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The Impact of Transportation Infrastructure on Women's Employment in India

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Abstract

Indian women's labor force participation is extremely low and they are much less likely than men to work in the non-farm sector. Earlier research explained women's labor supply by individual characteristics, social institutions, and cultural norms, but not enough attention has been paid to the labor market opportunity structure that constrains women's labor market activities. Using data from the India Human Development Survey (IHDS) in 2004–05 and 2011–12, we examine how village transportation infrastructure affects women's and men's agricultural and non-agricultural employment. Results from fixed-effect analysis show that access by paved or unpaved roads and frequent bus services increase the odds of non-agricultural employment among both males and females. The effect of road access on non-farm employment (relative to not-working) is stronger among women than among men. Improved transportation infrastructure has a stronger positive effect on women's non-farm employment in communities with more egalitarian gender norms.

1. Introduction

India has one of the lowest levels of female labor force participation (FLFP) among developing countries. According to the 68th round data of National Sample Survey (NSS) collected in 2011–2012, the FLFP rate was 35.8 percent in rural areas and 20.5 percent in urban areas, with the total FLFP being 31.2 percent (Andres et al. 2017). This is well below the global average of around 50% (Dasgupta and Verick 2017) and lower than some of the neighboring countries such as Bhutan, Nepal, and Bangladesh (see Table 1). The FLFP in India has been stagnant since the late 1980s and declined further during the past decade despite the rising female education and rapid economic growth (Klasen and Pieters 2015). Another important characteristic of Indian women's employment is the disproportional concentration in the agricultural sector. About 37% of the male workers and only 20% of the female workers in rural India were usually employed in the non-farm sector, according to the

2009–10 National Sample Survey (NSS) (Jatav and Sen 2013). The NSS also reported that from 2004–05 to 2011–12, a growing proportion of the workforce started moving to non-farm activities, but this sectoral relocation was more prominent for male workers than for their female counterparts (Chowdhury 2011; Shaw 2013).

Agriculture increasingly forms a smaller share of India's GDP and with agricultural mechanization, opportunities in agriculture continue to decline (Papola 2012). Moreover, much of the agricultural employment for women tends to be on the family farm (Desai, Dubey, Joshi, Sen, Shariff, and Vanneman 2010), and does not result in independent income. As compared with the work on family farm and family business, women who work as wage laborers or in salaried jobs are more likely to receive direct payments, which are separated from their family income. Research shows that it is not women's employment per se but employment outside of the family farms that contributes to women's control over resources and decision-making power (Anderson and Eswaran 2009). Another study found that off-farm wage employment improves poor women's happiness through increased income (Van den Broeck and Maertens 2017). Therefore, we focus on women's non-farm employment in this paper.

Earlier research used individual demographic characteristics, education, culture, labor policy, and labor market characteristics to explain the supply and demand of women's labor (Brinton, Lee, and Parish 1995; Das, Jain-Chandra, Kochhar, and Kumar 2015; Jensen 2012; Klasen and Pieters 2015). Researchers attribute the low FLFP in India to increased rural income, reduced number of farming jobs, and the lack of jobs in the other sectors that are suitable for women (Andres, Dasgupta, Joseph, Abraham, and Correia 2017; Chatterjee, Murgai, and Rama 2015). However, not enough attention has been paid to the role of economic development policies such as transportation infrastructure investment in shaping women's labor market activities. Women are more likely than men to lack access to motorized transport options (Salon and Gulyani 2010) and to spend more time traveling to work (Anand and Tiwari 2006). The limited mobility tends to restrict women's economic activities and curtail their status in the society. Therefore, it is important to investigate whether improved road conditions and access to transport could help women to diversify their livelihood strategies out of agriculture into non-agricultural activities.

Although India has successfully maintained rapid economic growth in the past decade, its infrastructure is widely viewed as inadequate and inefficient. In 2000, about 40% of the 825,000 villages in India lacked access to all-weather roads (World Bank 2011). The average travel speed of trucks and buses was only 30–40 kilometers per hour. Recognizing the poor rural transportation conditions, the Government of India launched the national rural road construction program—the Pradhan Mantri Gram Sadak Yojana (PMGSY)—in 2000. This rural road construction program prioritizes villages with a population of 1000 or more, thereafter extending to villages with a population of 500–1000. By 2017, over 136,000 roadworks with 523,907 km of roads have been built under the PMGSY. In addition, the Indian Government has set a target of $1 trillion for infrastructure spending during the period of 2012–2017 to not only improve transportation networks but also provide electricity, water, and telecommunication services, among other things (Planning Commission Government of India 2013). With rising investments in infrastructure

development in India, a better understanding of the consequences of infrastructure development, especially transportation, may yield substantial policy benefits.

Transportation infrastructure has been shown to increase agricultural trade and income (Aggarwal 2015; Donaldson 2018), reduce poverty (Khandker, Bakht, and Koolwal 2009), boost local market development (Mu and van de Walle 2011), increase migration (Morten and Oliveira 2014), and relocate laborers from agriculture to the non-agricultural sector (Asher and Novosad 2016). However, most prior studies focus on highways and railroads that provide inter-region connections. There is comparatively less research examining the economic effects of local transportation services and smaller-scale roads connecting villages. Albeit that studies have documented the link between the lack of access to public transit and limited job opportunities for minority population in the US (Holzer, Quigley, and Raphael 2003; Sanchez 1999), the implications of bus services for labor market activities have not been investigated in developing countries. Moreover, earlier studies investigating the impact of village transportation infrastructure on employment did not situate the analysis in India's social context marked by ingrained gender inequality (Aggarwal 2015; Asher and Novosad 2016). This study particularly takes into account the patriarchal values and gender relations in India and considers the restrictions imposed by community gender context on women's labor market activities.

Going beyond previous literature, this study provides estimates of the impact of access to rural roads and bus services on the economic activities of Indian women and men. Using two waves of data from the India Human Development Survey (IHDS), this study answers three research questions: 1) How does village transportation infrastructure influence women's participation in non-agricultural work in India? 2) How does the improvement in rural transportation infrastructure affect the gender gap in non-agricultural work participation? 3) How does the effect of transportation infrastructure on women's employment vary by the gender context of the communities? India's diverse regional contexts provide a unique opportunity for us to compare areas that have experienced substantial improvement in infrastructure investment to those that have not in terms of the implications for women's labor market activities. We adopt fixed-effect models to examine how the improvements in transportation infrastructure lead to changes in individuals' employment sector between 2005 and 2012.

2. Theory and Literature

Women's labor force participation is determined by a confluence of social and economic forces at both the household and societal levels. Previous literature has considered various factors that determine the supply and demand of women's labor. Several *labor supply conditions*, such as increased age at marriage, declining fertility, and reduced family obligations, are theorized to free women's time for labor market activities (Brinton, Lee, and Parish 1995). Meanwhile, increases in women's education and work experiences improve their qualifications for jobs. However, whether these labor supply conditions can be translated into women's work participation also depends on *labor demand conditions*, namely the characteristics of local labor markets, such as the availability of jobs, gender discrimination, and gender segregation in the labor markets (Brinton, Lee, and Parish 1995;

Spierings 2014). In the Indian context, scholars claimed that the recent decline in FLFP is due to a combination of supply-side and demand-side factors (Chatterjee, Murgai, and Rama 2015; Klasen and Pieters 2015; Lahoti and Swaminathan 2016). Rising household income and husbands' education reduce women's labor supply. Further, the slow growth of sectors that draw women's labor also leads to limited demand for women's work.

In this study, we provide a theoretical framework explaining how village transportation infrastructure shapes women's non-farm employment in India by altering various aspects of the labor supply conditions and labor demand conditions. We suggest that improvements in the transportation infrastructure in rural India tend to promote women's work participation and employment in the non-farm sector by increasing access to both local and external job opportunities, reducing women's time spent in domestic drudgeries, and possibly by introducing more egalitarian gender attitudes.

