Employment Transitions of Women in India: A Panel Analysis

Sudipa Sarkar[1], Soham Sahoo[2], Stephan Klasen[3]

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Abstract

This study analyses employment transitions of working-age women in India. The puzzling issue of low labour force participation despite substantial economic growth, strong fertility decline and expanding female education in India has been studied in the recent literature. However, no study so far has looked into the dynamics of employment in terms of labour force entry and exit in this context. Using a nationally representative panel dataset, we show that women are not only participating less in the labour force, but also dropping out at an alarming rate. We estimate an endogenous switching model that corrects for selection bias due to initial employment and panel attrition, to investigate the determinants of women's entry into and exit from employment. We find that an increase in wealth and income of other members of the household leads to lower entry and higher exit probabilities of women. Along with the effects of caste and religion, this result reveals the importance of cultural and economic factors in explaining the low workforce participation of women in India. We also explore other individual and household level determinants of women's employment transitions. Moreover, we find that a large public workfare program significantly reduces women's exit from the labour force. Our study indicates that women's entry and exit decisions are not necessarily symmetric, and it is important to consider the inter-temporal dependence of labour supply decisions.

Keywords: Female labour force participation; Employment transition; Panel data; Sample selection; Attrition; India

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[1] University of Warwick, UK. S.Sarkar.2@warwick.ac.uk

[2] Indian Institute of Management Bangalore. soham.sahoo@iimb.ac.in

[3] University of Goettingen, Germany. sklasen@uni-goettingen.de

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1 INTRODUCTION

In spite of having significant economic growth, strong fertility decline and rapidly rising female education in the last two decades, India has not witnessed a commensurate rise in the female labour force participation rate. High economic growth has been accompanied by the closing of the gender gap in educational participation. Moreover, fertility rate has also declined from 4.2 in 1988 to 2.6 in 2012 (World Bank, 2012). While this environment seems conducive for women's participation in economic activities, various studies document rather low, stagnant, and declining female labour force participation in India during this period (Himanshu, 2011; Klasen and Pieters, 2015; Afridi et al., 2017; Siddiqui et al., 2017). This puzzle has attracted some attention in the recent literature (e.g. Klasen and Pieters, 2015; Sorsa et al., 2015; Afridi et al., 2017).

The decision for a woman to work is a complex issue that involves social norms, educational attainment, care responsibilities for children and elderly, other household responsibilities, access to other services, and availability of employment opportunities. There is a growing literature which seeks to explain the drivers of women's labour force participation by analysing various supply and demand side factors in developing economies.[4] Most of the studies in this literature analyse repeated micro-level cross-section data to examine the trend in women's employment over time, and how that is associated with the changes in potentially explanatory factors. In absence of individual level panel data, the analysis in the existing literature on trends has been done at an aggregate level (state or district) without observing how an individual's employment status changes over time along with the explanatory factors (e.g. Lahoti and Swaminathan, 2016). Moreover, cross-sectional analysis fails to capture the inter-temporal aspect of labour supply decisions.

We use a nationally representative individual-level panel dataset to investigate women's employment transitions in India. Our study contributes to the existing literature in multiple ways. First, we show that there is substantial dynamics in female employment over time. In particular, we estimate the rate of entry into and exit from employment at the individual level. Second, we exploit cross-sectional and temporal variations to attribute the employment dynamics of women to various explanatory factors. Specifically, we estimate how the entry and exit probabilities are impacted by factors such as household and spousal income, assets, childcare needs, education, caste, religion and other policy relevant variables including a large

[4] See Klasen (2017) for an overview.

rural workfare program. A crucial distinction of our paper from other related studies is that we explicitly consider the inter-temporal dependence of women's labour supply decision by focusing on entry and exit. While most other studies compare women in the labour force with those not working, use of panel data allows us to observe the actual changes in women's economic participation along with its determinants. Additionally, our analysis examines the assumption of symmetry or reversibility that underlies the static models estimated using cross-sectional data (Long and Jones, 1980; Gould and Saupe, 1989; Weiss, 1997; Jeon, 2008). In other words, by estimating separate entry and exit equations, we shed light on whether factors affecting labour force participation have equal but opposite effect on the probability of non-participation.

Using individual level panel data for 2005 and 2012 from the India Human Development Survey (IHDS), we show that women in India are not only participating less, they are also dropping out of the labour force at an alarming rate, suggesting very low rates of labour market attachment. We consider the sample selection problems of endogenous initial employment and panel attrition in our analysis of employment entry and exit probabilities. We estimate a switching regression model that rectifies this issue of double selectivity. Our results indicate that an increase in wealth as well as income of other members of the household leads to lower entry and higher exit probabilities of women. While the effect of household income is consistent with other studies in the literature, our identification strategy relies on temporal variation and hence it offers more credibility on the direction and magnitude of the effect. We also argue that the estimated negative (positive) effect of household wealth on women's entry into (exit from) employment is a lower bound of the true effect. Further, we find that the presence of an adult male with higher levels of education significantly discourages women to enter or remain in the labour market. Having a new-born child makes women to exit employment, indicating that provision of childcare facilities can be an important policy instrument in this context. We also explore the effects of education, marital status, household composition, caste, and regional characteristics. We find that the National Rural Employment Guarantee Scheme (NREGS), a large public workfare program, has a significant effect on women's employment transition. NREGS targets one third of the beneficiaries to be women, and it also offers equal wage rate to men and women. Thus, it is favourable for women's labour force participation. We find that women are significantly less likely to exit from the labour force in districts with higher incidence of NREGS implementation measured by the average labour expenditure incurred in the program.

Our study highlights the importance of designing policies that create a favourable condition for women to retain their employment status. Such policies need to be multipronged given the role women have to play in the household economy. On one hand female employment has direct positive effect on women's empowerment and indirect effect on her children's welfare (Afridi et al., 2016). On the other hand, employment may pose a double burden for women as the prevailing social norms make them responsible for the care economy and household chores as well. Our study shows that many of these factors are intertwined in determining the dynamics of women's labour force participation. This issue has macroeconomic implications as well. Existing evidence suggests that gender gap in employment reduces economic growth (Klasen and Lamanna, 2009). Besides, India has the potential to benefit from a 'demographic dividend' with 65 percent of its population in working-age (National Sample Survey, 2011-12). This high share of working-age population can foster higher economic growth through greater labour force participation, savings, and investment channels (Bloom and Williamson, 1998). But the demographic dividend will be missed if women, who constitute almost half of the population, do not participate in the labour market.

The structure of the paper is as follows. Section 2 sets the context by depicting broad trends in female labour force participation in India and reviewing the related literature. Section 3 discusses the data and provides a descriptive analysis. Section 4 explains the econometric model used to analyse female employment transition. The results of the econometric analysis are provided in Section 5. Section 6 concludes.

2 BACKGROUND AND RELATED LITERATURE

A number of studies have sought to explain low female labour force participation rate (LFPR) in India. To set the context, we estimate the LFPR of male and female using nationally representative data from National Sample Survey Organisation (NSSO). These are repeated cross-sectional survey data that have been used in most of the studies in the existing literature on this issue. Figure 1 shows huge difference in LFPR between male and female in India for a larger age group (15-60) as well as more narrow 'prime' age group (25-55).[5] While more than

[5] The LFPR from NSSO data is estimated considering both the usual principal activity status and subsidiary activity status of an individual during the one year preceding to the date of survey. We follow this definition because it is closer to the definition of work participation used in IHDS, as discussed in the next section. Although the levels differ, yet the trends in LFPR are similar even when it

90 percent male in the age-group of 15–60 years have participated in the labour force, only 48 percent of women are seen to be working in 1984 which has further declined to 33 percent in 2012. The LFPR for males does not show any decline for the age-group 25–55 (98 percent across the years). This difference in LFPR between the two age-groups is due to the increasing educational enrolment of individuals aged 15–24. Almost half of the individuals in 15–24 age-group are currently enrolled in 2012. This is true for women also; almost 40 percent female aged 15–24 are currently enrolled in 2012. However, the LFPR of 25–55 year old women does not show much improvement; rather it shows the same declining pattern over time from 51 percent in 1984 to 39 percent in 2012. The drop is especially stark – from 51 percent to 39 percent – between 2005 and 2012.

What explanations does the existing literature offer to explain this observed fall in female LFPR? At a macroeconomic level, female labour force participation is hypothesized to have a U-shaped relationship with economic growth (Goldin, 1995). This suggests as the economy grows moving from an agrarian society to an industrial and service sector-based economy, female labour force participation rates fall initially and then it increases again at a later stage of economic development. However, recent studies have pointed out weak empirical evidence to support the feminization U-hypothesis in a cross-country context and cross-state context in India (Gaddis and Klasen, 2014; Lahoti and Swaminathan, 2016). Economic development in India has not been led by labour-intensive manufacturing sector, thus producing growth with low employment intensity which disadvantages women more than men (Lahoti and Swaminathan, 2016). The sectors that tend to hire female workers have expanded the least during the last decades (Klasen and Pieters, 2015; Chatterjee, Murgai and Rama, 2015). It appears, therefore, that the type of economic growth that has taken place in India has generated few employment opportunities for women. At the same time, stagnation of agriculture and lack of non-farm jobs are considered to be the major factors driving the declining participation in rural areas (Kannan and Raveendran, 2012; Kapsos et al., 2014).

On the other hand, supply side factors may have also played an important role in explaining low labour force participation of women. Rising household income and partner's education appears to lead to declining female participation in the labour force (Chand and Srivastava, 2014; Klasen and Pieters, 2015; Sorsa et al., 2015). Besides, increasing female education does not seem to

is based on only principal activity status. Labour force participation includes both employed and those who are seeking for employment.

promote female participation. There has been a substantial increase in the pursuit of education by rural females in India between 1993 and 2009-10. Sorsa et al. (2015) find that in contrast to other BRIC countries or OECD countries, education and household income are negatively correlated with female labour force participation in India. Afridi et al. (2017) suggest that the returns to home production of educated women may have increased more than the returns to market production, adversely affecting women's engagement in the labour market.

