Discussion Paper Series

RIEB

Kobe University

DP2012-25

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Revised November 30, 2012

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First Draft: 3rd September 2012
This Draft: 29th November 2012

Abstract

The present study examines whether employment in the rural non-farm sector (RNFE) has any poverty-reducing and/or vulnerability-reducing effect in Vietnam and India. To take account of sample selection bias associated with RNFE, we have applied treatment-effects model, a variant of Heckman sample selection model. It is found that log per capita consumption or log mean per capita expenditure (MPCE) significantly increased as a result of access to RNFE in Vietnam and India - which is consistent with poverty reducing role of accessing RNFE - with the aggregate effect larger in Vietnam than in India. Access to RNFE significantly reduces vulnerability too in both countries, implying that diversification of household activities into non-farm sector would reduce such risks. When we disaggregate non-farm sector employment by its type, we find that poverty and vulnerability reducing effects are much larger for sales, professionals, and clerks than for unskilled or manual employment in the non-farm sector in both countries. However, as even unskilled or manual non-farm employment significantly reduces poverty and vulnerability in India and poverty in some years in Vietnam, this has considerable policy significance as the rural poor do not have easy access to skilled non-farm employment.

Key Words: Poverty, Vulnerability, Non-farm sector, Treatment Effects Model, Vietnam, India
JEL Codes: C21, C31, I32, O15

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Acknowledgements
This project is funded by IFAD. We acknowledge valuable comments and advice from Samuel Annim, Md. Azam, Md. Faruq Hassan, Woojing Kang, Armando Barrientos, and Takahiro Sato. We thank Woojin Kang for preparing VHLSS Data sets at the early stage of the project. The views expressed are, however, those of the authors' and do not necessarily represent those of the organisations to which they are affiliated.

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1. Introduction

Across the developing world, it is well recognized that rural economies are not purely agricultural and farm households earn an increasing share of their income from non-farm activities. Traditionally, rural non-farm economy (RNFE) was considered to be a low-productivity sector diminishing over time where agricultural households simply supplement their income. But, since the late 1990s, its role in economic growth and poverty reduction began to be increasingly recognised given the increasing share of RNFE across developing countries (e.g. Lanjouw and Lanjouw, 2001, Haggblade, et al., 2010). The share of income from RNFE in total rural income varies - from 34% in Africa, to 47% in Latin America and 51% in Asia, but it is recognised that RNFE is becoming increasingly important in terms of its share and growth as well as potential roles in poverty reduction in Asia, particularly in emerging countries, such as China and India. Although most of the low and middle-income Asian countries traditionally relied on agriculture, they have undergone structural changes in recent years, due to industrialisation and globalisation as well as commercialisation of agriculture.

Within Asia, the share of income from RNFE varies from over 70% for the Philippines and Sri Lanka to below 40% for China, India and Nepal. With constraints on farm expansion and continuing growth of rural population, greater attention is thus being given to non-farm activities. Policy interest in RNFE arises not just because of its significance in generating incomes, but also because of its increasing importance in creating employment, especially for rural women and the poor.

Among Asian countries, the present study focuses on two countries – Vietnam and India, both of which experienced impressive economic growth but varying poverty reduction

in recent years. These two countries are characterised by high average GDP per capita growth rate in 1990-2010 (Vietnam 5.8%; India 4.9%) and a decreasing share of agricultural value added in GDP in the same period (Vietnam 39% to 20%; India 29% to 16%). Poverty indices have declined during this period, but there is a variation in the speed of poverty reduction. While Vietnam experienced a faster poverty reduction in terms of headcount ratio based on US$1.25 (64% in 1993 to 21% in 2006, further down to 13% in 2008), the speed of poverty reduction has been relatively slow in India (49% in 1994 to 42% in 2005). As shown by Imai et al. (2012a, b) and Gaiha et al. (2012 a, b), the speed of improvement in nutritional indicators has been slow in India in recent years despite the country's economic growth. There is a need for investigating the reasons for diverse progress in income and non-income poverty focusing on household's livelihood strategies, including the choice of farm and non-farm employment. The present study will aim to provide insights into varying pace of poverty reduction and vulnerability in these two countries.

The main hypothesis we examine is whether access to RNFE reduces poverty and a related but distinct aspect, vulnerability, defined as a probability of falling into poverty in the next period, in rural areas in Vietnam and India. We focus only on rural areas because rural economy is distinct from urban economy in its structure and rural poverty is still predominant in these countries. We will use Vietnam Household Living Standards Survey (VHLSS) in 2002, 2004 and 2006 for Vietnam and National Sample Survey Data in 1993-4 and 2004-5 for India. Given the sample selection bias associated with access to RNFE or non-farm sector employment and the data structure where only large cross-sectional data are available and the panel data are not available[1], we will apply treatment effects model, a variant of Heckman two-step sample selection model (Heckman, 1979). We also examine

[1] It is possible to construct a small panel based on the intersections of different rounds of household cross-sectional data of VHLSS in Vietnam, but attrition bias is serious as only a small subset of the total households were revisited.

whether the effect of reducing poverty and vulnerability is different among different types of non-farm sector employment, namely, "unskilled manual work", "production", "sales", and "professionals/ clerk".

While the farm or agricultural sector has played a central role in these countries, the share of non-farm activities has increased significantly in recent years. However, detailed empirical studies estimating the direct and/or indirect effects of rural non-farm income or employment on poverty remain limited and the present study seeks to fill this gap. The rest of the paper is organised as follows. The next section reviews extant studies on the effects of non-farm sector on poverty in Vietnam and India. Section 3 briefly summarises the data sets we will use. Sections 4 and 5 discuss the specification of econometric models and results, respectively. Concluding observations are offered in the final section.

2. The Literature

While the farm or agricultural sector has played a central role in Vietnam and India, the share of non-farm has increased significantly in recent years. However, formal empirical studies to estimate the direct and/or indirect effects of income or employment in non-farm sector employment on poverty are still few. On the direct effects, van de Walle and Cratty (2004) using VLSS data on Vietnam in 1993 and 1998 found significant effects of non-farm employment in reducing poverty. While van de Walle and Cratty (2004) claim that they consider the endogeneity of non-farm sector in reducing poverty, they simply estimated the share of hours worked in non-farm sector in total (or the probability of participating in non-farm sector) and poverty separately and compared the signs and statistical significance of coefficient estimates of explanatory variables without taking account of simultaneity. Thus their results are only suggestive of different covariates of non-farm employment and poverty. Informal evidence from India and Bangladesh suggests that indirect effects also matter, for

example, the labour market tightening, or expansion of casual non-farm employment is strongly correlated with growth in agricultural wages. While building upon van de Walle and Cratty (2004), our proposed research applies improved methodologies to take account of the endogeneity issues to more comprehensive and recent data sets.

RNFE would be potentially important for breaking the poverty traps through various routes - such as lack of education and/or nutrition. For example, people who are educated at secondary school or higher are likely to have a higher probability of finding a job in rural non-farm sector (e.g. in trading, manufacturing office works) and their children tend to be more educated, which causes a 'virtuous' circle (e.g. Knight et al., 2009, 10). However, those who are not educated tend to be trapped in a 'vicious' circle. Likewise, undernourished people tend to be trapped in poverty as low nutritional levels imply low efficiency and high probability of being unemployed as predicted by the efficiency-wage hypothesis (e.g. Bliss and Stern, 1978, Dasgupta and Ray, 1986, 87). The poverty-nutrition hypotheses have been recently examined by Jha et al. (2009) and Imai et al. (2012a) in the context of rural India. Reardon et al. (2000) also emphasises the barriers faced by poor households that prevent them from investing in non-farm assets, suggesting the existence of the poverty trap. That is, it is not an automatic process for poor agricultural households to enter into the non-farm sector. Unlike agricultural jobs, rural non-farm employment tends to be less physically intensive and requires lower calories, as the activity intensity determines the nutritional status in rural India (Imai et al. (2012b). Since RNFE tend to better promote food security to the poor than farm employment (Owsu et al., 2011), the former has the potential to break the poverty trap.