Access to job opportunities

There is a shortage of short-term and long-term employment opportunities for women in rural areas in India (Chowdhury 2011; World Bank 2010). The lack of non-farm jobs suitable for women in rural villages partially explains the recent decline in FLFP in India (Chatterjee, Murgai, and Rama 2015). Investment in transportation infrastructure can provide employment opportunities to rural women by connecting them to labor markets beyond the immediate community. Improved road conditions and bus services reduce the time and money required to commute to nearby urban areas. When the urban wage net of commuting costs is higher than the agricultural income, rural women would be attracted to external labor markets. Moreover, the presence of paved road, frequent bus services, and access to train stations could reduce the time needed to travel to the work sites, making it feasible for women to engage in paid work in nearby towns while fulfilling family obligations.

On the other hand, transportation changes local labor market conditions within the village itself. Improvement in transportation infrastructure tends to increase agricultural productivity by introducing capital and technology (Aggarwal 2015), which reduces the demand for labor in the agricultural sector. Connections to outside markets could also boost the growth of the non-farm sector within the village (Asher and Novosad 2016). A prior study finds that better rural roads can enhance the development of local markets, services, and institutions (Mu and van de Walle 2011), which generates more non-farm job opportunities. These changes within the village tend to attract women out from agricultural production and into paid work the in the non-farm sector.

Time spent in domestic drudgeries

A considerable proportion of women's time in less developed regions is spent on domestic chores, food production, and other unpaid work. Women in poor families have to combine the inputs of time and market goods in order to maintain subsistence, which requires them to work for long hours in both paid and unpaid work without choice. Time-poverty literature found that women are more likely than men to be time poor (Bardasi and Wodon 2010). In addition to household labor such as cooking and cleaning, poor women in India and other

developing countries spend a significant amount of time fetching firewood and water, preparing cow dung cakes, and cleaning drains (Agarwal 1986; Jain 1985). Better transportation infrastructure provides access to social services and markets and brings in modern technologies and facilities such as tap water and modern fuel. These amenities would free up women's time spent in household drudgeries, and thus creates opportunities for women to participate in labor activities on the farm and in the non-farm sector. For example, an improvement in road conditions could lead to easier delivery of modern cooking fuels such as kerosene or LPG, thereby reducing the time that women have to spend in collecting firewood.

Changes in gender attitudes

Well-built transportation networks may promote the exchange of information between villages and the larger society, leading to greater exposure to modern ideas and Western culture that communicate egalitarian gender ideologies. Diverse cultural exposure may weaken the traditional gender attitudes that prefer confining women to domestic activities. Family members then imbibe more positive attitudes toward women's participation in labor market activities outside of the household. In addition, as described by the labor queue theory, employers would only consider women for job openings when the labor demand exceeds the supply of males in the queue (Reskin and Roos 1990). Changes in gender norms may alter the gender-biased preference of employers and reduce the prejudice against women in the local labor market. By reshaping attitudes toward women's employment, improvement in transportation connections may lead to greater increases in the participation of women in non-farm work as compared to that of men.

The arguments above together lead to our *Hypothesis 1: Improvements in village transportation infrastructure increase women's employment in the non-agricultural sector.*

Next, we examine whether an improvement in village transportation infrastructure could possibly reduce the gender gap in non-agricultural work participation. Due to the lack of agricultural jobs for women and the limited number of female-labeled non-farm jobs within the village, such as those of teachers, nurses, and clerks, fewer women are employed in rural India than their male counterparts (Chatterjee, Murgai, and Rama 2015; Shaw 2013). Despite the social norms that confine women to the domestic space, there is a huge unmet need for jobs among rural women who have achieved a certain level of education. In the IHDS-II survey conducted in 2012, 61% of the married women between ages 15–49 who were not working said that they would be willing to work if they found a suitable job. This leaves a larger room for the increase in women's participation in the non-farm sector, as compared with men's non-farm employment, as most men are already occupied by farming or non-farm jobs. In addition, as discussed above, improvements in rural transportation infrastructure would free up women's time spent in household drudgeries for labor market activities. Transportation connections to the world outside would also change gender attitudes toward women's employment. These mechanisms imply a positive impact of transportation infrastructure on females' labor supply but the same mechanisms do not work for men. Therefore, we expect that transportation networks connecting villages should have a more pronounced impact on the non-farm employment among women than that among

men. We propose our *Hypothesis 2a: The gender gap in non-agricultural employment will be reduced with better transportation infrastructure in villages.* On the other hand, nearly all Indian men in the working-age are already involved in the labor market, and their labor supply is not restricted by family responsibilities and the unequal gender norms. Once provided transportation access, they could easily travel to nearby towns and cities to pursue non-farm jobs which provide higher wages than agricultural work. Asher & Novosad (2016) find that rural road construction only relocates male workers from agriculture to the non-farm sector. Indian men are able to change their labor market behavior more easily than women and they are more likely to respond to newly available non-farm job opportunities. Thus, we propose a competing hypothesis that *Hypothesis 2b: Better transportation infrastructure in villages will widen the gender gap in non-agricultural employment.*

However, it needs to be noted that village transportation may reduce the necessity of women's work for the welfare of the family by increasing the income of other family members. Studies find that in India, women in the lower economic strata are far more likely to be employed than those in the higher strata (Kapsos, Silbermann, and Bourmpoula 2014) because their wages are necessary for the family to meet basic sustenance needs. Prior research has found that as family income increases, women move out from subsistence employment and become economically inactive (Kapsos, Silbermann, and Bourmpoula 2014). Transportation infrastructure has been seen to increase male employment in the non-agricultural sector and household income (Asher and Novosad 2016; Donaldson 2018), which possibly reduces the needs for women's earnings. This countervailing pathway may weaken the effect of transportation infrastructure on women's non-agricultural employment, and broaden the gap between the non-farm employment of men and women.

It is also important for studies on women's labor force participation to take into account patriarchal values and gender relationships (Brinton and Lee 2016). The impact of rural transportation infrastructure on women's labor market activities is possibly conditioned by the gender context of local communities. In South Asian countries, there is a strong normative preference for female seclusion (Sharma 1990). The preferences for confining women to the domestic realm is perceived as the basis of the dichotomy between male and female or between the "public" and "private" realms of activities. Women are seen as intruders in the public world (Derne 1994). The ideology that women should be modest, obedient, docile, and attached to the home motivates husbands and families to restrict women's mobility (Derne 1994). The practice of *purdah/ghunghat* (or seclusion) is the most visible marker of gender. It is performed in a variety of forms, including "wearing a full *burqa*, covering one's face with a shawl or *sari* when in the presence of men, lowering voices and eyes in the presence of men, remaining in separate rooms or behind a screen when unrelated men are present, or not going to public places unaccompanied" (Stroope 2015).

The practice of *purdah/ghunghat* varies widely across regions and communities in India due to the prevalence of different social systems, kinship structures, and gender norms (Desai and Andrist 2010). Women's seclusion is much more acute in north India than in south India. In north India, women have little autonomy or freedom of movement and a married woman is kept largely invisible to outsiders and under the authority of her husband's family,

while women in south India are less secluded and have more freedom to venture outside the home (Jejeebhoy and Sathar 2001).

As one dimension of the gendered structure in the community context, the practice of *purdah/ghunghat* places restrictions on women's movements and adversely affects women's ability to participate in economic activities outside the home (Asadullah and Wahhaj 2016). Working women have noted that due to women's lack of mobility, employers are reluctant to assign them on-site jobs or jobs that require them to travel at night (Liddle and Joshi 1986). Overprotective supervisors always send someone to accompany female employees when they are traveling to the work sites. In communities with more strict practices of *purdah/ghunghat*, employers may prefer hiring males due to the inconvenience that women encounter at work. Moreover, in places with more traditional gender norms, women themselves are less responsive to the availability of job opportunities due to resistance from the community and family members. Therefore, we propose that *Hypothesis 3: Improvements in village transportation infrastructure have a stronger positive impact on women's employment in communities with a more egalitarian gender context.*

3. Data and Methods

Data

This study uses data from two waves of the IHDS, which were conducted in 2004–05 and 2011–12, respectively, by the National Council of Applied Economic Research (NCAER) in India and the University of Maryland (Desai, Vanneman, and National Council of Applied Economic Research 2011–12). The interviews taken during this survey were spread across 34 states and Union Territories, and span 971 urban blocks and 1,503 villages in 388 districts in India. The 2004–05 sample consisted of 41,554 randomly selected households containing over 200,000 individuals; 83% of the same households (as well as any split households) were resurveyed in 2011–12. An additional sample of 2,148 households was added to refresh the urban sample where the re-contact rates were lower. This brings the 2011–12 sample to 42,152 households containing 215,748 individuals. The household questionnaire covered topics like household economic activities (including agricultural production, business operation, and consumption), social networks, and living standards. Through household roaster, the survey also collected information on each household member's demographic characteristics, education, work status, income, and health. In each survey, women aged 15 to 49 years responded to additional questions about health, gender relations, fertility, and natal care in the eligible women questionnaire. At both waves, the IHDS conducted village-level focus group discussions among village government officials, local businessmen, and other adults, to collect information about village structure, infrastructure, labor market characteristics, land use, and agricultural production, among other things. We combine data from all three sources: the household questionnaire, the eligible women questionnaire, and the village questionnaire.

