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# NONFARM ACTIVITY AND POVERTY REDUCTION IN RURAL VIETNAM: 2002-2008

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**Abstract**

This paper uses the Vietnamese Households Living Standards Surveys of 2002, 2004, 2006 and 2008 to examine the effects of nonfarm activity on poverty in rural Vietnam. We show that nonfarm activity helps the poor, but not the poorest, given that households need to own a minimum level of endowment to partake in nonfarm activity. We find an inverted-U shaped relationship between households' endowment levels and the probability of participating in nonfarm activity. Also, in contrast to previous studies which largely by-passed the endogeneity of nonfarm activity, we instrument it with nonfarm networks, and find that nonfarm activity plays an important role in poverty reduction, however, this impact decreases over time.

**Key words: instrumental variable, nonfarm, poverty, rural Vietnam**

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## 1. Introduction

Agricultural households derive their incomes from land, labor and capital. However, in developing countries, per capita land is small, resulting in labor surplus in the sector. In addition, rural households are faced with credit constraints, which impede their access to the latest technology for capital investment. Moreover, income from agriculture, and the prices of agricultural products, is not stable due to changing weather conditions. All these point out to non-farm activity as an important instrument to generate welfare for rural households, to reduce poverty, and to absorb the growing labor force in agriculture (Kung and Lee 2001; Lanjouw and Lanjouw 2001).

There is an expanding literature that relates nonfarm activity to economic outcomes in developing countries. In the context of Honduras, Ruben and Berg (2001) show that nonfarm income allows farmers to increase their yields and labor productivity through creating demand for input into non-agricultural production. For Nigeria Oseni and Winters (2009) find that participating in nonfarm activities helps farm households to overcome credit constraints and reduce risk. This, therefore, improves farm production and smooths their consumption. It is generally argued that diversifying into nonfarm activity provides an extra income for the poor, and a self-insurance tool against negative shocks (Ferreira and Lanjouw, 2001). However, although nonfarm activity may contribute to poverty reduction, it is not necessarily the case that the poor benefits the most from these activities. In the context of rural Vietnam, Walle and Cratty (2004) find that some, but not all, of Vietnam's poor in rural areas benefited from nonfarm market economy in the 1990s. Further, the poor generally face entry barriers to participate in high-return nonfarm activities. It is often held that nonfarm employment is mainly concerned with labor that has a relatively high level of education (Lanjouw, 1999; Ruben and Berg, 2001; Cherdchuchai and Otsuka, 2006). Having low levels of education might push the poor into low-return activities (Lanjouw and Murgai, 2009, Kijima et al, 2006). Thus, the poor's engagement with nonfarm economy may be characterized with low levels of labor productivity (Lanjouw, 2001).

Our objective is to investigate whether the poor people may participate in nonfarm activity, and next if it happens, we consider the impact of nonfarm activity on poverty and welfare status. Therefore, our contribution is as follows: First, we analyze the impact of nonfarm activity and poverty in Vietnam for the 2000s. As discussed below, there are several compelling reasons to consider the Vietnamese case for this decade. For instance, the new Enterprise Law adopted in 2000, and subsequent adjustments in the private sector, provides a substantially useful policy experiment upon which to explore the relationship in question. Second, we examine the relationship between the probability of participating in nonfarm activity and the endowments of rural households in order to shed light on the background of the association. This approach is unique to this study in exploring the nonfarm activity-poverty link. Third, in contrast to previous studies, we explore the effects of participating in nonfarm activity on poverty by addressing the endogeneity problem. Our identification strategy is to instrument nonfarm participation of households with nonfarm networks. Finally, binary poverty model is criticized because of arbitrary selection of poverty line. As expenditure is continuous, we do a complementary analysis where we consider the impact of

change in nonfarm activity on change in household expenditure. Meanwhile, this allows us to look at the dynamics of household expenditure.

The process of renovation in Vietnam started in the late 1980s in order to shift the economy from a centrally planned to a market economy. The country has achieved considerable success in economic growth since the late 1990s, which has been primarily driven by rapid industrialization and urbanization. In this context, labor's departure from agriculture for higher returns in non-agricultural sectors has been an ongoing process. On the other hand, economic reforms in the 1990s laid the initial grounds for private and foreign investment sectors to develop. The year 2000 witnessed an important turning-point for private sector development with the promulgation of Enterprise Law, which officially recognized the right of doing business. The Enterprises Law eliminated over one-hundred business license requirements and simplified the registration procedures for new businesses. As a result, there has been a significant increase in the number of private enterprises registrations from 14,457 in 2000, to 27,662 in 2003, and to around 36,000 in 2004 (Hakkala and Kokko, 2007). Meanwhile, all domestic enterprises have been given the right to trade commodities freely since 2001 (Decision 46/2001/QD-TTg). This led to a strong increase in the number of enterprises registered for international trading activities, i.e., from 2,400 in early 1998 to around 18,000 in early 2004 (Thanh, 2005, pp. 77). All these meant potential opportunities for rural households to participate in nonfarm activities.[1]

There have also been some "push" factors in rural labor's pursuit for jobs in nonfarm sectors. Land constraints are still prevalent in Vietnam. The lack of cultivated land leads to a large seasonal unemployment in rural areas. Households with agricultural land of under 0.2 ha formed 23.37% of the rural population, 37.65% had between 0.2 ha and 0.5 ha and 17.21% had, between 0.5 ha and 1 ha (Rural Census, GSO, 2006). This has naturally forced rural households to participate in nonfarm activities.

Thus, Vietnam is particularly salient place to study the impact of nonfarm activities on poverty. The availability of household surveys that cover almost the entire decade of the 2000s allows exploring whether the background above helped the poor with exiting poverty. Minimum endowment requirements, possible low returns, and corresponding barriers to employment in nonfarm sectors seem to be strong challenges for poverty alleviation.

An also important problem associated with analyzing the impact of nonfarm activities on poverty reduction is the difficulty to identify the relationship econometrically due to reverse causality. Most studies do not address or by-pass this problem, thus, the exact magnitude of nonfarm activity impact on poverty is not accurately estimated. For instance, focusing on rural Vietnam for the 1990s, Walle and Cratty (2004) did not consider this issue; studies in other countries like Francisco and Peter (2001); Corral and Reardon (2001); Kijima et al (2006) also ignore this issue. Justino et al (2008) investigate the effects of change in rural

[1] In this paper, nonfarm activities include all economic activities outside agriculture, livestock, fishing and hunting.

employment in the main export sector on household welfare. To address the endogeneity problem, they use change in employment in the export sector at commune level rather than household level. We address the endogeneity problem by using the nonfarm employment network as instrument for the nonfarm employment. The reason why we utilize instrumental variable to address the endogeneity problem rather than variables at commune level is that using variables at commune level does not allow us to consider directly the impact of employment at household level on poverty or expenditure.

This paper will be organized as follows: Section II constructs theoretical model. Section III describes the data. Section IV provides descriptive statistics relating to nonfarm activity. Section V issues methodology and examine instrumental variable model specification. Section VI analyses the empirical results. Finally, we draw a conclusion in section VII.

