Gender Difference in Wages in Casual Labour Market in India: An Analysis of the Impact of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA)

Work in Progress

Deepak Varshney[1]
Delhi School of Economics
University of Delhi

1. Introduction

India's casual labour market provides more than 80 percent of the rural jobs, and the data on wages shows that females earn only 60 percent of what males earn as casual workers.[2] Deininger, Jin, and Nagarajan (2013) find that 50 to 68 percent of the gender wage gap in the casual labour market in India is attributed to the discrimination. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), introduced in February 2006, besides being a major poverty alleviation programme has some special provisions to improve the labour force participation and wages of females (MORD 2012). Since its implementation there has been a debate in the evaluation literature about MGNREGA's impact in rural India in general, and more specifically its impact on females. Some studies find a positive impact on female casual wages (Azam 2012), while others find no such impact (Zimmermann 2015; Mahajan 2014). This sets the motivation for this study. First we examine the evolution of gender wage gaps for the period 2004/5 through 2011/12. Next, using a different econometric technique, which we believe is more robust to some of the other techniques adopted so far, we study whether any change in gender wage gaps over the same period may be attributed to the MGNREGA. Below we discuss some reasons for why we should anticipate that MGNREGA may have influenced gender wage gaps.

[1] Ph.D. student at Delhi School of Economics, University of Delhi. Email: deepak@econdse.org.

[2] A casual worker is someone who is engaged in others' farm or non-farm enterprises and in return gets a wage according to a daily or an irregular work contract. We have used the 61st round of Employment and Unemployment Survey conducted in 2004/5 for these calculations.

MGNREGA, has several provisions that address gender differences in wages in the casual labour market (GOI 2005). It provides a legal guarantee of 100 days of employment in unskilled work to each household at scheduled minimum wages. Any member of the household, irrespective of gender, has the right to work under the scheme. Moreover it reserves one-third of total employment to females. Further, it provides work within a radius of five kilometers from the place of residence, and also provides child care facilities at the work site, making it especially attractive to females who may be may be averse to traveling long distances for work.

The mandate of providing employment at the scheduled minimum wages is not new for India. It goes back to the Scheduled Minimum Wage Act (1948). As pointed out by Basu, Chau, and Kanbur (2010), this act has been poorly enforced. Rani and Belser (2012) find about 53 per cent of casual workers in 2004/5 were receiving wages less than state level minimum wages. Menon and Meulen (2015) find no impact of India's minimum wage legislation on gender difference in wages.

With regards to minimum wages under MGNREGA, there are some features that make its enforcement better than that under the Scheduled Minimum Wage Act. The provision of social audits in MGNREGA serves as a powerful tool to spread awareness of the wage rate guarantee and other provisions, and also to ensure better implementation because of increased monitoring. Afridi and Iversen (2014) find a decline in employment generated irregularities in the scheme due to social audits. Further, the MGNREGA has a better Management Information System (MIS) that helps to monitor its implementation and identify inefficiencies and bottlenecks within the system.

According to the 64th round of the Employment and Unemployment Survey conducted in 2007/8, males earn Rs 65 per day (2004/5 prices), while females earn Rs 61 while working in MGNREGA. On the other hand in private casual labour market, males earn Rs 62, while females earn Rs 41 (also calculated from the same survey). This clearly shows that gender difference in wages is much lower while working in MGNREGA as compared to the private casual labour market, suggesting better implementation of MGNREGA's equal wage provision to all. Further, it is possible that female workers treat MGNREGA's wage as a benchmark, and in turn demand higher wages in the private casual labour market. Thus it is possible that the scheme resulted in greater gender parity of wages in the private casual labor market as well.

Another channel by which it could affect gender wage parity is through its effects on female labour supply. As stated above, the scheme through its special provisions targets to increase female labour force participation rate (LFPR). Rosenzweig (1978) shows that variations in female labour supply could affect male wages and the direction of effect is ambiguously predicted by theory. Given that other papers (Azam 2012; Afridi, Mukhopadhyaya, and Sahoo 2016) find an increase in female casual labour in public works as a result of MGNREGA, it is possible that an increase in female labour supply because of MGNREGA may have reduced gender difference in wages.

Yet another channel through which MGNREGA could affect gender wage gap is the increase in bargaining power of females as they now have a guaranteed outside option.[3]

We estimate two sets of impacts on gender wage gap. First is its impact on what are called Phase I and II districts over the period 2004/5 and 2007/8, second, its impact on Phase 3 districts, over the period 2007/8 and 2011/12. This second set of estimates are novel and have not been studied earlier. We present impact estimates for all India as well as for top performing states.

Casual labour market in India offers different employment opportunities in the agricultural peak and off-peak seasons. There is greater opportunity to find work during the agricultural peak season as compared to the off-peak season. Imbert and Papp (2015) show that MGNREGA's implementation is mainly in the dry season.[4] We follow the same definition of seasons as adopted in their paper and present our impact estimates disaggregated by seasons as well.

We use triple difference with matching (TDM) to estimate the effect of MGNREGA on gender wage gaps. The estimator exploits the phase wise roll out of the scheme. MGNREGA was first implemented in 200 districts of the country in February 2006 (Phase I); it was then extended to 130 districts in April 2007 (Phase II); and finally to the remaining districts from April 2008 onwards (Phase III), (MORD 2012). Thus, 2004/5 is the baseline pre-MGNREGA period; 2007/8 is characterized by partial implementation wherein Phase I and II districts had the scheme, while Phase III did not; and by 2011/12 MGNREGA had been implemented throughout

[3] Card, Cardoso, and Kline (2016) show that the bargaining power of females is significant in explaining the gender wage gap in Portugal. They show that shortfall in female's relative bargaining power explains about 3 percentage points of the gender wage gap.

[4] They define dry season from January to June which roughly corresponds to the agricultural off-peak season. The rainy season from July to December which roughly corresponds to the agricultural peak season.

the country. While the phase wise roll out of the scheme has been exploited by several papers to identify the MGNREGA effect, we precede this with matching across the two groups of districts (Phase I and II, and Phase III), which we believe improves the robustness of our results.

We find that there has been an almost 6 percentage point improvement in female wages vis-à-vis male wages, over the period 2004/5 and 2011/12, however we do not find evidence that this is due to MGNREGA.

The remainder of the paper is organized in the following way: section 3.2 presents a review of related literature; section 3.3 describes the data used, the target population and the analysis sample; section 3.4 discusses the empirical strategy wherein we formulate the estimation equations and describe the procedure to estimate the TDM impact estimates; section 3.5 presents descriptive statistics; section 3.6 discusses the results; section 3.7 has robustness tests; and section 3.8 concludes.

2. Review of Literature

There are several studies that have examined the impact of MGNREGA on a range of labour market outcomes; LFPR (Azam 2012; Khera and Nayak 2009), private employment (Imbert and Papp 2015), public works (Azam 2012; Imbert and Papp 2015), and casual wages (Azam 2012; Mahajan 2014; Berg et al. 2015; Imbert and Papp 2015; Zimmermann 2015). We limit this review to papers that discuss the gendered impact of MGNREGA.

2.1. Impact on wages

Azam (2012) examines the impact of MGNREGA on casual wages for both genders separately. His was one of the first papers to use the phase wise roll out of the MGNREGA to identify causal impacts using a Difference-in-Difference (DID) estimator. Like us, he also uses data from EUS for the years 2004/5 and 2007/8 and finds an 8 per cent increase in casual wages for females as compared to a 1 percent increase for males.