In the analysis, we restrict the sample to 20,640 rural women and 19,481 rural men who were between ages 25 and 52 in 2005 (thus between 32 and 59 years old in 2012) and were interviewed at both waves of the survey. By the age of 25, most people have completed their education, so the analysis does not need to consider the influence of increased educational

opportunities for young women's labor market activities. After deleting cases with missing values at either wave of the survey, the sample is reduced to 17,771 women and 16,827 men. In the conditional fixed-effect multinomial logistic models assessing the effect of road conditions, removing persons who did not change employment status between the two waves and cases with missing values results in an analytical sample of 7,251 women and 6,469 men, with two observations for each person. The sample contains 7,014 women and 6,281 men in the person fixed-effect models examining the effect of bus services. On average, individuals included in the sample were 36 years old at IHDS-1. Sixty percent of the women and 29 percent of the men received no education.

The *dependent variable* is a time-varying categorical variable reflecting the respondents' employment status and sectors at each wave of the IHDS. The first category, "not working," contains respondents who did not work or worked for less than 240 hours in the past year. The second category, "agricultural employment," includes respondents who participated in a combination of agricultural and non-agricultural work for more than 240 hours in the past year (including work on own farm, family business, agricultural labor, non-agricultural labor, and salary work). If the amount of non-agricultural work reaches 240 hours in the past year, the respondent is categorized into the third group, which is "non-agricultural employment". We use 240 hours as the cut-off because it distinguishes individuals who devote substantial time to a certain type of work and those who do not. This definition is also employed by the other major national-scale surveys in India such as the National Statistical Survey (NSS). Using the same definition will allow for comparisons between our study and the studies using the NSS data.

The two focal *independent variables* measure the village road condition and bus frequency, respectively, at both waves of the IHDS. The village road condition contains three categories, including no access by road, access by *katcha* (unpaved or dirt) road, and access by *pucca* (paved) road. The frequency of bus services in the village is categorized into once a day, 2–6 times a day, and 7 or more times a day, contrasting to no bus services.

The effect *moderator*, village gender context, is captured by the practice of *purdah*, which is measured by the percentage of sampled women aged 15 to 49 years in a village who said that they practice *purdah*, at the baseline survey in 2005. In this analysis, we control for a myriad individual, household, and village level characteristics that vary over time. At the individual level, the respondents' age, the number of children under age 6 in the household, and the number of married women in the household are simply continuous variables measured at both waves. Marital status is also a time-varying variable that compares the status of unmarried, widowed, separated or divorced, and married but spouse not present to married women. The other family member's income is calculated by using the sum of family income from each type of farm and non-farm activity minus the respondent's contribution. The IHDS is the only data source in India that provides information on other family member's income, which is an important predictor of the labor market activity of females (Kapsos, Silbermann, and Bourmpoula 2014; Klasen and Pieters 2015). The measure of household assets is originally a sum of 30 items indicating household possessions and housing quality. We construct a categorical variable reflecting the quintiles of household assets among all households in India.

To account for the burden of household drudgeries for women (such as fetching water and firewood), we measure the number of hours that electricity is available per day in the household, whether the household has piped (public supply) water, and whether the household uses modern fuel, such as LPG, kerosene, and coal, for cooking at both waves. As regards village characteristics, we control for the village population at each wave of the survey because the national rural road construction program (PMGSY) prioritizes villages with larger populations. The goal of PMGSY was to provide all habitations having populations greater than 1000 and 500 with connectivity by 2003 and 2007, respectively. The wage level in a village is calculated using the average hourly wage of all sampled adult men and adult women, respectively, in each village who undertake salary/wage jobs in the non-farm sector at each wave of the survey. (The average village wage level is not available for 2,005 women out of 17,771 women in our analytical sample because there are not any women taking salary/wage jobs in their villages. Thus, their village wage level is mean imputed.)

Methods of analysis—We first present the descriptive statistics, showing men's and women's non-agricultural employment sectors, occupational types, socio-demographic characteristics, and village characteristics in 2005 and 2012. Next, we estimate person fixed-effect multinomial logistic regression models predicting the employment sectors of females and males separately (see equation 1). We first use not working (k=1) as the reference outcome category, contrasting agricultural employment (k=2) and non-agricultural employment (k=3) to not working. Then, we set agricultural employment (k=2) as the base category to examine the odds of non-agricultural employment (k=3) relative to agricultural employment.

$$log\left(\frac{p_{ijk}}{p_{ij1}}\right) = \mu_{kt} + \beta_{1k}x_{ijt} + \beta_{2k}v_{jt} + \gamma_k z_{ij} + \tau_k w_j + \alpha_{ijk} + \theta_{jk}, \quad k = 2, 3 \tag{1}$$

Equation 1 is essentially a set of binary logistic regression models that simultaneously compare each response category k to the first category. In this model, x_{it} represents the time-varying characteristics of individuals and v_{jt} represents the time-varying characteristics of villages. The fixed effect α_{ijk} vary both over individuals and response categories and the fixed effect θ_{jk} varies over villages and response categories. The time-invariant traits of individuals z_{ij} and villages w_j as well as the fixed effects α_{ijk} and θ_{jk} will be canceled out when estimating the model using conditional maximum likelihood. There are concerns of endogeneity of rural road construction and bus services because they are influenced by demand and the political bargaining power of local governments. We use person fixed-effect models to rule out all the observed and unobserved time-invariant individual and village characteristics that potentially confound the relationship between village transportation infrastructure and respondents' employment sectors. By using the person fixed-effect models, we take advantage of the longitudinal data and estimate how changes in rural transportation conditions are associated with changes in men's and women's participation in agricultural work and non-agricultural work over time. To test our Hypothesis 2, we assess the gender

difference in the effects of village transportation variables by pooling men and women in the sample and including interaction terms between transportation conditions and gender in the fixed-effect multinomial logit regression models. Finally, to test our Hypothesis 3, we examine the interactive effects between transportation conditions and the village-level practice of *purdah* in the fixed-effect multinomial logit models predicting women's and men's employment sectors.

4. Results

Figure 1 describes the changes in women's and men's employment sectors between 2005 and 2012. The proportion of women who were not working and those working in the agricultural sector both declined over the seven-year period between 2005 and 2012. The non-agricultural employment rate increased significantly for both men and women during the said period, though the rate remained much lower for women. Only 10 percent of the women participated in non-agricultural work in 2005, while the number increased to 18 percent in 2012. The non-agricultural employment rate for men, on the other hand, increased from 47 percent in 2005 to 54 percent in 2012. The proportional change in men's non-agricultural employment over the interval was thus much smaller than the corresponding change for women (a 15 percent increase for men vs. an 80 percent increase for women).

We further present the broad areas in which rural Indian women and men ages 25 to 59 years old were employed in 2005 and 2012 in Table 2 (statistics calculated using the IHDS data). As we mentioned earlier, women's employment was heavily concentrated in the agricultural sector (including forestry and fishery) as compared with that of men, and the relocation from the agricultural sector to the non-agricultural sector was more prominent among men than among women. The numbers in Table 2 show that the percentage of women who were employed in the agricultural sector (including forestry and fishery) dropped from 61 percent in 2005 to 46 percent in 2012. Women tended to enter the industrial sector by taking jobs such as construction workers, drivers, and mobile operators, the percentage of which increased from 11 percent to 24 percent between the two waves of the survey. Meanwhile, a small but nontrivial proportion of women took professional and managerial jobs and clerical, sales, and service jobs, and these jobs accounted for a slightly higher proportion of all jobs over time.

