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## Is India's employment guarantee program successfully challenging her historical inequalities?

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# DEPARTMENT OF ECONOMICS

## Working Paper

### **Is India's Employment Guarantee Program Successfully Challenging Her Historical Inequalities?**

by

Kartik Misra

Working Paper 2019-09



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# Is India's Employment Guarantee Program Successfully Challenging Her Historical Inequalities?

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## Abstract

By providing 100 days of guaranteed employment to every rural household, the National Rural Employment Guarantee Act (NREGA) can challenge the hegemony of the landed elite as major employers in the Indian countryside and raise market wages which have long been depressed. This paper shows that the impact of NREGA is conditioned and complicated by historical inequalities in agricultural landownership which have persisted since the colonial period. I find that in the lean season of agriculture, the program is highly successful in raising wages and generating more public employment in districts that were not characterized by historically high levels of socio-economic inequality. In these districts, the increase in public employment crowds-out labor primarily from domestic work, reflected in increased women's participation in the program. However, high inequality in landownership adversely impacts the bargaining power of workers and the enforcement of their entitlements under NREGA. This is most evident when I examine the impact of NREGA on rural wages. I find that in districts where land is concentrated in the hands of relatively few large landowners, private agricultural wages declined despite NREGA, whereas they remain largely unchanged in districts that have more equitable land distribution. These findings are consistent with the hypothesis that NREGA has not become a credible alternative to private employment in regions with high land inequality. (*JEL* O12, I38, J42, J43, P48)

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# 1 Introduction

The role of historic institutions in determining the trajectory and success of government policies and developmental programs has long been established.<sup>1</sup> The colonial land revenue system in India led to severe economic inequality and concentration of political power in certain parts of the country and this power imbalance continues to be relevant today. Existing evidence suggests that social fragmentation and concentration of political and economic power arising out of this institution affects public goods provision (Banerjee and Somanathan, 2007) and agricultural productivity (Banerjee and Iyer, 2005). However, if a public policy has the potential to correct these historical imbalances, then its impact depends not only on how well its implemented, but also on the resilience of local elite whose position it aims to challenge. The Mahatma Gandhi National Rural Employment Guarantee Act (henceforth NREGA) is one such policy that empowers workers by providing them public employment which erodes the economic hegemony of the large landowners as major employers in the Indian countryside. NREGA is an employment guarantee scheme that is intended to increase the availability of public employment and thereby put a floor on wages. The *unintended* consequence of the NREGA, if implemented properly, would be an increase in the relative bargaining power of the landless and marginal peasants vis-a-vis the landowners.

This paper focuses on the colonial land revenue system to show that historical institutions play a major role in the implementation and success of employment guarantee programs at the local level. The British categorized all cultivable land in India under landlord and non-landlord based systems. In the former, the responsibility for tax collection was vested in large landlords and in the latter, individual farmers or village communities were directly responsible for paying their taxes.<sup>2</sup> In landlord districts, a class of large land-owners emerged who became de facto owners of all cultivable land under their control which enabled them to remain politically influential even after India's independence (Banerjee and Iyer, 2005). This concentration of economic and political power in landlord districts is in sharp contrast to non-landlord districts where land was more equitably distributed. This difference in political and economic influence of large landowners provides an opportunity to understand how political economy factors may assist or obstruct the implementation of welfare programs in a region.

Landlord regions in India are characterized by lower productivity and investment in agriculture and in comparison to other districts. These areas also witnessed a lower provision of public goods like schools and roads. This disparity has been attributed to the inability of landless workers to collectively demand public goods from the state as they were engaged in class-conflicts with large

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<sup>1</sup>See Acemoglu, Johnson, and Robinson (2000) for a full discussion on the role of institutions in determining long-term growth and development of post-colonial countries.