In addition to the role of demand and supply side factors, the extant literature also highlights the importance of social and cultural factors which keep women outside the labour force. This is especially crucial in the context of a patriarchal society like India where prevailing gender norms discourage women to step out of their home to participate in economic activities, and frown upon women, including particularly more educated women, being employed in occupations not deemed appropriate for them (Klasen and Pieters, 2015). Other determinants relate to infrastructure, access to finance, labour laws and rural employment programs (Sorsa et al., 2015).

Inter-temporal dependence in labour supply and the need for panel data analysis

While several papers have investigated the determinants of women's labour force participation, in this context, they have ignored the possibility that employment status can be dynamic where a woman might enter into and exit from the labour force at various points in her life. Women are more likely than men to experience such transitions because childbearing and childcare responsibilities are borne primarily by women (Glick and Sahn, 2005).

The early theoretical literature has highlighted the inadequacy of cross-sectional models to capture the inter-temporal dependence of women's workforce participation (Heckman and Willis, 1977; Nakamura and Nakamura, 1985). It is argued that unobserved individual heterogeneity may result in persistence of employment status (either employed or unemployed) – which has different policy implication than a scenario where women mostly have transitory employment (Nakamura and Nakamura, 1985; Glick and Sahn, 2005). If the participation probability in a given year is correlated with prior work status, then the decisions of entry and withdrawal (and the factors affecting them) may not be symmetrically opposite (Long and Jones, 1980; Weiss, 1997; Jeon, 2008). Heckman and Willis (1977) point out that transaction costs in taking up or leaving a job is a potential source of inter-temporal dependence in labour supply decisions. If taking up employment involves cost of searching for an appropriate job, or breaking the cultural barrier, then the total benefit of being employed must exceed these fixed

costs for a woman to enter the workforce. On the other hand, being employed may change the constraints, aspiration, preference towards work, or expected consumption standards so that it would increase the probability of working in the next period. Thus, the entry and exit relationships may not be symmetric or reversible – they may be differently affected by the explanatory factors. Hence it is important to separately identify which factors affect the likelihood of entry vis-à-vis exit to make informed policy decisions.

The dynamics of women's work-participation has been analysed mostly using data from developed countries such as USA (Long and Jones, 1980), Canada (Jeon, 2008), UK (Khoudja and Platt, 2018), and some other countries of Europe (Gustafsson et al., 1996). Due to the paucity of individual panel data, this issue is relatively under-researched in the context of developing countries (Glick and Sahn, 2005). Our paper contributes to this literature by studying women's employment transitions in India.

3 DATA AND DESCRIPTIVE ANALYSIS

The data we use for this study come from the India Human Development Survey (IHDS). It is a nationally representative, multi-topic survey of 41,554 households and 215,754 individuals in 1503 villages and 971 urban neighbourhoods across 33 states and union territories of India. IHDS is a household level panel survey which was first conducted in 2004-05 and the second round of re-interview was carried out in 2011-12 (for brevity we will refer to the first survey round as 2005 and second round as 2012).

The sample for our analysis constitutes of 41,665 women aged 25–55 years in 2005. These women are followed in 2012 to identify employment transition at the individual level. A woman is considered to be employed if she has reported working as a salaried, casual wage earner, in business or in the family farm for more than 240 hours in the survey year. According to this definition and recall period for reporting employment, we find that 50 percent of women are employed in our baseline sample in 2005. Out of this sample, 33,013 or 79.23 percent women are re-interviewed in 2012.[6] Among them, 57 percent report to be employed in 2012. In contrast, the corresponding figure on employment of men was at a steady 90 percent in both 2005 and

[6] While rate of attrition is low for the households, it is not ignorable at the individual level. The rate of attrition was 14.85 and 31.37 percent respectively for rural and urban sample of women considered in our analysis (Table 1). We address the issue of individual attrition in our econometric analysis in the next section.

2012. Instead of following the same individuals over time, if we consider 25–55 age-group in 2012, then 53 percent women are found to be employed. The employment rate for men in this age-group is 93 percent in 2012. Therefore, we find substantially lower employment rates of women as compared to men in both the rounds of IHDS.[7] Since the main objective of this paper is to analyse the dynamics of employment, therefore we stick to the sample of women aged 25–55 in 2005 and follow them in 2012 for the purpose of our analysis.

Use of longitudinal data allows us to explicitly look into the change in employment status of women between the two years when the data were collected. We follow the literature on labour force transition and define labour market "entry" or "exit" for every woman in the sample (Long and Jones, 1980; Gould and Saupe, 1989). The outcome of entry is defined for the sub-sample of women who were not employed in 2005. For this set of women, one can either enter the labour market (Entry = 1) or remain not employed (Entry = 0) in 2012. By not employed, we mean those who are unemployed or who remain out of the labour force. Similarly, the outcome of exit is defined based on the sub-sample of women who were employed in 2005. Among them, one can either leave the employment (Exit = 1) or remain to be employed (Exit = 0) in 2012.

$$Entry = \begin{cases} 1 & if\ not\ employed\ in\ 2005\ but\ employed\ in\ 2012 \\ 0 & if\ not\ employed\ in\ both\ 2005\ and\ 2012 \end{cases} \quad (1)$$

$$Exit = \begin{cases} 1 & if\ employed\ in\ 2005\ but\ not\ employed\ in\ 2012 \\ 0 & if\ employed\ in\ both\ 2005\ and\ 2012 \end{cases} \quad (2)$$

Table 1 describes the sample of women considered for our analysis based on their employment status in the two survey years. We find that 23 percent of women in our sample have experienced transition in employment status, i.e. they have either exited or entered employment. The true estimate of transition would be even higher, because some of the women who are not observed in the second round due to attrition are also likely to have changed their employment status. To put the transition estimate of women in perspective, we compare it with that of men. In contrast to women, only 11 percent of men in the same age-group have either exited or entered employment (Appendix Table A1). The proportion of men who are employed in both

[7] While the estimates of female LFPR are very close between IHDS and NSSO for the year 2005, they differ in 2012. This is because of two reasons. First, the survey instruments differ in various ways between NSSO and IHDS. Second, NSSO provides repeated cross-sectional data while IHDS has followed the same set of households over time. Therefore, the panel sample of IHDS may not be comparable with the cross-sectional sample of NSSO in 2012. We follow the same definition of employment in both IHDS 2005 and 2012 data for consistency; thus our analysis of employment transition is valid.

rounds is almost double the proportion of women employed in both rounds. On the contrary, while there are only a few men not-employed in both rounds (1.5 percent), the corresponding number of women is considerably large (24 percent).

Table 2 shows the dynamics of women's employment between the two survey rounds. There are 20,786 women in the relevant age-group not employed in 2005; these women constitute the sample for entry. Among these women, we observe that 25.37 percent entered employment in 2012 (Entry = 1), 47.72 percent remained not employed (Entry = 0), and due to attrition we do not have information for 26.91 percent (Table 2). On the other hand, the sample for exit comprises of 20,879 women who were already employed in 2005. Among them, 20.60 percent exited from employment by 2012 (Exit = 1), 64.75 percent remained employed (Exit = 0), and 14.65 percent are missing from the data due to attrition. The employment dynamics of men portrays a very different pattern (Appendix Table A2). Among men who were not employed in 2005, the proportion who entered employment in 2012 is 51.73 percent, which is double the corresponding figure for women. Among employed men, only 6.7 percent exited employment in 2012. Therefore, women are three times more likely to exit employment than men. Comparing between rural and urban areas, we find that entry is especially lower for urban women as compared to their rural counterpart. However, this difference can be caused because of significantly higher attrition of urban women who were not employed in 2005.

Our descriptive analysis reveals that women are substantially more likely than men to experience employment dynamics, suggesting a much lower labour market attachment. We further examine the patterns of women's employment transitions based on the type of employment. Figure 2 shows that women have a different propensity to exit from employment depending on the nature of employment they had in 2005. Women who were working in a family business or farm were more likely to exit from work as compared to casual wage and salaried workers. In 2005, almost half of all employed women worked on the family farm, followed by 27 percent working as a casual wage labourer in agriculture. Figure 3 shows that this pattern remains similar when we look at those who were employed in both 2005 and 2012. Considering women who entered into employment in 2012, family farm has the highest proportion of entrants. The persistence of female labour in a family farm could potentially be a form of 'disguised unemployment' in rural areas that accommodates women who do not have any other alternative employment. 'Feminization of agriculture' could be another possible explanation (Lastarria-Cornhiel, 2008; Chandrasekhar et al., 2017). We also find that the rate of attrition varies substantially not only between employed and unemployed women, but also

across different types of employment. This indicates that attrition is not random. Since we do not observe the employment status of women who drop out of the sample in 2012, it necessitates incorporating the incidence of endogenous attrition in our analysis of employment transition. The next section lays out an econometric model to deal with these issues.

4 EMPIRICAL METHODOLOGY

The objective of this study is to identify the employment transition probabilities and their determinants. In particular, we are interested in estimating how the probabilities of entry into and exit from employment are affected by various individual, household, and other factors. Towards this objective, we have two separate linear probability models for entry and exit given as follows.

$$Prob(Entry_{ihds} = 1) = \boldsymbol{X}_{ihds}\,\boldsymbol{\beta} + u_{ihds} \quad (3)$$

$$Prob(Exit_{ihds} = 1) = \boldsymbol{X}_{ihds}\,\boldsymbol{\gamma} + \varepsilon_{ihds} \quad (4)$$

The subscripts i, h, d, and s respectively denote individual, household, district and state. The dependent variable in Equation *(3)* is a binary indicator of whether a woman has entered into employment between 2005 and 2012. In Equation *(4)* the dependent variable indicates whether a woman has exited from employment between 2005 and 2012. The vector $\boldsymbol{X}_{ihds}$ includes various individual, household, and regional characteristics that affect the employment transition probabilities. While we include the same explanatory factors in the two equations, we allow their effects to differ for entry and exit. A discussion of the explanatory variables is provided later in this section.

