-22,180.53** (8,849.48)	-43,376.55*** (12,095.53)
Sigma	27,817.30*** (1,877.888)	13,551.93*** (903.102)	14,412.08*** (1,070.826)
Pseudo R2	0.0275	0.0276	0.0300
Observations	460	460	460

Notes: Robust standard errors in parentheses. Estimates are adjusted for sampling weights. *, **, *** mean statistically significant at 10%, 5%, and 1%, respectively.