Mahajan (2014) examines the impact of MGNREGA on agricultural and non-agricultural wages. She uses the same data and the same methodology as adopted by Azam (2012), includes the interaction between state and time dummies to capture the state differential time trends. She finds no impact on agricultural and non-agricultural wages, for either gender.

Berg et al. (2015) examine the impact of MGNREGA only on agricultural wages. They use district level monthly data from the Agricultural Wages in India (AWI) reports for the period 2000/1 to 2010/11, and again employ DID to identify the impact. They find a positive impact of about 5.3 per cent increase in agricultural wages, but find that the scheme is gender neutral.

Imbert and Papp (2015) show a positive impact on casual wages in the dry season, but not in the rainy season. They find that the increase in casual wages is driven by male workers. The paper reports an insignificant impact on casual wages for females.

Zimmermann (2015) uses regression discontinuity approach on EUS data for 2007/8 and finds an insignificant impact of MGNREGA on casual wages for females.

The above studies show mixed results on the impact of MGNREGA on female wages. This provides the context for our study in which we examine the impact of MGNREGA on gender difference in wages using TDM, a different econometric methodology which we believe is more robust to some of the techniques used earlier.

2.2. Impact on other outcomes

Khera and Nayak (2009) examine the participation of female workers in MGNREGA and their perceptions about the scheme. Their study is based on a primary survey of about a 1000 females in six Hindi-speaking states of Northern India.[5] The paper finds that 32 percent of total MGNREGA workers are females. It finds that average female wages in the private casual labour market was Rs 47 and 58 per day for agricultural and other casual works, respectively. However, the average female wages was much higher at Rs 85 while working in MGNREGA, with no gender disparity in wages paid under the scheme. Apart from the stipulated wages, the paper also documents other drivers that makes MGNREGA attractive for females; the females report that MGNREGA as providing employment in the village itself that makes participation easier for them; they also reports that MGNREGA is attractive for them as it is administered by the local government, and not by a private employer.

MORD (2012) finds that in 2011/12, the share of female work in MGNREGA employment was about 47 percent which was 14 percentage points higher than the statutory requirement of 33 percent.

[5] Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Rajasthan and Uttar Pradesh.

Azam (2012) finds a positive impact on public works and LFPR especially driven by females.

Afridi, Mukhopadhyaya, and Sahoo (2016) use the Young Lives Survey data from Andhra Pradesh to examine the impact of MGNREGA on female LFPR, bargaining power, and child educational outcome. They use temporal variation in rainfall shocks along with MGNREGA implementation intensity as instruments to identify the impacts. They find that a mother's participation in the labour force results in almost two additional months of attendance in a school year. They also find an increase in bargaining power of working females as an explanation of their result.

3. Data, Target Population and Analysis Sample

As noted earlier, we use nationally representative individual level data from EUS, conducted by the NSSO, Government of India. We use the 55th, 61st, 64th and 68th rounds canvassed in 1999/2000, 2004/5, 2007/8 and 2011/12, respectively. The main analysis of the paper is based on 2004/5, 2007/8 and 2011/12 data. For the robustness tests, we use 1999/2000 and 2004/5 rounds. We use current daily status to define casual wages for male and females.[6]

We consider rural areas of 19 major states that together covered 98 percent of the India's rural population in 2004/05. We make a consistent panel of 484 districts for 2004/5, 2007/8 and 2011/12 rounds by dropping those districts which split into districts that had different MGNREGA phases.[7] The analysis is restricted to individuals between 18 to 60 years of age who were engaged in at least some casual work during the week preceding the survey. With these restrictions our analysis sample consists of 27,317 individuals in 2004/5; 36,825 in 2007/8; and 18,279 in 2011/12. Our choice of target population and analysis sample is comparable with Imbert and Papp 2015 and with Azam 2012.[8]

4. Empirical Strategy

To measure the evolution of gender difference in casual wages between 2004/5 through 2011/12, we estimate the following equation:

[6] The EUS collects information on labour market outcomes for three reference periods one of which is the current daily status wherein information on labour market status for each day of the preceding week of the survey is collected.

[7] To begin with, we had 499 districts in 61st and 64th rounds, and 524 districts in 68th round.

[8] Imbert and Papp (2015) consider the same 19 states, while Azam (2012) looks at 18 of these states, excluding Maharashtra.

$$Y_{idt} = \lambda_0 + \lambda_1 Female_{idt} + \lambda_2 Year11_{\ t} + \lambda_3 (Female_{\ idt} * Year11_t) + \boldsymbol{\theta X}_{idt} + \{\eta_d\} + \in_{idt}$$

(Eq. 1)

where *i* stands for individual, *d* for district, and *t* for year (either 2004/5 or 2011/12). Y is the logarithm of real daily casual wage (in Rs per day in 2004/5 prices).[9] $Female$ is a dummy variable for being female and $Year11_t$ is a dummy variable for 2011/12. $\boldsymbol{X}$ is a vector of individual level characteristics that include age, age squared, marital status, caste, religion, and education. $\{\eta_d\}$ represents district fixed effects. $\in$ is the error term and it captures residual factors that influence wages. λ_3 captures the differential change in female vis-à-vis male wages, for the period 2004/5 through 2011/12. Note that λ_3 is not a causal estimate, but is useful nonetheless as it describes the evolution of gender difference in wages in India over time.

Next, we describe the TDM procedure to estimate the effect of MGNREGA on gender wage gaps. To estimate the effect of MGNREGA on gender wage gaps on Phase I and II districts, we consider these districts as the treatment group and Phase III districts as the control group.

The idea behind the TDM estimator is as follows. If we *assume* that in the absence of MGNREGA, the evolution of gender wage gaps would be the same across the two groups of districts, namely, Phase I and II, and Phase III, then any observed difference in the presence of the MGNREGA may be attributed to the scheme itself. What makes one hesitate in making this assumption is that the two groups of districts are very different from each other by design (Zimmerman 2015): On average, Phase I and II rank higher in terms of share of Scheduled Castes and Scheduled Tribes, SC/ST population,[10] and they rank lower in terms of agricultural wage and agricultural productivity (Imbert and Papp 2015).

We do two things to address this concern. First, using 2004/5 data, we match each Phase I and II district with a weighted combination of Phase III districts such that the predicted probability of receiving the scheme by 2007/8 is similar in both. We then compare the outcomes in each Phase I and II district with the weighted average of outcomes across matched Phase III districts. This

[9] Nominal wages are expressed in 2004/5 prices using state level Consumer Price Index for Rural Labour constructed by the Labour Bureau of India.

[10] These are groups that have been identified as deserving of affirmative action on account of being historically disadvantaged.

ensures comparing like with like in terms of the likelihood of being treated, and makes it more likely that the assumption holds good. Implementing the matching procedure essentially involves modifying the individual level survey weights provided by the NSSO. This is explained in the Appendix 3.A. Second, we test the assumption by looking at data from pre-MGNREGA years (1999/2000 and 2004/5) and verifying that it holds during this period.[11]

4.1. Triple Difference Regression Specification to study impact on Gender Wage Gap

We estimate the following regression on individual level data belonging to districts in the common support.[12]

$$Y_{idkt} = \alpha_0 + \alpha_1 Female_{idkt} + \{\mu_d\} + \sum_l \beta_l \left(State_k^l * Year07_t\right)$$
$$+\alpha_2 (Ph12_{\ d} * Female_{idkt}) + \alpha_3 (Ph12_{\ d} * Year07_t) + \alpha_4 (Year07_{\ t} * Female_{idkt})$$
$$+ \alpha_5 (Ph12_{\ d} * Year07_t * Female_{idkt}) + \boldsymbol{\gamma X}_{idkt} + \boldsymbol{\delta Z}_{dkt} + \varepsilon_{idkt}$$

(Eq. 2)

where *i* stands for individual, *d* for district, k for state, and *t* for year (either 2004/5 or 2007/8). Y is the logarithm of real daily casual wage (in Rs per day in 2004/5 prices).[13] $Female$ is a dummy variable for being female, $\{\mu_d\}$ represents district fixed effects, and $Year07_t$ is a dummy variable for 2007/8 and $\{State_k^l\}$ is a set of dummy variables, one for each state.[14] The interaction terms $State_k^l * Year07_t$ allow state specific changes over time.[15] $Ph12$ is a dummy variable for Phase I and II districts. $\boldsymbol{X}$ is a vector of individual level characteristics that include age, age squared, marital status, caste, religion, and education. $\boldsymbol{Z}$ includes district level rainfall and its squared value.[16] ε is the error term and it captures residual factors that influence wages.