3. Data

Vietnamese Data

We will use Vietnam Household Living Standards Surveys (VHLSS) 2002, 2004, and 2006. The VHLSSs were initially implemented in 2002 to collect detailed household and commune level data. These are multi-topic household surveys with nationally representative household samples. They commonly cover a wide range of issues, including household composition and characteristics (e.g. education and health); detailed record on expenditure for both food and non-food items, health and education; employment and labour force participation (e.g. duration of employment and the precise categories of occupations); income by sources (e.g. salary/wage, payment in cash and in kind, farm and non-farm production etc.); housing, ownership of assets and durable goods; and participation of households in anti-poverty programs. Commune level surveys collect data on demography, economic conditions, agricultural production, and non-farm employment, local infrastructure, public services such as education and health facilities. Occupational code of employment provided by VHLSS would enable us to classify non-farm sector employment in several sub-components broadly defined (i.e., manual/unskilled; production; sales; professionals/clerk).

Indian Data

The NSS, set up by the Government of India in 1950, is a multi-subject integrated sample survey conducted all over India in the form of successive rounds relating to various aspects of social, economic, demographic, industrial and agricultural statistics. We use the data in the 'Household Consumer Expenditure' schedule, quinquennial surveys in the 50th round, 1993–94, and in the 61st round, 2004-05.[2] These form repeated cross-sectional data sets, each of which contains a large number of households across India. The consumption schedule contains a variety of information related to mean per capita expenditure (MPCE), disaggregated expenditure over many items together with basic socio economic

[2] We are not using 55th round in 1999-2000 as the consumption data in 55th round are not comparable with those in 50th or 61st round because of the change in recall periods. The consumption data are comparable between 50th round and 61st round.

characteristics of the household (e.g., sex, age, religion, caste, and land-holding). To derive wages at the level of NSS region, we supplement the consumption schedule by Employment and Unemployment schedule because the consumption survey and the employment survey collect data on different households and can be linked only at the aggregate level (e.g. NSS region level).[3] Non-farm sector employment can be classified into sub-categories by using National Classification of Occupations (NCO).

4. Methodologies

(1) Treatment Effects Model

To estimate the effect of non-farm sector employment on poverty and vulnerability, we employ a version of treatment effects model. The main idea of treatment effects model is to estimate poverty defined by household consumption per capita for two different regimes (de Janvry et al., 2005) - households participating only in the farm labour market and those participating in both farm and non-farm labour markets. It is a version of the Heckman sample selection model (Heckman, 1979), which estimates the effect of an endogenous binary treatment. This would enable us to take account of the sample selection bias associated with access to non-farm sector. In the first stage, access to non-farm sector is estimated by the probit model.[4] In the second, we estimate log of household consumption or vulnerability measure after controlling for the inverse Mills ratio which reflects the degree of sample selection bias.

The merit of treatment effects model is that sample selection bias is explicitly estimated by using the results of probit model. However, the weak aspects include (i) strong assumptions are imposed on distributions of the error terms in the first and second stages; (ii)

[3] Definitions of the variables of VHLSS and NSS data are provided in Table A1.
[4] More specifically, we run the probit model at household levels for whether any household members have access to non-farm sector and then estimate the poverty equation in the second stage.

the coefficient estimates may be sensitive to choice of the explanatory variables and instruments; and (iii) valid instruments are rarely found in non-experimental data and if the instruments are invalid, the results will depend on the distributional assumptions.

The selection mechanism by the probit model for accessing rural non-farm economy (RNFE) can be more explicitly specified as (e.g., Greene, 2003):

$$D_i^* = X_i\beta + u_i \qquad (1)$$

and $D_i^* = 1 \quad if\ D_i^* = X_i\beta > 0$

$D_i^* = 0 \quad otherwise$

where $\Pr\{D_i = 1 | X_i\} = \Phi(\gamma' X_i)$

$\Pr\{D_i = 0 | X_i\} = 1 - \Phi(\gamma' X_i)$

D^* is a latent variable. In our case, D takes the value 1 if an i^{th} household has at least one household member who has access to non-farm employment and 0 otherwise. X is a vector of individual, household and regional characteristics and other determinants at commune or community levels. Φ denotes the standard normal cumulative distribution function.

Since available variables are different for Vietnam and India, we assume different specifications (or the choice of explanatory variables) for individual access to RNFE for X_i.

Vietnam:

$$D_i^* = D_i(\hat{W}_i^m, \hat{W}_i^f, M_i, E_i, H_i, L_i, R) \qquad (1)'$$

$\hat{W}_i^m$: a household average of predicted wages of male members. Daily wage rate is estimated by individual characteristics, such as, age, its square, dummy variables of educational categories, whether he is working for the household's own farm (or non-farm) sector as a wage worker, whether the household belongs to ethnic majorities, size of land and its square, and regional and locational dummy variables (see Table A2).

$\hat{W}_i^f$: a household average of predicted wages of female members. $\hat{W}_i^m$ and $\hat{W}_i^f$ serve as instruments for the household's non-farm participation equation.

We assume here that the labour productivity proxied by wage rate is an important determinant of participation in non-farm sector employment. That is, only high productivity worker with higher agricultural wages rate can participate in RNFE as an analogy of theory of workfare where only high productivity workers can participate in workfare scheme or higher waged workers can afford exercising the 'real option' of switching from the agriculture labour marker to workfare or the non-farm labour market given the switching costs (Scandizzo et al., 2009).[5]

M_i: whether the household head is male.

E_i: a set of dummy variables of educational attainment of the household head (whether he or she has no education; whether completed primary education; whether completed lower secondary education; whether completed upper secondary education; whether completed technical education; whether completed higher education).

H_i: household composition/ characteristics (household size; the share of female members; dependency burden (the share of household members below 15 years or above 65 years; whether a household belongs to ethnic majority) of the i^{th} household.

L_i: size of land (in hectare) owned by the household and its square for the i^{th} household.

R: a set of regional dummy variables (whether a household is located in red river delta region; northeast region; northwest region; north central coast region; south central coast

[5] Two issues should be discussed regarding the effects of wage rates on participation in RNFE. First, access to non-farm sector employment is likely to have an indirect effect of reducing consumption poverty of an agricultural household through increased agricultural wage rates. This would require disaggregated non-farm and farm wages data (preferably over time), which neither VHLSS nor NSS data have. Second, related to the first point, the wage rate is endogenous. While we estimate daily wage rate for men and women separately for Vietnam, we use the estimated wage rate aggregated at NSS region level for India due to data constraints.

region; central highlands region; north east south region; Mekong river delta region; central coast region; low mountains; and high mountains).

India:

Because of data limitations, a different set of explanatory variables is chosen as determinants of accessing rural non-farm employment.

$$D_i^* = D_i(\overline{W}, E_i, H_i, L_i, B_i, R) \qquad (1)''$$

$\overline{W}$: wage rate estimated using employment data and aggregated for NSS region. The results for wage equations (based on NSS50-10 and NSS61-10) are given in Table A3. Explanatory variables in the wage rate equations include age and its square, a number of dummy variables on literacy and educational attainments, land, Scheduled Tribe (ST), Scheduled Caste (SC), non-agricultural or agricultural self- employment, religion. State fixed effects are considered by inserting state dummy variables.[6]

E_i: a set of variables on the highest level of educational attainment of household members (e.g. whether completed primary school, secondary school, or higher education).

H_i: a set of variables indicating household composition, such as whether a household is headed by a female member, number of adult male or female members, dependency burden: the share of household members under 15 years old or over 60 years old.[7]

L_i: owned land as a measure of household wealth.[8]

B_h: Social backwardness of the household in terms of (i) whether a household belongs to SCs and (ii) whether it belongs to STs.

R: a vector of state dummy variables.

[6]However, for NSS61, we have used the regional price because aggregate wage rate is automatically dropped due to the collinearity problem in the non-farm sector employment participation equation.
[7]Female headedness was dropped in all the regressions based on NSS50, because it consistently shows a counter-intuitive sign.
[8]Square of land is dropped due to the collinearity problem.

The linear outcome regression model in the second stage is specified below to examine the determinants of poverty - as proxied by household consumption (log of MPCE for the Indian NSS data and log of per capita real household consumption for the Vietnamese VHLSS data) or vulnerability derived by Chaudhuri's (2003) method which captures the probability of a household falling into poverty in the next period.[9] It is noted here that non-farm labour marker participation is estimated in the first stage of the treatment effects model, while poverty is estimated (proxied by log per capita household consumption or household vulnerability) in the second stage. We use log household consumption and vulnerability as a measure of poverty because treatment effects model requires that the dependent variable in the second stage is continuous and the standard binary measure of poverty (0 or 1) cannot be used. Moreover, as suggested by previous literature, households in India and Vietnam tend to be vulnerable to shocks (e.g. Imai et al, 2011; Gaiha and Imai, 2009). We denote household poverty - either log per capita household consumption or vulnerability - as W_i.

$$W_i = Z_i\gamma + \theta D_i + \varepsilon_i \qquad (2)$$
$$(u, \varepsilon) \sim \text{bivariate normal}[0,0,1,\sigma_\varepsilon,\rho].$$

where θ is the average net effect (ANE) of access to rural non-farm sector employment. In case log per capita household consumption is estimated, the positive estimate of θ implies that accessing RNFE increases consumption and thus decreases poverty. In the case of vulnerability, the negative estimate of θ implies that access to rural non-farm sector employment decreases vulnerability.