Whether a woman makes an entry or exit depends on her initial status of employment. The sample of women considered in the regression for entry consists of those who were not employed in 2005. On the other hand, the exit decisions are observed only for those who were employed in 2005. Since the initial employment status is potentially endogenous, therefore we have a sample selection problem if we estimate the entry and exit probabilities based on these sub-samples and ignore the endogeneity of the initial status of employment (Heckman, 1981). The empirical literature on poverty dynamics and employment transitions deals with the issue of endogenous initial condition using a switching regression model (Stewart and Swaffield, 1999; Bruce, 2000; Cappellari and Jenkins, 2004; Jeon, 2008). Similar to the Heckman's two step estimator, this method involves estimating a first stage probit equation of initial employment

status, and calculating the inverse Mills ratio (IMR_{emp}) which is then included in the entry and exit equations to correct for sample selection bias (Orme, 1997; Bruce, 2000; Jeon, 2008). We adopt a similar framework and specify the initial employment decision in the following equation:

$$Emp^{*}_{0,ihds} = \boldsymbol{Z}_{ihds}\boldsymbol{\alpha} + v_{ihds} \tag{5}$$
$$Employed_{0,ihds} = 1\left[Emp^{*}_{0,ihds} > 0\right]$$

$Emp^{*}_{0,ihds}$ is a latent continuous variable which measures the gains from employment and whose observable counterpart is the binary indicator of whether a woman was employed in 2005 ($Employed_{0,ihds} = 1$) or not ($Employed_{0,ihds} = 0$). $\boldsymbol{Z}_{ihds}$ is the vector of baseline characteristics that determine the probability of employment in 2005.

In addition to initial employment status, we also need to take into account the problem of panel attrition in our model. Almost 20 percent of the women from 2005 sample are not included in the 2012 sample; therefore, we do not observe their employment status in 2012 and hence we cannot define entry or exit variables for these women. If attrition is non-random, excluding these women can result in biased estimates in the entry and exit equations. From Table 2 we find that women who were not employed in 2005 are more likely to be absent from the 2012 sample. It is possible that these women managed to get employment by migrating to some other place, although they are not considered in our estimation of the entry equation. The existing literature suggests that sample drop-outs are often endogenous for estimating transition probabilities and hence should not be ignored (Cappellari and Jenkins, 2004; Cappellari, 2007). Therefore we introduce another latent variable $Retention^{*}_{ihds}$ capturing the propensity to remain in the sample; we can observe the binary indicator of whether the individual remained in the sample ($Retention_{ihds} = 1$) or dropped out ($Retention_{ihds} = 0$):

$$Retention^{*}_{ihds} = \boldsymbol{W}_{ihds}\boldsymbol{\delta} + e_{ihds} \tag{6}$$
$$Retention_{ihds} = 1[Retention^{*}_{ihds} > 0]$$

Equations *(5)* and *(6)* reflect the two sources of sample selectivity that need to be dealt with while estimating employment entry and exit. Our descriptive analysis suggests that initial employment and sample attrition are likely to be correlated. Therefore, we follow the recommendation of Vella (1998) and estimate both Equations *(5)* and *(6)* using a bivariate probit model. Subsequently we calculate two selection correction terms, λ^{1}_{ihds} for initial employment and λ^{2}_{ihds} for retention. Controlling for these additional variables would correct for endogeneity

arising from the double selection problem due to initial employment and attrition. Therefore, the estimation equations for entry and exit become:

$$Prob\left(Entry_{ihds} = 1 \mid Employed_{0,ihds} = 0, Retention = 1\right) = \boldsymbol{X}_{ihds}\,\boldsymbol{\beta} + \eta\lambda^1_{ihds} + \theta\lambda^2_{ihds} + u_{ihds} \quad (7)$$

$$Prob\left(Exit_{ihds} = 1 \mid Employed_{0,ihds} = 1, Retention = 1\right) = \boldsymbol{X}_{ihds}\,\boldsymbol{\gamma} + \xi\lambda^1_{ihds} + \zeta\lambda^2_{ihds} + \varepsilon_{ihds} \quad (8)$$

The derivation of λ^1_{ihds} and λ^2_{ihds} from a bivariate probit selection model is illustrated in Tunali (1986). This method has also been used by various other studies, especially in labour economics (e.g. Kimmel, 1998; Cutillo and Centra, 2017). Accordingly, the selection correction terms are derived as follows.

If $Employed_{0,ihds} = 1$ and $Retention_{ihds} = 1$,

$$\lambda^1_{ihds} = \phi(\boldsymbol{Z}_{ihds}\boldsymbol{\alpha})\frac{\Phi\left(\frac{\boldsymbol{W}_{ihds}\boldsymbol{\delta} - \rho\boldsymbol{Z}_{ihds}\boldsymbol{\alpha}}{\sqrt{1-\rho^2}}\right)}{\Phi_2(\boldsymbol{Z}_{ihds}\boldsymbol{\alpha}, \boldsymbol{W}_{ihds}\boldsymbol{\delta}; \rho)}, \qquad \lambda^2_{ihds} = \phi(\boldsymbol{W}_{ihds}\boldsymbol{\delta})\frac{\Phi\left(\frac{\boldsymbol{Z}_{ihds}\boldsymbol{\alpha} - \rho\boldsymbol{W}_{ihds}\boldsymbol{\delta}}{\sqrt{1-\rho^2}}\right)}{\Phi_2(\boldsymbol{Z}_{ihds}\boldsymbol{\alpha}, \boldsymbol{W}_{ihds}\boldsymbol{\delta}; \rho)}$$

If $Employed_{0,ihds} = 0$ and $Retention_{ihds} = 1$,

$$\lambda^1_{ihds} = \phi(\boldsymbol{Z}_{ihds}\boldsymbol{\alpha})\frac{\Phi\left(\frac{\boldsymbol{W}_{ihds}\boldsymbol{\delta} - \rho\boldsymbol{Z}_{ihds}\boldsymbol{\alpha}}{\sqrt{1-\rho^2}}\right)}{\Phi_2(-\boldsymbol{Z}_{ihds}\boldsymbol{\alpha}, \boldsymbol{W}_{ihds}\boldsymbol{\delta}; -\rho)}, \lambda^2_{ihds} = \phi(\boldsymbol{W}_{ihds}\boldsymbol{\delta})\frac{\Phi\left(\frac{-\boldsymbol{Z}_{ihds}\boldsymbol{\alpha} + \rho\boldsymbol{W}_{ihds}\boldsymbol{\delta}}{\sqrt{1-\rho^2}}\right)}{\Phi_2(-\boldsymbol{Z}_{ihds}\boldsymbol{\alpha}, \boldsymbol{W}_{ihds}\boldsymbol{\delta}; -\rho)}$$

$\phi(.)$ and $\Phi(.)$ respectively denote the standard normal density and cumulative distribution functions. $\Phi_2(.)$ represents the bivariate standard normal distribution function and the correlation between the two error terms of the selection equations is assumed to be ρ.

The augmented entry and exit equations are estimated using linear probability models because it is straightforward to include the selection correction terms as additional independent variables in a linear model. Moreover, linear models require less distributional assumptions and are often preferred than non-linear models when the main interest is to estimate the marginal effects of the explanatory factors (Angrist and Pischke, 2008). The standard errors of the coefficients are estimated to be robust to heteroscedasticity and arbitrary serial correlation among observations in the same primary sampling units (PSU) i.e. village or town. Further, the standard errors are

bootstrapped to avoid the problem of generated regressors due to the inclusion of the selection correction terms.

Identification

For identification, the initial employment and attrition equations should include some explanatory variables (instruments) which are validly excluded from the main entry and exit equations. Otherwise, identification would completely hinge on the non-linear functional form of the inverse Mills ratios. For the initial employment equation we use two instruments. Rainfall, through its effect on agriculture, is likely to affect household income especially in rural areas. Female labour supply may increase as a coping strategy to reduce the uncertainty in earnings caused by lower rainfall (Attanasio et al., 2005; Bhalotra and Umana-Aponte, 2010). Therefore, we include district level rainfall of 2004 that corresponds to the baseline employment status as one of the identifying variables. To ensure that the exclusion restriction is met, we include the average rainfall between 2005 and 2011 in the main entry and exit equations. It is plausible to assume that the rainfall of 2004 will affect employment in 2005; however, it will not have any direct effect on employment decisions made between 2005 and 2012 especially after the rainfall during this time span has been included as control variable. Since urban areas do not have agricultural opportunities, rainfall may not be relevant for female employment. Therefore, we consider another variable that is pertinent to both rural and urban areas. Local economic development creates employment opportunities for women. Recently, a growing number of studies have used satellite data on night-time lights to measure economic growth and development at a regional level (Henderson et al., 2012). We use night-time luminosity averaged over a district as an indicator for the intensity of economic activities in the region.[8] While the average growth rate of nightlights between 2005 and 2011 is included in the entry and exit equations, nightlight of 2004 is included only in the baseline employment equation. The identifying assumption is that nightlights in 2004 would not have any direct effect on employment post-2005 except through its effect on employment in 2004, and other control variables such as income of the household.

[8] This variable is constructed from the satellite data on lights at night. This data is recorded worldwide for every one square kilometre area (approximately) by the Operational Linescan System (OLS) flown on the Defense Meteorological Satellite Program (DMSP) satellites. This dataset has been downloaded from the website of the National Oceanic and Atmospheric Administration (NOAA) of the USA (http://ngdc.noaa.gov/eog/dmsp/download_radcal.html) and matched at the district level using the latitude and longitude co-ordinates.

