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Non Agricultural Employment and Poverty in India – An Analysis Based on the 60th Round of NSS[1]

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Abstract

Using the National Sample Survey (NSS) household data for 2004, we analyse the determinants of individual participation in non-agricultural activities in rural and urban India. First, a multinomial logit estimation (MLE) is carried out to throw light on the determinants of (i) labour market participation of individuals as workers in agricultural and non-agricultural activities, and of (ii) self-employment in these two groups of activities. School and technical education, on the hand, and infrastructure (measured, for example, by road length per 100 square kilometres, number of telephone and mobile phone connections per 100 people), on the other, shape these choices, among other factors. Second, based on an MLE, the determinants of employment *within* non-farm activities (e.g. food processing, manufacturing and trading) are analysed. Again, school and technical education, and infrastructure have important roles. Other variables matter too. Those from socially disadvantaged groups (scheduled tribes or castes), for example, have lower probabilities of employment in manufacturing and trading. Finally, some forms of employment in non-agricultural activities have significant poverty reducing or welfare enhancing effects. Self-employment in non-agriculture is a case in point. Contrary to a widespread presumption in the development literature that non-farm activities expand easily to reduce poverty, it is emphasised that both poverty reduction and participation in non-agricultural activities depend on infrastructural development. Controlling for these and other effects, greater participation in non-agricultural activities reduces poverty.

Key Words: Non-farm sector, Non-agriculture, Diversification, Poverty, India
JEL Codes: L21, I32, J43, J44, O13, O14, O53

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I. Introduction

The purpose of this paper is to identify the determinants of participation in non-agricultural activities in rural and urban India in 2004, drawing upon the 60th round of National Sample Survey (NSS) data. In recent years, given the constraints on agricultural expansion, greater attention has been given to non-farm activities in view of their potential for economic development and poverty reduction (e.g. Lanjouw and Lanjouw, 2001)[3]. It is, however, not straightforward to identify the role of non-farm activities in economic development as there is a great deal of diversity in their skill-composition, varying from highly skilled in manufacturing to relatively unskilled in trading. Besides, whether incomes are higher depends on not just the nature of the activity but also on the status of the employed person (i.e. whether self-employed or a labourer). Even if productivity and wages or incomes in non-farm activities are not higher than those in farming, the former *as an option* makes a difference, as it facilitates income diversification by farmers and agricultural labourers, and helps them cope with various shocks in a risky environment and reduce poverty *ex post* in a dynamic context. [4, 5] Given the high likelihood of seasonal unemployment in agricultural economies, total household income is likely to increase if there are more choices for workers or self-employed to work in non-farm activities that are not affected by seasonality.

Diversification of agricultural sector into non-cereal crops and fruits and vegetables is associated with higher productivity of agricultural (Gaiha and Imai, 2006; Joshi et al. 2004). This in turn would facilitate expansion of non-agricultural

[3] Note that non-farm and non-agricultural activities are used synonymously.
[4] See Kochar (1999) for the evidence from rural India based on the ICRISAT data or Kijima et al. (2006) for the case of rural Uganda.

activities, mainly in food-processing, trade or manufacturing requiring agricultural raw materials as inputs. In other words, there are strong inter-relationships between farm and non-farm activities. Economic growth of the local economy is likely to be enhanced through this interaction[6].

Despite its growing importance, there have been relatively few empirical studies of the determinants of participation in non-farm activities and/or the role of participation in such activities in poverty reduction. One notable exception is van de Walle and Cratty (2004), which investigates the determinants of participation in rural non-farm activities and poverty incidence or consumption expenditure at the same time using Vietnamese household data. In another contribution, based on household data in rural Uganda, Matsumoto et al. (2006) identify the determinants of participation in non-farm activities.

Our study attempts to build on these studies by investigating the determinants of participation in non-agricultural activities, drawing upon the 60th round of National Sample Survey (NSS) data for 2004, which covers households and individuals in both rural and urban India. Our focus is on disaggregation of participants in non-farm activities into (1) workers and self-employed, as also (2) by type of non-farm activity (viz. food-processing, manufacturing, and trade), separately for both rural and urban

[5] However, using NSS data in 1983 and 1999, Eswaran et al. (2006) report that the growth in wage earnings and poverty reduction are due mainly to the increase in agricultural productivity, rather than non-agricultural productivity growth.

[6] The linkages between farm and non-farm activities have been emphasised in the development literature (notably Mellor and Lele, 1972, and Mellor, 1976). There are production linkages – backward and forward. Backward linkages relate to the demand of farmers for inputs e.g. ploughs, engines and tools, while forward linkages are linked to the need for processing of agricultural commodities e.g. spinning, canning and milling. Moreover, there are consumption linkages. As agricultural income rises, it feeds into higher demand for non-farm goods produced locally or in neighbouring villages/towns. Finally, there are linkages through the supply of labour and capital. As agricultural productivity rises, either labour is released or wages go up. Also, agricultural surpluses could finance expansion of the non-farm sector. And the latter in turn could stimulate agricultural production via lower input costs, technological change and ploughing back of profits into farming.

areas. We use household and individual characteristics and state-level variables on infrastructure (proxied by per capita road length area, availability of telephones per 100 persons, and electricity consumption per capita) in analysing the determinants of participation. The relationship between household expenditure and (predicted) participation in different types of non-farm activities will also be analysed along the lines of van de Walle and Cratty (2004).

The rest of the paper is organised as follows. The next section provides a brief description of the data set. Section III discusses econometric models, specifications, and variables used in our analysis. Regression results are discussed in Section IV. The final section offers some concluding remarks to put the analysis in perspective.

II. Data

The National Sample Survey (NSS), which was first set up in 1950 by the National Sample Survey Organisation (NSSO) under the Government of India, collects socio-economic data in all parts of India. We use the data on 'Employment and Unemployment' and 'Expenditure' in 60th round survey conducted during January - June in 2004. A stratified multi-stage sample design was adopted whereby (1) the first stage units (FSU) were first allocated all over the India, based on the survey in 1991 and the sample size of each FSU was adjusted according to population census in 2001; and then (2) households in the selected villages and blocks in FSU were stratified into two second stage strata according to their land-holding. That is, the survey is designed so that sample households can reasonably represent the entire population in India.[7]

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[7] Tables are presented in Appendices 1, 2, and 3 to show some key features of the data we use in this paper. Appendix 1 summarise distributions of self employed and workers by

Appendix 4 provides descriptive statistics and correlation matrix used in our analysis in the next section. 'Employment and Unemployment' survey data are at individual level. The total number of individuals in the data is 306,100, consisting of 273,490 in rural areas and 32,610 in urban areas. We use the sample of individuals aged 15 to 65 years old and exclude the sample not in 'labour force' based on the definition used by NSSO (e.g. those who go to school, do domestic duties only). After controlling for missing observations in explanatory variables[8], 136,319 individuals remained for our econometric analysis, out of which 94,894 were in rural and 41,425 were in urban areas.

III. Models and Specifications

(1) Multinomial Logit Models for Participation in Non-farm Sectors

To identify the determinants of individual participation in non-agricultural and agricultural activities, we employ a multinomial logit model.

Model (a) –Choice of Agricultural and Non-Agricultural Sector/ Worker and Self-Employed:

$$\Pr(Y_i = j) = \frac{e^{(X_i\beta'_{1j} + \beta'_2 I)}}{\sum_{k=0}^{3} e^{(X_i\beta'_{1k} + \beta'_2 I)}}, \quad j = 0,1,2,3 \qquad (1)$$

where Y_i represents an individual's choice among 4 unordered alternatives:

Y_1 = Worker in Non-Agricultural Sector,
Y_2 = Worker in Agricultural Sector,
Y_3 = Self-employed in Non-Agricultural Sector,
[Y_0 =Self-employed in Agricultural Sector (which is set as the reference case

agricultural and non-agricultural sector by regions. Appendix 2 focuses on the distribution of self employed and workers in different non-agricultural activities and agricultural sector by region. Poverty indices, expenditure, and education statistics are shown in Appendix 3.

[8] Among 35 states and union territories, the variable on road length at state level used in our analysis is available for only 32 and unavailable for Chhattisgarh, Jharkhand, and Uttaranchal.

where we assume that $\beta_0 = 0$. Hence the results for Y_0' are not shown].

Following Greene (2000), we can normalise the equation (1) by setting $\beta_0 = 0$ as:

$$\Pr(Y_i = j) = \frac{e^{(x_i \beta_{1j}')}}{1 + \sum_{k=1}^{3} e^{(x_i \beta_{1k})}}, \quad j = 1, 2, 3 \qquad (2)$$

$$\Pr(Y_i = j) = \frac{1}{1 + \sum_{k=1}^{3} e^{(x_i \beta_{1k})}}, \quad j = 0 \qquad (3)$$

Probabilities for four different choices can be derived from equations (2) and (3).