[11] We make a consistent panel of 392 districts for 55th round and 61st Round. To begin with, we had 432 districts in 55th round and 484 districts in 61st round. We drop those districts which have different MGNREGA phases after splitting from a parent district.

[12] Construction of the common support has been explained in the Appendix 3.A.

[13] Nominal wages are expressed in 2004/5 prices using state level Consumer Price Index for Rural Labour constructed by the Labour Bureau of India.

[14] There are no Phase III districts in the states of Bihar and Jharkhand. Rather than drop them, we combine these two states with the adjoining state of West Bengal.

[15] Mahajan (2014) argues that states in India have been on different growth paths and it is important to account for this by including state and year interactions.

[16] For the years 1999/2000, 2004/5 and 2007/8 rainfall data was sourced from International Crop Research Institute for Semi-Arid Tropics, ICRISAT. For 2011/12 it was sourced from the Indian Meteorological Department, Government of India.

Estimating the above equation with modified survey weights makes α_5 a TDM estimator. It captures the differential effect of the scheme on female vis-à-vis male wages in Phase I and II districts.

In order to estimate the effect of MGNREGA on gender wage gaps in Phase III districts, we estimate a specification similar to (Eq. 2) using data on 2007/8 and 2011/12. Recall that in 2007/8, the scheme was implemented in Phase I and II, but not in Phase III and by 2011/12 all districts had the scheme. Thus, in this specification we consider Phase III districts as treated, and Phase I and II as control. An important caveat in interpreting this specification is that the control districts may have seen varying intensity of implementation and are in that sense not pure controls.

5. Descriptive Statistics

Table 1 presents the LFPR, disaggregated by gender, for 2004/5 and 2011/12. The LFPR was 39 percent for females as compared to 90 percent for males in the year 2004/5. The corresponding figure in 2011/12 was 29 percent for females as compared to 88 percent for males. Over the period 2004/5 and 2011/12, the LFPR has declined significantly by about 10 and 2 percentage points for females and males, respectively. The reason for greater decline for females is highly debated in the literature.[17] Here we do not discuss the reasons for this decline. The above statistics show a small presence of females in the rural labour force in India. As far as the participation in casual labour market is concerned, a similar pattern is observed. The share of females is only 33 as compared to 67 percent for males in the year 2004/5. The corresponding share for females in 2011/12 is 25 as compared to 75 percent for males.

Table 2 presents the wages (in Rs per day in 2004/5 prices) paid in the private casual labour market, disaggregated by gender, for 2004/5 and 2011/12. The casual wages for females was Rs 35 as compared to Rs 56 for males in 2004/5. The corresponding figure for females in 2011/12 was Rs 56 as compared to Rs 84 for males. Thus, females earn about 63 and 67 percent of male earning in 2004/5 and 2011/12, respectively. Female earning as a percentage of male increased between 2004/5 and 2011/12 by 3 percentage points. We find similar results for other moments

[17] Rangrajan et al. (2011) find that female are withdrawing from the labour force to attend education and domestic duties.

of casual wages with the highest increase at the median: median wages of females as a percentage of male wages increased from 60 to 69 percent over this period.

Figure 1 plots casual wages for male and female wages across deciles, for 2004/5 and 2011/12. It also shows the scheduled minimum wage lines for the corresponding years. For females, the casual wages are lower than the minimum wage at all deciles in 2004/5, and up to the 8th decile in 2011/12. For males, the casual wages are lower than the minimum wage up to the 7th decile in 2004/5, and up to the 4th decile in 2011/12. Clearly there is poor implementation of minimum wage legislation for both genders, but it is worse for women, although the situation has improved for both genders over this period.

Table 3 presents the gender wage gaps across the 9 deciles, separately for 2004/5 and 2011/12. Two sets of quantile regressions have been estimated for each year. The first is without controls, while the second is with various individual level controls. The coefficient on male dummy is interpreted as gender wage gap (in percent). The results with controls shows that the gender wage gap has declined at each decile over time.

Table 4.1 presents the summary statistics of explanatory variables disaggregated by gender for 2004/5 and for 2011/12. For both years: the average age (in years) is higher for females as compared to their counterparts; the share of never married female is lower than their counterparts; the share of separated or divorced females is higher than their counterparts, this may be as these females possibly act as the head of the family; the share of other caste females is lower than their counterparts, also noted by Mahajan and Ramaswami (2015); the share of schedule caste female is insignificantly different than their counterparts; the share of schedule tribe female is higher than males; the share of Muslim females is lower than males, the share of illiterate females is higher than illiterate males, and for the remaining categories of education the share of males is higher than females. The share of currently married female in comparison to their counterparts is insignificantly different in 2004/5, and for 2011/12 it was significantly lower. The share of other backward class female in comparison to their counterparts is lower in 2004/5, and for 2011/12 it was higher. Table 4.2 presents the summary statistics for rainfall. As expected, the result shows that dry season rainfall is lower than the rainy season rainfall.

6. Results

6.1. Gender differences in casual wages, 2004/5 and 2011/12

Table 5 presents the evolution of the gender wage gap over the period 2004/5 and 2011/12. The results are based on equation 1. The first column presents the estimates without controls while the second column presents it with individual controls. We only interpret the results in column 2.[18] The coefficient on female dummy (λ_1) indicates that female wages were 40 percentage points lower vis-à-vis male in 2004/5. The coefficient on year11 dummy (λ_2) indicates that there is an increase of 41.8 percentage points in casual wages for males over the period 2004/5 through 2011/12. The coefficient on interaction of female and year11 dummy (λ_3) shows that female wage has increased by 5.9 percentage points' vis-à-vis male wages, over this period. The coefficient on individual controls shows the following: the casual wages increased with age in a concave manner; the coefficient on currently married persons shows higher increase in casual wages with reference to the never married persons; schedule tribes shows decline in casual wages with reference to the other caste category; the casual wages increase with the education level.

6.2. Impact on Phase I and II districts, 2004/5 and 2007/8

Table 6 presents the TDM impact estimates for gender difference in casual wages on Phase I and II districts, for all-India, disaggregated by seasons. First column presents the result for a whole year. The second and third columns present the result for dry and rain seasons, respectively.

With regards to the gender wage gap, the coefficient on α_5 shows an insignificant differential effect of the scheme on female vis-à-vis male wages in Phase I and II districts, for whole year, and for both seasons. This result is in contrast with the Azam (2012) who finds that the impact on casual wages is driven by females, for whole year. It is however consistent with Zimmerman (2015) who finds an insignificant impact on casual wages for both genders, and also with Berg et al. (2015) who find an insignificant impact on gender wage gap.