The conditions of transportation infrastructure also changed dramatically during the survey interval, particularly because of the strong push by the Indian Government through the Pradhan Mantri Grameen Sadak Yojana (PMGSY) mentioned earlier. Figure 2 shows that many more villages were accessible by *katcha* and *pucca* roads in 2012 than in 2005. The percentage of people living in villages not accessible by roads dropped from 6 percent to 1 percent during the seven-year interval. As far as the frequency of bus service is concerned, the proportion of villages with no bus services dropped from 47 percent in 2005 to 38 percent in 2012. More villages had bus services one to six times a day in 2012 than in 2005, but slightly fewer villages had bus services 7 times or more a day in 2012 as compared to 2005.

Table 3 presents the descriptive statistics of the socio-demographic characteristics of individuals and village characteristics in 2005 and 2012. In the analytical sample, about 90 percent of both men and women were married in 2005. The percentage of unmarried individuals in 2005 was higher among the men than among the women, given that women usually marry at an earlier age than men. Seven years later, the percentage of women who were married dropped to 83.6 percent, whereas the number increased to 93.5 percent among men. Females were more likely than males to be widowed and to have their spouses absent from the household (mostly due to labor migration) at both waves. The average number of children under age 6 in each household decreased from about 1 to 0.6 between the two waves of the survey. As a proxy for household structure, the average number of married women in each household was 1.5 at both waves, indicating that a substantial proportion of women lived in extended families.

We consider the other family members' income because it reflects whether the women's work is needed for the family to maintain sustenance. Because in India men are more likely to be the major income earner in a household than women, the income of a man's family members was more likely than that of a woman to be ranked at a lower quintile. In this rural sample, there are more households located at the lower end rather than the higher end of the quintiles. With regard to the household facilities, in 2005 on an average each household had about 10 hours of electricity available per day, which increased to 11.5 hours in 2012. About 31 percent of the households had piped water publicly supplied in 2005 and it reached 38 percent in 2012. The percentage of the households that used modern fuel for cooking grew from about 33 percent to 36 percent over the two rounds of the survey.

At the village level, the average size of the population in a village grew from about three thousand in 2005 to 4.2 thousand in 2012. The average hourly wage for adult men employed in the non-farm sector in each village raised by about 25 percent, from 19.7 Rupees in 2005 to 24.9 Rupees in 2012. The average hourly wage for women increased from 12.7 Rupees in 2005 to 16.5 Rupees in 2012. In terms of the community gender context, 60 percent of the women in a typical village practiced *purdah* at both waves, and there was a significant variation among villages across the country (standard deviation = 0.4). In our sample, about 17 percent of the women lived in the villages where no one practiced *purdah*, and about 27 percent of the women lived in the villages where all practiced *purdah* in 2005 (numbers not shown in the tables).

The person fixed-effect multinomial logistic regression models assessing the impact of road conditions on the employment sectors of the women and the men are presented in Table 4. The coefficients of the survey wave II across the columns indicate that employment in the non-farm sector increased significantly among women over the seven-year interval, while the employment in the farm sector (relative to not working) decreased. Similarly, among men, the odds of working in the agricultural sector (relative to not working) declined over time and the odds of non-agricultural employment (relative to agricultural employment) increased over the period. These trends may reflect the fact that women enter the labor force after completing childbearing and both the men and the women tend to relocate from the agricultural sector to the non-agricultural sector. For women, marital status does not affect their sector of employment. For males, the married ones are more likely than the never-

married men and the widowed men to be employed, and they are more likely to enter the non-agricultural sector. The number of children under age six in the household is negatively associated with the likelihood of female employment in both the agricultural and non-agricultural sectors because it imposes a greater childcare burden on women. As expected, the presence of young children has no significant impact on the employment of men. The number of married women, a proxy for an extended household structure, is associated with a lower odds of farm employment (vs. not working) among females and a lower odds of non-farm employment (vs. not working and farm employment) among both females and males. A higher level of other family members' income makes women less likely to participate in farm work and non-farm work (relative to not working) but does not affect their transition from the farm sector to the non-farm sector. This implies that women's transition into the non-farm sector is not driven by household economic needs. When family members' income increased, the male respondents also become less likely to be employed in both the farm sector and the non-farm sector (relative to not working) or to relocate from the farm sector to the non-farm sector. Men and women from wealthy families (household assets in the higher quintiles) are more likely than those from poor families to participate in non-farm labor activities.

We expect that improvement in household amenities and facilities can free up women's time and allow them to participate in labor market activities especially those off the family farm. Results in Table 4 show that the hours of electricity supply is associated with a higher odds of women's agricultural employment but a lower odds of transition from farm work to non-farm work. The availability of piped water through public supply tends to increase women's employment in the non-agricultural sector (relative to not working) as we expected, but similar effects are found among men as well. We suspect that the public water supply is related to the level of economic development in the villages which in turn determines the availability of non-farm employment opportunities. Therefore, the association is similar for women and men. The adoption of modern fuel by the household does not have significant relationships with women's and men's employment status. Regarding village-level characteristics, the population size of the village does not matter for women's employment sectors, but it is positively associated with men's agricultural work (vs. not working) and is negatively associated with their transition from farm to non-farm work. An increase in the local wage level leads to a higher odds of relocation to the non-farm sector from the farm sector among men but does not influence the employment sectors of women.

In terms of the transportation conditions, gaining *katcha* roads increases the likelihood that women join the non-farm sector (relative to not working) by about 57 percent (exp(0.451) = 1.57) and improves their odds of transition from farm to non-farm work by 40 percent (exp(0.337)=1.40). Access by *pucca* roads decreases the odds of male employment in the farm sector (relative to not working) by 44 percent (exp(−0.581)=0.56) and boosts men's odds of non-farm employment (relative to farm employment) by 35 percent(exp(0.302)=1.35). As we expected, access by roads can create more non-agricultural job opportunities within the village and provide connections to the external job markets, which in turn enhances non-farm employment among rural men and women. The negative impact of road access on men's agricultural employment may be attributable to the decreased demand for labor after the introduction of technology and capital in agricultural

production or the influx of laborers from outside of the village. We suspect that as men move to the non-farm sector, women may fill up the slack in the agricultural sector, but the results do not seem to support our conjecture.

Table 5 presents person fixed-effect multinomial logistic regressions showing the impact of bus services on women's and men's employment sectors, with the same set of control variables included as in Table 4. Slightly different from the impact of road access, the transition from no bus to two to six times a day improves the odds of women participating in farm labor activities (relative to not working) by 15 percent (exp(0.143)=1.15). Bus services of seven times per day or more are associated with a 23 percent (exp(0.207)=1.23) increase in women's non-farm employment (relative to not working) and a 20 percent (exp(0.179)=1.20) higher odds of male non-farm employment (relative to farm employment). These findings from the fixed-effect regression models in Tables 4 and 5 provide support to our Hypothesis 1 about the positive influence of village transportation infrastructure on the participation of men and women in non-farm work.

As a supplementary analysis, we also consider how the location of the village, in addition to the transportation conditions, matter for rural people's non-farm employment, because earlier research shows that rural non-farm wage employment in India is concentrated in small- and medium-size service firms located in the "corridors" of interurban transport and in broad swathes around cities (Bhalla 1997). We test the interactive effects between road conditions and the distance to the nearest town in regression models (results not shown in Tables). Results show that distance to towns neither has a significant impact on women's employment sectors nor alters the effects of road access on women's employment sectors. However, a greater distance to towns predicts a lower odds of non-farm employment among men, and strengthens the effect of road access on men's non-farm employment (relative to farm employment). The distance only matters for men possibly because men are more able than women to travel outside of the village to search for jobs, whereas women are more constrained to the farm and non-farm job opportunities within the villages. For villages that are close enough to the urban centers, the men may have already been able to get access to jobs even without a *pucca* or *katcha* road. Thus, gaining access by roads makes a bigger difference for men in villages that are more remote.