## 2. Theoretical model

To illustrate how nonfarm activity can affect household expenditure growth, consider a household of *N* laborers that produce a farm good. Total farm production with L labours is AL - $\frac{bL^2}{2}$ (b>0), where A is land holding of households. The marginal product of farm labor is linearly increasing in land holdings and decreasing in the number of farm labor (L). As nonfarm labor markets begin to develop, the household may dedicate amount of its labor M to participate in nonfarm activity with a given wage w.

The households' problem is to choose M labours participating in nonfarm activity in order to maximize their income or consumption.

$$\text{Max } \Pi = AL - \frac{bL^2}{2} + wM \qquad (1)$$

$$\text{Subject to: } L + M = N \qquad (2)$$

Households will maximize their consumption based on the allocation of their labours into farm and nonfarm activity.

From equation (2), we have L = N – M. Inserting it into equation (1), we obtain:

$$\text{Max } \Pi = A(N-M) - \frac{b(N-M)^2}{2} + wM \qquad (3)$$

Taking first-order condition of equation (3) with respect to M, we have:

$$\Pi'_M = -A + b(N-M) + w \qquad (4)$$

A necessary condition for maximizing $\Pi$ is $\Pi'_M$ equal zero, yielding:

$$-A + b(N-M) + w = 0 \Rightarrow M^* = \frac{bN + w - A}{b} \qquad (5)$$

A sufficient condition for maximizing $\Pi$ is that the second-order condition of $\Pi$ with respect to M must be negative. From equation (4), we have the second-order condition of $\Pi$ with respect to M, yielding:

$$\Pi''_M = -b < 0$$

From the optimal nonfarm labor M* in (5), we see that household will send out a large number of nonfarm labours when total their labours (N) is large or nonfarm wage is high or household's land holdings are small.

**3. Data**

This study uses the Vietnamese Household Living Standards Surveys (VHLSSs) in 2002, 2004, 2006 and 2008. These surveys are nationally representative, and include two questionnaires at household and commune levels. The *household survey* contains detailed information on education, health, employment, housing, non-farm employment, food and non-food expenses, consumer durables, and credit. The *commune survey* provides information on infrastructure and institutions at the commune level. These surveys were implemented by the Vietnamese General Statistics Office with technical assistance from the World Bank, and funded by UNDP. The number of households covered in VHLSSs is: 22630 in 2002, 6938 in 2004, 6882 in 2006, and 6837 in 2008.

While the VHLSSs are comprehensive and methodologically sound, they do not observe the *same* households consistently over the period 2002-2008. Thus, the dynamism in the nonfarm activity-poverty relationship is initially analyzed by focusing on the data that relate to pairs of two years. The VHLSSs of 2002 and 2004 form a panel dataset covering 4,092 households observed in both years, of which 3,204 live in rural areas and 888 in urban areas. Similarly, the VHLSSs of 2004 and 2006 generate a panel dataset including 4,277 households, of which 3,277 households live in rural areas and 1,000 households in urban areas. Finally, the VHLSSs of 2006 and 2008 create a panel dataset covering 4,090 households, of which 3,113 households live in rural areas and 977 households reside in urban areas.

Further, the datasets of 2002, 2004 and 2006 jointly cover 1,952 households, of which 1,541 live in rural areas. There are also 1,835 households jointly covered in 2004, 2006 and 2008, of which 1,435 are rural households. Thus, we also use these samples for further inference. It is worthy of note that there is no link between the surveys of 2002 and 2008.[2]

We use the Vietnam General Statistics (GSO) poverty line to define poverty. The poverty lines are 1,915,000 VND per person per year in January 2002, 2,077,000 VND in January

[2] Note that due to urbanization in Vietnam, some rural households in a given year may have migrated to urban areas in the following year. This leaves some households out of the dataset. Thus, the datasets utilized in the regressions are: panel 2002-04 includes 3159 rural households; panel 2004-06 includes 3249 rural households; panel 2006-08 includes 3082 rural households; panel 2002-04-06 includes 1505 rural households; and panel 2004-06-08 includes 1421 rural households.

2004, 2,559,000 VND in January 2006, and 3,358,000 VND in January 2008. We use expenditure per capita as our main measure of household welfare.

## 4. Descriptive statistics

Table 1 provides the data on the percentage of farm and nonfarm households from 2002 to 2008. The results show that percentage of farm households accounts for about 50% and has a decreasing trend over time, while percentage of non-farm households increases over time. This shows that there is a shift of labor out of agriculture to non-farm activity.

Table 2 reports the percentage of nonfarm households in rural areas by regions. The results indicate that percentage of nonfarm households are the largest in two regions: Red River Delta and South East, with their percentage share increased dramatically over time. This is because these regions include Ho Chi Minh City and Hanoi as the largest industrial clusters. While the percentage of nonfarm households in mountainous areas like North East, North West and Central Highlands is smaller than the other regions and increases modestly, it only increased dramatically between 2002 and 2004, and then remained unchanged over the period 2004-08.

Table 3 presents the percentage of households participating in nonfarm activity by splitting per capita expenditure into five quintiles. The results show that the likelihood of participating in nonfarm activity increases with expenditure, meaning that the richer the households are, the higher the probability of partaking in nonfarm activity. In addition, percentage share of non-farm households among the rich remained unchanged from 2002 to 2008, among the middle and the relatively rich increased modestly over the period 2002-08. While percentage of non-farm households among the poor increased dramatically from 36.14 percent in 2002 to 47.04 percent in 2008. Meanwhile, the growth of nonfarm households among the poor is higher than among the poorest.

Dividing households into farm and nonfarm households, we find that mean per capita expenditure of nonfarm households is greater than that of farm households in both years 2002 and 2008 (Table 4). Specifically, the mean per capita expenditure of farm households and nonfarm households is 2363 and 3163 thousand dong in 2002 and 2008, respectively. Meanwhile, the gap of mean per capita expenditure between farm households and nonfarm households increased from 800 thousand dong in 2002 to 1656 thousand dong in 2008. Relating to access to land, in general, area of land of nonfarm households is smaller than that of farm households, suggesting that households with small land are more likely to participate in nonfarm activity. Nonfarm household head is one year younger than farm household head. Nonfarm households have larger size compared with farm households, this indicates that households with large size are more likely to supply labours for nonfarm activity.

## 5. Econometric Method

In our empirical analysis, we first investigate the common covariates which affect both nonfarm activity and poverty. Second, we analyse the impact of nonfarm activity on poverty by using instrumental variables estimation to address the endogeneity problem.