Here Z_i is a vector of determinants of W. For Vietnam this is estimated by:

$$Z_i = Z_i(M_i, E_i, H_i, L_i, R) \qquad (2)'$$

for Vietnam and

[9] The methodology will be discussed in the next subsection.

$$Z_i = Z_i(E_i, H_i, L_i, B_i, R) \qquad (2)''$$

for India. That is, we include all the variables used for the non-farm sector participation equation ((1)' or (1)'') except the instruments, predicted wages.

Using a formula for the joint density of bivariate normally distributed variables, the expected poverty for those with access to rural non-farm sector employment is written as:

$$\begin{aligned} E[W_i | D_i = 1] &= \beta' Z_i + \theta + E[\varepsilon_i | D_i = 1] \\ &= \beta' Z_i + \theta + \rho\sigma_\varepsilon \frac{\phi(\gamma' X_i)}{\Phi(\gamma' X_i)} \end{aligned} \qquad (3)$$

where ϕ is the standard normal density function. The ratio of ϕ and Φ is called the inverse Mill's ratio.

Expected poverty (or undernutrition or vulnerability) for non-participants is:

$$\begin{aligned} E[W_i | D_i = 0] &= \beta' Z_i + E[\varepsilon_i | D_i = 0] \\ &= \beta' Z_i - \rho\sigma_\varepsilon \frac{\phi(\gamma' X_i)}{1 - \Phi(\gamma' X_i)} \end{aligned} \qquad (4)$$

The expected effect of poverty reduction associated with RNFE is computed as (Greene, 2003, 787-789):

$$E[W_i | D_i = 1] - E[W_i | D_i = 0] = \theta + \rho\sigma_\varepsilon \frac{\phi(\gamma' X_i)}{\Phi(\gamma' X_i)[1 - \Phi(\gamma' X_i)]} \qquad (5)$$

If ρ is positive (negative), the coefficient estimate of θ using OLS is biased upward (downward) and the sample selection term will correct this. Since σ_ε is positive, the sign and significance of the estimate of $\rho\sigma_\varepsilon$ (usually denoted as β_λ) will show whether there exists any selection bias. To estimate the parameters of this model, the likelihood function given by Maddala (1983, p.122) is used where the bivariate normal function is reduced to the univariate function and the correlation coefficient ρ. The predicted values of (3) and (4) are

derived and compared by the standard t test to examine whether the average treatment effect or poverty reducing effect is significant.

The results of treatment effects model will have to be interpreted with caution because the results are sensitive to the specification of the model or the selection of explanatory variables and/or the instrument. Also important are the distributional assumptions of the model. Despite these limitations, the model is one of the few available methods to control for sample selection bias and capable of yielding insights into whether access to rural non-farm sector employment leads to poverty reduction.

(2) Vulnerability Measure

It would be ideal to use panel data to derive household's vulnerability measures, but, in its absence, we can derive a measure of 'Vulnerability as Expected Poverty' (VEP), an *ex ante* measure, based on Chaudhuri (2003) and Chaudhuri, Jalan and Suryahadi (2002) who applied it to a large cross-section of households in Indonesia[10] and defined vulnerability as the probability that a household will fall into poverty in the future after controlling for the observable household characteristics. Accordingly, it takes the value from 0 to 1, and the higher the value of vulnerability measure, the higher is the probability of a household falling into poverty in the next period. Imai et al. (2011) derived and analysed Chaudhuri's vulnerability measure using the VHLSS data for Vietnam, and Imai (2011) derived it using the Indian NSS data. We will use these cross-sectional vulnerability measures subject to the caveat of estimating vulnerability from a single cross-section that cannot capture the effect of aggregate shocks affecting all the households in the sample area. The details of derivation of Chaudhuri's vulnerability measure is found in Appendix. Imai et al. (2011) and Imai (2011)

[10] See a summary by Hoddinott and Quisumbing (2003a, b) of methodological issues in measuring vulnerability.

provide a full set of results of vulnerability for Vietnam and India.

4. Econometric Results

This section summarises the results of treatment effects model which is applied to estimate the effects of participation in RNFE (Rural Non-farm Economy) or non-farm sector employment. Vulnerability estimates based on VHLSS and NSS data are reported in Imai et al. (2011) and Imai (2011) and we highlight only the results of treatment effects model.

Table 1 gives the results of treatment effects model applied to VHLSS data in 2002, 2004 and 2006. For each year, two different proxies for poverty have been tried as a dependent variable - log of per capita consumption and vulnerability. The first panel reports the results of the first stage probit model for whether a household member participates in the non-farm sector labour market and the second panel gives the results for OLS whereby log per capita consumption or vulnerability is estimated.

The first panel of Table 1 suggests that predicted wage rates as well as household characteristics (e.g. educational attainment, household composition) affect the probability of a household member participating in the non-farm sector labour market. In 2002 and 2006, both predicted male wage rate and female wage rate positively and significantly increased the probability of the household having a member participating in the non-farm sector employment, while in 2004 only male wage rate was positive and significant. Other variables show more or less expected results (e.g. higher educational attainment tends to increase the probability of participating in non-farm employment; belonging to ethnic majority increases the probability; a household head with a younger head is more likely to participate in non-farm employment; locations affect the probability). $\rho\sigma_{\varepsilon}$ or β_{λ} in equation (3) is statistically significant (except the case of consumption in 2004 and in 2006), implying that

there exists sample selection bias that should be corrected for in deriving the average treatment effects. Use of treatment effects model is justified in most cases.

The second panel of Table 1 shows the results of determinants of per capita household consumption and household vulnerability for 2002, 2004 and 2006. For example, size of household significantly decreases consumption in all the years and significantly decreases vulnerability in 2002, 2004 and 2006. A household headed by an older head tends to have higher per capita consumption and lower vulnerability with non-linear effects. Higher dependency burden is associated with lower per capita consumption and higher vulnerability. Education and location are important determinants of both consumption and vulnerability. $\hat{\theta}$, an estimate of θ in equations (3) and (5) shows the average net effects (ANF) and it is positive and significant except in the case of consumption for 2004. However, ANF should not be treated as a treatment effect if the sample selection term, β_{λ}, is statistically significant. At the bottom of the table, we report the average treatment effect (ATE), the difference of the expected outcome for participants in non-farm employment and for non-participants after controlling for sample selection (as in equation (5), sum of ANF and the sample selection term). In order to evaluate the effect of access to non-farm employment on poverty after taking account of sample selection, we need to base our discussion on ATE, rather than ANF (Imai, 2011).

In 2002, per capita consumption was significantly higher by 19.2% for participants in the non-farm labour market than for non-participants after taking account of sample selection, which is consistent with the poverty reducing role of RNFE. In the same year, vulnerability as a probability of falling into poverty is reduced by 14.9% as a result of participating in non-farm sector employment. In 2004, per capita consumption is significantly higher by 12.9% for non-farm labour market participants than for non-participants after controlling for sample selection, while the vulnerability is lower for non-farm labour market participants by

7.3%. In 2006, per capita consumption is higher by 13.1% and vulnerability is lower by 5.9% if the household has access to non-farm employment. In sum, we confirm that RNFE substantially reduced consumption poverty and consumption vulnerability (as a probability of falling into consumption poverty) throughout the period 2002 to 2006. The results may suggest that RNFE opens up a new set of consumption bundles which others could not avail of.

(Table 1 to be inserted)

To see how non-farm sector employment in different categories affects poverty and vulnerability, we have repeated the same model by changing only the definition of binary-classification of non-farm employment. Only the final results of ATE are summarised in Table 2. Sub-categories are broadly defined by occupational code of individual members participating in the non-farm employment - "Unskilled manual employment" (mechanical and physically demanding jobs e.g. unskilled building construction works), "Production" (jobs classified in manufacturing sector or associated with production, e.g. employment in plant and machine operators/ assemblers or craftsman), "Sales" (jobs associated with sales and trade) and "Professionals/ clerks" (managers, professionals, technicians, clerks). It should be noted that these categories are broadly defined by the occupational categories within which ranks or skill requirements are diverse. Hence, the results should be interpreted with caution. Also, different occupational coding systems are used for Vietnam and India and the results are not necessarily comparable.