<sup>2</sup>The British assigned land tax liability by categorizing all cultivable land in India under (a) landlord based system (*Zamindari*), (b) non landlord districts including individual cultivator-based system (*Ryotwari*), and village-based system (*Mahalwari*).

landlords over the question of land re-distribution (Banerjee and Iyer, 2005). The divergence in development indicators of landlord and non landlord districts continues to persist as seen in Table 1. For instance, in 2004, 35 percent of the population in landlord districts was below the poverty line while the corresponding figure for non-landlord districts was 24 percent.

In 2005, India legislated NREGA which entitles 100 days of work to every rural household at the legal minimum wage. It is the largest public employment program in the world which generated 2.35 billion work-days of employment in the financial year 2016-2017.<sup>3,4</sup> Not only is it important to evaluate the success of the program in providing income security to the poor as argued by Drèze (2005), but also to compare its impact between regions characterized by high land inequality. There are two reasons why the labor market impact of NREGA may differ between these districts. First, as major employers of rural labor, large landlords can keep wages depressed.<sup>5</sup> Second, they may use their political power to subvert the implementation of NREGA in order to ensure that workers continue to depend on them for their livelihoods.

By recognizing public employment as a *legal right*, NREGA provides an alternative source of employment for rural workers and in the process, introduces legal minimum wage as a floor for private employers. This mechanism forms the basis of its potential to erode the economic power of landowning elites. Unlike public goods like schools, roads and hospitals, NREGA creates a sharp divide between class interests of workers and large landowners and therefore, its implementation at the local level may be highly contested. The outcome of this class-conflict determines the ability of workers to get their legal entitlements under NREGA. In regions where local elite are successful in subverting the demands of workers, NREGA provision is lower. This inadequate provision of NREGA dilutes its potential to increase the bargaining position of workers and allows large landowners to keep rural wages depressed in landlord districts. Thus, historical institutions of a region play an important role in determining the success of policies like NREGA and condition its impact on wages, private and self-employment by controlling the number of workdays under NREGA.

Existing explanations attribute differences in the provision and labor market impacts of NREGA to limited administrative capacities and low awareness of peoples' legal entitlement and wages in states like Bihar (Ravallion, van de Walle, Dutta, and Murgai, 2015). This paper provides a more holistic explanation for heterogeneity in wage and employment effects of NREGA by linking the empirical evidence of uneven implementation of the program across states (Imbert and Papp (2015)) with the colonial institution of land revenue. I argue that local political economy factors explain differences in political will to implement the program at the district-level in rural labor markets

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<sup>3</sup>More details of the national level impact of NREGA can be found on the official NREGA website [http://mregaweb4.nic.in/netnrega/all\\_lvl\\_details\\_dashboard\\_new.aspx](http://mregaweb4.nic.in/netnrega/all_lvl_details_dashboard_new.aspx).

<sup>4</sup>There is no official basis for providing 100 days of employment. During situations like drought, this limit can be increased. For instance, in 2014, the government increased the official limit to 150 days in response to a drought.

<sup>5</sup>In this paper, I use the term 'landlord' to refer to large capitalist farmers who own large areas of cultivable land and hire wage labor for agricultural production.

across the country. Historical patterns of landownership and concentration of socio-economic power associated with it, determine how decisions to implement NREGA are taken and whether workers are successful in enforcing their legal rights under the program. Differences in political participation of people in its implementation and monitoring may be responsible for variation in its provision and performance at the regional and social level. In landlord districts, the landowning class also controls political decision-making at the local level. This limits the ability of small farmers and landless workers to demand their legal entitlements under NREGA, as they rely on these elites for employment and livelihood support.

There are three primary contributions of this paper. I provide the first empirical estimates of the causal impact of the role of the historic land tenure system in conditioning the effect of NREGA on rural labor markets. This paper treats the landlord districts as *sui generis* labor markets to evaluate the performance of NREGA in these districts and compares it to non-landlord districts which were a part of British India.<sup>6</sup> Second, I analyze how NREGA specifically affects *agricultural* labor markets in landlord and non-landlord districts to better understand the impact of NREGA on agricultural labor which is most affected by seasonality of production. This is important because agriculture is the predominant occupation of rural economies and landless agricultural workers and small; and marginal farmers rely exclusively on NREGA during the lean season of agriculture.<sup>7</sup> Finally, by looking at the participation and demand rates across districts, this paper suggests mechanisms through which land distribution and the associated political economy institutions may impact the functioning of NREGA.<sup>8,9</sup>