### 5. 1. Econometric models of nonfarm activity and poverty

Are there trade-offs between nonfarm activity and poverty reduction? Do the same variables affect both poverty and nonfarm in the same direction? For example, household size may have a negative impact on poverty but positive effect on participating in nonfarm activity. Likewise, access to agricultural land might reduce poverty but have a negative relationship with nonfarm activity. In order to better understand the background of the relationship in question, we estimate separate models that relate to the determinants of poverty and nonfarm participation with common explanatory variables. Our model for nonfarm activity is as follows:

$$Q_i = \alpha_1 + \alpha_2 D + \alpha_3 X_i + \varepsilon_i \quad (6)$$

$Q_i$ is equal to 1 if household has at least one member participating in nonfarm activity and zero if no member participating in nonfarm activity. D is dummy variable for regions. $X_i$ is a vector of exogenous household characteristics which include: age of the household head, education of household head and spouse, household size, number of adults and children, ethnicity of household head, land for annual crop, perennial crop, forest and surface water land. $\varepsilon_i$ is error term.

The poverty equation is:

$$P_i = \sigma_1 + \sigma_2 D + \sigma_3 X_i + \varepsilon_i \quad (7)$$

$P_i$ is equal to 1 if the $i^{th}$ household is poor and zero otherwise.

Because $Q_i$ and $P_i$ are binary variables, we use a probit model. We estimate these regressions using the datasets of 2002, 2004, 2006, and 2008, separately.

### 5.2. Non-parametric relationship between nonfarm activity and household endowments

Analysing the determinants of nonfarm activity and poverty allows us to consider the common covariates. However, is there a barrier to participating in nonfarm activity? Does an increase in household endowments lead to a rise in the probability of partaking in nonfarm activity? We answer these questions by estimating the non-parametric relationship between the probability of participating in nonfarm activity and household endowments. We regress the log of expenditure per capita on a set of exogenous variables (these variables are the same as in the model of determinants of poverty) using OLS estimation. We also regress nonfarm participation with the same set of exogenous variables above using Probit model. Then, we estimate non-parametrically the relationship between the probability that the household works in non-farm activity and its fitted log of expenditure per capita. This approach reduces significantly the reverse causation between nonfarm activity and expenditure per capita and the measurement error in expenditure (Du et al, 2005, p. 696).

### 5.3. Instrumental variables estimation

To investigate the effects of nonfarm activity on poverty, we use the probit model of the following sort:

$$P_i = \beta_1 + \beta_2 D + \beta_3 X_i + \beta_4 R_i + \varepsilon_i \quad (8)$$

where

$R_i$ is a measure of nonfarm activity, and $\varepsilon_i$ is the error term.

The main econometric problem with estimating the effect of nonfarm activity on poverty is endogeneity. First, unobservable factors at the household level such as ability, culture, and parental characteristics that affect nonfarm activity might also affect poverty. Also, reverse causation from poverty to nonfarm activity is very likely. Poverty can affect the probability of participating in nonfarm activity, and the participation may help move out of poverty. To address these issues, we instrument nonfarm activity with nonfarm networks.

For an accurate instrumentation, an instrumental variable needs to be valid, exogenous, and excludable from the equation of interest. We argue the validity of nonfarm networks based on migration networks literature (see Banerjee, 1984; Yap, Lorene Y. L, 1977). A number of studies use migration networks as instrument for migration. For instance, Brauw and Harigaya (2007) do so to study the impact of seasonal migration rural household welfare in Vietnam during the 1990s. See also Rozelle et al, 1999; Taylor et al, 2003; Du et al, 2005. Similarly, nonfarm networks can be used as an instrument for nonfarm activity. Kajisa (2007) shows the role of nonfarm networks in seeking a job in nonfarm activity. Indeed, the relationship among villagers in a village in rural Vietnam is still strong. And most of marriages occur within village, so people living in the same village are well known to each other. Many of them are relatives to each other. In addition, labor market imperfections are widespread such that rural people mostly access to job information from other people in the village, rather than through formal means. Therefore, nonfarm employment networks play an important role in seeking for employment opportunities in nonfarm economy. These arguments are supported statistically in our case in that the first-stage F-statistics exceed 10 (Stock and Yogo 2005). We use the past nonfarm participation rate at the village level as an instrument for current nonfarm activity. On the other hand, our regressions are at the household level, so nonfarm networks at the village level two years ago is considered to be exogenous. Finally, nonfarm networks at the village level two years ago is expected to have no effect on current poverty or household expenditure other than its effect through household's current participation in nonfarm activity, so it should be excludable.

We utilize three measures of nonfarm activity: i) number of household members partaking in nonfarm activity; ii) the ratio of household members participating in nonfarm activity to household size; iii) the ratio of household's working hours in nonfarm activity to total working hours. The first measure enables us to consider the participation of household members in nonfarm activity within the past twelve months and poverty and expenditure effect of an increase in one member working in nonfarm activity. However, the number of household members participating in nonfarm activity depends on number of household's working labours, if households have a big size, they would be more likely to send their members participating in nonfarm activity. Therefore, the second measure of nonfarm activity allows us to consider the relative magnitude of nonfarm employment. Another aspect

of nonfarm measurement is that the first two measures do not distinguish the length of different households' employment in nonfarm activity. For example, some households work in nonfarm activity for three months in a year, other households work for twelve months. Thus, we also utilize the number of household's hours in nonfarm activity as another measure. In sum, using three measures of nonfarm activity allows us to consider its impact through different lenses and check robustness of our results.

Thus, the first-stage nonfarm equation is:

$$R_{it} = \alpha_1 + \alpha_2 M_{t-1} + u_{it} \quad (9)$$

where $M_{t-1}$ is the share of people who participated in nonfarm activity to total working population at village level[3] in the previous period as instrument for the first and second measure of nonfarm activity or $M_{t-1}$ is the share of nonfarm working hours to total working hours at village level as instrument for the third measure of nonfarm activity.

To estimate equations (8) and (9), we need to use panel datasets including 2002-04, 2004-06 and 2006-08.

The above analysis only allows us to consider the statics of nonfarm activity while it ignores the impact of change in nonfarm activity on the dynamics of household's living standard. Next, we explore the effect of change in nonfarm activity on welfare of households as measured by expenditure growth. So, we have the following equation for expenditure growth:

$$Y_{it} = \gamma_1 + \gamma_2 D + \gamma_3 X_{it} + \gamma_4 R_{it} + e_i \quad (10)$$

where $Y_{it}$ is log expenditure per capita.

Taking the first difference of equation (10), we can eliminate the household-specific heterogeneity and obtain:

$$\Delta Y_{it} = \gamma_2 D + \gamma_3 X_{it-1} + \gamma_4 \Delta R_{it} + \Delta e_i \quad (11)$$

Equation (11) shows the effect of change in nonfarm activity on change in expenditure per capita. $X_{it-1}$ of equation (11) is initial characteristics of household that may affect change in expenditure. The unobservable factors may affect both changes in nonfarm activity and expenditure growth. Further, the wealth of households might affect the probability of participating in nonfarm activity, and nonfarm activity also helps households to increase their welfare or expenditure. To address the endogeneity problem, we use lagged change in nonfarm network size at village level as instrument for change in nonfarm activity at household level.

From equation (9), we have:

$$\Delta R_{it} = \alpha_3 \Delta M_{t-1} + \Delta u_{it} \quad (12)$$

[3] VHLSSs select one village to represent each commune. Therefore, when we refer to village level, we also refer to commune level.

Equation (12) is the first stage of regression of equation (11).