In the above equations, X_i is a vector of individual and household characteristics and a state-level infrastructure proxied by road length per 100 square kilometres, availability of telephones and mobile phone connections per 100 persons, and electricity consumption per capita. The regression is clustered at household level so that individuals within a household are allowed to be correlated while those across different households are independent. The sample is restricted to the individuals aged 15 to 65 years old, and does not include students or housewives who are not in the formal labour market. The model is estimated separately for rural and urban areas, as their economic structures vary.

More specifically, we use the explanatory variables defined as follows.

Whether Female: 1 = if an individual is female; 0 = male (Dummy variable)

Whether Household Head: 1 = if an individual is household head; 0= otherwise

Whether Married: 1 = if an individual is married; 0 = otherwise.

Education: 0= not literate; 1= literate without formal schooling; 2= literate but below primary school; 3= primary school; 4= middle; 5= secondary; 6 = higher secondary; 7 = diploma/ certificate course; 8 = graduate; 9 = postgraduate and above.

Whether Technical Education: Whether an individual had any technical degree or education (1 or 0).

Household Size: the number of normally resident members of a household.

Land: Land possessed- 0= less than 0.005 hectare; 1 = 0.005-0.01 hectare; 2 = 0.02-0.20 hectare; 3= 0.21-0.40 hectare; 4= 0.41-1.00 hectare; 5 = 1.01- 2.00 hectares; 6 = 2.01- 3.00 hectares; 7 = 3.01-4.00 hectares; 8 = 4.01-6.00 hectares; 9 = 6.01- 8.00 hectares; 10= greater than 8.00 hectares.

Whether Hindu: Whether household religion is Hinduism (1 or 0).

Whether Islam: Whether household religion is Islam (1 or 0).

Whether Scheduled Tribe: Whether the household belongs to a Scheduled tribe (1 or 0).

Whether Scheduled Caste: Whether the household belongs to a Scheduled Caste (1 or 0).

Whether Backward Caste: Whether the household belongs to other backward castes (1 or 0).

Infrastructure: Road length per 100 Sq kms: total road length per 100 square kilometres, Teledensity-numbers of telephones and mobile phone connections per 100 persons, or electricity consumption per capita (state or union territories level)

Model (b) –Choice of Different Activities in Non-Agricultural sector

As an extension of Model (a), an individual's choice of different sub-sectors in non-agricultural sector is estimated by a multinomial logit model. Here the reference case is the agricultural sector.

$$\Pr(Y_i' = j) = \frac{e^{(X_i\beta_{1j}')}}{\sum_{k=0}^{3} e^{(X_i\beta_{1k}')}}, \quad j = 0, 1, 2, 3, 4 \qquad (4)$$

Y_1' = An individual works in Food Processing Industry,
Y_2' = Manufacturing Industry,
Y_3' = Trade,
Y_4' = Other Non-Agricultural activities
[Y_0' = Agricultural sector is the reference case where we assume that $\beta_0 = 0$. Hence the results for Y_0' are not shown].

This model is estimated by the same set of explanatory variables. In this model, workers and self employed are not distinguished.

(2) OLS for Expenditure Function

From Model (a) above, the predicted probabilities of being a worker ($=\hat{\Pr}(Y_1)$) or a self-employed person ($=\hat{\Pr}(Y_3)$) in the non-farm are obtained. They are used as one of the explanatory variables in the expenditure function to see the effects of participation in non-farm sector on household expenditure. Because $\hat{\Pr}(Y_1)$ or $\hat{\Pr}(Y_3)$ is computed at individual level and expenditure is available only at household level, the unit of the analysis is individual and the regression is clustered at household level so that individuals within a household are allowed to be correlated while those across different households are independent. The same set of variables is used in the expenditure function, which is specified as:

$$C_i = \alpha_0 + \alpha_1 \hat{\Pr}(Y_1) + X_i\alpha_2 + \varepsilon_i \qquad (5)$$

or $$C_i = \alpha_0 + \alpha_1 \hat{\Pr}(Y_3) + X_i\alpha_2 + \varepsilon_i \qquad (5)'$$

where X_i is a set of individual and household characteristics, and infrastructural variables, and ε_i is an error term.

(3) Logit model for Poverty Function

A direct extension of estimation of expenditure function is to estimate a logit model whereby the binary variable on whether a household expenditure per capita is

under a poverty threshold is estimated by the same set of explanatory variables. We use the poverty lines at state level reported by Jha et al. (2006)[9].

$$\Pr(Y_i = 1) = \frac{e^{\alpha_0 + \alpha_1 \hat{\Pr}(Y_1) + X_i\alpha_2}}{1 + e^{\alpha_0 + \alpha_1 \hat{\Pr}(Y_1) + X_i\alpha_2}} \qquad (6)$$

$$\text{or} \quad \Pr(Y_i = 1) = \frac{e^{\alpha_0 + \alpha_1 \hat{\Pr}(Y_3) + X_i\alpha_2}}{1 + e^{\alpha_0 + \alpha_1 \hat{\Pr}(Y_3) + X_i\alpha_2}} \qquad (6)'$$

Y_i takes the value 1 if household expenditure per capita is under the poverty line and 0 otherwise. The explanatory variables are the same as in equation (5) or (5)'.

IV. Econometric Results

In this section, we will discuss the results obtained from the models discussed earlier. The Huber-White sandwich estimator of variance is used to correct the standard errors for heteroscedasticity.

(1) Multinomial Logit Models for Participation in Non-farm Sectors

Model (a) –Choice of Agricultural and Non-Agricultural Sector/ Worker and Self-Employed:

Table 1 shows the results for Model (a) in rural areas. Since our focus is on non-agricultural activities, we will concentrate on the probabilities of being a worker (Choice (1)) and of being self employed (Choice (2)) in these activities. While the coefficient does not exactly correspond to marginal effect, we can analyse the relative

[9] These reflect the official poverty lines used by the Government of India for the year 2004 (Jha et al., 2006).

size of the effect of each explanatory variable on each choice by comparing coefficient estimates.[10]

Given the large sample size (the number of observations being 94,894), it is not surprising that most of the coefficient estimates of explanatory variables are highly significant. Based on Choice (0) (Self-employed in Agricultural Sector) as the reference case, the probability of being a worker in non-agricultural sector (Choice (1)) is affected by (i) a female dummy (positive and significant), (ii) age (negative and significant), (iii) whether the person is a household head (negative and significant), (iv) whether the person is married, (v) education (positive and significant), (vi) technical education (positive and significant), (vii) household size and its square (positive/negative and significant), (viii) land and

[10] By differentiating (2) and (3) as in Greene (2000), the marginal effects of the characteristics on the probabilities in case X_i is a continuous variable are:

$$\delta_j = \frac{\partial \Pr(Y_i' = j)}{\partial X_i} = \Pr_j\left[\beta_j - \sum_{k=0}^{3} \Pr(Y_i' = k)\beta_k\right] = \Pr_j\left[\beta_j - \bar{\beta}\right]$$

Hence, the larger β_j is, the larger the marginal effect, but the former does not match the latter.