In order to estimate the role of land inequality on the functioning of NREGA, this paper combines the exogenous assignment of colonial land revenue system which was based primarily, on the date of conquest, with the phase-wise implementation of NREGA. [Banerjee and Iyer \(2005\)](#) show that territories conquered between 1820 and 1856 were accorded ‘non-landlord’ status and those acquired before or after this period were assigned as ‘landlord’ regions. This assignment was therefore, exogenous and not based on rural labor market considerations. Then, to causally estimate the differential impact of NREGA between landlord and non-landlord districts, I use the district wise implementation of the program in a differences-in-difference and triple difference framework.

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<sup>6</sup>These include districts that had individual or village based land revenue systems and excludes districts that were not directly under British rule in India.

<sup>7</sup>Agricultural production is spread over the *dry or lean* and *rainy or peak* season. In the dry season the crops are sowed and employment opportunities are fewer in comparison to the peak season when the crop is harvested.

<sup>8</sup>Demand rate refers to the ratio of households that demand NREGA work and the total number of households in a district. Likewise, participation rate is the proportion of households that participate in NREGA in a district and excess demand is the difference between demand rate and participation rate.

<sup>9</sup>These rates are calculated based on household level data on NREGA participation using the 66th Round of the National Sample Survey Organization (NSSO) data for the period 2009-2010. Respondents were asked whether members of the households wanted work under NREGA and if they did, whether they got work. However, data does not contain information about the number of days that households would ideally like to work under NREGA. This limitation of our data restricts us from ascertaining unmet demand in terms of the number of days.

I find that NREGA has been far more successful in non-landlord labor markets in raising rural casual wages and generating more public employment in the dry season.<sup>10</sup> In particular, real casual wages rose by 6 percentage in non-landlord districts which from a baseline mean of 2.60 log points. This implies an increase of 62 Indian Rupees (0.94 USD) in real terms in non-landlord districts. This translates into an 18 percent *differential* wage increase in non-landlord districts compared to landlord districts. This implies that the difference in wages between landlord and non-landlord districts after NREGA was around 207 Indian Rupees per day (3.14 USD).<sup>11</sup> Similarly, people in these districts increased time spent in public employment by around 1 percentage point per day and reduced time spent in private employment by around 3 percentage points per day from the baseline mean. This corresponds to a reduction of 5.4 days in private employment in the six months of the lean season after the introduction of NREGA. On the other hand, the impact of NREGA in landlord districts is relatively muted in terms of wages, public employment creation and time spent in private employment.<sup>12</sup>

I further decompose the impact of NREGA on private employment which consists of private wage employment, self-employment and domestic employment. The decline in private employment witnessed in non-landlord districts is primarily driven by a 2.6 percentage point decline in time spent in unpaid domestic work. This translates into a reduction of 4.7 days in domestic employment over the entire lean season. This is important because, women in India disproportionately shoulder responsibility for unpaid work and a decline in time allocated to domestic work implies that they benefit more from NREGA. Further, crowding-out of private employment because of public works as suggested by [Imbert and Papp \(2015\)](#) may actually be driven by re-allocation of labor-time from unpaid domestic work as opposed to private wage labor.

Next, I estimate the impact of NREGA on agricultural labor markets. I find that in the dry season the *differential* private agricultural wage increase in non-landlord districts compared to landlord districts was around 20 percent. In order to understand changes in agricultural labor demand in response to NREGA, I analyze changes in time allocated to self-employment and private wage employment in agriculture. I find that in landlord districts people *reduce* time spent in self-farming by 1.6 percentage points post-NREGA. This is because, self-farming on small plots of land is a subsistence mechanism adopted by households. When workers are provided employment under NREGA, they can substitute public employment for self-farming in order to augment their incomes. This substitution would not change the output produced by self-farming. Since several adult members of the household may participate in self-farming, substitution of labor time from self-farming to NREGA by some individuals may not impact output. This peculiar labor abundant feature of agricultural labor markets in developing countries has been extensively studied by [Lewis \(1954\)](#) and [Sen \(1966\)](#)

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<sup>10</sup>Casual wages is defined as wages paid for unskilled manual labor.