The retention equation should also contain an identifying explanatory variable that is validly excluded from the main equations. The existing literature dealing with non-random attrition issues in developing country panel data indicates that the survey interview procedure often captures variables that are able to predict panel attrition. For example, Maluccio (2004) uses quality of first round interview variables as instruments for such selection at the household level. Mahringer and Zulehner (2015) use whether the individual was the respondent for the family specific questions in the interview to predict individual level attrition. Following the same line of thought, we use a linear function of the person identifier in the 2005 sample as an instrument for retention. Person identifiers are numbers that are assigned to each member of the household by the survey enumerator. We posit that persons who are recorded first are those with higher attachment to the household and hence less likely to subsequently drop out of the sample. To ensure that the person identifier is not picking up the effect of intra-household relationship which may be an important determinant of labour supply decisions, we include relationship to household head as a control variable in all the equations. After controlling for relationship patterns, the person identifier should predict attrition but not have any direct effect on labour supply decisions.

Other explanatory variables

Following the literature on the determinants of female labour force participation, we include various explanatory variables at the level of individual, household, and community. Apart from the identifying variables used in the selection equations, all equations include some common variables that are defined from the baseline survey of 2005. Among the individual characteristics, we include dummy variables to indicate age-categories, marital status, relationship to household head, and own education level of the woman. Having young children implies childcare duties, hence it can affect female labour supply. Therefore we include the number of children below 5 years of age as an explanatory variable. The effect of in-laws has been found to differ across existing studies. On one hand, in-laws may interfere and prevent women to participate in the workforce (Sorsa et al., 2015). On the other hand, they may provide childcare support and allow women to work (Chatterjee et al., 2015). Therefore, we include a dummy variable to indicate cohabitation with the father or mother in-law. In the context of India, household status, reflected by the caste of the household, plays a major role in female participation in the labour force (Eswaran et al., 2013). So we include dummy variables to reflect the caste of the household. For similar reasons, religion dummies are also included. We include household size which may affect intra-household decisions about labour supply. The

need for elderly care may preclude women from working outside of the home. To capture this effect we include the number of elderly members (above 65 years age) present in the household.

As discussed in the background section, various studies have emphasized the role of household's income and education of males in explaining the falling trend in female LFPR. We account for such factors in our analysis. First, we include the highest education level of male members in the household. Second, we include an asset index to reflect the wealth level of the household.[9] Finally, we include household's total income excluding the woman's own income.[10] Although assets and income both broadly reflect the standard of living of a household, they may not measure the same aspect of it. For instance, when income levels are volatile in presence of shocks, wealthier households may be able to smooth consumption by selling off assets. In such scenario, women from wealthier households may have lower propensity to increase their labour supply than those from poorer households. Thus, the dynamics of women's labour supply may respond differently to variation in assets and income. Hence we control for both these measures of economic status in the regressions. In addition to these variables, every regression includes state fixed effects to account for state-specific differences in gender norms and other unobservable factors.

The initial employment and retention equations include only baseline characteristics along with the instruments. In the entry and exit equations, we also include additional variables capturing the change in some key factors between 2005 and 2012. By analysing changes over time, this framework helps us to account for time invariant individual heterogeneity and explore how these explanatory factors affect female employment. We include the number of new children born between the two rounds, and the change in number of elderly persons to investigate whether women's labour force transition is affected by the need for childcare and elderly care,

[9] The asset index is calculated based on the number of durable consumer goods and housing related assets possessed by the household. These assets include items such as television, fridge, telephone, motor cycle, washing machine, etc.

[10] It requires us to calculate individual level income to arrive at this measure of household income net of woman's own income. For wage or salary earners, individual level income is reported in the survey. However, in case of family business or farm work, we only know the aggregate household income and which members participated in that work. For these kinds of work, we calculate individual income assuming that each participating member earns equally. The main results presented in the next section are not sensitive to this assumption, and are qualitatively unchanged even if we use other measures of household income. However, we prefer to use this measure because it is less endogenous to a woman's own labour supply.

respectively. The other two major variables are changes in household assets and income. These are included even after controlling for the baseline asset and income levels.

In addition to the individual and household level variables, we look into the role of government policy in promoting female labour supply. Specifically, we analyse the effect of a large rural workfare program, the National Rural Employment Guarantee Scheme (NREGS), on women's employment entry and exit probabilities. NREGS is implemented in rural areas to provide livelihood security to households. Every rural household is entitled to 100 days of annual employment in unskilled public works conducted under this scheme. It targets one-third of the beneficiaries to be women, and offers an equal wage rate to men and women. Thus, it has the potential to raise female labour force participation (Afridi et al., 2016). The scheme was initiated in 2006 and subsequently spread in all districts of India. We use the total NREGS-labour related expenditures in each district between 2006 and 2011 to measure the intensity of the program.[11] This district level variable is included as an explanatory variable to evaluate whether higher availability of jobs in the district affects employment transition of rural women.

We carry out the analysis for the overall sample, and also for rural and urban areas separately. In the overall sample, a binary variable indicating whether the household lives in a rural or urban area is included. Summary statistics on the relevant variables are provided in Table 3.

5 RESULTS

We begin this section by explaining the results of estimation of the two selection equations for initial employment and attrition. In the subsequent discussion, we will focus on the entry and exit equations.

Initial employment

Table 4 presents the marginal effects of the explanatory variables from the selection equation for women's employment in 2005. The first set of variables denotes various age categories where the omitted base category is 25-29 years. The coefficients imply that the effect of age on employment is nonlinear – the initial employment probability is higher for middle aged women

[11] Since NREGS targets rural households only, therefore, the variable has been divided by the total number of rural households in the district to normalize it with respect to the district size. Also, we get similar results when other measures of NREGS implementation, e.g. average fund allocation, is used. These data were obtained from the official website of NREGS (http://www.nrega.nic.in).

and lower for both younger and older women. As compared to married women (base category), single women are less likely to be employed in rural areas. Villagers often attach social stigma to single women's participation in economic activities outside of the home, which could explain this finding. In contrast, single women in urban areas do not face this constraint; rather they may enjoy greater freedom and work opportunities as compared to rural women. Probably due to similar reasons, women who are widowed, separated or divorced are also more likely than married women to participate in employment in urban areas; in addition, such women will have a higher need for own earnings. We find that women who are household heads (base category) are more likely to be employed than any other member of the household. Consistent with other studies such as Klasen and Pieters (2015), employment has a U-shaped relationship with education, particularly in urban areas. The omitted category here indicates no formal education, while the included dummies reflect primary, secondary, and tertiary as the highest level of education completed by the woman. In rural areas, women without any formal education have a higher probability of being employed than women with any other level of education. However, in urban areas, women with lowest (no formal schooling) and highest (tertiary educated) levels of education are more likely to have employment than those with mid levels of education. Having young children (below 5 years of age) significantly reduces the likelihood of being employed. However, if the mother or father in-law co-resides in the household, it helps women to participate in employment, perhaps by sharing the household chores and childcare duties. Women from lower caste households are more likely to participate (except Scheduled Caste in rural areas). Hindu women are more likely to be employed than Muslims, but less likely than other religions. Belonging to a larger household helps women in urban areas to join the workforce. Also, having an elderly member (aged above 65 years) has a positive effect on women's employment in rural areas. While interpreting these effects, it should be noted that in this cross-sectional regression, the direction of causality is less clear. For instance, women who are employed may ask the elderly to stay with the family to look after the children and other household duties. If the household has an educated male member, it reduces the probability of women's employment, consistent with Afridi et al. (2017). We also find that there is a strong and significant negative income and wealth effect. Overall, urban females are less likely to be employed than their rural counterpart.

We find that the instruments have significant impact on women's employment in 2005. Rainfall has a negative effect in rural areas, suggesting that women tend to participate more in the labour market when agricultural production is adversely affected by low rainfall. The average marginal

effect of nightlights is negative both in rural and urban areas. To investigate this further, we include a quadratic term of nightlights in the same regressions. Figure 4 shows that there is a clear U-shaped relationship between local economic development and female employment in the cross-sectional data.[12]

Attrition

The determinants of sample retention are presented in Appendix Table A3. The effect of the instrument is statistically significant and its direction supports our hypothesis. Even after taking into account intra-household relationship patterns, we find a significant negative effect of the individual identifier variable on the probability of retention. Thus, individuals recorded lower in the list in 2005 have higher probability of attrition from the 2012 survey. The effects of other explanatory variables are in the expected direction. Due to the patrilocal residence system, women stay with their husband's family after marriage. We therefore find that younger and unmarried women are more likely to drop out of the sample in 2012 because some of them may have moved after marriage. Women with higher levels of education are less likely to be present in the sample as they may have greater mobility. Having young children and living with in-laws or in a larger family increase the likelihood of retention. Belonging to a richer family and living in a more developed (as captured by night lights) or in an urban area increase women's mobility and decrease the probability of retention.

Entry and Exit:

Next we move on to discuss the main results of entry and exit probabilities, presented in Tables 5 and 6 respectively.[13]

The coefficients on the age dummies show that as women get older, they are less likely to enter and more likely to exit the labour force. Only in rural areas, women aged 30–34 years have higher probability of entry than the youngest category of 25–29 years (omitted base category). It

[12] This is similar to cross-sectional tests of the so-called feminization U hypothesis. See Goldin (1995) and Gaddis and Klasen (2014).

[13] The coefficients of the selection correction terms on retention and initial employment are jointly significant for entry equation in the overall and rural sample. The selection correction term of initial employment individually has significant effect on the probability of entry in the overall and rural sample. Therefore, it would be incorrect to ignore the sample selection issue. Further, from the bivariate probit selection model, we find a statistically significant correlation between the error terms of the initial employment and retention equations. This implies that the use of double selectivity correction model is appropriate in this context.

is not surprising that the oldest group aged 50–55 years have the lowest probability for entry and highest probability for exit as compared to younger women. In 2012, these women are 57–62 years old, therefore, some of them have retired from employment. However, more surprising is that women even in their early forties start reducing their participation in the labour force as reflected by significantly lower entry and higher exit probabilities.