[18] The result in column 1 shows similar patterns as of column 2 with regards to the evolution of gender difference in wages over the study period.

For star states, the result on the impact on gender difference in wages is presented in the table 7.[19] The coefficient α_5 shows that there is an insignificant differential effect of the scheme on female vis-à-vis male wages in Phase I and II districts, for whole year, and for both seasons.

6.3. Impact on Phase III districts, 2007/8 and 2011/12

Table 8 presents the TDM impact estimates on Phase III districts. Once again the coefficient α_5 shows an insignificant impact of MGNREGA on gender wage gap in Phase III districts, for whole year, and for both seasons. As noted in the empirical strategy, it is problematic to interpret the impact on Phase III districts if there was a change in the intensity of implementation in Phase I and II districts over the time, and in that case our impact estimates may not give us the actual magnitude of the impact of MGNREGA. To see the extent of this concern, we compare the share of public works in Phase I and II districts, over the period 2007/8 through 2011/12. We find an insignificant increase in the intensity of implementation.[20] Thus, the varying intensity of Phase I and II districts does not seem to be a concern for our analysis.

Table 9 presents the TDM impact estimates on Phase III districts for gender difference in wages, for star states. The coefficient α_5 shows an insignificant impact on Phase III districts, for whole year, and for both seasons. This shows an insignificant impact on Phase III districts in a better performing state.

7. Robustness Test

Appendix Table B.1 presents the pre-MGNREGA trends in gender difference in casual wages for the period 1999/2000 and 2004/5, for whole year and separately for dry and rainy seasons. We use the same specification (Eq.2) to estimate the TDM impact estimates of MGNREGA. We designate the Phase I and II and Phase III districts in a same way as we done for the main

[19] The star states includes: Himachal Pradesh, Uttarakhand, Rajasthan, Chhattisgarh, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. As noted earlier, we have chosen star states as identified by Imbert and Papp (2015) to maintain the comparability with the literature.

[20] We compute fraction of a unit time for public works using our analysis sample. For Phase I and II, we found 0.003 fraction of unit time (equivalent to 0.3 percent) spent in public works for both 2007/8 and 2011/12. For Phase III, we found 0.000 fraction of unit time (equivalent to 0.0 percent) spent in public works in 2007/8 and 0.004 (equivalent to 0.4 percent) in 2011/12.

analysis. The coefficient α_5 shows the impact of MGNREGA on Phase I and II districts for gender difference in wages in the pre-MGNREGA period. For all-India, the result shows an insignificant impact of MGNREGA on the gender difference in wages, for whole year, and for both seasons. It clearly shows that there is no differential trend in Phase I and II and Phase III districts. Therefore, it makes a stronger case that our impact estimates for all India met the common time trend assumption.

Appendix Table B.2 presents the pre-MGNREGA trends in gender difference in wages for star performing states for 1999/2000 and 2004/5, for whole year and separately for dry and rainy seasons. For whole year, the result shows an insignificant impact of MGNREGA on gender difference in wages in pre-MGNREGA period. For dry and rainy season as well, we do not find evidence on differential trend in Phase I and II and Phase III districts in case of gender difference in wages in the pre-MGNREGA period. Here also we met a common time trend assumption to identify the true impact of the scheme.

As noted by Imbert and Papp (2015) DID framework failed to meet the common time trend assumption despite the fact that a wide range of individual and district controls were used. Thus, using matching procedure before applying DID is more robust to identify the causal impact.

8. Conclusion

We study the gender difference in wages in casual labour market in rural India for the period 2004/5 to 2011/12. This period saw the implementation of MGNREGA which has a special focus towards improving the status of women in the labour market. We first describe the evolution of gender difference in wages over the period 2004/5 and 2011/12. We then analyze the impact of MGNREGA on gender wage gap by estimating two sets of impact estimates: first, the impact on Phase I and II districts over the period 2004/5 and 2007/8; second, the impact on Phase III districts over the period 2007/8 and 2011/12. We use TDM to estimate impacts.

We find that there has been an improvement in female wages vis-à-vis male wages, over this period. Controlling for individual characteristics, there has been a 6 percentage point reduction in the gender wage gap at the mean. With regard to the impact of MGNREGA on gender wage gaps, we find an insignificant impact on both the Phase I and II districts as well as the Phase III districts, both at the all India level and in the better performing states.

We conclude that the improvement in female wages vis-à-vis male wages, over this period is not due to MGNREGA. One explanation for the improvement in female wages could be the decline in female labour supply over the same period. Mahajan and Ramaswami (2015) find evidence to support this hypothesis. They formally test and confirm the Boserup (1970) hypothesis for India which says that the high gender wage gap is associated with high female labour supply. Another explanation for the decline in gender wage gap could be higher economic growth. Cuberes and Teignier-Baqué (2012) argued that the difference in female and male wages is primarily due to human capital differentials, which may improve over time with economic growth. Deininger, Jin, and Nagarajan (2013) reject this hypothesis for the casual labour market in India and find no link between gender wage gap and economic growth. This seems plausible as the casual labour market offers unskilled jobs, and here human capital differentials should not matter much.

Reference

Afridi, F., A. Mukhopadhaya., and S. Sahoo. 2016. "Female Labor Force Participation and Child Education in India: Evidence from the National Rural Employment Guarantee Scheme." *IZA Journal of Labour & Development* (2016) 5:7.

Afridi, F., and V. Iversen. 2014. "Social audits and MGNREGA delivery: Lessons from Andhra Pradesh." *India Policy Forum* 10(1): 297-341.

Azam, M. 2012. *The Impact of Indian Job Guarantee Scheme on Labor Market Outcomes: Evidence from a Natural Experiment*. IZA Discussion Paper 6548. Bonn, Germany: Institute for the Study of Labor.

Basu, Arnab K., Nancy H. Chau, and Ravi Kanbur. 2010 "Turning a Blind Eye: Costly Enforcement, Credible Commitment and Minimum Wage Laws." *The Economic Journal* 120, no. 543 (2010): 244-269.

Berg, E., S. Bhattacharyya, R. Durgam, and M. Ramachandra. 2015. *Can Public Works Increase Equilibrium Wages? Evidence from India's National Rural Employment Guarantee.* Working Paper 2015. Bristol, UK: University of Bristol.

Boserup, Ester. 1970. Women's role in economic development. New York: St. Martin.

Card, D., A.R.Cardoso., and P.Kline. 2016. "Bargaining, Sorting, and the Gender Wage Gap: Quantifying the Impact of Firms on the Relative Pay of Women." *The Quarterly Journal of Economics* (2016) 131 (2): 633-686.

Cuberes, D., & Teignier-Baqué, M. 2012. *Gender inequality and economic growth.* Background Paper. Washington D.C, USA: World Bank

Deininger, K., S. Jin, and H. Nagarajan. 2013. "Wage Discrimination in India's Informal Labor Markets: Exploring the Impact of Caste and Gender." *Review of Development Economics* 17 (1): 130-47.

GOI (Government of India) 2005. *The National Rural Employment Guarantee Act: The Gazette of India, Extraordinary.* New Delhi: Government of India.

Gupta, S. 2006. "Were District Choices for NFFWP Appropriate?" *Journal of Indian School of Political Economy* 18(4): 641-648.

Heckman, J., H.Ichimura, and P.E.Todd.1997. "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme." *The Review of Economic Studies* 64(4): 604-654

Imbert, C., and J.Papp.2015. "Labor Market Effects of Social Programs: Evidence from India's Employment Guarantee." *American Economic Journal: Applied Economics* 2015, 7(2): 233–263.