Indian men are much more likely than women to be employed in the non-farm sector. Our next goal is to examine whether the improvement in the transportation infrastructure can reduce the gender gap in non-agricultural employment in India. We compare the coefficients of road conditions for women and men in Tables 4 by pooling the sample of male and female respondents, and estimating fixed-effect multinomial logistic regression models including interaction terms between all the covariates and gender. According to these models, the positive effects of road access on women's non-farm employment (relative to not working) in column 2 are significantly larger than those for men in column 5. It means that gaining *katcha* or *pucca* roads is more likely to drive women than men from not working to non-farm employment. The influence of road conditions on the odds of relocation from the farm to the non-farm sector does not vary by gender. The comparison of the coefficients of bus frequency in the models for women and those in the models for men in Table 5 shows that the effects of bus frequencies on employment sectors are not statistically different across

the gender groups. Therefore, our Hypothesis 2 is only partially supported by the empirical results, as road access improves women's transition from not working to non-farm work more than that of men.

Finally, we investigate whether the influence of transportation on women's work sectors is conditioned by the community gender context. Models in Table 6 include interactions between road conditions and the village level practice of *purdah* measured at IHDS-1. (The level of purdah practice in Indian villages increased slightly between 2005 and 2012. We have tried to treat gender context as a time-varying variable and the results remain largely unchanged.) The negative and significant coefficients of the interaction terms in columns 2 and 3 imply that the effects of road access on women's non-agricultural employment are weaker in the villages where *purdah* was more widely practiced. In these communities, even when the women are provided easier access to non-farm jobs, they are unable to take advantage of the job opportunities due to restrictions on their physical mobility and norms that disallow interaction between women and unrelated men. In columns 4 and 5, the positive coefficients of the interaction terms indicate that in more traditional gender contexts getting access by roads has a larger positive impact on men's participation in farm and non-farm work (relative to not working).

Figure 3 presents the predicted values of the odds ratios of the participation of women and men in non-farm work (relative to farm work) in villages with different road conditions under two extreme conditions—where no one practices *purdah* in a village and where everyone practices *purdah* in a village. (Calculations are based on columns 3 and 6 in Table 6.) In communities with egalitarian gender norms (that is, where no one practices *purdah*), the odds of women's non-farm work participation (vs. farm work) increases by 78 percent when villages get connections by *katcha* roads, and it is more than doubled with connections by *pucca* roads, while in this context men's non-farm work participation is not significantly influenced by road access. Thus, improvement in road conditions is more likely to reduce the gender gap in non-agricultural employment in communities following more egalitarian gender norms. In communities with the traditional and unequal gender norms, the effects of roads are significant for men rather than for women.

In Table 7, we examine the interactive effects between bus services and village-level *purdah* in models for women and men. Negative and significant interaction effects are found for women. The transition from no bus service to having bus once a day leads to higher odds of non-farm employment (vs. not working and farm work) among women, but this positive effect becomes weaker in villages with a more traditional/unequal gender context. In contrast, columns 5 and 6 show that gaining bus service of 2–6 times a day has a stronger positive impact on men's non-farm work (relative to not working and farm work) in villages with more traditional gender norms than in villages with egalitarian gender norms. Taken together, these results support our Hypothesis 3 that improvement in village transportation infrastructure has a stronger positive impact on women's non-farm employment in communities with a more egalitarian gender context. Such interactions do not exist or are in the opposite directions for men.

Figure 4 shows the predicted odds ratios of non-farm employment (relative to farm employment) by the frequency of bus services among women and men in villages under two extreme gender contexts, one wherein no one practices *purdah* and the other wherein all women in a village practice *purdah*. Similar to the results for road access, increased bus frequency significantly boosts the non-farm employment of women but not that of men in villages following an egalitarian gender norm, but bus services benefit men more than women in villages following the traditional unequal gender norms.

5. Discussion and Conclusion

In this paper, we address the role of village transportation in shaping women's employment in the non-agricultural sector. Relying on a framework of factors pertaining to the demand side and the supply side of women's labor, we argue that transportation promotes women's non-agricultural work in several ways. The effect of transportation may operate through increasing women's access to non-farm job opportunities, freeing up women's time from family obligations, and changing gender attitudes among family members and local employers. We draw on longitudinal data and fixed-effect models to estimate the effect of transportation infrastructure on women's employment sectors. Moreover, we examine whether an improvement in village transportation reduces the gender gap in non-farm employment, and whether the transportation effects on women's non-farm work participation are conditioned by the community gender context.

The results show that gaining access by *pucca* and *katcha* roads and an increase in bus frequency in a village improve women's participation in non-agricultural work, which has important implications for women's lives in rural India. Women's agricultural work often takes place on the family farm, which does not generate independent income or increase their power in deciding how to spend family income. In contrast, employment in the non-farm sector is more likely than the work on family farms to generate independent income for the woman. This helps increase women's control over economic resources and consequently endows them with greater decision-making power. Prior research has shown that earned income, especially from working off the family farm, enhances women's relative bargaining power and autonomy (Anderson and Eswaran 2009). The direct payment from non-farm work can also raise child welfare, given that the extra income accruing to women is likely to be invested in children (Koolwal and Van de Walle 2013; Schultz 2001). Therefore, as one of the paths to economic growth, government investment in transportation has the potential to contribute to women's autonomy and empowerment by providing them access to non-farm jobs.

In addition, we find that improvement in road conditions tends to shrink the gender gap in non-agricultural employment, by boosting the non-farm work of women more than that of men. Earlier research reported that the impact of construction of rural roads on non-agricultural employment is pronounced for men but insignificant for women, because men have lower costs and higher gains in relocating from the farm to the non-farm sector (Asher and Novosad 2016). Unlike this previous study, we show a more encouraging finding that investment in rural transportation propels both women and men into the non-farm sector (the

impact of road construction is even stronger among women than among men), rather than exclusively benefiting men.

The large variation in gender practices across villages in India allows us to examine how the community gender context constrains the effect of transportation infrastructure on women's labor market activities. We find that improvements in transportation infrastructure have a weaker positive impact on women's non-agricultural employment in communities following more traditional gender practices. Given the strict practice of *purdah* that restricts their physical mobility, women are not able to take on non-farm jobs outside the household or beyond the local village even if easy transportation is provided. Hence, the barriers caused by traditional gender practices have to be removed for women to respond to the improved access to job opportunities. Where preference for women's seclusion is low, transportation improvements lead to a greater impact on women's non-farm work than on men's, resulting in a smaller gender gap. With two waves of data collected seven years apart, we are unable to trace long-term changes in gender norms. Although the gender norms did not change dramatically over the two waves of the IHDS, they may change toward a gender egalitarian direction over the long term, which will increase the impact of transportation networks on women. This is an area that deserves further investigation over a longer period.

Finally, our findings highlight the importance of access to work opportunities in enhancing women's labor market activities. There has been a heated scholarly discussion on why FLFP in India has been stagnant over the past several decades and has even declined recently. Traditionally, the time required by household drudgery and care-taking responsibilities draw women out from the labor market. Popular explanations for the recent decline in FLFP aver that rising family incomes and expanded post-secondary education have suppressed women's labor supply (Kapsos, Silbermann, and Bourmpoula 2014; Klasen and Pieters 2015). On the demand side, scholars have recognized the availability of limited agricultural job opportunities, given the decline in farm sizes and the rise in mechanization in farming, and the slow growth of white-collar jobs suitable for women (Klasen and Pieters 2015; Neff, Sen, and Kling 2012). We substantiate the demand-side explanation by showing that rural women in India would seize the growing non-farm job opportunities within the villages and take up non-agricultural jobs in neighboring towns when easier transportation is provided. In the Indian case, connecting women to a broader labor market outside of the local village might be a remedy for the incidence of low non-farm employment among women and the stagnant FLFP, especially since increased education levels among Indian women have prepared a qualified workforce for the non-agricultural sectors. In addition to generating industrial and service job positions suitable for women, it is also desirable to foster an institutional and social environment that allows more women, especially educated women, to take up non-farm jobs.