Table 1 Multinomial Logit Regression for the Choice of (1) Workers in Non-agricultural Sector, (2) Worker in kers Agricultural Sector, (3) Self-employed in Non-agricultural Sector, and (4) Self-employed in Non-agricultural Sector (Rural India)

	Choice (1) Worker in Non-agricultural Sector			**Choice (2) Worker in Agricultural sector**			**Choice (3) Self-employed in Non-agricultural sector**		
	Coef.	Z value		Coef.	Z value		Coef.	Z value	
Whether Female	**0.417**	**(11.01)**	**	**0.305**	**(8.46)**	**	**-0.340**	**(-6.25)**	**
Age	**-0.108**	**(-77.62)**	**	**-0.018**	**(-18.98)**	**	**-0.024**	**(-18.12)**	**
Whether Household Head	**-1.093**	**(-23.45)**	**	**-2.878**	**(-71.51)**	**	**-1.295**	**(-24.94)**	**
Whether Married	**-0.740**	**(-20.01)**	**	0.036	(1.03)		**-0.200**	**(-4.36)**	**
Education	**0.070**	**(10.75)**	**	**-0.038**	**(-7.22)**	**	**0.177**	**(26.12)**	**
Whether Technical Education	**1.311**	**(10.24)**	**	**-0.332**	**(-2.48)**	*	**0.873**	**(7.18)**	**
Household Size	**0.112**	**(8.38)**	**	-0.015	(-1.48)		**0.086**	**(4.75)**	**
Household Size Squared	**-0.002**	**(-2.92)**	**	**0.001**	**(2.36)**	*	-0.001	(-0.87)	
Land	**-1.239**	**(-44.11)**	**	**-1.009**	**(-38.70)**	**	**-1.211**	**(-38.03)**	**
Land Squared	**0.077**	**(29.46)**	**	**0.075**	**(31.71)**	**	**0.068**	**(18.37)**	**
Whether Hindu	**0.878**	**(14.27)**	**	**1.178**	**(19.75)**	**	**0.929**	**(12.25)**	**
Whether Muslim	**0.793**	**(10.01)**	**	**0.998**	**(13.14)**	**	**1.235**	**(13.50)**	**
Whether Scheduled Tribe	**-0.546**	**(-10.76)**	**	**0.120**	**(2.75)**	**	**-1.171**	**(-15.91)**	**
Whether Scheduled Caste	0.063	(1.31)		**0.607**	**(14.31)**	**	-0.083	(-1.49)	
Whether Backward Caste	**-0.115**	**(-3.35)**	**	**0.155**	**(5.33)**	**	0.041	(1.02)	
Road Length per 100 Sq kms	**0.004**	**(11.74)**	**	**0.001**	**(2.37)**	*	**0.003**	**(9.30)**	**
Constant	6.437	(52.26)		3.976	(34.96)		2.446	(17.88)	
No. of Observations	94894			**Hausman Tests for IIA assumption**: Ho: Odds are independent of other alternatives.					
Joint Significance Test	Wald $Chi^2(48)$=	31220.12	**	Omitted	Chi^2	evidence			
Pseudo R^2	32.71			Choice(1)	1427.461**	against Ho			
				Choice (2)	-0.003	for Ho			
				Choice(3)	-3.801	for Ho			
Cases where Other Infrastrucral Variables are used instead of Road Length per 100 Sq kms									
Teledensity (no. of telephones & Mobile phone connections per 100)	**0.057**	**(18.09)**	**	**0.039**	**(14.23)**	**	**0.021**	**(5.83)**	**
Electricity Consumption per capita	**0.0007**	**(9.98)**	**	**0.0006**	**(9.16)**	**	**0.0004**	**(6.15)**	**

Notes: 1. Reference case: Self-employed in Agricultural Sector (Choice (0))

its square (negative/positive and significant), (ix) whether Hindu /Muslim (both positive and significant), (x) whether the person is from a Scheduled Tribe /Backward Caste (both negative and significant), and (xi) road length (positive and not significant).

Our comments on these results are brief and selective.

Both formal and technical education enable individuals to be employed as workers in non-agricultural sector. Positive coefficient of household size and negative coefficient of its square imply that it is easier for a large household to let some of its household members engage in non-agricultural sector but this advantage l gets smaller as the household size becomes larger. Those from socially disadvantaged groups, such as Scheduled Tribes or Backward Castes, are, however, less likely to work in non-agricultural sector.

The result on road length suggests that better infrastructure is a precondition for workers to be in non-agricultural sector (with self-employed in agricultural sector as the default/ reference case). Teledensity and electricity consumption also influence participation as workers in alternative specifications (without road length). So the role of infrastructure is further corroborated.

The last column of Table 1 shows that the probability of being self employed in non-agricultural sector (Choice (3)) is affected by various individual and household characteristics and the infrastructural variable. Since the results are generally similar to those for Choice (1), we focus only on the major differences below.

First, the female dummy is negative and significant. That is, men are more likely to be self employed in non-agricultural sector. The dummy variable on whether the person is from a Scheduled Caste is negative and not significant, while it is positive and significant for Choice (1). The coefficient of infrastructure is positive and significant

for three different measures, further underlining the importance of infrastructure in non-farm sector employment.

It is assumed in the multinomial logit model that the odds ratio, based on the ratio of probability of one choice relative to that of another, does not depend on other choices. This follows from the independence of irrelevant alternatives (IIA) assumption (Greene, 2000). We use the Hausman test to check whether the coefficient estimates of the original model are systematically different from those of another model in which one choice is omitted (Greene, *ibid*.). The results are shown at the bottom of Table 1. In two out of three cases, the result favour the IIA. Hence some caution is necessary in taking all results at value.

Table 2 contains the results for urban India for the same model. As we are interested in the determinants of participation in non-agricultural sector, as before, we will concentrate on the results for Choice (1) and Choice (3).

As the results are generally similar to those in Table 1, we shall confine our remarks to some differences in the results for these choices.

For Choice (1), the coefficient estimates of household size and its square are not significant; while for Choice (3), the coefficient estimate of household size is positive and significant only at the 10% level. Whether the religion is Hindu or Islam does not influence Choice (1) or Choice (3). The coefficient estimates of infrastructural variables are significant for road length and availability of telephones for both Choice (1) and Choice (3). While the importance of infrastructure in non-agricultural employment is corroborated, the case is stronger for rural areas. As in Table 1, in two out of the three cases, the Hausman test favours the IIA.

Table 2 Multinomial Logit Regression for the Choice of (1) Workers in Non-agricultural Sector, (2) Workers in Agricultural Sector, (3) Self-employed in Non-agricultural Sector, and (4) Self-employed in Non-agricultural Sector (Urban India)

	Choice (1) Worker in Non-agricultural Sector			**Choice (2) Worker in Agricultural sector**			**Choice (3) Self-employed in Non-agricultural sector**		
	Coef.	Z value		Coef.	Z value		Coef.	Z value	
Whether Female	**0.420**	**(3.73)**	**	**0.401**	**(3.25)**	**	-0.112	(-0.95)	
Age	**-0.063**	**(-22.88)**	**	**-0.011**	**(-3.56)**	**	**-0.019**	**(-7.04)**	**
Whether Household Head	**-0.813**	**(-6.95)**	**	**-2.154**	**(-16.10)**	**	**-0.467**	**(-3.92)**	**
Whether Married	**-0.281**	**(-2.53)**	*	**0.419**	**(3.15)**	**	**0.195**	**(1.72)**	+
Education	**0.177**	**(13.12)**	**	**-0.056**	**(-3.42)**	**	**0.176**	**(13.00)**	**
Whether Technical Education	**1.046**	**(5.02)**	**	-0.337	(-1.06)		**0.586**	**(2.79)**	**
Household Size	-0.005	(-0.16)		-0.057	(-1.33)		**0.058**	**(1.66)**	+
Household Size Squared	0.002	(1.27)		0.002	(0.99)		0.000	(0.10)	
Land	**-1.415**	**(-23.02)**	**	-0.695	(-10.49)		**-1.319**	**(-20.93)**	**
Land Squared	**0.088**	**(13.24)**	**	**0.059**	**(8.31)**	**	**0.077**	**(10.69)**	**
Whether Hindu	0.120	(0.85)		0.205	(1.24)		0.068	(0.48)	
Whether Muslim	-0.117	(-0.66)		0.035	(0.16)		0.216	(1.20)	
Whether Scheduled Tribe	**-0.957**	**(-6.10)**	**	0.131	(0.72)		**-1.408**	**(-8.59)**	**
Whether Scheduled Caste	-0.028	(-0.19)		**0.729**	**(4.56)**	**	-0.343	(-2.36)	*
Whether Backward Caste	**-0.676**	**(-7.89)**	**	-0.065	(-0.62)		-0.687	(-7.90)	**
Road Length per 100 Sq kms	**0.001**	**(2.33)**	*	0.000	(0.35)		**0.001**	**(2.21)**	*
Constant	7.864	(31.63)		2.701	(9.50)		4.689	(18.48)	
No. of Observations	41425			**Hausman Tests for IIA assumption**: Ho: Odds are independent of other alternatives.					
Joint Significance Test	Wald $Chi^2(48)$=	9006.64	**	Omitted	Chi 2	evidence			
Pseudo R^2	20.85			Choice(1)	96.907**	against Ho			
				Choice (2)	12.229	for Ho			
				Choice(3)	38.158	for Ho			
Cases where Other Infrastrucral Variables are used instead of Road Length per 100 Sq kms									
Teledensity (no. of telephones & Mobile phone connections per 100)	**0.023**	**(3.04)**	**	**0.017**	**(2.27)**	*	**0.019**	**(2.49)**	*
Electricity Consumption per capita	0.0002	(1.27)		**0.0003**	**(2.16)**	*	0.0004	(0.38)	

Notes: 1. Reference case: Self-employed in Agricultural Sector (Choice (0))

2. **= Coefficient is significant at 1 % level. * = significant at 5 % level. + =significant at 10 % level.