Khera, R., and N. Nayak. 2009. "Women Workers and perceptions of the National rural employment Guarantee act." *Economic and Political Weekly* 44(43): 49-57.

Mahajan, K. 2014. "Farm wages and public works: How robust are the impacts of national rural employment guarantee scheme?" *Indian Growth and Development Review* Vol. 8 No. 1, 2015 pp. 19-72

Mahajan, K. and Ramaswami, B. 2015. *Caste, Female Labor Supply and the Gender Wage Gap in India: Boserup Revisited.* Working Paper. New Delhi: Indian Statistical Institute.

MORD (Ministry of Rural Development). 2012. *MGNREGA Sameeksha: An Anthology of Research Studies on the Mahatma Gandhi National Rural Employment Guarantee Act, 2005, 2006–2012*. Government of India. New Delhi.

Menon, N and Y. Meulen. 2015. "The Impact of Minimum Wage on Male and Female Employment and Earnings in India" USA: mimeo, Rutgers University.

NSSO (National Sample of Survey Organization) 2006. *Employment and Unemployment Situation in India, 2004-05 (Part-I).* Technical Report. Ministry of Statistics and Programme Implementation, Government of India. New Delhi.

Rangarajan, C., P.I. Kaul, and Seema. 2011. "Where is the missing labor force?" *Economic and Political Weekly* 46 (39): 68-72.

Rani, Uma, and Patrick Belser. 2012 "The effectiveness of minimum wages in developing countries: The case of India." *International Journal of Labour Research* 4, no. 1 (2012): 45-66.

Rosenzweig, Mark R. 1978. "Rural wages, labor supply, and land reform: A theoretical and empirical analysis." *The American Economic Review* (1978): 847-861.

Zimmermann, L. 2015. *Why Guarantee Employment? Evidence from a Large Indian Public-Works Program.* Working Paper. Georgia, USA: University of Georgia

Appendix A

This appendix describes how individual level weights provided by the NSSO have been modified to implement the matching procedure. Here we describe how this is done to study the effect on Phase I and II districts using data from 2004/05 and 2007/08.[21] The procedure involves two steps which are explained below.

Step 1: Derivation of District Level Weights using Kernel Matching

Using 2004/5 data, we first run a district level logistic regression to estimate the probability of receiving the scheme (propensity score) in the early phases, i.e. by 2007/08. The dependent variable is whether a district is observed to be Phase I or Phase II (the variable takes value 1 if it is so, and 0 if it is Phase III).[22] The explanatory variables are all at the district level and consist of share of SC/ST households, average casual wage (2004/5 prices), literacy rate, average cultivable land holding size, average monthly per capita consumption expenditure (2004/5 prices) and state dummies. The propensity scores of the treatment group (Phase I and II) lie within the interval [0.050; 0.999], whereas they lie within [0.001; 0.966] for the control group (Phase III). Therefore, the common support *S*, is given by all districts whose propensity score lie within [0.050; 0.966].[23] For the rest of the analysis only districts in the common support are considered.

Suppose there are *J* Phase I and II treatment districts, *t1, t2, …, tJ*, and *K* Phase III control districts, *c1, c2, …,* and *cK*. For each treatment district tj, we use kernel matching to derive the set of matching weights $\{M(tj, ck)\ k = 1, \dots, K\}$ over the *K* control districts. Each $M(tj, ck)$ depends on the distance between P_{tj} and P_{ck}, where P is the propensity score and is defined as follows:

$$M(tj, ck) = \frac{G(\frac{P_{ck} - P_{tj}}{h})}{\sum_{k=1}^{K} G(\frac{P_{ck} - P_{tj}}{h})}$$

(Eq. 2)

[21] Modified weights to study the effect on Phase III districts are created in a similar manner.
[22] To study the effect on Phase III districts using data from 2007/08 and 2011/12, a separate logistic regression is estimated to get propensity scores for being a Phase III district.
[23] Out of 484 districts considered (277 Phase I and II, and 207 Phase III), 391 districts (81 percent) form the common support, of which 196 are Phase I and II, and 195 are Phase III.

where $G(u) = \frac{3}{4}(1 - u^2)$ is the Epanechnikov kernel function, and h is the bandwidth parameter.[24]

Step 2: Combing Individual level weights from NSSO with District Level Matching Weights

First, the individual level weights provided by the NSSO for 2007/08 are adjusted such that the sum of all individual level weights within each district is equal to the corresponding value in 2004/05. Denote the adjusted weight of individual i in district d as, $w_{i,d}$, where $d \in \{t1, t2, \dots, tJ; c1, c2, \dots, cK\}$.

For an individual *i* living in treatment district *tj*, the modified weight is given by:

$$\frac{w_{i,tj}}{\sum_{d=t1}^{tJ} \sum_{i \in d} w_{i,d}}$$

For an individual *i* living in control district *ck*, the modified weight is given by:

$$\frac{w_{i,ck}}{\sum_{i \in ck} w_{i,ck}} * \left(\sum_{u=t1}^{tJ} \frac{\sum_{i \in u} w_{i,u}}{\sum_{d=t1}^{tJ} \sum_{i \in d} w_{i,d}} * M(u, ck) \right)$$

[24] We set bandwidth to 0.06 following Leuven and Sianesi (2003).

Table 1: Labour force participation rate (LFPR), and share of males and females in the private casual labour, for rural India

	2004/5	2011/12	Difference (2004/5-2011/12)
LFPR			
Males (%)	90.5	88.2	2.3***
Observations	87,671	64,582	
Females (%)	39.0	28.8	10.2***
Observations	88,809	65,453	
All (%)	64.6	58.4	6.2***
Observations	176,480	130,035	
Private casual labour			
Share of males in private casual labour (%)	67	75	-8***
Observations	18,622	13865	
Share of female in private casual labour (%)	33	25	8***
Observations	8,695	4414	
All observations[#]	27,317	18,279	