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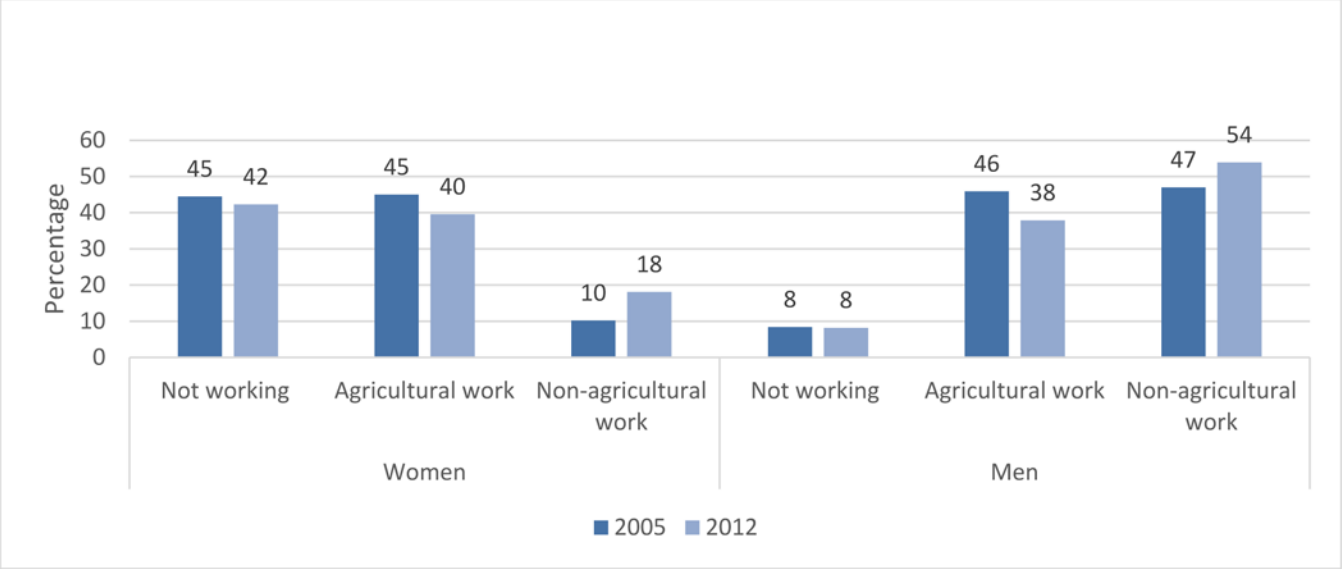

Figure 1: Trends for Agricultural and Non-agricultural Employment among Women and Men aged 25–59 Years between 2005 and 2012

Note: Respondents are defined as doing agricultural work if their total work hours was more than 240 in the past year and their work hours in non-agricultural sector did not reach 240 hours. Respondents are considered participating in non-agricultural work if they worked for more than 240 hours in the non-agricultural sector in the past year.

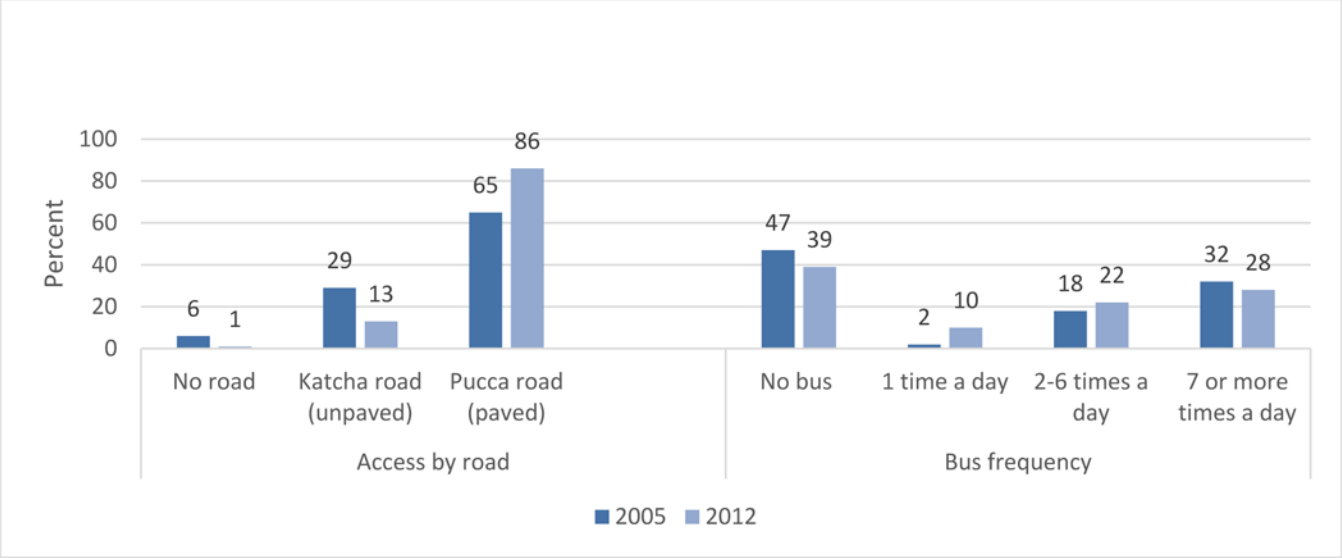

Figure 2:
Changes in Transportation Infrastructure in Indian Villages between 2005 and 2012

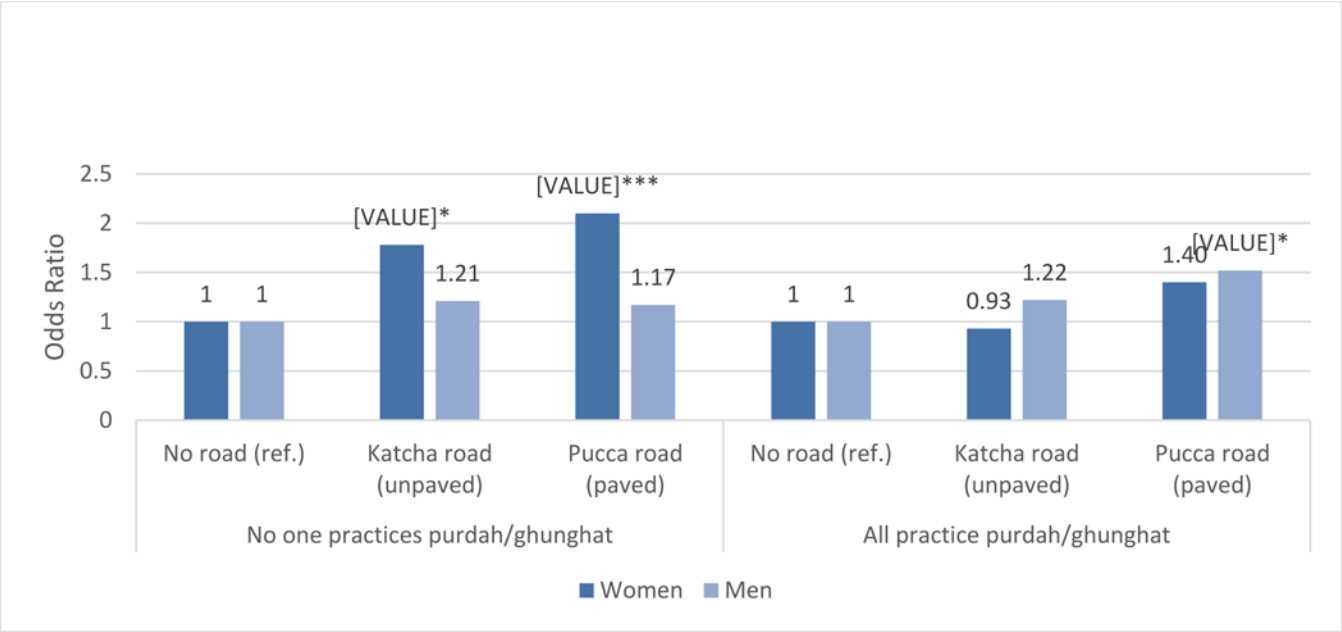

Figure 3:

The Effect of Road Access on the Odds of Rural Women's and Men's Non-agricultural Employment (Relative to Agricultural Employment), by Community Gender Context Note: *** p<0.001, ** p<0.01, * p<0.05