3. Among 35 states and unions for which NSS data are available, 3 have been dropped as the infrastructural variables are not available.

Model (b) –Choice of Different Activities in Non-Agricultural Sector

In Table 3, using a multinomial logit model, we further disaggregate non-agricultural sector into sub groups in rural areas, namely, Choice (1): Food Processing, (2): Manufacturing (3): Trade, (4): Other non-agricultural activities. Choice (0) for Agricultural Sector is the reference case. We shall comment briefly and selectively to avoid cluttering the text.

Significant determinants of working in food processing (Choice (1)) include; (i) being female (negative) and married (negative), (ii) age (negative), (iii) formal education (positive), (iv) land (negative), (v) Hindu or Muslim (both positive), and (vi) road length (positive). These results suggest that school education enables participation in food processing. Road length also has a positive and significant effect. If it is replaced by teledensity or electricity consumption per capita, infrastructure continues to have a robust effect. Typically, men or younger people tend to work in the food processing industry in rural areas.

The results for Choice (2) of working in manufacturing are generally similar to those for Choice (1). However, the coefficient of technical education is positive and significant. Household size has a positive and significant significant effect. Negative and significant coefficients of Scheduled Tribe or Caste imply that, if the worker belongs to a socially disadvantaged group, the chances of being employed in manufacturing are low. Those in states with better infrastructure are more likely to work in manufacturing.

Although the results for Choice (3) of trading are also similar to those for Choice (2), a few differences are noted. If the person is a household head, he or she is likely

Table 3 Multinomial Logit Regression for the Choice for Sub-sectors in Non-agricultural Employment: (1) Food Processing Industry, (2) Manufacturing, (3) Trade, (4) Other Non-agricultural activities and (5) Agricultural Sector (Refernce Case) (Rural India)

	Choice (1) Food Processing			**Choice (2) Manufacturing**			**Choice (3) Trade**			**Choice (4) Other non-agricultural Sector**		
	Coef.	Z value		Coef.	Z value		Coef.	Z value		Coef.	Z value	
Whether Female	**-0.806**	**(-6.33)**	**	**-1.031**	**(-11.43)**	**	**-2.580**	**(-18.07)**	**	**0.133**	**(6.21)**	**
Age	**-0.009**	**(-2.73)**	**	**-0.025**	**(-10.14)**	**	**-0.033**	**(-17.61)**	**	**-0.079**	**(-81.04)**	**
Whether Household Head	0.002	(0.02)		0.030	(0.37)		**0.243**	**(3.52)**	**	**1.029**	**(36.71)**	**
Whether Married	**-0.307**	**(-2.80)**	**	**-0.226**	**(-2.68)**	**	0.108	(1.55)		**-0.876**	**(-34.80)**	**
Education	**0.077**	**(4.41)**	**	**0.096**	**(7.80)**	**	**0.195**	**(21.62)**	**	**0.103**	**(22.39)**	**
Whether Technical Education	0.383	(1.17)		**1.308**	**(8.45)**	**	**1.155**	**(9.50)**	**	**1.439**	**(18.65)**	**
Household Size	-0.019	(-0.49)		**0.102**	**(2.99)**	**	**0.047**	**(1.89)**	+	**0.138**	**(11.97)**	**
Household Size Squared	0.002	(1.24)		-0.002	(-1.16)		-0.001	(-0.78)		**-0.003**	**(-4.73)**	**
Land	**-0.448**	**(-5.34)**	**	**-0.626**	**(-11.50)**	**	**-0.531**	**(-15.55)**	**	**-0.440**	**(-28.48)**	**
Land Squared	-0.008	(-0.57)		**0.021**	**(2.54)**	*	**0.023**	**(4.66)**	**	**0.018**	**(10.19)**	**
Whether Hindu	**0.781**	**(3.08)**	**	0.118	(0.71)		0.033	(0.33)		0.050	(1.12)	
Whether Muslim	**0.600**	**(2.04)**	*	-0.236	(-1.13)		**0.249**	**(2.00)**	*	**0.242**	**(4.24)**	**
Whether Scheduled Tribe	-0.089	(-0.41)		**-0.988**	**(-4.99)**	**	**-0.782**	**(-7.46)**	**	**-0.749**	**(-19.39)**	**
Whether Scheduled Caste	-0.143	(-0.85)		**-0.314**	**(-2.87)**	**	**-0.382**	**(-5.09)**	**	**-0.476**	**(-13.27)**	**
Whether Backward Caste	0.170	(1.25)		0.004	(0.05)		**-0.136**	**(-2.30)**	*	**-0.202**	**(-7.47)**	**
Road Length per 100 Sq kms	**0.003**	**(10.59)**	**	**0.003**	**(9.75)**	**	**0.003**	**(13.57)**	**	**0.003**	**(14.30)**	**
Constant	-3.193	(-9.45)		-1.674	(-7.01)		-1.376	(-8.37)		2.332	(31.02)	
No. of Observations	94894			**Hausman Tests for IIA assumption**: Ho: Odds are independent of other alternatives.								
Joint Significance Test	Wald $Chi^2(64)$=	21435.42	**	Omitted	Chi 2	evidence						
Pseudo R^2	26.24			Choice(1)	-1.15	for Ho						
				Choice (2)	1.956	for Ho						
				Choice(3)	6.478	for Ho						
				Choice(4)	-92.369	for Ho						
Cases where Other Infrastrucral Variables are used instead of Road Length per 100 Sq kms												
Teledensity (no. of telephones & Mobile phone connections per 100)	**0.017**	**(1.77)**	+	**0.030**	**(3.78)**	**	**0.051**	**(12.90)**	**	**0.013**	**(5.73)**	**
Electricity Consumption per capita	**0.0003**	**(3.73)**	**	**0.0003**	**(6.84)**	**	**0.0002**	**(6.87)**	**	**0.00004**	**(1.74)**	+

Notes: 1. Reference case: Agricultural Sector (Choice (5))

2. **= Coefficient is significant at 1 % level. * = significant at 5 % level. + =significant at 10 % level.

3. Among 35 states and unions for which NSS data are available, 3 have been dropped as the infrastructural variables are not available.

to be in trading. The dummy variable on whether the religion is Islam is positive and significant. A person from socially disadvantaged groups is not likely to work in trading activities. Infrastructural variables are positive and significant.

For Choice (4) of working in 'other non-agricultural activities', the dummy variable on gender (i.e. whether the person is a woman) is *positive* and significant. The coefficients of being a household head and household size are both significant and positive. Those of both school and technical education are also significant and positive. If the religion is Islam, the probability of working in other non-agricultural activities is high. As in the results for Choice (2) and Choice (3), the coefficients of belonging to socially disadvantaged groups are negative and significant. Infrastructural variables are all positive and significant. The Hausman test results support the IIA assumption for all four choices.

Table 4 applies exactly the same model used for rural areas in Table 3 to urban areas. As the results in Table 4 reflect a generally similar pattern to that in Table 3, we do no more than summarise the important findings

First, higher levels of both school and technical education are associated with higher probabilities of working in urban non-farm activities, regardless of type of non-farm activity. Second, the coefficient of household size is significant (or close to significant), implying that a larger household has greater flexibility in assigning a household member to non-farm activities. Third, affiliation to a socially disadvantaged group lowers the chances of employment in non-farm activities. Fourth, coefficients of infrastructural variables are positive and significant (i.e. road length and teledensity), regardless of the type of non-farm activity. The Hausman test favour the IIA in three out of the four cases.