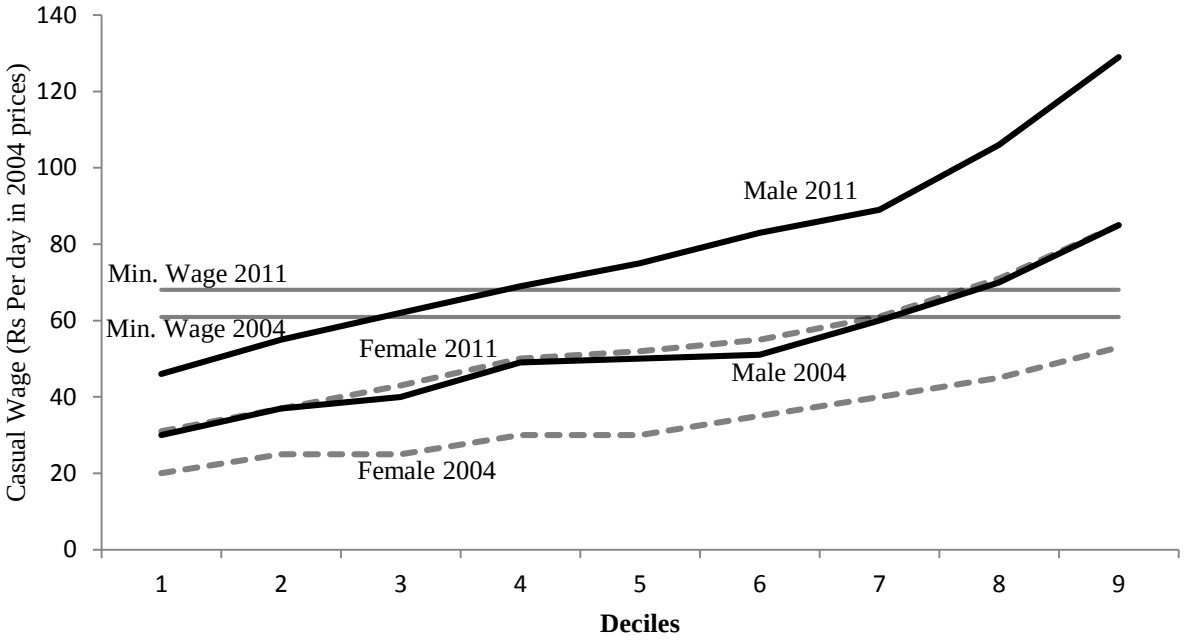
Source: Employment and Unemployment Survey (EUS) 2004/5(61st round) and 2011/12 (68th round), National Sample Survey Organization (NSSO), Government of India.
Notes: We consider current daily status (CDS) for the labour market calculations. The estimation of LFPR is done using the data on individuals between 18-60 in rural areas of 19 major states of India. Labour force constitutes of individuals who are 'working' (employed) or 'seeking or available for work' (unemployed). Working are those working as self-employed, regular wage earner, casual labour in private works, casual labour in public works. The share of males and females in the private casual labour has been done on the basis our analysis sample (individuals between 18-60 engaged in some private casual work in rural parts of 19 major states of India). EUS weights have been used in the estimation. * significant at 10%; ** significant at 5% ; *** significant at 1%. '#' This constitutes the analysis sample.

Table 2 : Casual wage rates (in Rs per day in 2004/5 prices) in private casual labour, rural India

	Male	Female	Difference (Male-Female)
2004/5			
Mean	56	35	21***
Median	50	30	20***
2nd Decile	37	25	12***
8th Decile	70	45	25***
Observations	18284	8566	26,850
No. of districts	484	484	
2011/12			
Mean	84	56	28***
Median	75	52	23***
2nd Decile	55	37	18***
8th Decile	106	71	35***
Observations	13771	4398	18,169
No. of districts	484	484	

Source: EUS 2004/5(61st round) and 2011/12 (68th round), NSSO, Government of India.
Notes: Casual wage rates have been estimated using the analysis sample. The casual wages for 2011/12 have been deflated to 2004/5 prices by consumer price index for rural labour. The numbers of observations are less than the analysis sample because some casual workers have not reported the wage data. EUS weights have been used in the estimation. * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 3.1 : Private Casual Wage Rates in Rural India



Source: EUS 2004/5(61st round) and 2011/12 (68th round), NSSO, Government of India. Minimum wages for 2004 and 2011 have been taken from the Labour Bureau of India, Ministry of Labour and Employment, Government of India.

Notes: Male and female wages have been calculated for each decile using the analysis sample. In the graph, we label 2004/5 as 2004 and 2011/12 as 2011, just for brevity. We aggregate minimum wages for unskilled workers at the all India level by collating the state-wise data on minimum wages.

Table 3: Gender (Log) Wage Gap across deciles, for rural India, 2004/5 and 2011/12

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	At Mean
2004/5										
Without controls										
Coefficient on male dummy (n=26850, N=484)	0.41*** (0.00)	0.40*** (0.00)	0.47*** (0.00)	0.49*** (0.00)	0.51*** (0.00)	0.38*** (0.00)	0.41*** (0.00)	0.44*** (0.00)	0.47*** (0.00)	0.45*** (0.01)
With controls										
Coefficient on male dummy (n=26834, N=484)	0.41*** (0.00)	0.42*** (0.00)	0.40*** (0.00)	0.48*** (0.00)	0.51*** (0.00)	0.42*** (0.00)	0.39*** (0.00)	0.34*** (0.00)	0.34*** (0.00)	0.40*** (0.01)
2011/12										
Without controls										
Coefficient on male dummy (n=18169, N=484)	0.39*** (0.00)	0.40*** (0.00)	0.37*** (0.00)	0.33*** (0.00)	0.37*** (0.00)	0.41*** (0.00)	0.37*** (0.00)	0.40*** (0.00)	0.42*** (0.00)	0.39*** (0.01)
With controls										
Coefficient on male dummy (n=18167, N=484)	0.40*** (0.00)	0.39*** (0.00)	0.35*** (0.00)	0.31*** (0.00)	0.35*** (0.00)	0.37*** (0.00)	0.36*** (0.00)	0.34*** (0.00)	0.33*** (0.00)	0.36*** (0.01)

Notes: The quantile regression have been used to estimate the gender wage gap across each decile. The left hand side variable is logarithm of casual wage. The right hand side is the male dummy. The individual controls used in the regression are: Age, Age square, Marital status: Never married, Currently married, Other (Separated/Divorced), Caste: Other, Schedule caste, Schedule tribe, Other backward classes, Muslim, Education: Illiterate, Primary and below, Middle, Secondary and above. EUS weights have been used in the estimation. 'n' is the number of observations. 'N' is the number of districts. Robust standard errors in the parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.1: Descriptive statistics for explanatory variables by gender, rural India, 2004/5 and 2011/12

	2004/5			20011/12		
Explanatory variables (Individual)	Male	Female	Difference (Male-Female)	Male	Female	Difference (Male-Female)
Age (in years)	34	36	-2***	36	38	-2***
Marital status :						
Never married	0.186	0.061	0.125***	0.179	0.050	0.129***
Currently married	0.784	0.790	-0.007	0.798	0.775	0.023***
Other (Separated/Divorced)	0.030	0.149	-0.118***	0.023	0.175	-0.153***
Caste :						
Other caste	0.167	0.118	0.049***	0.147	0.113	0.033***
Schedule caste	0.333	0.332	0.002	0.320	0.323	-0.002
Schedule tribe	0.128	0.164	-0.036***	0.114	0.163	-0.049***
Other backward classes	0.371	0.386	-0.015**	0.419	0.401	0.018**
Muslim	0.103	0.042	0.061***	0.114	0.058	0.056***
Education :						
Illiterate	0.457	0.771	-0.314***	0.358	0.636	-0.277***
Primary and below	0.318	0.161	0.157***	0.335	0.228	0.107***
Middle	0.155	0.050	0.105***	0.175	0.082	0.093***
Secondary and above	0.069	0.018	0.051***	0.131	0.054	0.077***
No. of observations	18622	8695		13865	4414	
No. of districts	484	484		484	484	

Source: EUS 2004/5(61st round) and 2011/12 (68th round), NSSO, Government of India.
Notes: EUS weights have been used in the estimation. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4.2: Descriptive statistics (mean) for district level rainfall, disaggregated by season

	Rainfall (Annual in mm)	Rainfall (Dry season in mm)	Rainfall (Rainy season in mm)
2004/5	1055	361	704
2011/12	997	196	803
Difference (2004/5-2011/12)	58	165***	-99***
Number of districts	484	484	484

Source: For 2004/05 rainfall data was sourced from International Crop Research Institute for Semi-Arid Tropics, ICRISAT. For 2011/12 it was sourced from the Indian Meteorological Department, Government of India. Dry season corresponds to January to June. Rainy season corresponds to July to December. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Evolution of gender differences in casual wages between 2004/5 and 2011/12