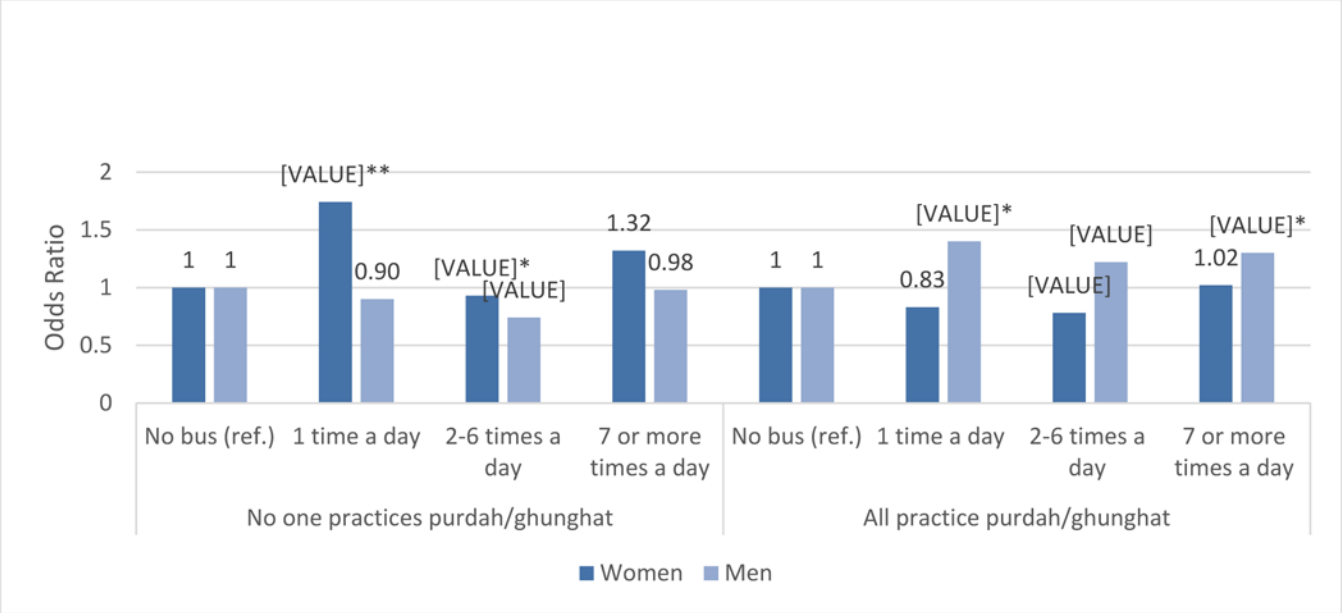

Figure 4:

The Effect of Bus Frequency on the Odds of Rural Women's and Men's Non-agricultural Employment (Relative to Agricultural Employment), by Community Gender Context Note: *** p<0.001, ** p<0.01, * p<0.05

Table 1.

Female Labor Force Participation Rate in Countries in South Asia

Country	2010	2017
India	28.6	27.2
Afghanistan	14.7	19.5
Bangladesh	30.0	33.0
Bhutan	64.6	58.0
Sri Lanka	34.8	35.0
Maldives	50.1	42.9
Nepal	79.6	82.7
Pakistan	21.7	24.9

Note: FLFP is defined as the percentage of female population ages 15+ that are in the labor force.

(Source: ILO)

Table 2.

The Type of Employment among Working Women and Men between Ages 25 to 59 in India

	Female		Male	
Type of employment (%)	**IHDS-I (2004–05)**	**IHDS-II (2011–12)**	**IHDS-I (2004–05)**	**IHDS-II (2011–12)**
Professional and managerial jobs	7.62	9.68	9.74	8.50
Clerical, sales, and service	11.70	12.98	18.46	17.89
Agricultural, forestry, and fishery	60.68	45.82	30.17	22.21
Craft workers	9.92	7.76	14.34	14.42
Construction workers, drivers, and mobile operators	10.08	23.54	27.29	36.42
Other (student, retired, disabled, and unknown occupation)	0	0.22	0	0.56
N	9,864	12,665	26,771	27,563

Table 3.

Descriptive Statistics of Individual, Household, and Village Characteristics of Indian Women and Men in 2005 and 2012

	IHDS-I (2004–05)		*IHDS-II (2011–12)*	
	Women	**Men**	**Women**	**Men**
	Percentage /Mean (SD)	**Percentage /Mean (SD)**	**Percentage /Mean (SD)**	**Percentage /Mean (SD)**
Marital status (%)				
Married	89.6	89.9	83.6	93.5
Unmarried	1.0	8.4	0.8	3.3
Widowed	4.9	1.2	9.5	2.1
Separated/Divorced	0.8	0.5	0.9	0.5
Married (spouse not present)	3.7	0.2	5.1	0.5
Number of children under age 6 in the household	1.0	1.1	0.6	0.7
	(1.2)	(1.2)	(0.9)	(1.0)
Number of married women in the household	1.5	1.5	1.4	1.4
	(.9)	(.9)	(.8)	(.8)
Other family members' income (%)				
Negative (ref.)	3.5	17.6	3.0	12.3
Quintile 1 (lowest)	23.8	35.8	20.7	36.8
Quintile 2	21.7	14.5	21.2	16.9
Quintile 3	18.3	11.5	20.1	12.6
Quintile 4	16.7	10.5	17.9	11.3
Quintile 5 (highest)	16.0	10.1	17.1	10.1
Household assets (%)				
Quintile 1 (poorest)	20.4	20.1	21.8	21.9
Quintile 2	23.4	23.0	21.4	21.5
Quintile 3	25.6	25.9	27.2	27.0
Quintile 4	19.4	19.8	17.2	17.1
Quintile 5 (richest)	11.2	11.2	12.4	12.4
Electricity (hours available)	9.8	9.9	11.5	11.5
	(8.5)	(8.5)	(8.0)	(7.9)
Piped water (%)	31.6	31.2	38.1	37.8
Modern fuel (%)	33.6	33.1	36.4	36.0
Village population (in thousand)	3.1	3.0	4.2	4.2
	(4.3)	(4.2)	(6.3)	(6.4)
Village wage level (per hour)	12.7	19.6	16.5	24.8
	(11.0)	(11.0)	(12.0)	(12.6)
Village-level practice of *purdah* (Average proportion)	0.6	0.6	0.6	0.6
	(0.4)	(0.4)	(0.4)	(0.4)
Number of individuals	17,771	16,827	17,771	16,827

Table 4.

Person Fixed-Effect Multinomial Logistic Regression Models Assessing the Impact of Road Conditions on Women's and Men's Employment Sectors

	Women			Men		
	Farm vs. not working	Non-farm vs. not working	Non-farm vs. Farm	Farm vs. not working	Non-farm vs. not working	Non-farm vs. Farm
	(1)	(2)	(3)	(4)	(5)	(6)
Survey 2012	−0.108**	0.767***	0.876***	−0.354***	−0.003	0.351***
	(0.038)	(0.052)	(0.052)	(0.065)	(0.063)	(0.041)
Marital status						
Married (ref.)						
Unmarried	0.659	0.111	−0.548	−0.749***	−1.482***	−0.734***
	(0.740)	(0.716)	(0.885)	(0.202)	(0.191)	(0.159)
Widowed	−0.199	−0.152	0.048	−0.776*	−0.827*	−0.051
	(0.151)	(0.192)	(0.191)	(0.375)	(0.353)	(0.237)
Separated/Divorced	−0.147	−0.502	−0.355	−0.747	−0.751	−0.003
	(0.438)	(0.469)	(0.424)	(0.545)	(0.548)	(0.430)
Married, spouse not present	−0.113	−0.237	−0.124	−0.073	−0.281	−0.208
	(0.139)	(0.204)	(0.213)	(0.535)	(0.562)	(0.415)
Number of children under age 6 in the household	−0.115***	−0.134***	−0.019	0.069	0.067	−0.002
	(0.023)	(0.035)	(0.035)	(0.039)	(0.039)	(0.023)
Number of married women in the household	−0.101*	−0.316***	−0.215***	−0.025	−0.286***	−0.261***
	(0.040)	(0.064)	(0.063)	(0.066)	(0.065)	(0.042)
Other family members' income						
Negative (ref.)						
Quintile 1	−0.128	−0.269	−0.141	−0.110	−0.316*	−0.206**
	(0.134)	(0.183)	(0.169)	(0.139)	(0.137)	(0.070)
Quintile 2	−0.346*	−0.416*	−0.071	−0.485**	−0.813***	−0.328***
	(0.135)	(0.186)	(0.173)	(0.151)	(0.148)	(0.082)
Quintile 3	−0.635***	−0.711***	−0.076	−0.861***	−1.326***	−0.466***