Table 4 Multinomial Logit Regression for the Choice for Sub-sectors in Non-agricultural Employment: (1) Food Processing Industry, (2) Manufacturing, (3) Trade, (4) Other Non-agricultural activities and (5) Agricultural Sector (Refernce Case)
(Urban India)

	Choice (1) Food Processing			**Choice (2) Manufacturing**			**Choice (3) Trade**			**Choice (4) Other non-agricultural Sector**		
	Coef.	Z value		Coef.	Z value		Coef.	Z value		Coef.	Z value	
Whether Female	**-1.078**	**(-5.85)**	**	**-1.013**	**(-8.75)**	**	**-1.485**	**(-14.37)**	**	0.054	(0.84)	
Age	**-0.023**	**(-6.68)**	**	**-0.032**	**(-11.54)**	**	**-0.029**	**(-12.51)**	**	**-0.046**	**(-24.63)**	**
Whether Household Head	**0.336**	**(2.52)**	*	**0.387**	**(4.00)**	**	**0.407**	**(4.58)**	**	**0.506**	**(7.27)**	**
Whether Married	**-0.495**	**(-3.51)**	**	**-0.147**	**(-1.34)**		0.063	(0.65)		**-0.561**	**(-7.20)**	**
Education	**0.226**	**(12.10)**	**	**0.217**	**(15.49)**	**	**0.279**	**(21.59)**	**	**0.192**	**(18.32)**	**
Whether Technical Education	**0.873**	**(3.90)**	**	**1.452**	**(8.09)**	**	**0.909**	**(5.25)**	**	**1.014**	**(6.28)**	**
Household Size	0.085	(1.53)		**0.082**	**(1.89)**	+	**0.078**	**(1.95)**	+	0.051	(1.60)	
Household Size Squared	-0.003	(-0.75)		-0.002	(-0.94)		**-0.006**	**(-2.17)**	*	0.001	(0.32)	
Land	**-1.084**	**(-12.98)**	**	**-1.180**	**(-18.86)**	**	**-1.048**	**(-19.98)**	**	**-0.943**	**(-21.32)**	**
Land Squared	**0.050**	**(3.45)**	**	**0.069**	**(7.97)**	**	**0.051**	**(7.21)**	**8	**0.047**	**(9.24)**	**
Whether Hindu	0.425	(1.55)		**0.537**	**(2.82)**	**	0.160	(1.10)		-0.052	(-0.42)	
Whether Muslim	0.448	(1.46)		0.358	(1.59)		**0.300**	**(1.72)**	+	-0.065	(-0.43)	
Whether Scheduled Tribe	**-0.910**	**(-2.96)**	**	**-1.865**	**(-7.72)**	**	**-1.334**	**(-8.03)**	**	**-1.148**	**(-8.60)**	**
Whether Scheduled Caste	**-0.715**	**(-3.56)**	**	**-0.635**	**(-4.38)**	**	**-0.472**	**(-3.90)**	**	**-0.660**	**(-6.11)**	**
Whether Backward Caste	**-0.455**	**(-3.56)**	**	**-0.527**	**(-5.33)**	**	**-0.609**	**(-7.05)**	**	**-0.656**	**(-8.71)**	**
Road Length per 100 Sq kms	**0.001**	**(3.69)**	**	**0.000**	**(2.34)**	*	**0.001**	**(3.12)**	**	**0.001**	**(3.61)**	**
Constant	0.252	(0.71)		1.373	(5.07)		1.803	(7.98)		5.242	(27.12)	
No. of Observations	41425			**Hausman Tests for IIA assumption**: Ho: Odds are independent of other alternatives.								
Joint Significance Test	Wald $Chi^2(64)$=	5323.33	**	Omitted	Chi 2	evidence						
Pseudo R^2	14.03			Choice(1)	-0.237	for Ho						
				Choice (2)	-1.820	for Ho						
				Choice(3)	0.561	for Ho						
				Choice(4)	495.039**	against Ho						
Cases where Other Infrastrucral Variables are used instead of Road Length per 100 Sq kms												
Teledensity (no. of telephones & Mobile phone connections per 100)	**0.019**	**(3.24)**	**	**0.013**	**(2.45)**	**	**0.013**	**(2.56)**	*	**0.011**	**(2.35)**	*
Electricity Consumption per capita	0.00001	(0.18)		0.00007	(1.10)		-0.00007	(-1.12)		-0.00075	(-1.38)	

Notes: 1. Reference case: Agricultural Sector (Choice (5))

2. **= Coefficient is significant at 1 % level. * = significant at 5 % level. + =significant at 10 % level.

3. Among 35 states and unions for which NSS data are available, 3 have been dropped as the infrastructural variables are not available.

(2) OLS for Expenditure Function

Table 5 reports the OLS results for the expenditure function. The results in Case (1) show that the coefficient of the predicted probability of being a worker in non-agricultural activities is negative and not significant in rural areas. In Case (2), the coefficient of the predicted probability of being self-employed in non-agriculture is, however, positive and significant in rural areas. That is, if a person is self employed in such activities, the expenditure tends to be higher. Since poverty is characterised as low expenditure, this finding is consistent with the poverty-reducing role of self-employment in non-farm activities. This is elaborated in the next sub-section.

In rural areas, larger household tends to have higher expenditure. After controlling for household size (by simply including it in a set of explanatory variables), the coefficient of land is negative and significant in Case (1) but positive and not significant in Case (2). The coefficient estimates for Hindu and Muslim are negative and significant. None of infrastructural variables is significant in Case (1) or case (2). This implies that infrastructure influences consumption expenditure only indirectly through a higher probability of self-employment in non-farm activities.

In Case (3), the coefficient of the predicted probability of being a worker in non-agricultural activities is negative and significant in urban areas, while in Case (4) that of being self employed in such activities is positive and significant. Thus the poverty reducing role of non-agricultural is confirmed only for self employment in urban areas. It is noted that in Case (3) and Case (4), the coefficient of land is positive and significant and those for Hindu and Muslim are negative and significant. Those from socially disadvantaged groups tend to have lower expenditure. Better infrastructure contributes to higher monthly expenditure in urban areas both directly and indirectly (through a higher probability of self-employment in non-farm activities)..

(3) Logit Model for Poverty Function

Table 6 gives the results of a logit model for poverty function where the dependent variable takes the value 1 if household monthly expenditure per capita is below the poverty threshold and 0 otherwise. The results are generally consistent with those in Table 5. However, in Case (1), the coefficient of the predicted probability of being a worker in non-agricultural activities is negative and significant in rural areas. This confirms the poverty reducing effect of non-agricultural activities. The difference from the corresponding result in Table 7 may be due to the existence of a threshold effect. In Case (2), the coefficient of the predicted probability of being self-employed in non-agricultural sector is also negative and significant.

The third and fourth columns of Table 6 show the results for urban areas. Consistent with the results in Table 5, the significant poverty reducing effect is found only in Case (4) for self-employment.

Table 5 OLS on the Effects of Non-Agricultural Employment on Monthly Household Expenditure in Rural and Urban Areas
(Dependent Variable: Monthly Household Expenditure)

	[Rural]						[Urban]					
	Case (1): Rural Areas **Effect of Predicted Probability of being a Worker in Non-Agricultural Activities on Household Expenditure**			***Case (2): Rural Areas*** **Effect of Predicted Probability of being Self Employed in Non-Agricultural Activities on Household Expenditure**			***Case (3): Urban Areas*** **Effect of Predicted Probability of being a Worker in Non-Agricultural Activities on Household Expenditure**			***Case (4): Urban Areas*** **Effect of Predicted Probability of being Self Employed in Non-Agricultural Activities on Household Expenditure**		
	Coef.	t value		Coef.	t value		Coef.	t value		Coef.	t value	
Predicted Probability of being a Worker in Non-Agricultural Sector	**-2575.593**	**(-0.83)**					**-5661.621**	**(-2.97)**	**			
Predicted Probability of being Self Employed in Non-Agricultural Sector				**6762.616**	**(2.30)**	*				**12139.160**	**(4.95)**	**
Whether Female	-28.990	(-0.09)		77.451	(0.22)		**571.609**	**(2.68)**	**	**967.914**	**(3.47)**	**
Age	-37.882	(-0.89)		-9.598	(-1.35)		-25.578	(-1.42)		**-40.873**	**(-4.50)**	**
Whether Household Head	189.959	(0.79)		-392.923	(-1.61)		**-871.399**	**(-2.60)**	**	**-1703.306**	**(-3.47)**	**
Whether Married	317.872	(1.51)		685.497	(1.12)		**-573.547**	**(-2.68)**	**	**-863.005**	**(-3.77)**	**
Education	34.651	(1.28)		-73.161	(-1.30)		**397.903**	**(8.86)**	**	**325.148**	**(10.50)**	**
Whether Technical Education	**937.711**	**(3.41)**	**	143.430	(0.24)		**1561.761**	**(3.41)**	**	**1865.760**	**(3.93)**	**
Household Size	**568.194**	**(2.48)**	*	**497.243**	**(2.80)**	**	172.870	(1.39)		65.479	(0.47)	
Household Size Squared	-5.763	(-0.65)		-4.514	(-0.57)		**15.683**	**(2.20)**	*	**18.104**	**(2.47)**	*
Land	**-215.160**	**(-1.95)**	+	104.164	(0.43)		**269.952**	**(1.97)**	*	**474.345**	**(2.96)**	**
Land Squared	31.625	(1.08)		18.077	(0.48)		**-50.206**	**(-2.01)**	*	-21.314	(-0.99)	
Whether Hindu	**-5148.507**	**(-4.26)**	**	**-5209.874**	**(-4.30)**	**	**-787.034**	**(-2.44)**	*	**-786.121**	**(-2.41)**	*
Whether Muslim	**-6155.968**	**(-4.54)**	**	**-6440.081**	**(-4.45)**	**	**-2438.667**	**(-6.95)**	**	**-2771.423**	**(-8.53)**	**
Whether Scheduled Tribe	-1741.634	(-1.07)		-1224.505	(-0.94)		**-810.363**	**(-2.04)**	*	269.066	(0.62)	
Whether Scheduled Caste	-2577.598	(-1.55)		-2276.991	(-1.57)		**-2117.457**	**(-9.89)**	**	**-1611.720**	**(-7.39)**	**
Whether Other Backward Classes	-2023.308	(-1.40)		-1962.785	(-1.45)		**-1809.092**	**(-6.28)**	**	**-1555.459**	**(-5.47)**	**
Road Length per 100 Sq kms	0.247	(0.37)		-0.485	(-0.85)		**1.119**	**(5.25)**	**	**1.112**	**(5.24)**	**
Constant	9021.997	(2.72)		6297.654	(6.43)		9007.475	(4.20)		3249.076	(6.82)	
No. of Observations	94894			94894			41425			10665		
Joint Significance Test	F(17,33241)= 92.66**			F(17,33241)= 88.49**			F(17,17068)= 78.36**			F(22,14632)= 18.74**		
Teledensity (no. of telephones & Mobile phone connections per 100)	-25.366	(-0.52)		-27.734	(-0.47)		**14.617**	**(1.79)**	+	**16.556**	**(2.09)**	
Electricity Consumption per capita	-0.6396	(-1.38)		-0.6561	(-1.26)		0.0275	(0.24)		**0.1667**	**(1.71)**	+