	Dependent variable : Logarithm of casual wage (in Rs per day in 2004/5 prices)	
	Model 1	Model 2
Female , λ_1	-0.400*** (0.006)	-0.392*** (0.006)
Year11, λ_2	0.408*** (0.006)	0.403*** (0.006)
Year11 * Female , λ_3	0.058*** (0.011)	0.059*** (0.011)
Age (in years) , θ_1		0.012*** (0.002)
Age squared (in years), θ_2		-0.000*** (0.000)
Marital status : Never married is omitted		
Currently married (dummy) , θ_3		0.040*** (0.010)
Other (separated / divorce/widow) (dummy) , θ_4		0.010 (0.010)
Caste: Other caste is omitted		
Schedule caste (dummy), θ_5		-0.009 (0.009)
Schedule tribe (dummy) , θ_6		-0.022* (0.012)
Other backward class (dummy) , θ_7		0.004 (0.008)
Muslim (dummy), θ_8		0.011 (0.010)
Education : Illiterate is omitted (		
Primary and below (dummy), θ_9		0.024*** (0.006)
Middle (dummy), θ_{10}		0.046*** (0.009)
Secondary and above (dummy) , θ_{11}		0.040*** (0.011)
District fixed effect	Yes	Yes
No. of observations	45019	45001
No. of districts	484	484
	Average casual wage in Rs per day in 2004/5 prices	
For males, 2004/5	56 (n=18284)	56 (n=18284)
For females, 2004/5	35 (n=8566)	35 (n=8566)

Notes: Each column represents the result from separate regressions. The estimation has been done using equation 2 as described in the text. The coefficient λ_3 captures the change in female vis-à-vis male wages over the period 2004/5 through 2011/12. 'n' is the number of individual observations. EUS weights have been used in the estimation. Robust standard errors in the parenthesis. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Triple difference matching impact estimates for gender wage gap on Phase I and II districts, by season, all India, over the period 2004/5 and 2007/8

	Dependent variable : Logarithm of casual wage (in Rs per day in 2004/5 prices)		
	Whole year	Dry season	Rainy season
Female , α_1	-0.351*** (0.049)	-0.369*** (0.056)	-0.340*** (0.046)
Ph12*Female , α_2	-0.046 (0.050)	-0.020 (0.056)	-0.063 (0.049)
Ph12*Year07, α_3	-0.018 (0.023)	0.001 (0.023)	-0.037 (0.032)
Year07*Female, α_4	0.024 (0.058)	0.065 (0.060)	-0.001 (0.068)
Phase12*Year07*Female, α_5	0.020 (0.064)	-0.041 (0.068)	0.062 (0.074)
Controls, $\boldsymbol{\gamma, \delta}$	Yes	Yes	Yes
State dummy*Year07 , β_l	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
No. of observations	49316	24473	24843
No. of districts	391	391	390
	Average casual wage in Rs per day in 2004/5 prices		
For males, 2004/5	57 (n=14193)	57 (n=7162)	56 (n=7031)
For females, 2004/5	35 (n=7410)	36 (n=3448)	34 (n=3962)

Notes: Each column presents result from a separate regression. The individual controls used in the regression are : Age (in years), Age square (in years), Marital status: Never married, Currently married, Other (Separated/Divorced) , Caste: Other , Schedule caste , Schedule tribe , Other backward classes , Muslim , Education : Illiterate , Primary and below , Middle , Secondary and above . The districts level controls are rainfall (in mm) and square of the rainfall (in mm). The estimation has been done on the basis of equation 2 as described in the text. The coefficient α_5 measures TDM impact estimates for gender wage gap on Phase I and II districts. Dry season refers to January to June. Rainy season refers to July to December. All the regressions have been performed using modified individual level weights derived from district level matching weights, in the common support region. Our common support region comprises of 391 districts: 196-treatment (Phase I and II) and 195-control (Phase III). 'n' indicates the number of individual observations. The reason for 390 districts in rainy season is missing wage data for a district in the rainy season. Standard errors clustered at the district-year level in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Triple difference matching impact estimates for gender wage gap on Phase I and II districts, by season, star states, over the period 2004/5 and 2007/8

	Dependent variable : Logarithm of casual wage (in Rs per day in 2004/5 prices)		
	Whole year	Dry season	Rainy season
Female , α_1	-0.306*** (0.073)	-0.298*** (0.071)	-0.316*** (0.077)
Ph12*Female , α_2	-0.108 (0.077)	-0.107 (0.075)	-0.101 (0.082)
Ph12*Year07, α_3	-0.023 (0.037)	-0.027 (0.037)	-0.010 (0.051)
Year07*Female, α_4	0.021 (0.087)	0.037 (0.078)	0.008 (0.099)
Phase12*Year07*Female, α_5	-0.011 (0.098)	-0.032 (0.094)	-0.004 (0.109)
Controls, $\boldsymbol{\gamma, \delta}$	Yes	Yes	Yes
State dummy*Year07 , β_l	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
No. of Observations	19321	9616	9705
No. of districts	144	144	143
	Average casual wage in Rs per day in 2004/5 prices		
For males, 2004/5	55 (n=5370)	56 (n=2757)	55 (n=2613)
For females, 2004/5	34 (n=3194)	35 (n=1511)	33 (n=1683)

Notes: Each column presents results from a separate regression. The individual controls used in the regression are : Age (in years), Age square (in years), Marital status: Never married , Currently married , Other (Separated/Divorced), Caste: Other , Schedule caste , Schedule tribe , Other backward classes , Muslim , Education : Illiterate , Primary and below , Middle , Secondary and above . The districts level controls are rainfall (in mm) and square of the rainfall (in mm). The estimation has been done on the basis of equation 2 as described in the text. The coefficient α_5 measures TDM impact estimates for gender wage gap on Phase I and II districts. Dry season refers to January to June. Rainy season refers to July to December. The star states includes: Himachal Pradesh, Uttarakhand, Rajasthan, Chhattisgarh, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. All the regressions have been performed using modified individual level weights derived from district level matching weights, in the common support region. For star states, our common support region comprises of 144 districts out of 162 districts: 76-treatment (Phase I and II) and 68-control (Phase III). 'n' indicates the number of individual observations. The reason for 143 districts in rainy season is missing wage data for a district in the rainy season. Standard errors clustered at the district-year level in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Triple difference matching impact estimates for gender wage gap on Phase III districts, by season, all India, over the period 2007/8 and 2011/12

	Dependent variable : Logarithm of casual wage (in Rs per day in 2004/5 prices)		
	Whole year	Dry season	Rainy season
All India			
Female , α_1	-0.330*** (0.034)	-0.336*** (0.035)	-0.322*** (0.043)
Ph3*Female , α_2	-0.046 (0.041)	-0.027 (0.043)	-0.059 (0.050)
Ph3*Year11, α_3	0.009 (0.021)	-0.015 (0.023)	0.024 (0.029)
Year11*Female, α_4	-0.011 (0.046)	0.001 (0.043)	-0.015 (0.062)
Phase3*Year11*Female, α_5	-0.018 (0.055)	-0.067 (0.057)	0.028 (0.070)
Controls, $\boldsymbol{\gamma, \delta}$	Yes	Yes	Yes
State dummy*Year11 , β_l	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
No. of observations	42444	21124	21320
No. of districts	391	391	390
	Average casual wage in Rs per day in 2004/5 prices		
For males, 2007/8	65 (n=18376)	67 (n=9336)	63 (n=9040)
For females, 2007/8	42 (n=9361)	43 (n=4540)	40 (n=4821)