(Table 2 to be inserted)

Given the above caveats, ATE on consumption and vulnerability is different across different categories of non-farm employment. For example, "Unskilled and Manual" non-farm employment increased consumption by 5.1% in 2002 and by 11.0% in 2004, but in the mean time *increased* vulnerability (by 5.2% in 2004 and 5.8% in 2006). This implies that

non-farm manual employment may increase household consumption only at the cost of greater vulnerability in Vietnam. Non-farm sector in "Production" increased consumption significantly over the years with some variation (by 15.7% in 2002, 3.2% in 2004 and 13.8% in 2006) and decreased vulnerability by 15.6% in 2002 and by 2.1% in 2004. The poverty and vulnerability reducing effects of non-farm employment on "Sales" and "Professionals/ Clerks" are more clearly observed. On average, access to employment in "Sales" increased per capita consumption by 21.0% to 29.6% and reduced vulnerability by 6.0% to 26.7%. The effect of non-farm employment in "Professionals/ Clerks" on per capita consumption was also substantial over time (ranging from 15.4% to 22.0%), while vulnerability was substantially reduced at the same time. That is, with some variation, poverty and vulnerability reducing effects of skilled non-farm employment are much stronger than those of unskilled or manual employment.

(Table 3 to be inserted)

Table 3 gives the results of treatment effects model for the Indian NSS data. As before, the first panel presents the results of participation equation (probit model). Female headedness negatively affected participation in NSS61 (in 2004-2005).[11] Dependency burden is negative and significant, that is, the household with higher dependency burden is less likely to participate in the rural non-farm sector employment. Household headed by a younger head is more likely to participate in non-farm employment but with non-linear effects. A household with more educated members tends to participate in non-farm employment. If the household has more land, the probability of participating in non-farm employment is smaller. Belonging to Scheduled Caste and Scheduled Tribes is also associated with lower probability of participating in non-farm employment. For NSS50, higher predicted wages significantly lead to higher probability of participating in non-farm

[11] Because female headedness is measured with error in NSS50, it was not used in the regression.

employment. The coefficient estimate for regional price is positive, but not statistically significant for NSS61. The coefficient estimate of $\rho\sigma_\varepsilon$ or β_λ is significant except the cases for "vulnerability" in 1993-1994 and "log MPCE" in 2004-5.

The second panel of Table 3 reports the regression results of the second-stage equation for log MPCE or vulnerability. We report the regression results only selectively. For instance, in contrast to Vietnam, somewhat surprising are the findings that dependency burden significantly increased log MPCE , but decreased vulnerability. In India, higher dependency seems to imply that households need to earn more per person, and thus they tend to consume more and to be less vulnerable.(This sentence could be deleted as the result is intriguing). In 1993-1994, a household with an older head was more vulnerable with a strong non-linear effect, while age of the head had no significant effect on per capita consumption. On the contrary, a household with an older head consumed more with a strong non-linear effect in 2004-2005. In general, a household with a more educated household consumed more and was less vulnerable. As expected, the larger the size of the land a household owned, it consumed more and was less vulnerable. Belonging to Schedule Castes or Scheduled Tribes was associated with a lower level of consumption as well as a higher level of vulnerability.

We have summarised the results of ATE at the bottom of Table 3. It is confirmed that access to non-farm employment increased per capita consumption on average by 10.2% in 1993-4 and 10.4% in 2004-5. That is, the consumption increasing effect (or the effect of reducing consumption poverty) continued to be substantial. Vulnerability was significantly reduced by participation in non-farm employment - by 3.8% in 1993-4 and by 7.1% in 2004-2005 (in terms of the probability of falling into poverty in the next period). It can be concluded that in India participation in RNFE is likely to reduce household vulnerability significantly.

Table 4 reports a summary of the results for India where non-farm employment is disaggregated by occupational categories, as in Table 2. "Professionals/ Clerks" has the largest poverty and vulnerability reducing effects in 1993-1994 and 2004-2005, to be followed by "Production" and "Sales" which have similar magnitudes of poverty and vulnerability reducing effects. "Unskilled/ Manual" employment involves the smallest poverty and vulnerability reduction effects among the four categories, but the role of these effects should not be neglected given that the poor do not have easy access to skilled employment in non-farm sector. Access to unskilled/ manual employment in non-farm sector increased per capita consumption by 6.0% (8.4%) in 1993-1994 (2004-2005) on average, while it reduced the probability of falling into poverty by 4.0% (7.6%) in 1993-1994 (2004-2005).

(Table 4 to be inserted)

5. Concluding Observations

The present study examines whether participation in the rural non-farm sector employment or involvement in activity in rural non-farm economy (RNFE) has any poverty-reducing or vulnerability-reducing effect in Vietnam and India drawing upon nation-wide cross-sectional household data sets. To take account of sample selection bias associated with RNFE, we applied treatment-effects model, a variant of Heckman sample selection model.

We find that participation in non-farm sector employment significantly increased per capita consumption or expenditure in 2002, 2004, and 2006 for rural Vietnam and in 1993-1994 and 2004-2005 for rural India. The results are consistent with poverty and vulnerability reducing roles of accessing RNFE. This is important as a significant number of households were found to be not only poor but also vulnerable to shocks in the future (e.g. weather shocks, illness of household members, macro-economic slowdown) in Vietnam as

well as India (Gaiha and Imai, 2009; Imai et al., 2011). Diversification of household activities into non-farm sector would reduce such risks.

Disaggregation of non-farm sector employment by occupational categories shows that access to more skilled employment is likely to have larger poverty and vulnerability reducing effects than unskilled or manual employment. Non-farm employment in "Sales" and "Professionals/ Clerk" categories has stronger effects in reducing poverty and vulnerability in both Vietnam and India. "Unskilled/ Manual" employment significantly reduces poverty and vulnerability in India over the years and access of the rural poor to unskilled or manual employment is likely to be important in India given that the poor do not have easy access to skilled employment in non-farm sector. On the contrary, the poverty reducing effect of unskilled/ manual non-farm employment is observed in 2002 and 2004, but not in 2006 in Vietnam but with greater household vulnerability in 2004 and 2006. Non-farm employment associated with "Production" significantly reduced poverty and vulnerability over time in both India and Vietnam, except in 2006 when vulnerability rose in Vietnam. That is, we observe more consistent poverty and vulnerability effects of relatively unskilled/ physical demanding jobs in non-farm sector for India than for Vietnam.

Our results are consistent with recent views that non-farm sector plays a key role in helping poor agricultural households escape poverty, as emphasised by Knight et al. (2009, 2010) in the context of rural China. Policy interventions designed to help agricultural households diversify into non-farm sector activities (e.g. skill training; microfinance) would potentially reduce not only poverty but also vulnerability.

That there are more similarities than differences in the impact of rural non-farm employment between Vietnam -an economy in transition- and India -an emerging economy- is somewhat intriguing. Some clues may, however, emerge from a deeper understanding of differences in constraints to expansion of land, variation in population pressure, and

productivity, access to credit, decentralised structures of governance, and weak rural infrastructure, which is left for future research. That Vietnam has adapted rapidly to a market-oriented policy regime may in fact be key to why similarities in the impact of rural non-farm employment are so much more striking in these two countries.

Acknowledgements

This project is funded by IFAD. We acknowledge valuable comments and advice from Samuel Annim, Md. Azam, Md. Faruq Hassan, Woojing Kang, Armando Barrientos, and Takahiro Sato. We thank Woojin Kang for preparing VHLSS Data sets at the early stage of the project. The views expressed are, however, those of the authors' and do not necessarily represent those of the organisations to which they are affiliated.