Notes: 1. **= Coefficient is significant at 1 % level. * = significant at 5 % level. + =significant at 10 % level.

2. Among 35 states for which NSS data are available, 3 states have been dropped as the varaible on road length is not available.

Table 6 Logistic Model on the Effects of Non-Agricultural Employment on Poverty in Rural and Urban Areas
(Dependent Variable: Whether Household Monthly Household Expenditure is below Poverty Line)

	[Rural]				[Urban]			
	Case (1): Rural S Areas **Effect of Predicted Probability of being a Worker in Non-Agricultural Sector on Poverty**		***Case (2): Rural Areas*** **Effect of Predicted Probability of being Self Employed in Non-Agricultural Sector on Poverty**		***Case (3): Urban Areas*** **Effect of Predicted Probability of being a Worker in Non-Agricultural Sector on Poverty**		***Case (4): Urban Areas*** **Effect of Predicted Probability of being Self Employed in Non-Agricultural Sector on Poverty**	
	Coef.	t value	Coef.	t value	Coef.	t value	Coef.	t value
Predicted Probability of being a Worker in Non-Agricultural Sector	**-0.496**	**(-3.89)** **			**2.732**	**(5.45)** **		
Predicted Probability of being Self Employed in Non-Agricultural Sector			**-0.430**	**(-3.08)** **			**-1.972**	**(-5.38)** **
Whether Female	0.012	(0.60)	-0.010	(-0.50)	0.019	(0.36)	0.046	(0.85)
Age	**-0.017**	**(-9.37)** **	**-0.010**	**(-13.75)** **	**0.018**	**(3.81)** **	**0.005**	**(2.09)** *
Whether Household Head	**0.146**	**(5.37)** **	**0.115**	**(4.87)** **	**0.251**	**(4.02)** **	**0.307**	**(4.28)** **
Whether Married	**0.199**	**(5.48)** **	**0.312**	**(13.33)** **	**0.519**	**(7.97)** **	**0.426**	**(6.65)** **
Education	**-0.151**	**(-33.20)** **	**-0.145**	**(-29.23)** **	**-0.243**	**(-15.86)** **	**-0.206**	**(-15.67)** **
Whether Technical Education	**-0.820**	**(-7.91)** **	**-0.917**	**(-9.12)** **	**-0.560**	**(-3.49)** **	**-0.453**	**(-2.92)** **
Household Size	**0.444**	**(18.92)** **	**0.439**	**(18.69)** **	**0.578**	**(10.01)** **	**0.573**	**(9.94)** **
Household Size Squared	**-0.015**	**(-11.25)** **	**-0.015**	**(-11.15)** **	**-0.021**	**(-6.23)** **	**-0.021**	**(-6.09)** **
Land	**-0.110**	**(-4.51)** **	**-0.099**	**(-4.18)** **	-0.063	(-0.95)	**-0.165**	**(-2.61)** **
Land Squared	**-0.011**	**(-3.43)** **	**-0.011**	**(-3.57)** **	0.005	(0.53)	-0.002	(-0.16)
Whether Hindu	**1.218**	**(17.03)** **	**1.222**	**(17.08)** **	**0.670**	**(3.09)** **	**0.701**	**(3.19)** **
Whether Muslim	**1.190**	**(12.89)** **	**1.213**	**(13.10)** **	**1.439**	**(6.35)** **	**1.439**	**(6.23)** **
Whether Scheduled Tribe	**1.132**	**(19.28)** **	**1.152**	**(19.56)** **	0.333	(1.57)	0.228	(1.05)
Whether Scheduled Caste	**0.809**	**(14.02)** **	**0.823**	**(14.29)** **	**1.227**	**(11.37)** **	**1.212**	**(11.08)** **
Whether Other Backward Classes	**0.436**	**(9.12)** **	**0.452**	**(9.49)** **	**0.779**	**(7.85)** **	**0.726**	**(7.25)** **
Road Length per 100 Sq kms	**-0.001**	**(-5.36)** **	**-0.001**	**(-6.32)** **	**-0.001**	**(-4.26)** **	**-0.001**	**(-4.13)** **
Constant	-2.975	(-17.11)	-3.397	(-26.83)	-8.194	(-13.48)	-5.394	(-16.40)
No. of Observations	94894		94894		41425		41425	
Joint Significance Test	Wald $Chi^2(17)$= 3521.26**		Wald $Chi^2(17)$= 3514.83**		Wald $Chi^2(17)$= 1105.08**		Wald $Chi^2(17)$= 1124.35	
Pseudo R^2	12.26		12.25		17.53		17.45	
Teledensity (no. of telephones & Mobile phone connections per 100)	**-0.053**	**(-15.30)** **	**-0.056**	**(-16.41)** **	**-0.033**	**(-4.62)** **	**-0.031**	**(-4.45)** **
Electricity Consumption per capita	**-0.0002**	**(-6.89)** **	**-0.0003**	**(-7.39)** **	**-0.0006**	**(-6.28)** **	**-0.0006**	**(-6.32)** **

Notes: 1. **= Coefficient is significant at 1 % level. * = significant at 5 % level. + =significant at 10 % level.

2. Among 35 states for which NSS data are available, 3 states have been dropped as the varaible on road length is not available.

V. Concluding Observations

Using the National Sample Survey (NSS) data, the large cross-sectional household and individual data for India in 2004, this paper investigated the determinants of individual participation in non-agricultural activities in both rural and urban areas. Participation in these activities takes different forms: as workers and self-employed persons, and, within non-farm activities, by type of activities (e.g. food processing, manufacturing, trading). As these forms have different implications for poverty in rural and urban areas, their determinants have considerable policy significance.

School and technical education as well as infrastructure (proxied by road length, teledensity, and electricity consumption) are identified as significant determinants of participation in non-farm activities as workers and self-employed persons, among others.

These variables also influence participation within non-farm activities, grouped under food-processing, manufacturing, trading and the residual category of other non-agricultural activities. Specifically, positive and significant effects are associated with school and technical education, and different forms of infrastructure. Those from socially disadvantaged groups, such as Scheduled Tribes or Castes have lower probabilities of finding employment in these sub-sectors. As these groups suffer from social exclusion, and limited access to credit, expansion of education and better infrastructure may not benefit them much.

Finally, poverty reducing effects of non-agricultural activities are significant. Expenditure is positively affected by the probability of being self- employed in both urban and rural areas. The probability of being self- employed and that of being a worker significantly reduces poverty in rural areas. The former reduces poverty, while the latter has a positive association with poverty it in urban areas. This points to a

larger concentration of low-wage and unskilled jobs in urban areas. Regardless of the nature of employment (i.e. whether employed as a worker or as a self-employed person), members of Scheduled Tribes and Castes are highly likely to be poor.