## 6. Empirical results

### 6.1. Determinants of and relationship between nonfarm activity and poverty

Table 5 reports the results of equation (6) and (7) on the marginal impact on the probability of being poor and participating in nonfarm activity for four years 2002, 04, 06, 08. The results are mostly consistent among years.

*Regional effects*

Estimation result shows that living in Red River Delta, South Central Coast, South East and Mekong River Delta has more probability of being non-poor and partaking in nonfarm activity compared with North Central. This is because these regions have a good infrastructure. This creates a favourable condition for developing nonfarm activity. Living in North East and Central Highlands (these are mountainous and hilly areas) are also more likely to be non-poor but the probability of partaking in nonfarm employment is significant only in 2006 and 2008 for North East and in 2008 for Central Highlands.

*Landholdings*

Access to land significantly increases the probability of being non-poor, but it has the opposite effect on nonfarm employment. Having more annual crop land increases the likelihood of being non-poor but lowers the likelihood of working in nonfarm activity. This finding is consistent with Walle and Cratty (2004, who examine nonfarm diversification and poverty in rural Vietnam in 1990s. However, they can not find evidence that access to perennial land is significant impact on poverty. While we find that households with more perennial land are more likely of becoming non-poor and have less probability of partaking in nonfarm employment. Also, access to water surface land helps rural household to become non-poor and reduces probability of participating in nonfarm activity.

*Characteristics of household head*

Household head who is a male reduces the probability of participating in nonfarm activity. This factor is highly significant for all years. However, this factor is not significant for poverty except for 2002. Relating to age of household head, we find that nonfarm participation has a U-inverted shaped relationship with age of household head, this shows that age of household head increases with the probability of working in nonfarm activity and then declines.

*Ethnic Minorities*

Households belonging to the Kinh ( the ethnic Vietnamese) or the Chinese are more likely of being non-poor and participating in nonfarm activity. This factor is highly significant for all years 2002, 04, 06, 08.

*Education*

Relating to education variables, the reference group is the household head which has no education. Household with better-educated heads has more probability of being non-poor and increase probability of participating in nonfarm activity, however, the impact of education on poverty has a decreasing trend over time. The results of education of the spouse also confirm this. The role of education on participating in nonfarm activity does not show clear trend.

*Household Characteristics*

An additional household member increases the likelihood of being poor but helps household to increase a chance of participating in nonfarm employment. This may be interpreted in the following way. An extra household member causes the pressure on consumption per capita, while it provides more working labours to find jobs outside the household's farm. Households with children under age 6 have more probability of becoming poor. Meanwhile it lowers the likelihood of participating in nonfarm activity. This shows that households with children under age 6 have to take care of their children, so they do not have opportunity to participating in nonfarm activity.

## 6.2. Graphical relationship between the probability of nonfarm activity and endowments

The non-parametric results for four years 2002, 04, 06 and 08 are shown in the Figure 1. The finding is that the relationship between the likelihood of non-farm employment and fitted log expenditure per capita is nonlinear. The probability of participating in nonfarm activity increases with endowment of households and then decreases. This finding is similar to that of Du, Park and Wang (2005) when they find an inverted-U shaped relationship between the probability of migration and fitted log income in rural China.

The turning points occur at values of fitted log expenditure per capita which are 9.0 in 2002 and 2004, 9.3 in 2004 and 9.8 in 2008, while values of log poverty line are 7.56, 7.64, 7.85, 8.12[4] in 2002, 04, 06 and 08, respectively. So, the probability of partaking in nonfarm activity for the poor is lower than for the non-poor. When we look at the tails of the graph on the left side, we find that a minimum level of resource is required for taking advantage of nonfarm-participating opportunities. Our analysis of determinants of nonfarm participation in Section 6.1 also shows that household size – represents for labor supply of households - plays an important role in participating in nonfarm activity, and education and landholdings are critical factors for facilitating nonfarm participation. Taken together, these results suggest that the poorest households in rural areas are not likely to participate in nonfarm activity. Moreover, Figure 1 shows that at the same level of endowment, the probability of taking part in nonfarm activity declines over time, except for the rich people in 2008. It means that households must have more resources to increase the probability of participating in nonfarm activity over time.

## 6.3. The effect of nonfarm activity on poverty

[4] The poverty lines are 1915, 2077, 2559 and 3358, they are equivalent to log poverty lines equal 7.56, 7.64, 7.85, 8.12 in 2002, 04, 06 and 08, respectively

The estimation results of equation (8) with and without instrumental variables for three measures of nonfarm activity: number of household members partaking in nonfarm activity, ratio of household members partaking in nonfarm activity and ratio of nonfarm-working hours to total working hours of households are reported in Table 6, 7 and 8, respectively. We present for three panel datasets 2002-04, 2004-06 and 2006-08. Estimating the effect of number of household members working in nonfarm activity on poverty without instrumental variables, Table 6 indicates that an additional household member working in nonfarm activity increases the probability of being nonpoor by 7.2 percent, 6.5 percent and 3.5 percent in 2004, 2006 and 2008, respectively. When we use instrumental variable, Table A1 which reports results of equation (9) shows that nonfarm network has a highly significant impact on number of household member participating in nonfarm activity for three panel datasets 2002-04, 2004-06 and 2006-08. F-statistics which are very high (greater than 10) for three panel datasets 2002-04, 2004-06 and 2006-08 indicate that instrument is strong. Table 6 suggests that P-values of Wald test for exogeneity are significant for all panel datasets. It means that we reject the null hypothesis that number of household members participating in nonfarm activity is exogenous, so it is necessary to use instrumental variable. Estimation results with instrumental variables in Table 6 show that the effects of number of members partaking in nonfarm activity are larger than that without instrument. An additional household member working in nonfarm activity increases the probability of being nonpoor by 11.3 percent, 10.1 percent and 6.8 percent in 2002-04, 2004-06 and 2006-08, respectively.

Relating to the second measure of nonfarm activity, Table 7 reports the estimation results for the impact of ratio of household members participating in nonfarm activity to total working people of household on poverty with and without instruments for three panel datasets 2002-04, 2004-06 and 2006-08. Estimation results without instrumental variable show that ratio of household members working in nonfarm activity increases the likelihood of being nonpoor by 31.7 percent, 26.9 percent and 14 percent in 2002-04, 2004-06 and 2006-08, respectively. When we use instrumental variable, Table A2 of Appendix which reports the results of the first stage regression of equation (9) indicate that nonfarm employment network has a strong correlation with the ratio of household members working in nonfarm activity in three panel datasets 2002-04, 2004-06 and 2006-08. F statistics which are very high (greater than 10) for three panel datasets 2002-04, 2004-06 and 2006-08 show that instrument is strong. P-values of Wald test for exogeneity in Table 7 are significant for all panel datasets. It means that ratio of members participating in nonfarm activity is exogenous, so the estimation results will be biased without using instrumental variable. Estimation results with instrumental variable show that the effects of ratio of members partaking in nonfarm activity are larger than that without instruments, particular, ratio of members working in nonfarm activity increase the probability of being nonpoor by 50.1 percent, 44.1 percent and 29.9 percent in 2002-04, 2004-06 and 2006-08, respectively. Thus, unobservable variables are correlated with both ratio of members working in nonfarm activity and poverty. In that case, estimation results without instrumental variable lower the effect of ratio of members partaking in nonfarm activity on poverty.