Notes: Each column presents results from a separate regression. The individual controls used in the regression are : Age (in years), Age square (in years), Marital status: Never married , Currently married , Other (Separated/Divorced), Caste: Other , Schedule caste , Schedule tribe , Other backward classes , Muslim , Education : Illiterate , Primary and below , Middle , Secondary and above . The districts level controls are rainfall (in mm) and square of the rainfall (in mm). The estimation has been done on the basis of equation 2 after incorporating the definition of treatment to Phase III district and control as Phase I and II district. The coefficient α_5 measures TDM impact estimates for gender wage gap on Phase III districts. Dry season refers to January to June. Rainy season refers to July to December. All the regressions have been performed using modified individual level weights derived from district level matching weights, in the common support region. Our common support region comprises of 391 districts: 195-treatment (Phase III) and 196-control (Phase I and II). 'n' indicates number of individual observations. Standard errors clustered at the district-year level in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Triple difference matching impact estimates for gender wage gap on Phase III districts, by season, star states, over the period 2007/8 and 2011/12

	Dependent variable : Logarithm of casual wage (in Rs per day in 2004/5 prices)		
	Whole year	Dry season	Rainy season
Female , α_1	-0.367*** (0.051)	-0.392*** (0.053)	-0.342*** (0.069)
Ph3*Female , α_2	-0.065 (0.063)	-0.028 (0.067)	-0.096 (0.081)
Ph3*Year11, α_3	-0.012 (0.033)	-0.053 (0.039)	0.014 (0.044)
Year11*Female, α_4	0.055 (0.067)	0.082 (0.064)	0.030 (0.089)
Phase3*Year11*Female, α_5	-0.097 (0.082)	-0.112 (0.086)	-0.068 (0.104)
Controls, $\boldsymbol{\gamma}, \boldsymbol{\delta}$	Yes	Yes	Yes
State dummy*Year11 , β_l	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
No. of observations	16328	8161	8167
No. of districts	144	144	143
	Average casual wage in Rs per day in 2004/5 prices		
For males, 2007/8	67 (n=6682)	70 (n=3383)	65 (n=3299)
For females, 2007/8	42 (n=4085)	44 (n=1972)	40 (n=2113)

Notes: Each column presents results from a separate regression. The individual controls used in the regression are : Age (in years), Age square (in years), Marital status: Never married , Currently married, Other (Separated/Divorced), Caste: Other , Schedule caste , Schedule tribe , Other backward classes, Muslim , Education : Illiterate , Primary and below , Middle , Secondary and above . The districts level controls are rainfall (in mm) and square of the rainfall (in mm). The estimation has been done on the basis of equation 2 after incorporating the definition of treatment to Phase III district and control as Phase I and II district. The coefficient α_5 measures TDM impact estimates for gender wage gap on Phase III districts. Dry season refers to January to June. Rainy season refers to July to December. The star states are: Himachal Pradesh, Uttarakhand, Rajasthan, Chhattisgarh, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. All the regressions have been performed using modified individual level weights derived from district level matching weights, in the common support region. Our common support region comprises of 144 districts out of 162 districts: 68-treatment (Phase III) and 76-control (Phase I and II). 'n' indicates the number of individual observations. The modified individual level matching weights as described in the text have been used in the estimation. Standard errors clustered at the district-year level in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix B:

Table B.1: Triple difference matching impact estimates for gender wage gap on Phase I and II districts, by season, all India, over 1999/2000 and 2004/5

	Dependent variable : Logarithm of casual wage (in Rs per day in 2004/5 prices)		
	Whole year	Dry season	Rainy season
Female , α_1	-0.315***	-0.346***	-0.282***
	(0.023)	(0.038)	(0.030)
Ph12*Female , α_2	-0.070**	-0.048	-0.084**
	(0.031)	(0.043)	(0.039)
Ph12*Year04, α_3	0.070**	0.035	0.114**
	(0.025)	(0.027)	(0.036)
Year04*Female, α_4	-0.053	-0.036	-0.063
	(0.055)	(0.069)	(0.056)
Phase12*Year04*Female, α_5	0.014	0.017	0.004
	(0.061)	(0.075)	(0.063)
Controls, $\boldsymbol{\gamma}, \boldsymbol{\delta}$	Yes	Yes	Yes
State dummy*Year04 , β_l	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
No. of observations	42784	21389	21395
No. of districts	306	305	306
	Average casual wage in Rs per day in 2004/5 prices		
For males, 1999/2000	53 (n=15843)	55 (n=8205)	51 (n=7638)
For females, 1999/2000	33 (n=8484)	34 (n=4054)	31 (n=4430)

Notes: Each column presents results from a separate regression. The individual controls used in the regression are : Age (in years), Age square (in years), Marital status: Never married , Currently married, Other (Separated/Divorced), Caste: Other , Schedule caste , Schedule tribe , Other backward classes, Muslim , Education : Illiterate , Primary and below , Middle , Secondary and above . The districts level controls are rainfall (in mm) and square of the rainfall (in mm). The estimation has been done on the basis of equation 2 as described in the text. The coefficient α_5 measures TDM impact estimates for gender wage gap on Phase I and II districts. All the regressions have been performed using modified individual level weights derived from district level matching weights, in the common support region. Our common support region comprises of 312 districts out of 392 districts,: 160-treatment (Phase I and II) and 152-control (Phase III). 'n' indicates number of observations. Standard errors clustered at the district-year level in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table B.2: Triple difference matching impact estimates for gender wage gap on Phase I and II districts, by season, star states, over the period 1999/2000 and 2004/5

	Dependent variable : Logarithm of casual wage (in Rs. per day in 2004/5 prices)		
	Whole year	Dry season	Rainy season
Female , α_1	-0.276*** (0.037)	-0.285*** (0.048)	-0.264*** (0.047)
Ph12*Female , α_2	-0.116** (0.052)	-0.124** (0.057)	-0.098 (0.067)
Ph12*Year04, α_3	0.016 (0.037)	-0.029 (0.041)	0.080 (0.052)
Year04*Female, α_4	-0.033 (0.081)	-0.017 (0.084)	-0.039 (0.089)
Phase12*Year04*Female, α_5	-0.002 (0.095)	0.009 (0.097)	-0.029 (0.106)
Controls, $\boldsymbol{\gamma}, \boldsymbol{\delta}$	Yes	Yes	Yes
State dummy*Year04 , β_l	Yes	Yes	Yes
District fixed effects	Yes	Yes	Yes
No. of observations	16902	8539	8363
No. of districts	115	114	115
	Average casual wage in Rs per day in 2004/5 prices		
For males, 1999/2000	51 (n=5607)	54 (n=2949)	48 (n=2658)
For females, 1999/2000	32 (n=3543)	34 (n=1682)	31 (n=1861)

Notes: Each column presents results from a separate regression. The individual controls used in the regression are : Age (in years), Age square (in years), Marital status: Never married , Currently married, Other (Separated/Divorced), Caste: Other , Schedule caste , Schedule tribe , Other backward classes, Muslim , Education : Illiterate , Primary and below , Middle , Secondary and above . The districts level controls are rainfall (in mm) and square of the rainfall (in mm). The estimation has been done on the basis of equation 2 as described in the text. The coefficient α_5 measures TDM impact estimates for gender wage gap on Phase I and II districts. The star states includes: Himachal Pradesh, Uttarakhand, Rajasthan, Chhattisgarh, Madhya Pradesh, Andhra Pradesh and Tamil Nadu. All the regressions have been performed using modified individual level weights derived from district level matching weights, in the common support region. Out of 127 districts, we found 115 districts in the common support region: 62-treatment (Phase I and II) and 53-control (Phase III). 'n' indicates number of observations. Standard errors clustered at the district-year level in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.