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Table 1

The Results of Treatment Effects Model on the Effects of Individual Participation in Rural Non-Farm Employment for Vietnam on Poverty and Vulnerability for Vietnam

		2002				2004				2006			
1st Stage:	**Dependent Variable**	**Participation in Non-farm sector employment**				**Participation in Non-farm sector employment**				**Participation in Non-farm sector employment**			
		Coef.	Z value *1	Coef.	Z value	Coef.	Z value	Coef.	Z value	Coef.	Z value	Coef.	Z value
Explanatory Variables *2													
Predicted Daily Male Wage Rate		0.205	(20.57)*	0.139	(15.78)**	0.017	(4.56)**	0.012	(4.78)**	0.007	(4.22)**	0.003	(3.49)**
Predicted Daily Female Wage Rate		0.180	(13.74)*	0.076	(6.53)**	-0.006	(-1.56)	-0.004	(-1.57)	0.010	(3.94)**	0.006	(3.56)**
Whether a head is male		-0.170	(-6.12)*	-0.128	(-4.05)**	-0.064	(-0.82)	-0.077	(-1.05)	0.190	(2.30)*	0.112	(1.45)
Whether completed primary school		0.051	(1.47)	0.004	(0.11)	-0.323	(-1.08)	-0.652	(-2.42)*	0.139	(0.44)	0.090	(0.29)
Whether completed lower secondary school		0.260	(7.32)**	0.181	(4.98)**	-0.083	(-0.28)	-0.361	(-1.34)	0.290	(0.92)	0.284	(0.92)
Whether completed upper secondary school		0.259	(6.51)**	0.296	(7.25)**	0.115	(0.38)	-0.140	(-0.51)	0.424	(1.34)	0.425	(1.36)
Whether completed technical school		0.347	(7.04)**	0.478	(9.30)**	0.276	(0.91)	0.032	(0.12)	0.619	(1.94)†	0.595	(1.91)†
Whether completed higher school education		-0.009	(-0.15)	0.277	(4.35)**	0.330	(1.04)	0.035	(0.12)	0.740	(2.20)*	0.673	(2.08)*
Size of household		0.033	(5.41)**	0.029	(4.56)**	0.031	(2.17)*	0.014	(1.08)	0.049	(3.30)**	0.048	(3.52)**
Share of female members		0.023	(0.47)	-0.066	(-1.32)	-0.068	(-0.54)	-0.075	(-0.65)	-0.099	(-0.79)	-0.114	(-0.99)
Dependency Burden (share of household members under 15 or above 60)		0.171	(3.73)**	-0.079	(-1.66)†	0.020	(0.22)	-0.052	(-0.61)	0.171	(1.54)	-0.200	(-1.92)†
Size of land (hectare)		-24.483	(-22.71)**	-16.296	(-14.29)**	-20.501	(-7.63)**	-13.885	(-6.18)**	-10.523	(-4.29)**	-7.270	(-3.34)**
Size of land squared		30.071	(16.90)**	42.264	(9.77)**	56.908	(5.56)**	42.433	(4.90)**	21.561	(2.59)*	17.278	(2.50)*
Age of a household head		-0.120	(-23.71)**	-0.111	(-20.72)**	-0.132	(-10.51)**	-0.098	(-8.44)**	-0.123	(-8.98)**	-0.097	(-7.59)**
Age squared		0.001	(25.47)**	0.001	(23.28)**	0.001	(10.88)**	0.001	(9.26)**	0.001	(9.04)**	0.001	(7.97)**
Whether a household head is married		-0.122	(-3.81)**	-0.100	(-2.86)**	-0.181	(-2.01)*	-0.032	(-0.38)	-0.272	(-3.00)*	-0.178	(-2.09)*
Whether belonging to ethnic majorities		0.389	(10.53)**	0.383	(9.34)**	0.317	(3.55)**	0.807	(9.62)**	0.187	(2.24)*	0.554	(7.38)**
Constant		0.049	(0.35)	0.355	(2.39)*	2.161	(4.68)**	1.082	(2.55)	1.136	(2.25)	0.387	(0.81)
$\hat{\beta}_{\lambda}$		-0.217	(-21.12)**	-0.207	(-57.62)**	0.041	(0.47)	-0.157	(-45.61)**	-0.056	(-0.80)	-0.151	(-49.12)**
$\hat{\rho}$		-0.473	(-23.89)**	-0.795	(-95.06)**	0.103	(0.47)	-0.865	(-106.47)**	-0.142	(-0.81)	-0.879	(-122.40)**
2nd Stage:	**Dependent Variable**	**log per capita consumption**		**Vulnerability**		**log per capita consumption**		**Vulnerability**		**log per capita consumption**		**Vulnerability**	
		Coef.	Z value *1	Coef.	Z value	Coef.	Z value	Coef.	Z value	Coef.	Z value	Coef.	Z value
Whether a head is male		-0.035	(-3.75)**	0.064	(9.95)**	-0.044	(-1.85)†	0.022	(1.99)**	-0.005	(-0.22)	-0.001	(-0.11)
Whether completed primary school		0.120	(10.93)**	-0.085	(-12.99)**	0.112	(1.26)	-0.076	(-1.90)†	0.175	(1.94)†	-0.144	(-3.70)**
Whether completed lower secondary school		0.222	(19.48)**	-0.225	(-33.20)**	0.260	(2.97)**	-0.192	(-4.77)**	0.270	(2.97)**	-0.257	(-6.61)**
Whether completed upper secondary school		0.397	(30.68)**	-0.338	(-43.49)**	0.439	(4.97)**	-0.272	(-6.71)**	0.442	(4.75)**	-0.309	(-7.87)**

Whether completed technical school	0.501	(31.54)**	-0.430	(-43.33)**	0.580	(6.47)**	-0.327	(-8.03)**	0.561	(5.85)**	-0.350	(-8.89)**
Whether completed higher school education	0.802	(46.73)**	-0.383	(-33.38)**	0.803	(8.55)**	-0.308	(-7.28)**	0.753	(7.27)**	-0.343	(-8.39)**
Size of household	-0.091	(-48.98)**	-0.003	(-2.63)*	-0.086	(-20.23)**	0.000	(-0.12)	-0.093	(-19.71)**	-0.007	(-4.00)**
Share of female members	-0.050	(-3.21)**	0.048	(4.78)**	-0.075	(-2.02)*	0.039	(2.29)*	-0.008	(-0.22)	0.002	(0.11)
Dependency Burden (share of household members under 15 or above 60)	-0.276	(-19.39)**	0.401	(44.52)**	-0.121	(-4.49)**	0.071	(5.69)**	-0.257	(-7.72)**	0.202	(14.29)**
Size of land (hectare)	6.474	(21.36)**	-0.767	(-3.64)**	5.500	(5.17)**	-0.236	(-0.75)	7.029	(9.43)**	-0.306	(-1.09)
Size of land squared	-8.582	(-12.87)**	1.611	(1.71)†	-15.160	(-4.27)**	1.675	(1.35)	-15.385	(-6.97)**	1.585	(1.77)†
Age of a household head	0.026	(16.02)**	0.017	(17.53)**	0.018	(2.59)**	-0.003	(-1.66)*	0.014	(2.12)*	0.011	(6.18)**
Age squared	0.000	(-15.18)**	0.000	(-20.14)**	0.000	(-2.26)*	0.000	(0.19)	0.000	(-1.93)†	0.000	(-6.55)**
Whether a household head is married	0.123	(11.79)**	-0.011	(-1.57)	0.099	(3.52)**	-0.008	(-0.64)	0.109	(3.78)**	0.010	(0.85)
Whether belonging to ethnic majorities	0.188	(15.96)**	-0.463	(-64.07)**	0.273	(9.68)**	-0.424	(-37.32)**	0.276	(11.49)**	-0.305	(-30.36)**
$\hat{\theta}$	0.574	(33.94)**	0.208	(32.31)**	0.060	(0.42)	0.196	(31.62)**	0.226	(1.93)†	0.197	(35.30)**
Constant	7.019	(153.30)	0.231	(8.29)	7.415	(32.41)	0.748	(12.43)	6.982	(37.16)	0.304	(4.90)
No. of Observations	25136		20205		4032		4030		4091		4091	
Wald $Chi^2(27)$	20778**		1010**		2698**		7227**		3050**		6039**	
Variable	log per capita consumption		Vulnerability		log per capita consumption		Vulnerability		log per capita consumption		Vulnerability	
Treat With RNFE	8.015		0.115		8.040		0.088		7.650			
Control Without RNFE	7.823		0.265		7.912		0.162		7.519			
Average Treatment Effect (ATE) $(=\theta+\rho\sigma_{\varepsilon}\frac{\phi(\gamma' X_i)}{\Phi(\gamma' X_i)[1-\Phi(\gamma' X_i)]})$												
t statistics in brackets	**+19.2%**	**(55.34)****	**-14.9%**	**(-63.84)****	**+12.9%**	**(18.40)****	**-7.3%**	**(16.42)****	**+13.1%**	**(17.73)****	**-5.9%**	**(-16.46)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly? (based on ATE)	**YES**		**YES**		**YES**		**YES**		**YES**		**YES**	

Notes: *1. z or t statistics in brackets; + p<.10, * p<.05, ** p<.01. *2. Regional and locational dummy variables are included in both stages, but are not shown to save the space. Dummy variables are "whether in river delta region; North East region; North West region; North Central Coast region; South Central Coast region; Central Highlands region; North East South region; Central Coast region; Inland Delta; Hills; Low Mountains.