In terms of marital status, single and widowed women have lower entry probability especially in rural areas. The relationship variables reveal that wife and daughter-in-law of the household head are less likely to enter and more likely to exit the labour force. In fact, women who are household head have higher (lower) likelihood of entry (exit) than any other member of the household, implying that they either need to participate in income generating activities, or being head they enjoy greater economic freedom. The non-linear U-shaped relationship between own education level and employment remains valid even in the entry and exit equations. Women who have education level below primary and at least tertiary are more likely to enter and less likely to exit employment than those with mid-levels of education.

The number of new children born between the two rounds has a significant positive effect on women's exit from the labour market. The effect is negative but not statistically significant for entry, and the magnitude of the effect is rather small. Having a new-born child is associated with a 3 percentage points higher probability of exit. A caveat in interpreting this coefficient is that the fertility decision may be made jointly with the labour supply decision. Therefore the causal direction is not clear in this case. However, it is indicative of the fact that the need for childcare potentially restricts young mothers from continuing their labour market participation. The number of children who were below 5 years of age in 2005 positively affects entry, and negatively affects exit. These children are in the school-going age of 7-12 years age in 2012. Mothers may be able to participate in the labour market when these children join school. Therefore, the effects of younger and older children are in opposite direction because of the difference in childcare needs.

Presence of in-laws, the number of elderly members, or its change have mostly insignificant effects on the probability of entry. However, some of these variables significantly affect the decision to exit. Presence of in-laws, like its effect on baseline employment, reduces dropout from labour force by 3 percentage points in rural areas. But an increase in the number of elderly between the two rounds is significantly associated with women's higher propensity to exit from the employment. In the rural sample, having an additional elderly person in the household

increases the exit probability by 2.8 percentage points. This indicates that the additional responsibility of elderly care may force women to withdraw from the labour force.

Women from socially disadvantaged or backward caste categories are significantly more likely to enter employment and less likely to exit as compared to the high caste category. The effect of caste on employment transition is less prominent in urban areas. Religion also plays an important role in determining women's employment transition. Muslim women are less likely to take employment and more likely to quit as compared to Hindu women.

Women belonging to households that have highly educated male members are less likely to enter and more likely to withdraw from the labour force. This is especially true in the rural areas. Households that have educated males are likely to be economically better off and also have higher social status. This finding shows that social status of households in rural areas is a compelling factor that determines whether a woman would work, and how strong her attachment to the labour force is.

We investigate the hypothesis that women participate in the labour market when there is a need for augmenting household income, and they withdraw from employment when the household becomes more affluent. One potential concern in identifying the effect of household income on women's employment transition is the fact that we do not have an exogenous change in income. Income may itself be affected by individual's labour supply decisions, resulting in reverse causality. We try to mitigate this endogeneity problem by excluding an individual's own income from the measure of household income. Therefore, our income measure essentially consists of other household members' income. In the initial employment regression, we do find a significant negative effect of both household wealth (captured by asset holding) and income on women's employment in 2005. But this cross-sectional relationship may be capturing other household specific unobserved effects such as household's preference towards female employment and other gender norms. Therefore, we investigate the relationship from the entry and exit equations where by looking at changes over time, we are able to control for unobserved household and individual heterogeneity that are time invariant.

First, we examine how the probability of entry and exit varies with initial level of household assets and income. We find that females from wealthier households are less likely to enter and more likely to exit from employment. Looking at the distribution of initial asset holding, the coefficient would imply that women from the 75^{th} percentile household are 15 percentage points less likely to enter in employment than women from the 25^{th} percentile household in the overall

sample.[14] This effect is stronger for rural women. The corresponding effect on the exit probability is around 7 percentage points and it is in the opposite direction. The effect of initial income level is in the same direction as wealth, although the estimates are less precise in this case. If we look at the distribution of initial income, women from the 75th percentile household have about 1.4 percentage points higher probability of exit than women from the 25th percentile household in the overall sample.[15] Therefore, the effect of initial assets seems to be stronger than the effect of initial income on the likelihood of withdrawal from employment. For the urban sample we do not find any significant effect of initial wealth and income on the exit probability, although they do significantly reduce the probability of entry.

Next, we measure the changes in household wealth and income between 2005 and 2012 and include them as additional explanatory variables in the regression. An increase in income of other members of the household significantly reduces the probability of woman's entry into employment, and it increases the probability that she will exit from employment. This relationship is present in the overall and in both the subsamples, except for exit in the urban sample where the effect is not precise. The effect of household wealth is also in the same line: when a household becomes wealthier, women from that household have a greater chance of leaving employment and a lower chance of becoming employed. This effect of a change in asset ownership is found to be significant in the overall, rural, and urban samples. Comparing the magnitude of the coefficients between entry and exit equations, we find that the effect of changing income has a slightly stronger effect on the exit probability, while changing assets has a larger effect on entry probability. In the overall sample, a one standard deviation higher increase in income leads to 2 percentage points lower entry and 2.4 percentage points higher exit. However, the likelihood of entry diminishes by 2.9 percentage points while exit rises by 1.1 percentage points due to a one standard deviation higher increase in assets.

We argue that our estimated effect of wealth is potentially a lower bound of the true effect due to the following reason. If a woman enters employment, then total wealth of household may increase because of the additional contribution from the woman. However, we find a negative effect of rising wealth on women's entry probability. Therefore, it must be the case that the true

[14] In the distribution of household assets in 2005, the 25th and 75th percentile values are 8 and 18 respectively. We compare between these two levels to portray the difference in transition probabilities between women from a relatively poorer versus relatively richer household.

[15] In the distribution of initial income, households that are at the 25th percentile have Rs. 15,000 and those at the 75th percentile have Rs. 70,000 income.

negative effect is even larger in magnitude, which off-sets the positive effect of woman's own contribution to household wealth, and yields a negative coefficient. Similar argument can be made for the exit probability. The use of temporal variation in our analysis is particularly useful in this case; it provides a more credible estimation strategy than other studies in the literature which use cross-sectional variation.

We find that the National Rural Employment Guarantee Scheme (NREGS) has an important role to play in reducing women's withdrawal from employment. The intensity of NREGS implementation, as measured by the log of labour expenditure on this scheme, does not have a statistically significant effect on entry. However, the effect is statistically significant and negative on the likelihood of exit from employment. A standard deviation increase in this measure of NREGS implementation in the district would prevent women's exit from employment by around 3.4 percentage points. This suggests that the rural workfare program may not sufficiently attract women who are away from the workforce. Nonetheless, by expanding the set of employment opportunities, it may help those who are already participating in the labour force to retain employment. We also find that higher rainfall help employed women to continue working in rural areas, although it does not affect new participation. Higher growth rate of nightlights, reflecting intensity of economic activity in the region, attract more women into the workforce. Besides, holding other factors unchanged, women in urban areas have a significantly lower probability of entry and higher probability of exit than women in rural areas.

6 CONCLUSION

Our analysis sheds light on the important issue of low female labour force participation in the context of a large and growing emerging economy. Economic participation of a woman not only has bearing on her own empowerment, but also leads to better intra-household resource allocation resulting in improvements in the human capital of the next generation. Besides, to reap the demographic dividend, it is imperative that policies are made conducive for greater participation of women in the workforce (Klasen, 2017). However, a neglected issue in the literature is the fact that employment status is often dynamic, rather than static, in nature. In the context of India, our study is the first to explicitly model employment entry and exit probabilities of women.

We find that an increase in income of other members of the household leads to lower entry and higher exit probabilities of women. Household wealth measured by durable assets also has a similar effect. The significant effect of household income and wealth is an important finding that potentially provides an explanation why despite economic growth female labour force participation may not increase over time. It shows that when other members have better earnings, then women are discouraged from participating in the labour market. Besides, households with a higher educated adult male have less women entering employment and more women withdrawing from employment.

These findings are consistent with the literature which highlights the possibility that women may be disinclined to be employed because of family status concerns and societal norms that stigmatize women's market work (Eswaran et al. 2013, Klasen 2017). Along with the effects of caste and religion, these results reveal the interplay between cultural and economic factors that are important in explaining the low workforce participation of women in India. With an improvement in socio-economic status, households discourage its women to step out and engage in employment.

It is worth noting that our separate analysis of entry and exit highlights the issue of symmetry, or the lack thereof, in female labour force participation. Our findings suggest that many factors significantly affect either entry or exit, but not both. Furthermore, although the direction of effect on entry is opposite to that on exit, the absolute magnitude is often not the same. Such findings indicate that some of the labour force participation relationships observed in cross-section data are not reversible, and it is crucial to consider the inter-temporal dependence of labour supply decisions. An important implication of this result is that the twin issues of encouraging women to take up employment and improving women's retention in the labour market may not be effectively tackled by the same policy instruments. Our econometric analysis reveals that policies which provide childcare or elderly-care facilities can potentially reduce the rate of exit. The significant effect of the National Rural Employment Guarantee Scheme suggests that availability of opportunities play an important role in employment retention. But these variables do not have significant impact on the likelihood of new participation. Rather, low rate of entry is likely to be caused by more deep-rooted structural and cultural barriers. Our analysis shows the importance of designing policies that not only promote female employment, but also ensure that those who are already in the workforce can retain their employment status in the face of changing socio-economics within and outside the household.