Table 8 presents the estimation results for the impact of ratio of nonfarm working hours to total working hours of household on poverty with and without instruments for three panel datasets 2002-04, 2004-06 and 2006-08. Table A2 in Appendix which presents results of first stage regression of equation (9) shows that nonfarm network – share of nonfarm working hours to total working hours at village level in the previous year – has a positive and significant impact on ratio of nonfarm hours to total working hours of household. Meanwhile, F-statistics are greater than 10. It means that instrument is not weak. Table 8 shows that Wald tests of exogeneity are significant at 1 percent, 5 percent and 5 percent for 2002-04, 2004-06, 2006-08, respectively, it means that ratio of nonfarm hours to total working hours of household is endogenous to poverty. The results of Table 8 show that effects of ratio nonfarm hours of household with instrumental variable are greater than that without instrumental variables.

In sum, the effect of nonfarm activity on poverty would be biased. It is necessary to use instrumental variable to address the endogeneity problem. The estimation results show that the effects of nonfarm activity with instrumental variables are greater than that without instrumental variable. Meanwhile the impact of nonfam activity on poverty reduced over time. These results are strong for three different measures of nonfarm activity in three panel datasets 2002-04, 2004-06 and 2006-08. Our results suggest that persistent poor people has lower nonfarm return compared with other poor people.

### 6.4. The effect of nonfarm activity on welfare

Table B1 in Appendix reports the results of first stage model of equation (12) for panel dataset 2002-04-06 and Table B2 reports those for panel dataset 2004-06-08. We use lagged change in ratio of people working in nonfarm activity at village level as instrument for both measures of nonfarm activity: number of household members and ratio of household members working nonfarm activity. The results of Table B1 and B2 in Column (1) and (2) indicate that lagged change in ratio of people working in nonfarm activity at village level has a negative and significant impact on the change in number or ratio of household members working in nonfarm activity in both panel datasets 2002-04-06 and 2004-06-08. It means that growth in number or ratio of household members working in nonfarm activity will decline in the village with previous high growth in nonfarm employment, specifically, one percent increase in growth of ratio of people working in nonfarm activity at village in previous period led to 1.24 per cent reduction in growth of number of household members working in nonfarm activity in the following period for panel dataset 2002-04-06 (Column (1) of Table B1) and 0.78 percent for panel dataset 2004-06-08 (Column (1) of Table B2). Similarly, Table B1 and B2 of Column (3) suggest that lagged change in ratio of working hours in nonfarm activity at village level reduces change in ratio of household's working hours in nonfarm activity in both panel dataset 2002-04-06 and 2004-06-08. In all specifications and both panel datasets 2002-04-06 and 2004-06-08, F-statistics for instrument are greater than 10. So, we reject the hypothesis that instrument is weak.

In addition, Table 9 and 10 show that P-values for endogenous test statistics are statistically significant except for the model in Column (4) of panel dataset 2004-06-08, the P-value is

equal to 17.8 percent. This shows there is endogeneity problem between change in expenditure per capita and three measures of nonfarm activity. Therefore, OLS estimation will be biased, it is necessary to use instrumental variable.

Table 9 and 10 reports the results for equation (11) on the effect of three measures of nonfarm activity on expenditure growth. Estimating the effect of change in number of household members working in nonfarm activity on expenditure growth using OLS, we find a small coefficient (0.007) in 2002-04-06 and statistically insignificant coefficient (Column 1 of Table 9). Meanwhile, change in number of household members working in nonfarm activity had a significant impact on, but unexpected sign for expenditure growth in 2004-06-08 (Column 1 of Table 10). When we estimate equation (11) using instrumental variable estimation, we find that change in number of household members working in nonfarm activity had a positive and highly significant impact on expenditure growth in panel dataset 2002-04-06 (Column 2 of Table 9) and is statistically significant at nearly 10 percent (P-value equals 13 percent) in panel dataset 2004-06-08 (Column 2 of Table 10). Specifically, one percent increase in number of household member participating in nonfarm activity increased expenditure growth by 12.3 percent in panel dataset 2002-04-06 and by 13.2 percent in panel dataset 2004-06-08.

Relating to the second measure of nonfarm activity: ratio of household members working in nonfarm activity, OLS estimation results on the expenditure growth impact of change in ratio members participating in nonfarm activity show that it is statistically significant at 10 percent in panel dataset 2002-04-06 (Column 3 of Table 9) and statistically insignificant in panel dataset 2004-06-08 (Column 3 of Table 10) in panel dataset 2004-06-08. When we use instrumental variable, the results suggest that change in ratio of household members partaking in nonfarm activity is highly statistically significant in panel dataset 2004-06-08 (Column 4 of Table 9) and significant at nearly 10 percent (P-value equals 12 percent) (Column 4 of Table 10). We find that one percent rise in ratio of household members participating in nonfarm activity increased expenditure growth by 47.4 percent in 2002-04-06 and 45.2 percent in 2004-06-08. We also find that estimation coefficient with instrumental variable is much greater than one without instrumental variable.

Finally, using OLS estimation, we show that change in ratio of household's working hours in nonfarm activity is statistically insignificant and has unexpected sign for both panel datasets 2002-04-06 (Column 5 of Table 9), and has expected sign but statistically insignificant in 2004-06-08 (Column 5 of Table 10). When we use instrumental variable, we find that this factor has a positive and statistically significant impact on expenditure growth in both panel datasets 2002-04-06 and 2004-06-08. Specifically, one percent increase in ratio of household's working hours in nonfarm activity led to a rise in expenditure growth by 33.4 percent and 38.6 percent in panel datasets 2002-04-06 and 2004-06-08, respectively. Thus, Instrumental variable coefficients are much larger than those of OLS estimation.

Estimating the effects of change in nonfarm activity on expenditure growth without instrumental variable leads to downward bias. This is because unobservable factors may be correlated with both nonfarm participation and expenditure growth. For example, household

members with poor ability in farm may have had more probability of working in nonfarm activity. While they work on farm, they still participate in nonfarm activity. In that case, the OLS coefficient would both measure the effect of nonfarm activity and poor ability in farm on expenditure growth, and the estimated coefficient would be lower than the true effect of nonfarm activity on expenditure growth.

## 7. Conclusion

This paper uses Vietnam Households Living standards Surveys covering almost of the whole 2000s: 2002, 2004, 2006 and 2008 to examine the impact of nonfarm activity on poverty reduction in rural areas. We find that the probability of partaking in nonfarm activity increases and then decrease with the endowment of households. We also show that there is an entry barrier for the poorest in participating in nonfarm activity. This means that nonfarm activity helps the poor but not the poorest. Therefore, the government needs to support the poorest in rural areas so that they may have a minimum endowment for participating in nonfarm activity.