Our analysis points to two important policy concerns: one is that targeted interventions may be unavoidable to ensure that disadvantaged groups have easier access to non-farm employment opportunities to overcome persistent poverty. The second and often overlooked concern is that absorption of surplus rural labour force in non-farm activities is conditional on rapid expansion of school and technical education and better infrastructure. But since these factors also enhance welfare and reduce poverty directly, the overall effect through expansion of non-farm activities is likely to be substantially greater.

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Appendix 1 Distribution of Self Employed and Workers in Non-agricultural and Agricultural Sector by Region

	Workers in Non-agricultural Sector %	Workers in Agricultural sector %	Self-employed in Non-agricultural sector %	Self-employed in Non-agricultural sector %	Total % [No. of observations]
BIMARU (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh)	46.51	22.53	11.56	16.71	100 [46,328]
South (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat)	50.14	27.44	13.02	9.41	100 [46,890]
East (Assam, West Bengal and Orissa)	46.88	21.81	15.77	15.33	100 [18,227]
Other	51.2	18.68	12.67	17.46	100 [33,831]
Total					
%	48.82	23.79	12.82	14.38	100
[No. of Observations]	[70,928]	[34,848]	[18,621]	[20,885]	[145,282]

Appendix 2 Distribution of Self Employed and Workers in Different Non-agricultural Activities and Agricultural Sector by Region

	Food Processing	Manufacturing	Trade	Other Non-agricultural Sector	Agricultural Sector	Total % [No. of observations]
BIMARU (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh)	0.79	1.84	2.76	52.68	41.92	100 [46,328]
South (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat)	1.32	3.11	5.48	53.24	36.85	100 [46,896]
East (Assam, West Bengal and Orissa)	1.04	2.51	4.32	54.78	37.35	100 [18,227]
Other	0.9	2.3	3.77	56.9	36.13	100 [33,831]
Total						
%	1.02	2.44	4.07	54.11	38.6	100
[No. of Observations]	[1,478]	[3,548]	[5,914]	[78,609]	[55,733]	[145,282]

Appendix 3 Poverty Indices, Expenditure and Education by Region

	Poverty Rate [*1]	Monthly Household Expenditure	Education [* 2]	Total No. Observations
	%	Rps		
BIMARU (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh)	34.8	4006.6	2.19	46,328
South (Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat)	25.4	3681.4	2.73	46,869
East (Assam, West Bengal and Orissa)	32.2	5064.7	2.93	18,227
Other	18.8	5391.3	2.94	33,831
Total	27.7	4356.8	2.67	145,282

Notes: 1. Poverty Rates are calculated based on the number of individuals in labour force whose monthly household expenditure is below the poverty threshold. These figures are thus different from poverty head counts in Jha et al. (2006) based on the number of households under the poverty threshold.

2. This is based on the categorical ranking of educational level of individuals in labour force in NSS data; (not literate-0, literate without formal schooling-1, literate but below primary-2, primary-3, middle-4,

Appendix 4 Descriptive Statistics and Correlation Matrices

Rural Sector

Variable	Obs	Mean	Std. Dev.	Min	Max
Expenditure	101711	3966.886	67835.47	0	15000000
Poverty	101711	0.3523611	0.4777081	0	1
D_female	101711	0.315138	0.4645731	0	1
Age	101711	28.8837	18.7893	0	99
D_head	101711	0.3294432	0.4700134	0	1
D_married	101711	0.5807828	0.4934334	0	1
Education	101666	2.191982	2.44371	0	9
D_techedu	101711	0.0185427	0.134904	0	1
Hhsize	101711	6.567284	3.412947	1	34
Hhsize2	101711	54.77731	70.78436	1	1156
Land	101625	3.567449	2.245277	0	10
Land2	101625	17.76791	19.26572	0	100
D_hindu	101711	0.830569	0.375134	0	1
D_islam	101711	0.0962728	0.2949664	0	1
D_schtribe	101711	0.1407321	0.3477467	0	1
D_schcaste	101711	0.1855945	0.388781	0	1
D_backcaste	101711	0.4082843	0.4915187	0	1
Roadperarea	95009	94.30451	106.7271	10.5	1861
Teledensity	97073	7.464538	4.981607	1.9	52
Electricitypercapita	98016	554.8829	510.5532	75.44	7497

Urban Sector

Variable	Obs	Mean	Std. Dev.	Min	Max
Expenditure	43571	5267.037	16597.25	0	1169336
Poverty	43571	0.1011453	0.3015244	0	1
D_female	43571	0.2401827	0.4271992	0	1
Age	43571	29.32698	17.42103	0	99
D_head	43571	0.3926924	0.4883549	0	1
D_married	43571	0.5506185	0.4974369	0	1
Education	43554	3.652317	2.868193	0	9
D_techedu	43571	0.0677515	0.2513218	0	1
Hhsize	43571	5.731335	2.969043	1	30
Hhsize2	43571	41.66322	51.5589	1	900
Land	43434	1.286895	1.657029	0	10
Land2	43434	4.401782	11.35135	0	100
D_hindu	43571	0.7414106	0.4378645	0	1
D_islam	43571	0.1590737	0.365749	0	1
D_schtribe	43571	0.0714007	0.2574959	0	1
D_schcaste	43571	0.1362145	0.3430201	0	1
D_backcaste	43571	0.353974	0.4782067	0	1
Roadperarea	41573	173.2469	358.9128	10.5	1861.3
Teledensity	40926	10.18093	9.260187	1.9	52.09
Electricitypercapita	42568	693.1113	617.6521	75.44	7496.78

Rural Areas

	Expenditure	Poverty	D_female	Age	D_head	D_married	Education	D_techeducation	Hhsize	Hhsize^2	Land	Land^2	D_hindu	D_islam	D_schtribe	D_schcaste	D_backcaste	Roadperarea	Teledensity
Expenditure	1.00																		
Poverty0	-0.02	1.00																	
D_female	0.00	0.05	1.00																
Age	0.00	-0.11	-0.15	1.00															
D_head	0.00	-0.07	-0.38	0.61	1.00														
D_married	0.00	-0.03	-0.10	0.67	0.46	1.00													
Education	0.00	-0.20	-0.31	0.18	0.09	0.19	1.00												
D_techeducation	0.00	-0.07	-0.03	0.02	0.00	0.01	0.22	1.00											
Hhsize	0.02	0.15	-0.02	-0.12	-0.23	-0.04	-0.02	-0.03	1.00										
Hhsize2	0.02	0.09	-0.01	-0.09	-0.17	-0.03	-0.02	-0.03	0.93	1.00									
Land	0.01	-0.11	-0.01	0.04	-0.09	0.04	0.07	-0.02	0.33	0.29	1.00								
Land2	0.01	-0.11	-0.01	0.03	-0.09	0.04	0.06	-0.02	0.33	0.29	0.94	1.00							
D_hindu	-0.01	0.06	0.03	0.02	-0.01	0.04	0.01	-0.01	-0.02	-0.01	0.07	0.07	1.00						
D_islam	0.00	0.00	-0.05	-0.05	0.00	-0.05	-0.03	-0.01	0.06	0.04	-0.08	-0.09	-0.75	1.00					
D_schtribe	0.01	0.09	0.06	0.01	-0.01	0.01	-0.08	-0.02	-0.04	-0.05	0.04	0.02	-0.11	-0.10	1.00				
D_schcaste	-0.01	0.11	0.01	-0.02	0.01	-0.01	-0.07	-0.02	-0.07	-0.07	-0.23	-0.19	0.14	-0.16	-0.18	1.00			
D_backcaste	-0.01	-0.01	0.02	0.00	-0.02	0.01	-0.03	0.00	0.05	0.06	0.04	0.03	0.12	-0.04	-0.31	-0.41	1.00		
Roadperarea	0.00	-0.05	-0.02	0.01	0.01	-0.02	0.09	0.07	-0.07	-0.05	-0.14	-0.13	-0.05	0.04	-0.05	0.00	0.02	1.00	
Teledensity	0.00	-0.13	0.08	0.05	-0.02	0.04	0.05	0.08	-0.13	-0.11	-0.10	-0.05	-0.06	-0.07	-0.03	0.01	-0.01	0.42	1.00
Electricity	-0.01	-0.06	0.04	0.03	-0.01	0.03	0.02	0.02	-0.09	-0.08	-0.06	-0.02	0.06	-0.09	0.06	-0.01	-0.05	0.10	0.40