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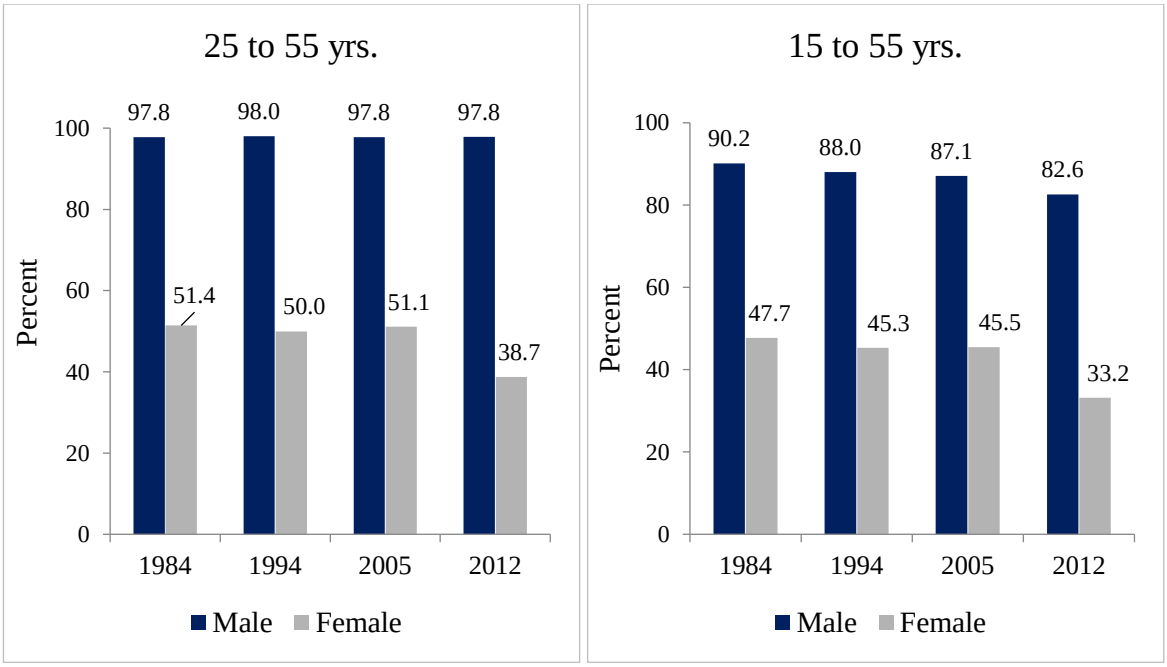
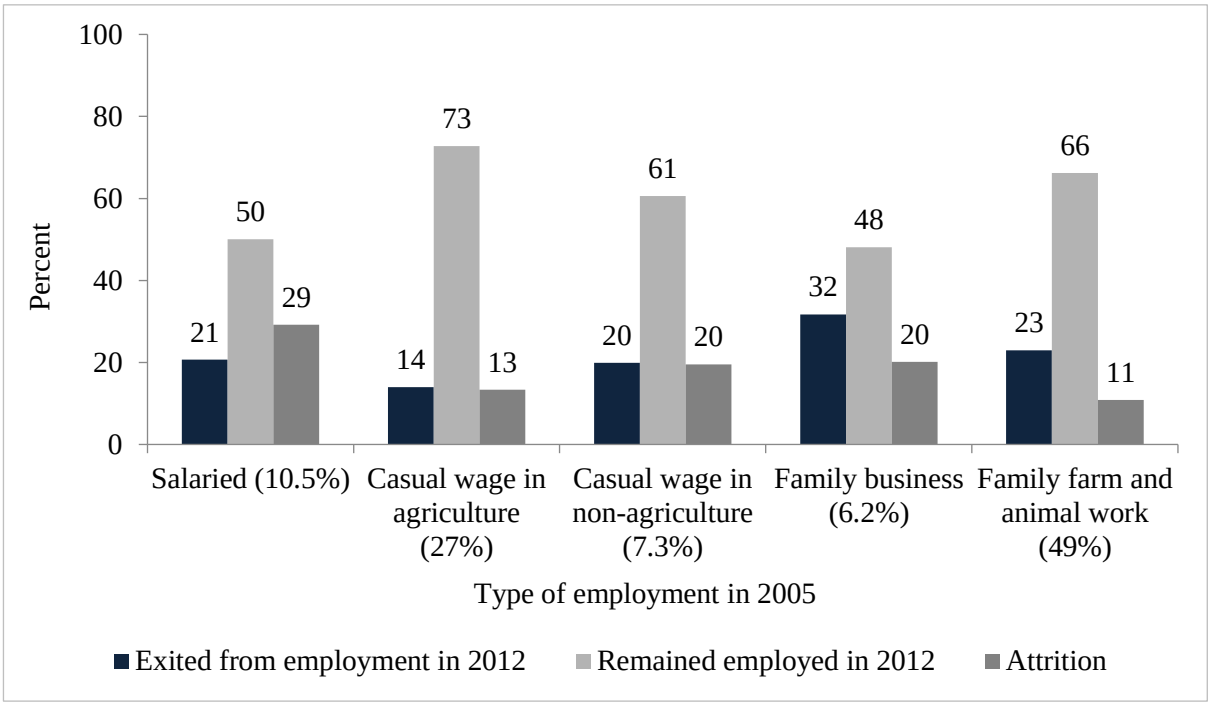
Figure 1: Labour force participation rate by gender (considering both usual principal and subsidiary activity status from NSS data)



Note: Authors' estimation using multiple rounds of National Sample Survey (NSS) data. Labour force participation is defined according to the usual principal as well as subsidiary activity status collected by NSS.

Figure 2: Distribution of employment status in 2012 within each type of employment in 2005 (for employed women aged 25-55 years in 2005)

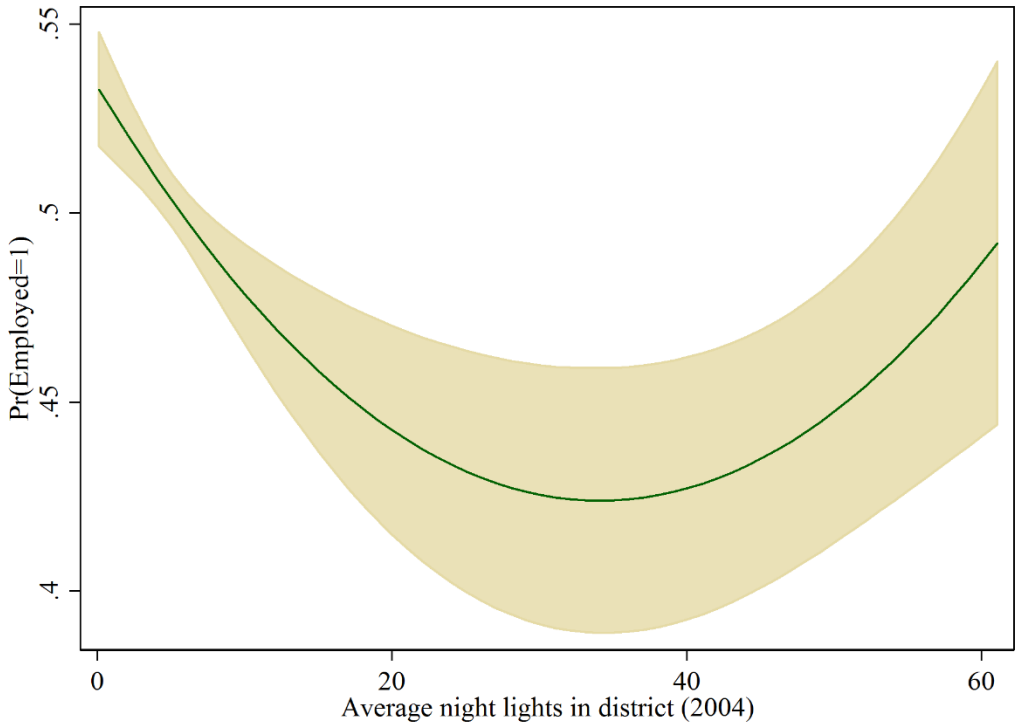


Source: Authors' calculation from IHDS data.

Figure 3: Distribution of type of employment in 2012 (women aged 25-55 years in 2005)

Source: Authors' calculation from IHDS data.

Figure 4: Relationship between employment of women (in 2005) and regional economic development proxied by nightlights



Source: Estimates from baseline employment regression using IHDS data.

Table 1: Description of the sample of women aged 25-55 years in 2005

	Overall	Rural	Urban
Employed in both rounds (Exit = 0)	13,519	11,899	1,620
%	*32.45*	*44.5*	*10.85*
Employed in 2005 but not in 2012 (Exit = 1)	4,302	3,268	1,034
%	*10.33*	*12.22*	*6.93*
Not employed in 2005 but employed in 2012 (Entry = 1)	5,273	3,794	1,479
%	*12.66*	*14.19*	*9.91*
Not employed in both rounds (Entry = 0)	9,919	3,808	6,111
%	*23.81*	*14.24*	*40.94*
Attrition	8,652	3,970	4,682
%	*20.77*	*14.85*	*31.37*
Total	41,665	26,739	14,926
%	*100*	*100*	*100*

Source: Authors' calculation from IHDS data. Column percentages are given in italics.

Table 2: Cross tabulation of employment status in both the rounds and attrition rates for women in 25-55 year age-group in 2005

	Status in 2012 (row percentage)		
Status in 2005	Not employed	Employed	Attrition
Overall			
Not employed (49.89 %)	47.72	25.37	26.91
Employed (50.11 %)	20.60	64.75	14.65
Total (N = 41,665)	34.13	45.10	20.77
Rural			
Not employed (35.34 %)	40.30	40.15	19.56
Employed (64.66 %)	18.90	68.82	12.27
Total (N = 26,739)	26.46	58.69	14.85
Urban			
Not employed (75.95 %)	53.91	13.05	33.05
Employed (24.05 %)	28.80	45.13	26.07
Total (N = 14,926)	47.87	20.76	31.37

Source: Authors' calculation from IHDS data. The percentages of employed and not-employed women are given within brackets.