Meanwhile we use instrumental variable: nonfarm employment networks to address the endogeneity problem between nonfarm activity and poverty. We use three measures of nonfarm activity, they are: number of household members partaking in nonfarm activity, ratio of household members participating in nonfarm activity and ratio of nonfarm-working hours to total working hours of household. Our results indicate that nonfarm participation helps rural household to become non-poor, however, this impact decrease over time.

Finally, we consider the impact of change in nonfarm activity on change in expenditure, also using three measures of nonfarm activity as above. We find that change in number or ratio of household members participating in nonfarm activity or ratio of nonfarm-working hours to total working hours of household has a positive impact on expenditure growth. The results will be biased downward without using instrumental variable.

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**Table 1: Percentage of households working in agriculture and non-farm activity over time**

| | 2002 | 2004 | 2006 | 2008 |
|---|---|---|---|---|
| Households working only on the farm | 54.75 | 50.78 | 49.72 | 49.29 |
| Households with at least one member working in nonfarm activity | 45.25 | 49.22 | 50.28 | 50.71 |
| **Total** | **100** | **100** | **100** | **100** |

Source: Calculation's authors based on the VHLSSs

**Table 2: Percentage of households working in non-farm activity by regions**

| Region | 2002 | 2004 | 2006 | 2008 |
|---|---|---|---|---|
| Red River Delta | 59.36 | 65.68 | 66.27 | 69.72 |
| North East | 30.57 | 37.32 | 39.08 | 36.16 |
| North West | 14.96 | 23.69 | 20.66 | 23.06 |
| North Central | 39.67 | 45.47 | 44.01 | 40.66 |
| South Central Coast | 59 | 59.43 | 60.34 | 58.03 |
| Central Highlands | 20.34 | 27.29 | 28.3 | 27.82 |
| South East | 51.03 | 57.51 | 59.53 | 65.09 |
| Mekong River Delta | 46.79 | 47.45 | 50.64 | 51.3 |

Source: Calculation's authors based on the VHLSSs

**Table 3: Percentage of nonfarm households by each expenditure per capita quintile**

| Quintile | 2002 | 2004 | 2006 | 2008 |
|---|---|---|---|---|
| The poorest | 21.11 | 23.56 | 25.93 | 27.85 |
| The poor | 36.14 | 43.01 | 44.84 | 47.04 |
| The middle | 48.56 | 54.65 | 53.59 | 52.27 |
| The relatively rich | 55.35 | 59.01 | 60.54 | 61.38 |
| The rich | 65.08 | 65.9 | 66.5 | 65.03 |

Source: Calculation's authors based on the VHLSSs

**Table 4: Characteristics of households by farm/nonfarm status**

| | 2002 | | 2008 | |
|---|---|---|---|---|
| | Farm households | Nonfarm households | Farm households | Nonfarm households |
| Mean per capita expenditure | 2363 | 3163 | 5587 | 7243 |
| | (1491) | (1765) | (3839) | (4459) |
| Annual crop land | 5.175 | 2.607 | 5.833 | 2.707 |
| | (8.15) | (5.515) | (11.07) | (6.274) |
| Perennial crop land | 1.695 | 0.757 | 1.758 | 1.03 |
| | (5.285) | (3.572) | (8.636) | (6.35) |
| Forest land | 2.401 | 0.563 | 2.257 | 0.904 |
| | (12.939) | (4.97) | (14.299) | (11.166) |
| Water surface land | 0.524 | 0.198 | 0.628 | 0.374 |
| | (5.532) | (1.827) | (7.102) | (2.914) |
| Age of household head | 47.6 | 46.6 | 50.4 | 48.7 |
| | (15.3) | (13.3) | (14.9) | (12.4) |
| Household size | 4.5 | 4.6 | 4.0 | 4.3 |
| | (1.94) | (1.66) | (1.8) | (1.52) |

*Note: Standard deviations are in the parentheses.*

Source: Calculation's authors based on the VHLSSs

**Table 5: Determinants of poverty and non-farm employment of rural households (marginal effects)**

Dependent variable for poverty regression equals 1 if households are poor, otherwise 0

Dependent variable for nonfarm regression equals 1 if households participate in nonfarm, otherwise 0

| | 2002 | | 2004 | | 2006 | | 2008 | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| VARIABLES | Poverty | Nonfarm | Poverty | Nonfarm | Poverty | Nonfarm | Poverty | Nonfarm |
| Red River Delta | -0.107*** | 0.197*** | -0.099*** | 0.197*** | -0.098*** | 0.228*** | -0.064*** | 0.286*** |
| North East | -0.099*** | 0.018 | -0.101*** | 0.030 | -0.085*** | 0.073*** | -0.068*** | 0.057** |
| North West | -0.012 | -0.034 | -0.046* | 0.094** | -0.042** | 0.056 | -0.057*** | 0.064 |
| **North Central (reference group)** | | | | | | | | |
| South Central Coast | -0.173*** | 0.260*** | -0.108*** | 0.216*** | -0.107*** | 0.236*** | -0.075*** | 0.219*** |
| Central Highlands | -0.015 | -0.016 | -0.090*** | -0.043 | -0.072*** | -0.029 | -0.080*** | -0.071** |
| South East | -0.251*** | 0.223*** | -0.182*** | 0.203*** | -0.134*** | 0.259*** | -0.132*** | 0.278*** |
| Mekong River Delta | -0.273*** | 0.217*** | -0.175*** | 0.149*** | -0.157*** | 0.210*** | -0.119*** | 0.227*** |
| **Landholdings** | | | | | | | | |
| Annual crop land | -0.008*** | -0.013*** | -0.006*** | -0.011*** | -0.004*** | -0.014*** | -0.004*** | -0.012*** |
| Perennial crop land | -0.013*** | -0.013*** | -0.009*** | -0.010*** | -0.007*** | -0.010*** | -0.002*** | -0.004*** |
| Forest land | -0.001* | -0.002*** | -0.0004 | -0.001 | -0.001* | -0.001** | -0.001** | -0.001 |
| Water surface land | -0.001** | -0.017*** | -0.010*** | -0.017*** | -0.006** | -0.008*** | -0.004** | -0.006*** |
| Sex of household head | 0.027** | -0.102*** | 0.018 | -0.091*** | 0.010 | -0.083*** | 0.015 | -0.083*** |
| Age of household head | -0.011*** | 0.003* | -0.004 | 0.004 | -0.007*** | 0.004 | -0.009*** | 0.002 |
| Age of household head-squared | .00009*** | -.00004** | 0.00003 | -.000064* | .00006*** | -0.00006* | .00211*** | -0.00004 |
| Ethnicity of household head | -0.286*** | 0.254*** | -0.309*** | 0.291*** | -0.233*** | 0.264*** | -0.251*** | 0.268*** |
| **Education of household head (no education as a reference group)** | | | | | | | | |
| Vocational education | -0.269*** | 0.322*** | -0.174*** | 0.270*** | -0.136*** | 0.289*** | -0.121*** | 0.264*** |
| Upperschool education | -0.202*** | 0.169*** | -0.130*** | 0.153*** | -0.118*** | 0.221*** | -0.089*** | 0.176*** |
| Lowerschool education | -0.137*** | 0.096*** | -0.140*** | 0.085*** | -0.118*** | 0.149*** | -0.111*** | 0.095*** |
| Primary school education | -0.097*** | 0.077*** | -0.091*** | 0.063*** | -0.065*** | 0.067*** | -0.073*** | 0.069*** |
| **Education of spouse of household head (no education as a reference group)** | | | | | | | | |
| Vocational education | -0.265*** | 0.348*** | -0.192*** | 0.303*** | -0.135*** | 0.245*** | -0.111*** | 0.319*** |
| Upperschool education | -0.173*** | 0.172*** | -0.101*** | 0.095*** | -0.083*** | 0.139*** | -0.072*** | 0.134*** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lowerschool education | -0.112*** | 0.078*** | -0.072*** | 0.079*** | -0.059*** | 0.029 | -0.070*** | 0.057** |
| Primary school education | -0.075*** | 0.052*** | -0.046*** | 0.032* | -0.034*** | 0.017 | -0.036*** | 0.065*** |
| Household size | 0.056*** | 0.054*** | 0.034*** | 0.064*** | 0.027*** | 0.078*** | 0.028*** | 0.081*** |
| Number of household member with age between 45 and 55 | -0.045*** | 0.022*** | -0.031*** | 0.039*** | -0.015** | 0.015 | -0.009 | 0.023** |
| Number of household member with age over 55 | -0.076*** | 0.044** | -0.094*** | 0.003 | -0.004 | -0.037 | -0.002 | 0.014 |
| Number of household member with age under 3 | -0.029** | 0.045*** | -0.012 | 0.011 | -0.007 | 0.016 | 0.012 | -0.025 |
| Number of household member with age under 6 | 0.112*** | -0.036*** | 0.087*** | -0.030* | 0.066*** | -0.036** | 0.037*** | -0.023 |
| Number of female household member with age over 55 | 0.052** | -0.068*** | 0.077** | -0.006 | -0.002 | 0.048 | -0.005 | -0.045 |
| Number of male household member with age over 60 | 0.026 | -0.021 | 0.063** | 0.006 | -0.015 | -0.016 | -0.024 | -0.032 |
| **Observations** | **22,620** | **22,620** | **6,938** | **6,938** | **6,882** | **6,882** | **6,837** | **6,837** |