	Women			Men		
	Farm vs. not working	**Non-farm vs. not working**	**Non-farm vs. Farm**	**Farm vs. not working**	**Non-farm vs. not working**	**Non-farm vs. Farm**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	(0.136)	(0.189)	(0.177)	(0.157)	(0.153)	(0.091)
Quintile 4	−0.713***	−0.731***	−0.018	−1.214***	−1.532***	−0.318**
	(0.139)	(0.195)	(0.185)	(0.162)	(0.157)	(0.102)
Quintile 5	−0.653***	−0.795***	−0.141	−1.407***	−1.774***	−0.367**
	(0.147)	(0.218)	(0.211)	(0.177)	(0.171)	(0.119)
Household Assets						
Quintile 1 (ref.)						
Quintile 2	−0.075	0.028	0.103	0.097	0.041	−0.055
	(0.072)	(0.101)	(0.095)	(0.139)	(0.138)	(0.070)
Quintile 3	−0.166	−0.001	0.165	0.267	0.286	0.020
	(0.090)	(0.126)	(0.119)	(0.157)	(0.157)	(0.086)
Quintile 4	−0.311**	0.156	0.467**	0.154	0.466*	0.312**
	(0.112)	(0.159)	(0.154)	(0.192)	(0.192)	(0.111)
Quintile 5	−0.389**	0.279	0.668**	0.209	0.713**	0.504**
	(0.144)	(0.222)	(0.226)	(0.234)	(0.233)	(0.158)
Electricity (hours available)	0.019***	−0.000	−0.019***	0.011	0.013*	0.002
	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)	(0.003)
Piped water	0.024	0.199*	0.175	0.219*	0.330**	0.111
	(0.066)	(0.093)	(0.093)	(0.111)	(0.110)	(0.068)
Modern fuel	−0.103	0.009	0.112	−0.023	−0.020	0.003
	(0.054)	(0.075)	(0.074)	(0.091)	(0.089)	(0.055)
Village population (in thousand)	0.008	−0.005	−0.013	0.020**	0.007	−0.013*
	(0.007)	(0.008)	(0.009)	(0.007)	(0.007)	(0.006)
Village wage level	−0.000	0.001	0.001	−0.007	0.003	0.010**
	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.003)
Access by road						

	Women			Men		
	Farm vs. not working	**Non-farm vs. not working**	**Non-farm vs. Farm**	**Farm vs. not working**	**Non-farm vs. not working**	**Non-farm vs. Farm**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
No (ref.)						
Yes, *katcha* (unpaved or dirt)	0.115	0.451*	0.337*	−0.355	−0.177	0.178
	(0.127)	(0.183)	(0.164)	(0.209)	(0.212)	(0.115)
Yes, *pucca* (paved)	0.092	0.360	0.267	−0.581**	−0.279	0.302*
	(0.129)	(0.185)	(0.166)	(0.207)	(0.212)	(0.119)
Number of person-years	14,990	14,990	14,990	13,162	13,162	13,162
Log-likelihood	−4754	−4754	−4754	−4155	−4155	−4155
Chi-square	882.0	882.0	882.0	812.9	812.9	812.9
Degree of freedom	46	46	46	46	46	46

Standard errors in parentheses

*** p<0.001

** p<0.01

* p<0.05

Table 5.

Person Fixed-Effect Multinomial Logistic Regression Models Assessing the Impact of Bus Service on Women's and Men's Employment Sectors

	Women			Men		
	Farm vs. not working	**Non-farm vs. not working**	**Non-farm vs. Farm**	**Farm vs. not working**	**Non-farm vs. not working**	**Non-farm vs. Farm**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Bus frequency						
No bus (ref.)						
1 time a day	0.025	0.259	0.234	0.132	0.326	0.195
	(0.103)	(0.148)	(0.146)	(0.177)	(0.174)	(0.104)
2–6 times a day	0.143*	−0.011	−0.154	−0.103	−0.085	0.018
	(0.072)	(0.101)	(0.097)	(0.120)	(0.117)	(0.072)
7 or more times a day	0.072	0.207*	0.135	−0.156	0.023	0.179*
	(0.071)	(0.100)	(0.098)	(0.120)	(0.117)	(0.074)
Number of person-years	14,990	14,990	14,990	13,162	13,162	13,162
Log-likelihood	−4737	−4737	−4737	−4154	−4154	−4154
Chi-square	916.6	916.6	916.6	815.4	815.4	815.4
Degree of freedom	48	48	48	48	48	48

Note: The models in this table include all the control variables

Standard errors in parentheses

*** p<0.001

** p<0.01

* p<0.05

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Table 6.

Person Fixed-Effect Multinomial Logistic Regression Models Assessing the Impact of Road Conditions on Women's and Men's Employment Sectors, Examining the Conditioning Role of Community Gender Context

	Women			Men		
	Farm vs. not working	**Non-farm vs. not working**	**Non-farm vs. Farm**	**Farm vs. not working**	**Non-farm vs. not working**	**Non-farm vs. Farm**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Access by road						
No (ref.)						
Yes, *katcha* (unpaved or dirt)	0.284	0.857**	0.574*	−1.169**	−0.975*	0.194
	(0.237)	(0.315)	(0.254)	(0.426)	(0.429)	(0.181)
Yes, *pucca* (paved)	0.339	1.081***	0.742**	−0.989*	−0.833*	0.155
	(0.237)	(0.313)	(0.252)	(0.408)	(0.413)	(0.183)
Yes, *katcha* × purdah	−0.227	−0.873	−0.646	1.257*	1.262*	0.005
	(0.317)	(0.460)	(0.409)	(0.555)	(0.570)	(0.267)
Yes, *pucca* × purdah	−0.334	−1.418**	−1.084**	0.590	0.854	0.264
	(0.312)	(0.453)	(0.400)	(0.533)	(0.551)	(0.266)
Number of person-years	14,990	14,990	14,990	13,162	13,162	13,162
Log-likelihood	−4734	−4734	−4734	−4148	−4148	−4148
Chi-square	921.5	921.5	921.5	827.4	827.4	827.4
Degree of freedom	50	50	50	50	50	50

Note: The models in this table include all the control variables

Standard errors in parentheses

*** p<0.001

** p<0.01

* p<0.05

Table 7.

Person Fixed-Effect Multinomial Logistic Regression Models Assessing the Impact of Bus Service on Women's and Men's Employment Sectors, Examining the Conditioning Role of Community Gender Context

	Women			Men		
	Farm vs. not working	**Non-farm vs. not working**	**Non-farm vs. Farm**	**Farm vs. not working**	**Non-farm vs. not working**	**Non-farm vs. Farm**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Bus frequency						
No bus (ref.)						
1 time a day	0.478 *	1.034 ***	0.556 *	0.859 *	0.758 *	−0.101
	(0.207)	(0.246)	(0.238)	(0.346)	(0.336)	(0.199)
2–6 times a day	0.268	0.197	−0.071	−0.071	−0.369	−0.299 *
	(0.152)	(0.181)	(0.159)	(0.223)	(0.223)	(0.137)
7 or more times a day	0.130	0.406 *	0.277	0.060	0.046	−0.014
	(0.151)	(0.186)	(0.172)	(0.234)	(0.229)	(0.147)
1 time a day × purdah	−0.695 **	−1.449 ***	−0.753 *	−1.123 *	−0.689	0.434
	(0.268)	(0.357)	(0.349)	(0.459)	(0.451)	(0.268)
2–6 times a day × purdah	−0.159	−0.341	−0.181	−0.007	0.487	0.494 **
	(0.195)	(0.253)	(0.233)	(0.309)	(0.307)	(0.185)
7 or more times a day × purdah	−0.049	−0.307	−0.258	−0.307	−0.034	0.273
	(0.194)	(0.254)	(0.242)	(0.316)	(0.310)	(0.193)
Number of person-years	14,990	14,990	14,990	13,162	13,162	13,162
Log-likelihood	−4727	−4727	−4727	−4146	−4146	−4146
Chi-square	935.6	935.6	935.6	830.2	830.2	830.2
Degree of freedom	54	54	54	54	54	54

Note: The models in this table include all the control variables

Standard errors in parentheses

*** p<0.001

** p<0.01

* $p<0.05$