Table 3: Summary statistics

VARIABLES	(1) N	(2) Mean	(3) S.D.
Employed	41,665	0.501	0.500
retention	41,665	0.792	0.406
Entry	15,192	0.347	0.476
Exit	17,821	0.241	0.428
Age (years)	41,665	37.93	8.915
Marital status: Married	41,665	0.871	0.335
Marital status: Single	41,665	0.0286	0.167
Marital status: Widowed	41,665	0.0704	0.256
Marital status: Separated/Divorced	41,665	0.0302	0.171
Household head	41,665	0.0610	0.239
Wife of head	41,665	0.691	0.462
Daughter of head	41,665	0.0377	0.190
Daughter-in-law of head	41,665	0.149	0.356
Other relationship to head	41,665	0.0611	0.240
No formal education	41,535	0.562	0.496
Primary educated	41,535	0.147	0.354
Secondary educated	41,535	0.235	0.424
Tertiary educated	41,535	0.0560	0.230
Number of children below 5	41,665	0.385	0.717
Mother/Father-in-law cohabitates	41,665	0.250	0.433
Caste: Others	41,665	0.335	0.472
Caste: OBC	41,665	0.395	0.489
Caste: SC	41,665	0.192	0.394
Caste: ST	41,665	0.0785	0.269
Religion: Hindu	41,665	0.805	0.396
Religion: Muslim	41,665	0.116	0.320
Religion: Others	41,665	0.0785	0.269
Household size	41,665	5.993	3.017
Number of elderly (above 65)	41,665	0.196	0.466
Highest education level of male	41,634	7.401	5.160
Household asset	41,665	12.86	6.278
Household income excluding own income (/10^5)	41,665	0.555	0.859
Change in number of elderly	33,013	0.0606	0.565
Number of new children born	33,013	0.145	0.456
Change in household asset	32,996	3.053	3.675
Change in household income excluding own income (/10^5)	33,010	0.210	1.336
Rainfall in 2004	41,665	1.159	0.893
Average annual rainfall 2005-2011	41,665	1.242	0.825
Night lights 2004	41,640	7.210	10.44
Growth rate of night lights 2005-2011	41,640	0.0873	0.0355
Log of total NREGS labour expenditure	39,243	-4.522	2.35
Urban area	41,665	0.358	0.479

Table 4: Probability of employment in the baseline (2005) – marginal effects of explanatory variables

VARIABLES	(1) All	(2) Rural	(3) Urban
Age 30-34 years	0.054***	0.057***	0.043***
	(0.007)	(0.009)	(0.011)
Age 35-39 years	0.074***	0.081***	0.054***
	(0.008)	(0.010)	(0.012)
Age 40-44 years	0.071***	0.074***	0.057***
	(0.009)	(0.012)	(0.013)
Age 45-49 years	0.059***	0.043***	0.071***
	(0.010)	(0.013)	(0.014)
Age 50-55 years	-0.011	-0.040***	0.031**
	(0.010)	(0.012)	(0.015)
Marital status: Single	-0.030	-0.122***	0.037
	(0.022)	(0.027)	(0.027)
Marital status: Widowed	0.016	-0.017	0.060***
	(0.015)	(0.017)	(0.022)
Marital status: Separated/Divorced	-0.008	-0.031*	0.048*
	(0.016)	(0.018)	(0.027)
Wife of head	-0.121***	-0.086***	-0.139***
	(0.016)	(0.020)	(0.022)
Daughter of head	-0.104***	-0.115***	-0.075***
	(0.019)	(0.024)	(0.024)
Daughter-in-law of head	-0.188***	-0.164***	-0.187***
	(0.017)	(0.020)	(0.026)
Other relationship to head	-0.247***	-0.235***	-0.215***
	(0.015)	(0.018)	(0.020)
Primary educated	-0.053***	-0.056***	-0.048***
	(0.007)	(0.009)	(0.011)
Secondary educated	-0.081***	-0.100***	-0.041***
	(0.007)	(0.010)	(0.011)
Tertiary educated	0.092***	-0.078***	0.167***
	(0.014)	(0.026)	(0.015)
Number of children below 5	-0.027***	-0.025***	-0.034***
	(0.004)	(0.005)	(0.006)
Mother/Father-in-law cohabitates	0.030***	0.024**	0.023*
	(0.008)	(0.009)	(0.013)
Caste: OBC	0.025***	0.023**	0.021**
	(0.007)	(0.010)	(0.010)
Caste: SC	0.004	-0.007	0.030***
	(0.009)	(0.012)	(0.011)
Caste: ST	0.097***	0.100***	0.085***
	(0.015)	(0.018)	(0.022)

Religion: Muslim	-0.075***	-0.076***	-0.071***
	(0.010)	(0.016)	(0.013)
Religion: Others	0.050***	0.067***	0.032**
	(0.014)	(0.020)	(0.016)
Household size	0.001	-0.002	0.009***
	(0.001)	(0.001)	(0.002)
Number of elderly (above 65)	0.014**	0.018**	0.003
	(0.006)	(0.007)	(0.010)
Highest education level of male	-0.004***	-0.003***	-0.006***
	(0.001)	(0.001)	(0.001)
Household asset	-0.011***	-0.010***	-0.010***
	(0.001)	(0.001)	(0.001)
Household income excluding own income (/10^5)	-0.045***	-0.043***	-0.051***
	(0.011)	(0.016)	(0.009)
Night lights 2004	-0.005***	-0.007**	-0.003***
	(0.001)	(0.003)	(0.001)
Rainfall in 2004	-0.013	-0.023***	0.007
	(0.008)	(0.008)	(0.007)
Urban area	-0.231***		
	(0.008)		
Observations	41,507	26,615	14,892
State fixed effects	Yes	Yes	Yes

Robust standard errors clustered at the PSU level are in brackets. *** p<0.01, ** p<0.05, * p<0.1. For each sample, estimates are obtained from a bivariate probit model that jointly estimates the probability of initial employment and sample retention, following the double selectivity model.

Table 5: Probability of entry into the employment

VARIABLES	(1) All	(2) Rural	(3) Urban
Age 30-34 years	0.018	0.054**	0.018
	(0.013)	(0.027)	(0.017)
Age 35-39 years	-0.011	0.031	-0.012
	(0.015)	(0.038)	(0.019)
Age 40-44 years	-0.023	0.010	-0.024
	(0.016)	(0.038)	(0.021)
Age 45-49 years	-0.063***	-0.066**	-0.057***
	(0.018)	(0.033)	(0.021)
Age 50-55 years	-0.110***	-0.196***	-0.084***
	(0.016)	(0.028)	(0.021)
Marital status: Single	-0.048	-0.198**	0.073
	(0.045)	(0.100)	(0.055)
Marital status: Widowed	-0.046*	-0.107***	0.030
	(0.024)	(0.036)	(0.032)
Marital status: Separated/Divorced	-0.014	-0.038	0.002
	(0.028)	(0.040)	(0.044)
Wife of head	-0.004	-0.074*	0.006
	(0.028)	(0.042)	(0.045)
Daughter of head	0.009	-0.101	0.070
	(0.039)	(0.071)	(0.054)
Daughter-in-law of head	-0.043	-0.198***	0.013
	(0.032)	(0.063)	(0.050)
Other relationship to head	-0.015	-0.212***	0.018
	(0.033)	(0.072)	(0.047)
Primary educated	-0.025**	-0.086***	-0.016
	(0.012)	(0.022)	(0.016)
Secondary educated	-0.039***	-0.123***	-0.029*
	(0.014)	(0.033)	(0.015)
Tertiary educated	0.023	-0.019	0.047
	(0.023)	(0.062)	(0.032)
Number of children below 5	0.027***	0.008	0.020**
	(0.007)	(0.012)	(0.010)
Mother/Father-in-law cohabitates	0.015	0.025	-0.001
	(0.014)	(0.021)	(0.019)
Caste: OBC	0.018*	0.046**	-0.001
	(0.010)	(0.018)	(0.012)
Caste: SC	0.038***	0.041**	0.021
	(0.013)	(0.019)	(0.018)
Caste: ST	0.084***	0.187***	0.081**
	(0.027)	(0.043)	(0.040)
Religion: Muslim	-0.062***	-0.121***	-0.049***

	(0.014)	(0.031)	(0.017)
Religion: Others	0.013	0.056	0.032
	(0.017)	(0.034)	(0.021)
Household size	0.004**	0.003	0.001
	(0.002)	(0.003)	(0.003)
Number of elderly (above 65)	0.007	0.002	0.028*
	(0.011)	(0.018)	(0.016)
Highest education level of male	-0.003***	-0.007***	-0.003*
	(0.001)	(0.002)	(0.002)
Household asset	-0.015***	-0.023***	-0.015***
	(0.002)	(0.004)	(0.002)
Household income excluding own income (/10^5)	-0.008	-0.015	-0.012**
	(0.006)	(0.012)	(0.006)
Change in number of elderly	0.002	-0.006	0.009
	(0.008)	(0.012)	(0.010)
Number of new children born	-0.010	-0.012	-0.011
	(0.009)	(0.012)	(0.013)
Change in household asset	-0.008***	-0.008***	-0.008***
	(0.001)	(0.002)	(0.002)
Change in household income excluding own income (/10^5)	-0.015***	-0.022***	-0.010***
	(0.003)	(0.005)	(0.003)
Average annual rainfall 2005-2011	-0.004	0.003	-0.005
	(0.009)	(0.012)	(0.010)
Growth rate of night lights 2005-2011	0.285*	0.436*	-0.057
	(0.166)	(0.234)	(0.226)
Log of total NREGS labour expenditure		-0.006	
		(0.007)	
Urban area	-0.159***		
	(0.027)		
Selection - Not employed	0.104**	-0.283**	0.058
	(0.050)	(0.132)	(0.092)
Selection - Retention	0.056	-0.072	-0.045
	(0.081)	(0.208)	(0.092)
Constant	0.629***	1.323***	0.553***
	(0.097)	(0.222)	(0.136)
Observations	15,118	7,349	7,571
R-squared	0.186	0.117	0.086
State fixed effects	Yes	Yes	Yes