<sup>11</sup>Using 2004-2005 exchange rate 1 USD = 66 Indian National Rupees.

<sup>12</sup>For instance, rural casual wages actually decline by around 6 percent from 2.55 log points in 2004-2005. This corresponds to a decline of 53 INR (0.81 USD) during this period. However, this result is not statistically significant.

among others. Further, since large landlords can use their economic and political power to depress wages in landlord districts, they do not reduce labor demand significantly. On the contrary, in non-landlord districts, private employment falls by close to 5 percentage points as better provision of NREGA empowers workers to demand higher wages which forces private employers to reduce labor demand.

Finally, this paper finds that landlord districts have a higher percentage of households demanding employment under NREGA. However, this higher demand is not matched by increased provision of public employment and correspondingly there is unmet excess demand for NREGA in these districts. This provides us with a mechanism through which the effect of NREGA is dampened in landlord districts. Local political economy factors may exert their influences by limiting the *number* of days for which NREGA operates. This reduces the livelihood support that NREGA was expected to provide and ensure that workers remain dependent on large capitalist farmers for wage employment. This is consistent with field based studies that find unmet NREGA demand in several parts of the country. For instance, [Mukhopadhyay, Sharan, et al. \(2015\)](#) find that the number of work days supplied was much less than what was demanded in Bihar, Jharkhand, Odisha and Rajasthan. In Rajasthan, since the provision of NREGA was less than its demand, workers belonging to the caste and the village of the village head *Sarpanch* were allocated more work-days ([Mukhopadhyay, Sharan, et al., 2015](#)).<sup>13</sup>

This paper contributes to several strands of literature. First, it connects the growing literature on historical institutions to the literature on impact evaluation of public programs. In their seminal paper [Acemoglu, Johnson, and Robinson \(2000\)](#) show that historical institutions are responsible for modern day economic performance in several post-colonial countries. These institutions like rule of law and property rights continue to have an impact on policy choices and their implementation as post-independence policy-makers are themselves the elite who benefit from these institutions. For instance, [Acemoglu, Johnson, Robinson, and Yared \(2008\)](#) find that in comparison to South American colonies of Peru and Bolivia, in the North American colonies more people owned land and property rights were secure as colonizers decided to settle in these regions. Further, these inequalities persist overtime as attempts to correct them are often unsuccessful. Likewise, land re-distribution attempts were more successful in US and Canada in comparison the experience of Spanish America ([Sokoloff and Engerman, 2000](#)). Extending this research to the Indian context, my results show that public programs like NREGA are less successful in raising wages in regions characterized by historical inequality.

Second, I use insights from the political economy literature to identify factors that explain the success of historical institutions in subverting public programs to ensure that the class interests

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<sup>13</sup>This paper studies the impact of NREGA on districts in British India and not territories that were under the rule of Indian kings and princes. Correspondingly, very few districts from states like Andhra Pradesh, Himachal Pradesh and Rajasthan are included in my sample.



of large landlords are safeguarded. Rural labor markets in India are usually characterized by few employers and many employees. Rawal (2008) shows that in 2003, the Gini coefficient of land-ownership in India was around 0.76.<sup>14</sup> In addition to this oligopolistic nature of the labor markets, local institutions and norms also determine people's ability to choose their employer and demand higher wages. Osmani (1990) shows that rural wage determination involves a process of co-operation between workers. However, this collective action is impeded in highly unequal labor markets as workers compete with each other to gain private employment. In highly unequal societies, economic growth is characterized by low employment and low wages. (Banerjee and Newman, 1993). In the specific context of agriculture, wealth distribution has two effects on productivity and labor demand. First, wealth determines the ability of farmers to undertake lumpy investments which increase the productivity of agriculture (Bardhan, Bowles, and Gintis, 2000). Second, wealth inequality creates different incentives for those who cultivate mainly their own land and those who cultivate other people's land (Banerjee and Iyer, 2005).<sup>15</sup> This paper shows that landlords use their economic power to keep wages depressed as the provision of NREGA is inadequate to provide workers with credible alternative employment.<sup>16</sup>