Source: Authors Calculation based on VHLSS 2002, 2004 and 2006.

Table 2

The Results of Averaged Treatment Effect (ATE) on the Effects of Rural Non-Farm Employment by Occupational Categories in Vietnam

	2002				2004				2006			
Dependent Variable	log per capita consumption		vulnerability		log per capita consumption		Vulnerability		log per capita consumption		vulnerability	
Explanatory Variables *2	**ATE**	t value *1	**ATE**	t value	**ATE**	t value	**ATE**	t value	**ATE**	t value	**ATE**	t value
Aggregate Effect	**+19.2%**	**(55.34)****	**-14.9%**	**(-63.84)****	**+12.9%**	**(18.40)****	**-7.3%**	**(16.42)****	**+13.1%**	**(17.73)****	**-5.9%**	**(-16.46)****
*Does RNFE Reduce Poverty (or Vulnerability) Significantly?*3.*	**YES**		**YES**		**YES**		**YES**		**YES**		**YES**	
Unskilled/ Manual	**+5.1%**	**(12.78)****	+0.5%	(1.30)	**+11.0%**	**(12.84)****	+5.2%	(7.35)**	+1.3%	(1.46)	+5.8%	(10.07)**
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		NO		**YES**		NO		NO		NO	
Production	**+15.7%**	**(41.31)****	**-15.6%**	**(-45.70)****	**+3.2%**	**(3.91)****	**-2.1%**	**(-3.20)****	**+13.8%**	**(16.23)****	+1.2%	**(8.15)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**		**YES**		NO	
Sales	**+29.6%**	**(78.37)****	**-26.7%**	**(-100.00)****	**+21.0%**	**(24.80)****	**-8.7%**	**(-13.60)****	**+22.2%**	**(25.48)****	**-6.0%**	**(-11.62)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**		**YES**		**YES**	
Professionals/ Clerk	**+20.0%**	**(5.64)****	**-24.9%**	**(-84.47)****	**+15.4%**	**(17.02)****	**-5.5%**	**(-7.88)****	**+22.0%**	**(23.72)****	**-7.3%**	**(-13.71)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**		**YES**		**YES**	

Notes: *1. t statistics in brackets; + p<.10, * p<.05, ** p<.01. *2. The same specification we used for the aggregate case (Table 1) is used for sub-categories of non-farm sector employment, determined by the occupational code (available in questionnaires for VHLSS data). *3. The case with an answer "YES" is shown in bold.

Source: Authors Calculation based on VHLSS 2002, 2004 and 2006.

Table 3

The Results of Treatment Effects Model on the Effects of Participation in Rural Non-Farm Employment for Vietnam on Poverty and Vulnerability for India

	1993-94 (NSS 50)				2004-2005 (NSS 61)			
1st Stage: Dependent Variable	**Participation in Non-farm sector employment**				**Participation in Non-farm sector employment**			
	Coef.	Z value*[1]	Coef.	Z value	Coef.	Z value	Coef.	Z value
Explanatory Variables*[2]								
Whether a household is headed by a female member	-	-	-	-	-0.039	(-1.18)	-0.064	(-2.02)*
Number of adult female members	0.030	(2.03)*	0.034	(2.31)*	0.002	(0.12)	-0.034	(-2.12)*
Number of adult male members	0.066	(4.92)**	0.059	(4.38)**	0.046	(2.88)**	0.012	(0.77)
Dependency Burden (share of household members under 15 or above 60)	-0.150	(-3.33)**	-0.186	(-4.05)**	-0.099	(-2.23)**	0.143	(3.39)**
Age of household head	-1.237	(-2.93)**	-1.386	(-3.28)**	-2.658	(-5.74)**	-2.308	(-5.24)**
Age squared	1.073	(2.29)*	1.262	(2.70)**	2.237	(4.58)**	2.072	(4.48)**
The max. education of adult (Primary)	0.301	(8.94)**	0.305	(9.02)**	0.195	(7.73)**	0.232	(9.48)**
The max. education of adult (Middle)	0.481	(12.10)**	0.481	(11.95)**	0.389	(14.89)**	0.429	(17.01)**
The max. education of adult (>=Matriculates)	0.527	(9.12)**	0.528	(9.01)**	0.541	(13.02)**	0.561	(14.27)**
Land (0.1<=2.5 ha) (default: the landless)	-0.033	(-0.66)	-0.040	(-0.80)	-0.091	(-4.31)**	-0.053	(-2.60)**
Land (>2.5 ha) (default: the landless)	0.164	(1.99)*	0.242	(2.90)**	0.147	(1.31)	0.171	(1.68)†
Whether a household belongs to SC (Scheduled Caste)	-0.021	(-0.68)	-0.028	(-0.89)	-0.119	(-3.82)**	-0.153	(-5.02)**
Whether a household belongs to ST (Scheduled Tribe)	-0.170	(-7.29)**	-0.176	(-7.46)**	-0.166	(-7.51)**	-0.195	(-9.14)**
Predicted male wages (at NSS region)	0.012	(14.71)**	0.008	(9.40)**	-	-	-	-
Aggregate Price (at NSS region)	-	-	-	-	0.026	(1.19)	0.013	(1.17)
Constant"	-0.470	(-2.63)	-0.235	(-1.32)	0.848	(2.70)	0.730	(3.87)
$\hat{\beta}_{\lambda}$	-0.196	(-14.38)**	0.012	(1.27)	-0.061	(-1.42)	-0.212	(-49.99)**
$\hat{\rho}$	-0.452	(-15.93)**	0.049	(1.27)	-0.163	(-1.44)	-0.800	(-85.56)**
2nd Stage: Dependent Variable	**log per capita MPCE**		**Vulnerability**		**log per capita MPCE**		**Vulnerability**	
Whether a household is headed by a female member	-	-	-	-	-0.036	(-3.90)**	0.051	(7.69)**
Number of adult female members	-0.402	(-92.40)**	0.153	(64.48)**	-0.149	(-32.14)**	0.101	(30.57)**
Number of adult male members	-0.339	(-86.29)**	0.152	(70.72)**	-0.093	(-20.08)**	0.094	(29.32)**
Dependency Burden (share of household members under 15 or above 60)	2.343	(176.86)**	-1.543	(-213.27)**	0.662	(52.52)**	-0.527	(-59.97)**
Age of household head	0.051	(0.41)	0.989	(14.38)**	0.596	(4.09)**	0.084	(0.90)

Age squared	-0.134	(-0.96)	-0.997	(-13.13)**	-0.291	(-1.97)*	-0.331	(-3.40)**
The max. education of adult (Primary)	0.052	(4.78)**	-0.055	(-9.18)**	0.048	(5.71)**	-0.143	(-28.39)**
The max. education of adult (Middle)	0.096	(7.05)**	-0.116	(-15.43)**	0.121	(10.02)**	-0.269	(-50.48)**
The max. education of adult (>=Matriculates)	0.182	(9.35)**	-0.228	(-21.24)**	0.259	(14.48)**	-0.342	(-40.25)**
Land (0.1<=2.5 ha) (default: the landless)	0.048	(3.38)**	-0.078	(-10.11)**	0.026	(4.10)**	-0.047	(-11.21)**
Land (>2.5 ha) (default: the landless)	0.040	(1.47)	-0.093	(-6.18)**	0.093	(2.98)**	-0.188	(-8.51)**
Whether a household belongs to SC (Scheduled Caste)	-0.140	(-15.01)**	0.090	(17.79)**	-0.147	(-16.15)**	0.222	(36.19)**
Whether a household belongs to ST (Scheduled Tribe)	-0.070	(-10.17)**	0.057	(15.20)**	-0.067	(-9.07)**	0.121	(27.63)**
$\hat{\theta}$	0.456	(18.65)**	-0.059	(-3.61)**	0.205	(2.90)**	0.284	(37.95)**
Constant	7.927	(143.21)	1.180	(38.56)	9.330	(123.29)	-0.024	(-0.87)
No. of Observations	21883		21883					
Wald $Chi^2(37)$ [Wald $Chi^2(95)$ for NSS61]	52256**		62554**					
Variable	**Log MPCE**		**Vulnerability**		**Log MPCE**		**Vulnerability**	
Treat With RNFE	**8.693**		**0.6036**		**9.5887**		**0.1705**	
Control Without RNFE	**8.591**		**0.6415**		**9.4848**		**0.2412**	
ATE ($= \theta + \rho\sigma_\varepsilon \frac{\phi(\gamma' X_i)}{\Phi(\gamma' X_i)[1-\Phi(\gamma' X_i)]}$); t value in brackets.	**+10.2%**	**(15.99)****	**-3.79%**	**(-9.94)****	**+10.4%**	**(38.47)****	**-7.08%**	**(-24.50)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly? (based on ATE)	**YES**		**YES**		**YES**		**YES**	

Notes: *1. z or t statistics in brackets; + p<.10, * p<.05, ** p<.01. *2. State dummies and included, but are not shown to save the space.