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level

**Figure 1: Probablity that household participates in nonfarm employment**

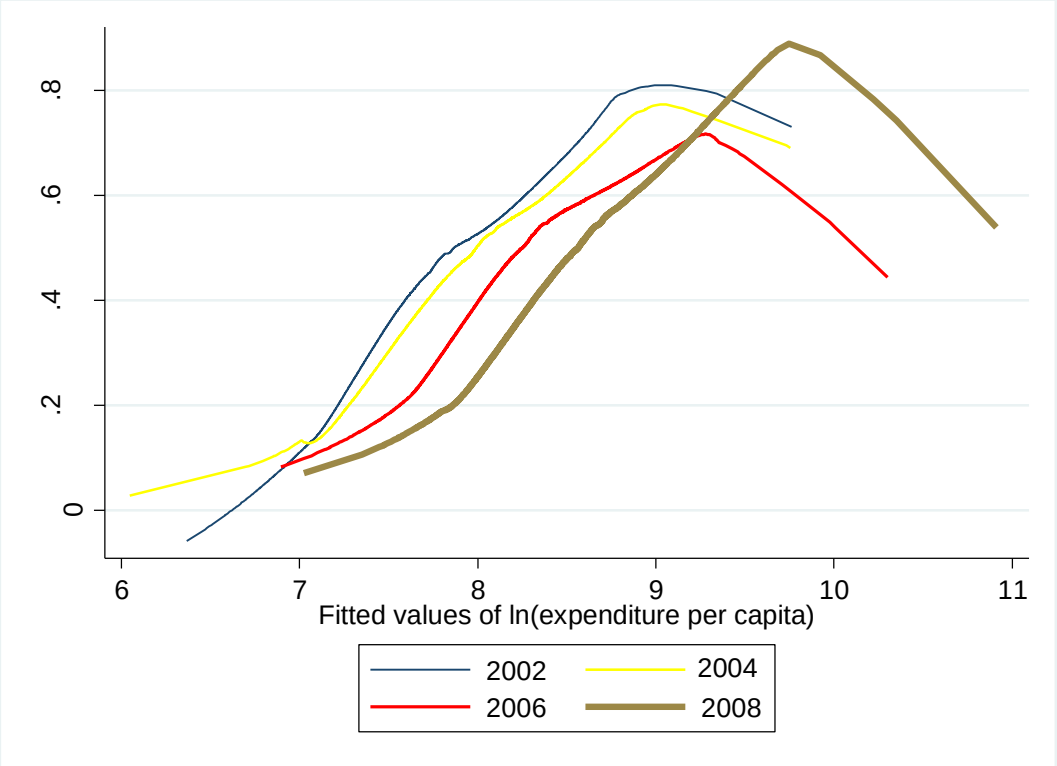


**Table 6 : Marginal effects of number of members working in nonfarm activity on poverty**

(Dependent variable is: 1 if household is poor, 0 otherwise)

| | 2002-04 | | 2004-06 | | 2006-08 | |
|---|---|---|---|---|---|---|
| | Probit | IV | probit | IV | probit | IV |
| Number of members working in non-farm activities | -0.072*** | -0.113*** | -0.065*** | -0.101*** | -0.035*** | -0.068*** |
| Control for dummy for regions | yes | yes | yes | yes | yes | yes |
| Control for characteristics of households | yes | yes | yes | yes | yes | yes |
| Number of observation | 3159 | 3159 | 3249 | 3249 | 3082 | 3082 |
| F-statisitics | | 990.33 | | 1106.59 | | 1137.38 |
| Wald test of exogeneity (/athrho = 0): Prob > chi2 = | | 0.0008 | | 0.0115 | | 0.0054 |

*** Significant at the 1% level

**Table 7: Marginal effects of ratio of nonfarm-working household members on poverty**

(Dependent variable is: 1 if household is poor, 0 otherwise)

| | 2002-04 | | 2004-06 | | 2006-08 | |
|---|---|---|---|---|---|---|
| | Probit | IV | probit | IV | probit | IV |
| Ratio of members working in nonfarm activities | -0.317*** | -0.501*** | -0.269*** | -0.441*** | -0.140*** | -0.299*** |
| Control for dummy for regions | yes | yes | yes | yes | yes | yes |
| Control for characteristics of households | yes | yes | yes | yes | yes | yes |
| Number of observation | 3159 | 3159 | 3249 | 3249 | 3082 | 3082 |
| F-statisitics | | 1119.58 | | 1306.19 | | 1276.62 |
| Wald test of exogeneity (/athrho = 0): Prob > chi2 = | | 0.0007 | | 0.0049 | | 0.0022 |