Urban Areas

	Expenditure	Poverty	D_female	Age	D_head	D_married	Education	D_techeducation	Hhsize	Hhsize^2	Land	Land^2	D_hindu	D_islam	D_schtribe	D_schcaste	D_backcaste	Roadperarea	Teledensity
Expenditure	1.00																		
Poverty0	-0.05	1.00																	
D_female	-0.01	0.06	1.00																
Age	0.03	-0.09	-0.22	1.00															
D_head	-0.01	-0.07	-0.35	0.62	1.00														
D_married	0.02	-0.05	-0.21	0.68	0.54	1.00													
Education	0.07	-0.20	-0.22	0.41	0.19	0.32	1.00												
D_techeducation	0.03	-0.07	-0.01	0.08	0.02	0.05	0.31	1.00											
Hhsize	0.06	0.21	0.00	-0.13	-0.28	-0.06	-0.12	-0.09	1.00										
Hhsize2	0.07	0.16	-0.01	-0.11	-0.22	-0.05	-0.10	-0.07	0.93	1.00									
Land	0.04	-0.03	0.00	0.04	-0.06	0.03	0.04	0.00	0.21	0.19	1.00								
Land2	0.03	-0.03	-0.01	0.03	-0.04	0.03	0.03	-0.01	0.17	0.17	0.90	1.00							
D_hindu	0.00	-0.08	0.00	0.06	0.04	0.05	0.09	0.03	-0.16	-0.14	0.01	0.01	1.00						
D_islam	-0.02	0.12	-0.01	-0.09	-0.06	-0.07	-0.13	-0.06	0.22	0.19	-0.03	-0.04	-0.81	1.00					
D_schtribe	0.01	0.00	0.03	0.00	0.01	0.00	-0.02	-0.01	-0.01	-0.01	0.06	0.04	-0.11	-0.01	1.00				
D_schcaste	-0.04	0.11	0.02	-0.04	-0.01	-0.02	-0.13	-0.04	-0.01	-0.03	-0.10	-0.08	0.13	-0.17	-0.08	1.00			
D_backcaste	-0.04	0.05	0.03	-0.02	-0.02	-0.01	-0.08	-0.03	0.02	0.02	0.06	0.03	0.08	-0.01	-0.15	-0.31	1.00		
Roadperarea	0.02	-0.06	-0.02	0.01	0.03	0.02	0.06	0.01	-0.07	-0.06	-0.11	-0.07	0.03	-0.04	-0.01	0.00	-0.07	1.00	
Teledensity	0.00	-0.07	-0.01	0.01	0.02	0.02	0.04	0.02	-0.10	-0.09	-0.13	-0.07	0.00	-0.04	-0.02	0.01	-0.03	0.76	1.00
Electricity	-0.01	-0.07	-0.01	0.00	0.03	0.02	0.04	0.03	-0.11	-0.10	-0.14	-0.07	0.04	-0.07	-0.02	0.00	-0.05	0.24	0.37

	Expenditure	Poverty	D_female	Age	D_head	D_married	Education	D_techeducation	Hhsize	Hhsize^2	Land	Land^2	D_hindu	D_islam	D_schtribe	D_schcaste	D_backcaste	Roadperarea	Teledensity
Expenditure	1.00																		
Poverty0	-0.02	1.00																	
D_female	0.00	0.05	1.00																
Age	0.00	-0.11	-0.15	1.00															
D_head	0.00	-0.07	-0.38	0.61	1.00														
D_married	0.00	-0.03	-0.10	0.67	0.46	1.00													
Education	0.00	-0.20	-0.31	0.18	0.09	0.19	1.00												
D_techeducation	0.00	-0.07	-0.03	0.02	0.00	0.01	0.22	1.00											
Hhsize	0.02	0.15	-0.02	-0.12	-0.23	-0.04	-0.02	-0.03	1.00										
Hhsize2	0.02	0.09	-0.01	-0.09	-0.17	-0.03	-0.02	-0.03	0.93	1.00									
Land	0.01	-0.11	-0.01	0.04	-0.09	0.04	0.07	-0.02	0.33	0.29	1.00								
Land2	0.01	-0.11	-0.01	0.03	-0.09	0.04	0.06	-0.02	0.33	0.29	0.94	1.00							
D_hindu	-0.01	0.06	0.03	0.02	-0.01	0.04	0.01	-0.01	-0.02	-0.01	0.07	0.07	1.00						
D_islam	0.00	0.00	-0.05	-0.05	0.00	-0.05	-0.03	-0.01	0.06	0.04	-0.08	-0.09	-0.75	1.00					
D_schtribe	0.01	0.09	0.06	0.01	-0.01	0.01	-0.08	-0.02	-0.04	-0.05	0.04	0.02	-0.11	-0.10	1.00				
D_schcaste	-0.01	0.11	0.01	-0.02	0.01	-0.01	-0.07	-0.02	-0.07	-0.07	-0.23	-0.19	0.14	-0.16	-0.18	1.00			
D_backcaste	-0.01	-0.01	0.02	0.00	-0.02	0.01	-0.03	0.00	0.05	0.06	0.04	0.03	0.12	-0.04	-0.31	-0.41	1.00		
Roadperarea	0.00	-0.05	-0.02	0.01	0.01	-0.02	0.09	0.07	-0.07	-0.05	-0.14	-0.13	-0.05	0.04	-0.05	0.00	0.02	1.00	
Teledensity	0.00	-0.13	0.08	0.05	-0.02	0.04	0.05	0.08	-0.13	-0.11	-0.10	-0.05	-0.06	-0.07	-0.03	0.01	-0.01	0.42	1.00
Electricity	-0.01	-0.06	0.04	0.03	-0.01	0.03	0.02	0.02	-0.09	-0.08	-0.06	-0.02	0.06	-0.09	0.06	-0.01	-0.05	0.10	0.40

	Expenditure	Poverty	D_female	Age	D_head	D_married	Education	D_techeducation	Hhsize	Hhsize^2	Land	Land^2	D_hindu	D_islam	D_schtribe	D_schcaste	D_backcaste	Roadperarea	Teledensity
Expenditure	1.00																		
Poverty0	-0.05	1.00																	
D_female	-0.01	0.06	1.00																
Age	0.03	-0.09	-0.22	1.00															
D_head	-0.01	-0.07	-0.35	0.62	1.00														
D_married	0.02	-0.05	-0.21	0.68	0.54	1.00													
Education	0.07	-0.20	-0.22	0.41	0.19	0.32	1.00												
D_techeducation	0.03	-0.07	-0.01	0.08	0.02	0.05	0.31	1.00											
Hhsize	0.06	0.21	0.00	-0.13	-0.28	-0.06	-0.12	-0.09	1.00										
Hhsize2	0.07	0.16	-0.01	-0.11	-0.22	-0.05	-0.10	-0.07	0.93	1.00									
Land	0.04	-0.03	0.00	0.04	-0.06	0.03	0.04	0.00	0.21	0.19	1.00								
Land2	0.03	-0.03	-0.01	0.03	-0.04	0.03	0.03	-0.01	0.17	0.17	0.90	1.00							
D_hindu	0.00	-0.08	0.00	0.06	0.04	0.05	0.09	0.03	-0.16	-0.14	0.01	0.01	1.00						
D_islam	-0.02	0.12	-0.01	-0.09	-0.06	-0.07	-0.13	-0.06	0.22	0.19	-0.03	-0.04	-0.81	1.00					
D_schtribe	0.01	0.00	0.03	0.00	0.01	0.00	-0.02	-0.01	-0.01	-0.01	0.06	0.04	-0.11	-0.01	1.00				
D_schcaste	-0.04	0.11	0.02	-0.04	-0.01	-0.02	-0.13	-0.04	-0.01	-0.03	-0.10	-0.08	0.13	-0.17	-0.08	1.00			
D_backcaste	-0.04	0.05	0.03	-0.02	-0.02	-0.01	-0.08	-0.03	0.02	0.02	0.06	0.03	0.08	-0.01	-0.15	-0.31	1.00		
Roadperarea	0.02	-0.06	-0.02	0.01	0.03	0.02	0.06	0.01	-0.07	-0.06	-0.11	-0.07	0.03	-0.04	-0.01	0.00	-0.07	1.00	
Teledensity	0.00	-0.07	-0.01	0.01	0.02	0.02	0.04	0.02	-0.10	-0.09	-0.13	-0.07	0.00	-0.04	-0.02	0.01	-0.03	0.76	1.00
Electricity	-0.01	-0.07	-0.01	0.00	0.03	0.02	0.04	0.03	-0.11	-0.10	-0.14	-0.07	0.04	-0.07	-0.02	0.00	-0.05	0.24	0.37