Source: Authors Calculation based on NSS50 and NSS61.

Table 4

The Results of Averaged Treatment Effect (ATE) on the Effects of Rural Non-Farm Employment by Occupational Categories in India

	1993-94 (NSS 50)				2004-2005 (NSS 61)			
Dependent Variable	log per capita consumption		vulnerability		log per capita consumption		Vulnerability	
Explanatory Variables *2	**ATE**	t value *1	**ATE**	t value	**ATE**	t value	**ATE**	t value
Aggregate Effect	**+10.2%**	**(15.99)****	**-3.8%**	**(-9.94)****	**+10.4%**	**(38.47)****	**-7.1%**	**(-24.50)****
*Does RNFE Reduce Poverty (or Vulnerability) Significantly?*3*	**YES**		**YES**		**YES**		**YES**	
Unskilled/ Manual	**+6.0%**	**(9.06)****	**-4.0%**	**(-10.08)****	**+8.4%**	**(30.06)****	**-7.6%**	**(-24.05)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**	
Production	**+14.3%**	**(20.54)****	**-2.8%**	**(-6.69)****	**+15.3%**	**(47.38)****	**-9.5%**	**(-26.49)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**	
Sales	**+14.7%**	**(20.37)****	**-2.6%**	**(-6.04)****	**+13.3%**	**(42.55)****	**-9.7%**	**(28.95)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**	
Professionals/ Clerk	**+24.1%**	**(33.98)****	**-4.6%**	**(-10.74)****	**+24.1%**	**(72.89)****	**-15.2%**	**(45.99)****
Does RNFE Reduce Poverty (or Vulnerability) Significantly?	**YES**		**YES**		**YES**		**YES**	

Notes: *1. t statistics in brackets; + p<.10, * p<.05, ** p<.01. *2. The same specification we used for the aggregate case (Table 1) is used for sub-categories of non-farm sector employment, determined by the occupational code (available in questionnaires for VHLSS data).
*3. The case with an answer "YES" is shown in bold.
Source: Authors Calculation based on NSS50 and NSS61.

Table A1
Definitions of the Variables of VHLSS and NSS data

Variable	Definition
VHLSS Data	
Rlconpc	log real per capita consumption expenditure in 2002 value
Headage	Age of household head
Headage2	(Age of household head)2
Married	Whether a household head has a spouse
Femaleshare	Share of female members
Femaleshare2	(Share of female members)2
Hhsize	Size of Household
Depburden	Ratio of dependency burden
Majorities	Whether a household belongs to ethnic majority
Noschooling_Head	Whether a household had no education
Primary_Head	Whether a household finished with primary school education
Lowersecon_Head	Whether a household finished with lower secondary school education
Uppersecon_Head	Whether a household finished with upper secondary school education
Technical_Head	Whether a household finished with technical school education
Higher_Head	Whether a household finished with higher school education
RedRiverDelta	Whether a household is located in red river delta region
NorthEast	Whether a household is located in northeast region
NorthWest	Whether a household is located in northwest region
NorthCentralCoast	Whether a household is located in north central coast region
SouthCentralCoast	Whether a household is located in south central coast region
CentralHighlands	Whether a household is located in central highlands region
NorthEastSouth	Whether a household is located in north east south region
MekongRiverDelta	Whether a household is located in mekong river delta region
CentralCoast	Whether a household is located in central coast region
Land	Size of Land (million hactare)
Land2	(Size of Land)2
NSS Data (India)	
Whether a household is headed by a female member	Whether a household is headed by a female member, (=1 if yes, =0 if no).
Number of adult female members	Number of adult female members (15 years old or above) in a household
Number of adult male members	Number of adult male members (15 years old or above) in a household
Dependency Burden	The share of children under 15 years old or adults over 60 years old in the total number of household members.
Age of household head	Age of household head (years)
Age squared	Square of age of household head
The max. education of adult (Primary)	The maximum level of educational attainment of adult member in the household is the completion of primary school.
The max. education of adult (Middle)	The maximum level of educational attainment of adult member in the household is the completion of middle school.
The max. education of adult (>=Matriculates)	The maximum level of educational attainment of adult member in the household is matriculates or higher.
Land (0.1<=2.5 ha) (default: the landless)	The area of owned land of the household is from 0,1 hectare to 2.5 hectare.
Land (>2.5 ha) (default: the landless)	The area of owned land of the household is larger than 2.5 hectare.
Land pc	The area of owned land per capita
Whether self-employed in non-agriculture	Whether the occupation type of the household head is self-employed in non-agriculture (=1 if yes, =0 if no).- default of the four choices is 'others'.
Whether agricultural labour	Whether the occupation type of the household head is agricultural labour (=1 if yes, =0 if no).
Whether non-agricultural labour	Whether the occupation type of the household head is labour in non-agriculture (=1 if yes, =0 if no).

Whether self-employed in agriculture	Whether the occupation type of the household head is self-employed in agriculture (=1 if yes, =0 if no).
Whether a household belongs to SC (Scheduled Caste)	Whether a household belongs to SC (Scheduled Caste) (=1 if yes, =0 if no).
Whether a household belongs to ST (Scheduled Tribe)	Whether a household belongs to ST (Scheduled Tribe) (=1 if yes, =0 if no).
RPW	Whether a household has access to Rural Public Works.
FFW	Whether a household has access to Food for Work Programme.
Predicted agricultural wage rate for males	Agricultural Wage Rate for male workers averaged at NSS region.
Poor	Whether the household per capita expenditure is under the national poverty line for rural areas.
poor (calorie based)	Whether the household is undernourished in terms of calorie intakes.
poor (protein based)	Whether the household is undernourished in terms of protein intakes.
Vulnerability Measure (based on 100% income poverty line)	Whether the household is vulnerable (based on 100% of the national poverty line).
Vulnerability Measure (based on 80% income poverty line)	Whether the household is vulnerable (based on 80% of the national poverty line).
Vulnerability Measure (based on 120% income poverty line)	Whether the household is vulnerable (based on 120% of the national poverty line).

Table A2

Wage Equations for male and female workers in rural areas of Vietnam based on VHLSS data in 2002, 2004 and 2006 (Tobit estimations)

Dependent Variable	2002		2004		2006	
	Male wage	Female Wage	Male wage	Female Wage	Male Wage	Female Wage
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Explanatory Variables*2	(t value)*1	(t value)	(t value)	(t value)	(t value)	(t value)
Age	0.358	0.108	1.612	1.612	0.628	0.257
	(8.89)**	(2.77)**	(3.48)**	(3.15)**	(1.29)	(0.72)
Age^2	-0.0004	-0.0008	-0.018	-0.017	-0.010	-0.002
	(7.53)**	(1.24)	(2.77)**	(2.19)**	(1.40)	(0.38)
Whether completed primary	0.561	0.506	2.453	8.180	6.628	-1.348
education	(3.26)**	(4.07)**	(0.55)	(2.31)*	(2.36)*	(0.23)
Whether completed lower	0.479	0.682	1.191	10.464	10.903	2.190
secondary education	(2.04)*	(4.41)**	(0.29)	(3.19)**	(3.37)**	(0.37)
Whether completed upper	1.150	2.023	3.725	11.849	14.349	7.789
secondary education	(5.07)**	(8.97)**	(0.79)	(3.46)**	(4.54)**	(1.28)
Whether completed	2.673	3.719	8.193	14.245	39.283	9.872
technical education	(8.43)**	(15.34)**	(1.79)†	(4.34)**	(5.20)**	(1.65)
Whether completed	5.086	6.628	17.784	25.776	-4.507	25.513
higher education	(13.77)**	(12.16)**	(3.57)**	(6.30)**	(3.01)**	(3.89)**
Whether working for their own	-2.960	-2.016	-11.609	-3.782	-4.507	-5.709
farm sector as a wage worker	(16.84)**	(13.75)**	(7.80)**	(1.78)†	(3.01)**	(4.57)**
Whether working for their own	-1.878	-1.453	-6.787	-0.0845	-0.668	-3.480
nonfarm sector as a wage worker	(9.53)**	(5.65)**	(2.50)*	(0.03)	(0.20)	(1.14)
Whether belonging to	0.343	-0.005	-20.440	-0.084	2.461	-0.798
ethnic majorities	(1.36)	(0.02)	(1.56)	(0.03)	(1.13)	(0.56)
Size of land (hectare)	-2.32	-1.934	-1.171	0.824	1.455	-3.00
	(0.33)	(0.40)	(0.75)	(0.61)	(0.50)	(0.95)
Size of land squared	-9.51	21.651	0.074	-0.139	-0.220	0.534
	(0.19)	(1.80)†	(0.49)	(1.46)	(0.59)	(1.32)
Constant	0.601	2.562	18.79	9.78	27.388	28.306
	(0.90)	(3.79)	(1.77)	(0.99)	(2.73)	(2.84)
Sigma	8.240	5.884	29.918	24.955	38.473	22.932
	(6.07)**	(10.05)**	(8.06)**	(5.92)**	(3.64)**	(19.67)**
Observations	12280	7502	1243	795	1456	1293
Joint significant test	F(23,12257) =68.06**	F(23,7479) =53.25**	F(23,1220) =7.85**	F(23,772) =7.11**	F(23,1433) =5.13**	F(23,1293) =7.30**