Bootstrapped standard errors clustered at the PSU level are in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Probability of exit from the employment

VARIABLES	(1) All	(2) Rural	(3) Urban
Age 30-34 years	-0.002	-0.003	0.028
	(0.012)	(0.016)	(0.039)
Age 35-39 years	0.005	0.006	0.034
	(0.016)	(0.021)	(0.047)
Age 40-44 years	0.029*	0.028	0.081
	(0.017)	(0.022)	(0.050)
Age 45-49 years	0.083***	0.083***	0.127**
	(0.017)	(0.021)	(0.059)
Age 50-55 years	0.196***	0.207***	0.181***
	(0.017)	(0.018)	(0.044)
Marital status: Single	0.056	0.124	-0.027
	(0.058)	(0.089)	(0.097)
Marital status: Widowed	0.030	0.043*	0.012
	(0.021)	(0.025)	(0.065)
Marital status: Separated/Divorced	0.026	0.035	-0.036
	(0.023)	(0.027)	(0.071)
Wife of head	0.051**	0.053**	-0.044
	(0.023)	(0.023)	(0.093)
Daughter of head	0.062*	0.056	0.051
	(0.034)	(0.046)	(0.069)
Daughter-in-law of head	0.080***	0.090***	-0.071
	(0.028)	(0.032)	(0.128)
Other relationship to head	0.116***	0.125***	-0.038
	(0.034)	(0.037)	(0.132)
Primary educated	0.034***	0.036***	0.001
	(0.012)	(0.012)	(0.041)
Secondary educated	0.028*	0.033*	-0.014
	(0.015)	(0.018)	(0.041)
Tertiary educated	-0.103***	-0.087	-0.008
	(0.032)	(0.054)	(0.122)
Number of children below 5	-0.017***	-0.018***	-0.033
	(0.006)	(0.007)	(0.029)
Mother/Father-in-law cohabitates	-0.030**	-0.029**	-0.008
	(0.012)	(0.012)	(0.041)
Caste: OBC	-0.018	-0.014	0.007
	(0.012)	(0.013)	(0.030)
Caste: SC	-0.025**	-0.020	-0.027
	(0.012)	(0.012)	(0.037)
Caste: ST	-0.017	-0.014	0.007
	(0.016)	(0.018)	(0.066)
Religion: Muslim	0.076***	0.062***	0.073

	(0.017)	(0.021)	(0.051)
Religion: Others	0.009	0.015	-0.050
	(0.022)	(0.023)	(0.048)
Household size	0.001	0.002	0.004
	(0.002)	(0.002)	(0.008)
Number of elderly (above 65)	0.008	0.004	0.022
	(0.010)	(0.011)	(0.032)
Highest education level of male	0.002**	0.003***	-0.001
	(0.001)	(0.001)	(0.004)
Household asset	0.007***	0.006***	0.003
	(0.002)	(0.002)	(0.007)
Household income excluding own income (/10^5)	0.026**	0.021*	0.002
	(0.011)	(0.013)	(0.042)
Change in number of elderly	0.028***	0.028***	0.021
	(0.007)	(0.008)	(0.022)
Number of new children born	0.032***	0.030***	0.030
	(0.008)	(0.008)	(0.028)
Change in household asset	0.003***	0.002*	0.009***
	(0.001)	(0.001)	(0.003)
Change in household income excluding own income (/10^5)	0.018**	0.023***	0.005
	(0.007)	(0.009)	(0.014)
Average annual rainfall 2005-2011	0.002	-0.013*	0.006
	(0.008)	(0.008)	(0.019)
Growth rate of night lights 2005-2011	-0.291*	-0.152	-0.513
	(0.152)	(0.165)	(0.479)
Log of total NREGS labour expenditure		-0.014***	
		(0.003)	
Urban area	0.123***		
	(0.035)		
Selection - Employed	0.060	0.037	0.299
	(0.063)	(0.076)	(0.233)
Selection - Retention	-0.205	-0.145	-0.290
	(0.129)	(0.217)	(0.221)
Constant	0.003	-0.065	0.082
	(0.061)	(0.081)	(0.193)
Observations	17,768	15,031	2,644
R-squared	0.116	0.106	0.111
State fixed effects	Yes	Yes	Yes

Bootstrapped standard errors clustered at the PSU level are in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Appendix

Appendix Table A1: Description of the sample of men aged 25-55 years in 2005

	Overall	Rural	Urban
Employed in both rounds (Exit = 0)	26,179	18,484	7,695
%	*62.27*	*69.06*	*50.38*
Employed in 2005 but not in 2012 (Exit = 1)	2,534	1,489	1,045
%	*6.03*	*5.56*	*6.84*
Not employed in 2005 but employed in 2012 (Entry = 1)	2,186	1,283	903
%	*5.2*	*4.79*	*5.91*
Not employed in both rounds (Entry = 0)	645	312	333
%	*1.53*	*1.17*	*2.18*
Attrition	10,494	5,196	5,298
%	*24.96*	*19.41*	*34.69*
Total	42,038	26,764	15,274
%	*100*	*100*	*100*

Source: Authors' calculation from IHDS data. Column percentages are given in italics.

Appendix Table A2: Cross tabulation of employment status in both the rounds and attrition rates for men in 25-55 year age-group in 2005

	Status in 2012 (row percentage)		
Status in 2005	Not employed	Employed	Attrition
Overall			
Not employed (10.05 %)	15.26	51.73	33.01
Employed (89.95 %)	6.70	69.23	24.06
Total (N = 42,038)	7.56	67.47	24.96
Rural			
Not employed (8.44 %)	13.82	56.82	29.36
Employed (91.56 %)	6.08	75.43	18.50
Total (N = 26,764)	6.73	73.86	19.41
Urban			
Not employed (12.88 %)	16.92	45.88	37.20
Employed (87.12 %)	7.85	57.83	34.32
Total (N = 15,274)	9.02	56.29	34.69

Source: Authors' calculation from IHDS data. The percentage of employed and not-employed men are given within brackets.

Appendix Table A3: Probability of retention between 2005 and 2012 – marginal effects of explanatory variables

VARIABLES	(1) All	(2) Rural	(3) Urban
Age 30-34 years	0.030***	0.031***	0.027**
	(0.006)	(0.007)	(0.012)
Age 35-39 years	0.055***	0.050***	0.059***
	(0.007)	(0.008)	(0.014)
Age 40-44 years	0.058***	0.046***	0.073***
	(0.008)	(0.009)	(0.015)
Age 45-49 years	0.051***	0.043***	0.058***
	(0.008)	(0.009)	(0.016)
Age 50-55 years	0.035***	0.022**	0.055***
	(0.008)	(0.009)	(0.016)
Marital status: Single	-0.116***	-0.132***	-0.100***
	(0.016)	(0.018)	(0.030)
Marital status: Widowed	-0.019	-0.031**	0.019
	(0.012)	(0.013)	(0.024)
Marital status: Separated/Divorced	-0.024*	-0.030**	0.001
	(0.013)	(0.014)	(0.030)
Wife of head	0.009	0.004	0.035
	(0.012)	(0.013)	(0.025)
Daughter of head	-0.062***	-0.066***	-0.055*
	(0.015)	(0.016)	(0.030)
Daughter-in-law of head	-0.022*	-0.039***	0.027
	(0.013)	(0.014)	(0.028)
Other relationship to head	-0.012	-0.015	-0.012
	(0.013)	(0.014)	(0.026)
Primary educated	-0.012*	-0.007	-0.019
	(0.006)	(0.007)	(0.012)
Secondary educated	-0.032***	-0.025***	-0.030***
	(0.007)	(0.008)	(0.011)
Tertiary educated	-0.065***	-0.087***	-0.051***
	(0.011)	(0.016)	(0.017)
Number of children below 5	0.006*	0.013***	-0.009
	(0.003)	(0.004)	(0.007)
Mother/Father-in-law cohabitates	0.037***	0.020**	0.058***
	(0.007)	(0.008)	(0.015)
Caste: OBC	0.028***	0.019***	0.030***
	(0.006)	(0.007)	(0.010)
Caste: SC	0.016**	0.001	0.038***
	(0.007)	(0.008)	(0.015)
Caste: ST	-0.010	-0.006	-0.007
	(0.013)	(0.013)	(0.030)

Religion: Muslim	-0.022**	-0.007	-0.043***
	(0.009)	(0.013)	(0.015)
Religion: Others	-0.013	-0.010	-0.018
	(0.012)	(0.015)	(0.019)
Household size	0.010***	0.006***	0.019***
	(0.001)	(0.001)	(0.002)
Number of elderly (above 65)	0.009*	0.007	0.016
	(0.005)	(0.006)	(0.012)
Highest education level of male	-0.002***	-0.001	-0.004***
	(0.001)	(0.001)	(0.001)
Household asset	-0.000	0.001	-0.002*
	(0.001)	(0.001)	(0.001)
Household income excluding own income (/10^5)	-0.010***	-0.009***	-0.011*
	(0.004)	(0.003)	(0.007)
Night lights 2004	-0.005***	-0.000	-0.007***
	(0.001)	(0.002)	(0.001)
Rainfall in 2004	0.001	-0.001	0.003
	(0.006)	(0.006)	(0.014)
Person ID within household	-0.010***	-0.008***	-0.012***
	(0.002)	(0.002)	(0.004)
Urban area	-0.093***		
	(0.007)		
Observations	41,507	26,615	14,892
State fixed effects	Yes	Yes	Yes

Robust standard errors clustered at the PSU level are in brackets. *** p<0.01, ** p<0.05, * p<0.1.

For each sample, estimates are obtained from a bivariate probit model that jointly estimates the probability of initial employment and sample retention, following the double selectivity model.