Finally, this paper uses existing field-based research to argue that by excluding workers from local decision-making, large landlords can control the implementation of NREGA using their economic and political power. This weakens its provision and impact on rural labor markets. The ability of workers to participate in local governance institutions like the *Gram Panchayat* the *Gram Sabha* is pivotal in ensuring that NREGA is successfully implemented at the village level.<sup>17</sup> However, high inequality creates a substantial divergence between the political interests of the rural working classes and the landed elites (Deininger and Feder, 2009). This divergence in class interests weakens collective-action as people demand different policies from the state and their ability to enforce their rights is highly diminished. For instance, in states like Chhattisgarh, demands for social audits of NREGA have often resulted in confrontation between citizens' groups and local elites. Such confrontations result in a high degree of opaqueness in the functioning of the program in these states (Shah, 2008). In line with this finding, this paper shows that in districts with high inequality in landownership, the provision of NREGA is low and correspondingly its impact on rural labor markets is muted.

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<sup>14</sup>In addition, Rawal (2006) show that over 40 percent of households in India are landless.

<sup>15</sup>It is well-known, cultivating other people's land generates incentive problems, which reduces investment and productivity.

<sup>16</sup>Any policy intervention like land reform that aims to reduce concentration of landownership would increase the bargaining power of workers. However, the success of legislative processes leading to such interventions is limited as suggested by evidence from around the world (Sokoloff and Engerman, 2000).

<sup>17</sup>The *Gram Panchayat* is the village council with elected leader(s) and the *Gram Sabha* is the village assembly comprising of all adult members of the village. Finally, an official of the rank of Block Development Officer serves as the Program Officer of NREGA who is responsible for the smooth running of the program in her block. Citizens are supposed to apply for work to the *Gram Panchayat* which is also responsible to maintain job cards and implement the works sanctioned by the block level officials. The *Gram Sabha* is required to monitor the execution of works under NREGA (Drèze, Dey, and Khera, 2006). Therefore, the program relies heavily on the ability of people to demand and monitor its implementation.

The rest of the paper is structured as follows, section 2 provides the context of historical land revenue institution and discusses the role of NREGA in changing labor market outcomes. Section 3 presents a simple model of rural labor markets to understand the role of landownership in limiting the impact of NREGA. Section 4 discusses the data used in this paper and presents descriptive evidence for the role of land revenue system in determining the success of NREGA. Section 5 discusses the empirical methodology and presents an analysis of the main results of the paper and Section 6 presents robustness checks for the main specification. Section 7 provides an analysis of the agricultural labor markets after the introduction of NREGA and section 8 deals with issues of demand and participation at the district level and finally section 9 concludes the paper with policy implications.

## 2 Context

### 2.1 Historical Land Revenue Institutions

In India, the British instituted different tax revenue systems in different parts of the country. This assignment of land revenue system led to high inequality in landownership under the landlord based system known as the *Zamindari* system enacted in Bengal Presidency, Oudh and Central Provinces.<sup>18</sup> In these regions, large landlords known as *zamindars* were responsible for tax collection from the entire village or several villages. This gave them complete control over their tenant farmers as they could decide the tax rate and evict tenants if they failed to comply (Banerjee and Iyer, 2005). Other systems of tax collection were the *Ryotwari* system and the *Mahalwari* system. In the former, individual cultivators owned land and were directly responsible for paying taxes and in the latter, village level bodies owned land and were jointly responsible for paying taxes (Banerjee and Iyer, 2005). These systems were introduced primarily in Madras and Bombay Presidencies; and Punjab and North Western Provinces respectively.<sup>19</sup> The distribution of land revenue system across British India can be seen in Figure 1.