*** Significant at the 1% level

**Table 8: Marginal effects of ratio of nonfarm-working hours on poverty**

(Dependent variable is: 1 if household is poor, 0 otherwise)

| | 2002-04 | | 2004-06 | | 2006-08 | |
|---|---|---|---|---|---|---|
| | Probit | IV | probit | IV | probit | IV |
| Ratio of nonfarm hours to total working hours of household | -0.202*** | -0.296*** | -0.158*** | -0.230*** | -0.108*** | -0.169*** |
| Control for dummy for regions | yes | yes | yes | yes | yes | yes |
| Control for characteristics of households | yes | yes | yes | yes | yes | yes |
| Number of observation | 3159 | 3159 | 3249 | 3249 | 3082 | 3082 |
| F-statisitics | | 1283.71 | | 1633.64 | | 1641.99 |
| Wald test of exogeneity (/athrho = 0): Prob > chi2 = | | 0.0025 | | 0.0252 | | 0.0477 |

*** Significant at the 1% level

## Table 9: The effect of change in nonfarm activity on change in expenditure per capita for the panel dataset 2002-04-06

| | Dependent variable: Δ log (expenditure per capita) | | | | | |
|---|---|---|---|---|---|---|
| VARIABLES | OLS | IV | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Chang in number of household members working in nonfarm activity | 0.007 | 0.123*** | | | | |
| Change in ratio of household members working in nonfarm activity | | | 0.091* | 0.474*** | | |
| Change in ratio of household's working hours in nonfarm activity | | | | | -0.001 | 0.334** |
| Control for dummy for regions | yes | yes | yes | yes | yes | yes |
| Control for initial characteristics of households | yes | yes | yes | yes | yes | yes |
| Number of observations | 1,505 | 1,505 | 1,505 | 1,505 | 1,505 | 1,505 |
| P-values of endogenous test statistics | | 0.0092 | | 0.0241 | | 0.0066 |
| F-statistics for instruments | | | | | | |

*** p<0.01, ** p<0.05, * p<0.1

Note: Dependent variable is the change in log of expenditure per capita between 2006 and 2004. Instruments are the lagged change in nonfarm network size that is the change between 2002 and 2004. Initial characteristics of households are characteristics in 2004.

## Table 10: The effect of change in nonfarm activity on change in expenditure per capita for the panel dataset 2004-06-08

| | Dependent variable: Δ log (expenditure per capita) | | | | | |
|---|---|---|---|---|---|---|
| VARIABLES | OLS | IV | OLS | IV | OLS | IV |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Change in number of household members working in nonfarm activity | -0.024** | 0.132 (p-value 0.13) | | | | |
| Change in ratio of household members working in nonfarm activity | | | 0.074 | 0.452 (p-value 0.12) | | |
| Change in ratio of household's working hours in nonfarm activity | | | | | 0.017 | 0.386** |
| Control for dummy for regions | yes | yes | yes | yes | yes | yes |
| Control for initial characteristics of households | yes | yes | yes | yes | yes | yes |
| Number of observations | 1,421 | 1,421 | 1,421 | 1,421 | 1,421 | 1,421 |
| P-values of endogenous test statistics | | 0.0581 | | 0.1775 | | 0.0468 |
| F-statistics for instruments | | 34.18 | | 47.98 | | 54.1 |

*** p<0.01, ** p<0.05, * p<0.1

Note: Dependent variable is the change in log of expenditure per capita between 2006 and 2004. Instruments are the lagged change in nonfarm network size that is the change between 2002 and 2004. Initial characteristics of households are characteristics in 2006.

## APPENDIX

### Table A1: Results of first stage

(Dependent variable: number of household members working in nonfarm activity)

| VARIABLES | 2002-04 | 2004-06 | 2006-08 |
|---|---|---|---|
| Lag of share of nonfarm-participating to total working people at village level | 2.497*** | 1.897*** | 2.179*** |
| Constant | 0.185*** | 0.256*** | 0.212*** |
| Observations | 3,159 | 3,249 | 3,082 |
| F-statistics | 990.33 | 1106.59 | 1137.38 |
| R-squared | 0.2388 | 0.2542 | 0.2697 |

*** p<0.01

### Table A2: Results of first stage
### (Dependent variable: ratio of members partaking in nonfarm activity)

| VARIABLES | 2002-04 | 2004-06 | 2006-08 |
|---|---|---|---|
| Lag of share of nonfarm-participating to total working people at village level | 0.585*** | 0.485*** | 0.529*** |
| Constant | 0.041*** | 0.054*** | 0.052*** |
| Observations | 3,159 | 3,249 | 3,082 |
| F-statistics | 1119.58 | 1306.19 | 1276.62 |
| R-squared | 0.262 | 0.287 | 0.293 |

*** p<0.01

### Table A2: Results of first stage
### (Dependent variable: ratio of nonfarm hours to total working hours of household)

| VARIABLES | 2002-04 | 2004-06 | 2006-08 |
|---|---|---|---|
| Lag of share of nonfarm working hours to total working hours at village level | 0.842*** | 0.742*** | 0.755*** |
| Constant | 0.063*** | 0.079*** | 0.067*** |
| Observations | 3,159 | 3,249 | 3,082 |
| F-statistics | 1283.71 | 1633.64 | 1641.99 |
| R-squared | 0.289 | 0.335 | 0.348 |

*** p<0.01

## Table B1: Results of first stage for panel dataset 2002-04-06

| VARIABLES | (1) | (2) | (3) |
|---|---|---|---|
| Lagged change in ratio of people working in nonfarm activity at village | -1.235*** | -0.313*** | |
| Lagged change in ratio of working's hours in nonfarm activity at village | | | -0.380*** |
| Constant | 0.044* | 0.019*** | 0.046*** |
| Observations | 1,505 | 1,505 | 1,505 |
| F-statistics | 90.96 | 109.7 | 100.55 |
| R-squared | 0.057 | 0.068 | 0.063 |

*** p<0.01, ** p<0.05, * p<0.1

Note: - In Column (1), dependent variable is change in number of household members working in nonfarm activity.

- In Column (2), dependent variable is change in ratio of household members working in nonfarm activity.
- In Column (3), dependent variable is change in ratio of household's working hours in nonfarm activity.

## Table B2: Results of first stage for panel dataset 2004-06-08

| VARIABLES | (1) | (2) | (3) |
|---|---|---|---|
| Lagged change in ratio of people working in nonfarm activity at village | -0.768*** | -0.208*** | |
| Lagged change in ratio of working's hours in nonfarm activity at village | | | -0.286*** |
| Constant | 0.112*** | 0.032*** | 0.018** |
| Observations | 1,421 | 1,421 | 1,421 |
| F-statistics | 34.18 | 47.98 | 54.1 |
| R-squared | 0.024 | 0.033 | 0.037 |

*** p<0.01, ** p<0.05, * p<0.1

Note: - In Column (1), dependent variable is change in number of household members working in nonfarm activity.

- In Column (2), dependent variable is change in ratio of household members working in nonfarm activity.
- In Column (3), dependent variable is change in ratio of household's working hours in nonfarm activity.