*Notes: *1. t statistics in brackets; + p<.10, * p<.05, ** p<.01. *2. Regional and locational dummy variables are included as explanatory variables, but are not shown to save the space. Dummy variables are "whether in river delta region; North East region; North West region; North Central Coast region; South Central Coast region; Central Highlands region; North East South region; Central Coast region; Inland Delta; Hills; Low Mountains. Regional dummy variables (used in Table 1) are included, but are omitted to save the space.

Source: Authors Calculation based on VHLSS 2002, 2004 and 2006.

Table A3

Wage Equations for male and female workers in rural areas of India based on NSS data in 1993 and 2004 (Tobit estimations)

	1993		2004	
	Male wage	Female Wage	Male Wage	Female Wage
	Coef.	Coef.	Coef.	Coef.
	(t value)	(t value)	(t value)	(t value)
Age	662.822	204.695	139.625	49.933
	(8.65)**	(3.65)**	(37.08)**	(10.15)**
Age^2	-4.072	-1.257	-1.638	-0.637
	(4.17)**	(1.69)	(39.07)**	(10.24)**
Whether is literate, but has not completed primary school	3,542.99	2,126.39	92.081	-205.98
	(12.71)**	(7.36)**	(5.10)**	(8.72)**
Whether completed primary school	7,518.66	3,208.70	175.043	-227.04
	(23.01)**	(7.49)**	(9.45)**	(9.53)**
Whether completed middle school	14,163.75	10,200.92	360.514	-192.21
	(29.57)**	(8.09)**	(19.49)**	(7.37)**
Whether completed secondary or higher secondary school	35,055.00	38,201.86	810.913	201.04
	(56.87)**	(26.88)**	(33.86)**	(5.63)**
Whether completed higher education	57,151.06	53,253.26	1,473.09	1,004.51
	(47.65)**	(17.32)**	(64.15)**	(20.43)**
Land Owned	0.349	-0.324	0.00	-0.082
	(0.98)	(4.86)**	(2.39)*	(8.35)**
Scheduled Tribe (ST) dummy (ST=1, otherwise=0)	-322.569	-1,018.14	-121.41	-108.96
	(0.87)	(4.08)**	(9.13)**	(7.53)**
Scheduled Caste (SC) dummy (SC=1, otherwise=0)	-2,177.57	-381.166	-	-
	(7.95)**	(1.89)		
non-agricultural self employment dummy (non-agricultural self employment=1 otherwise)	7,216.57	2,324.92	1,859.26	566.23
	(10.27)**	(5.49)**	(68.44)**	(21.97)**
agricultural self employment dummy (agricultural self employment=1 otherwise=0)	7,899.48	5,204.41	2,196.08	880.79
	(15.13)**	(14.37)**	(69.07)**	(22.83)**
Muslim dummy(Muslim=1, otherwise=0)	746.744	185.894	113.494	-330.9
	(1.61)	(0.46)	(5.59)**	(10.79)**
Constant	-2,171.00	4,216.78	-2,940.20	-1,749.97
	(1.50)	(4.18)**	(34.97)**	(16.65)**
Observations	33720	15849	67168	59221

*Notes: *1. Robust z statistics in brackets; + p<.10, * p<.05, ** p<.01. *2. State dummy variables are included as explanatory variables, but are not shown to save the space.

Source: Authors Calculation based on NSS 50 and NSS61.

Appendix: Deriving Vulnerability Measure[12]

Vulnerability measure as an expected poverty is specified as:

$$VEP_{it} \equiv V_{it} = Pr(c_{i,t+1} \leq z) \quad \text{(A.1)}$$

where vulnerability of household i at time t, V_{it}, is the probability that the *i-th* household's level of consumption at time t+1, $c_{i,t+1}$, will be below the poverty line, z.

Three limitations, amongst others, should be noted in our measure of vulnerability. First, the present analysis is confined to a consumption (used synonymously with income) threshold of poverty. Second, our measure of vulnerability in terms of the probability of a household's consumption falling below the poverty threshold in the future is subject to the choice of a threshold. Third, while income/consumption volatility underlies vulnerability, the resilience in mitigating welfare losses depends on assets defined broadly-including human, physical and social capital. A household with inadequate physical or financial asset or savings, for example, may find it hard to overcome loss of income. This may translate into lower nutritional intake and rationing out of its members from the labour market (Dasgupta, 1997; Foster, 1995). Lack of physical assets may also impede accumulation of profitable portfolios under risk and generate poverty traps.

The consumption function is estimated by the equation (A.2).[13]

$$\ln c_i = X_i \lambda + e_i \quad \text{(A.2)}$$

where c_i is log of real per capita household consumption (for Vietnam) and mean per capita consumption (MPCE) (i.e. food and non-food consumption expenditure) (for India) for the household and X is a vector of observable household characteristics and other determinants of consumption. It is further assumed that the structure of the economy is relatively stable over time and, hence**,** future consumption stems solely from the uncertainty about the

[12] This Appendix is based on Imai (2011) and Imai et al. (2011).
[13] We have used White-Huber sandwich estimator to overcome heteroscedasticity in the sample.

idiosyncratic shocks, e_i. It is also assumed that the variance of the disturbance term depends on:

$$\sigma_{e,i}^2 = X_i\theta \qquad \text{(A.3)}$$

The estimates of β and θ are obtained using a three-step feasible generalized least squares (FGLS)[14]. Using the estimates $\hat{\beta}$ and $\hat{\theta}$, we can compute the expected log consumption and the variance of log consumption for each household as follows.

$$E[\ln C_i | X_i] = X_i\hat{\beta} \qquad \text{(A.4)}$$

$$V[\ln C_i | X_i] = X_i\hat{\theta} \qquad \text{(A.5)}$$

By assuming $ln\, c_i$ as normally distributed and letting $\Phi(\cdot)$ denote the cumulative density function of the standard normal distribution, the estimated probability that a household will be poor in the future (say, at time t+1) is given by:

$$\hat{VEP}_i \equiv \hat{v}_i = \hat{Pr}(\ln c_i < \ln z | X_i) = \Phi\left(\frac{\ln z - X_i\hat{\beta}}{\sqrt{X_i\hat{\theta}}}\right) \qquad \text{(A.6)}$$

This is an *ex ante* vulnerability measure that can be estimated with cross-sectional data. Note that this expression also yields the probability of a household at time *t* becoming poor at *t+1* given the distribution of consumption at *t*.

A merit of this vulnerability measure is that it can be estimated with cross-sectional data. However, it correctly reflects a household's vulnerability only if the distribution of consumption across households, given the household characteristics at time t, represents time-series variation of household consumption. Hence this measure requires a large sample in which some households experience positive shocks while others suffer from negative

[14] See Chaudhuri (2003), Chaudhuri et al. (2002), and Hoddinott and Quisumbing (2003b) for technical details.

shocks. Also, the measure is unlikely to reflect unexpected large negative shocks (e.g., Asian financial crisis), if we use the cross-section data for a normal year.