After India's independence in 1947, several legislations aiming to correct the balance of power between the landlords and workers were enacted. In the early 1950s, the system of *zamindari* was formally abolished and laws imposing a ceiling on land holdings were legislated (Bardhan, 1984). Basole and Basu (2011) show that average landholding size declined from 22 acres to 18 acres for large capitalist farmers between 1960 to 2003. However, during the same period the proportion

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<sup>18</sup>Bengal Presidency comprised of present day states of West Bengal, Bihar, Odisha and parts of Assam in India. Oudh was a part of present day Uttar Pradesh and Central provinces comprised of districts from the present day state of Madhya Pradesh.

<sup>19</sup>Madras Presidency comprised of territory from modern day Tamil Nadu, parts of Karnataka, Andhra Pradesh and Telangana. Bombay Presidency primarily comprised of Maharashtra and Gujarat. Additionally, Punjab province comprised of the states of Punjab, Haryana and parts of Himachal Pradesh and finally, North West Province was made up of districts from western Uttar Pradesh.

of ‘effectively landless’ workers increased from 44 percent in 1960 to 60 percent in 2003.<sup>20</sup> This decline in the average size of land holding did not dampen the political and social influence of large capitalist farmers in the countryside for two reasons. First, political efforts to curtail the power of large landlords by imposing a ceiling on land holding size or tenancy reform in *zamindari* districts were largely unsuccessful as state legislatures were predominantly controlled by land-owning classes (Besley and Burgess, 2000).<sup>21</sup> As a consequence, most Indian states never saw any large scale land reform (notable exceptions being Kerala, Tripura and West Bengal). Second, public sector contribution in the gross capital formation in agriculture (GCFA) had started declining and private investment rose sharply from the 1980s (Gulati and Bathla, 2001).<sup>22</sup> As the state withdrew from investing in agriculture, the fissures between large landlords on the one hand, and peasants and landless workers on the other were exposed and the ability of landowners to undertake productive investment became the major determinant of agricultural output.

As landlords continued to exert a significant influence in the political and economic life at the state level, class-based antagonism persisted within and between communities in areas where land was concentrated with large *zamindars*. This rule had some exceptions as shown by Boyce (1987). In some cases, the abolition of *zamindari* led to the devolution of land control and rural power from the old landlords (many of whom had already transitioned into predominantly urban lifestyles in urban centers) to a rising class of rich peasants (*jotedars*).<sup>23</sup> However, in general, the power and influence of large landlords in the post-independence period continued unabated and wealth-inequality soared particularly between 1965-1980 when extensive public investment in rural areas took place (Banerjee and Iyer, 2005). This suggests that the landlord districts fell behind the others in terms of public investments in infrastructure and human capital formation. While the exact mechanism has not been defined by Banerjee and Iyer (2005), they suggest that class based antagonism reduced the possibility of collectively demanding public goods provision in these regions. In contrast, this paper shows that large landlords continue to exert significant influence in local decision-making which determines the provision of NREGA in their villages. Since, guaranteed public employment erodes their control over labor demand and harms their class interests, they may use their political and economic power to restrict its provision.

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<sup>20</sup>Basole and Basu (2011) classify all households as ‘effectively landless’ if they own less than 1 acre of land.

<sup>21</sup>Tenancy reform aims to strengthen the position of the tenant farmer by providing them with legal registration for the land they cultivate to protect them against unlawful eviction by the landlord. In addition, it also defines the share of output between the cultivator and the landlord (Besley and Burgess, 2000).

<sup>22</sup>Private households account for over 95 percent of private capital investment in agriculture and close to 75 percent of private investment is aimed at increasing mechanization and irrigation of the land.

<sup>23</sup>In the specific case of West Bengal, Boyce (1987) shows that the latter became principal obstacle to more far-reaching land reforms.

## 2.2 National Rural Employment Guarantee Act

In pursuance of the Directive Principles of State Policy which mentions the ‘right to work’, the Government of India legislated the Mahatma Gandhi National Rural Employment Guarantee Act in 2005.<sup>24</sup> NREGA is a ‘universal’ legal entitlement which guarantees 100 days of employment as ‘unskilled manual labor’ in a year to every rural household of India. Workers are paid according to a state level statutory minimum wage applicable to agricultural workers.<sup>25</sup> The employment provision under NREGA is expected to achieve the twin objectives of providing livelihood support and to create public assets which increase the productivity of agriculture. The total cost outlay of the program is around 0.4 percent of GDP every year since 2014 and 70 percent of this outlay is earmarked exclusively for wage payments. It is supposed to provide income to people during spells of drought or crop failure by giving them NREGA jobs when private employment dries up.<sup>26</sup> As a result of NREGA, in the period between 2006 and 2012, there was a significant increase in average daily-wages which has led to higher per-capita consumption expenditure, increased food intake and higher retention of household savings in the rural India (Mann and Pande, 2012).

On the one hand, it is generally agreed that the states of Kerala, Tamil Nadu, Rajasthan, Himachal Pradesh and Andhra Pradesh are the top performers in terms of employment creation and enforcement of the entitlement ((Dreze and Khera, 2009); (Dreze and Oldiges, 2007)). It is important to note that the districts from these states included in this paper had *non-landlord* system of land revenue.<sup>27</sup> On the other hand, evidence suggests that the expected benefits have not fully materialized in the poorest states like Jharkhand and Bihar which needed it the most (Dutta, Murgai, Ravallion, and Van de Walle (2012); Bhatia and Dreze (2006)). These regions had almost exclusively landlord based land revenue systems. If we compare changes in (real) wages post NREGA, one finds that there is a high level of heterogeneity in wage increase across the country. In Figure 2, I show that several districts of central and eastern India witness a more sluggish wage rise post-NREGA. This is particularly interesting since these were predominantly landlord based regions and rural wages were lower in these districts before NREGA was implemented. In comparison, districts in the southern and western part of the country see sharp wage increase after NREGA.

While implementation remains uneven across states and districts, there is evidence to suggest that NREGA has contributed to (a) increased rural wages; (b) reduced distress migration from traditionally migration-intensive areas; (c) usage of barren areas for cultivation; and (d) empowerment of the weaker sections and giving them a new sense of identity and bargaining power (Mann and

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<sup>24</sup>The Directive Principles of State Policy are non-enforceable provisions given in Part IV of the Indian Constitution are meant to inform and direct policy-making by the state.

<sup>25</sup>State level minimum wage varies significantly. For instance, in 2012, they ranged from a minimum of 122 Indian Rupees (1.8 USD) in Bihar and Jharkhand to 191 Indian Rupees (2.9 USD) in Haryana.

<sup>26</sup>If public employment is not provided within 15 days of workers demanding it, the state has to pay workers without any work.

<sup>27</sup>Large parts of states like Rajasthan and Andhra Pradesh were ruled by Indian kings and not part of British India. These districts are excluded from this study.

Pande, 2012). In 2008 around two-thirds of the workers surveyed from six north Indian states were able to avoid hunger due to NREGA and around 75 percent respondents credited NREGA for helping them sustain their livelihoods in the dry season of agriculture. Further, an equal proportion of workers also used their wages to buy medicines in 2007 (Khera and Nayak, 2009).<sup>28</sup>

The differences in how NREGA changes labor market outcomes in landlord and non-landlord districts present an important vector of institutional inequality which is analyzed in this paper. Since initial conditions like more equitable distribution of land are favorable in non-landlord districts, they may be better suited to take advantage of NREGA as discussed in the theoretical model below.

### 3 Simple Model of Rural Labor Markets

In rural labor markets, households typically engage in several economic activities to support their livelihoods. Almost all households own some land and depending on its size and productivity, they use the output to either consume or for sale in the markets. NREGA is primarily intended for landless workers, small; and marginal farmers who may need to augment their incomes by working in public employment. Some or all adult members may also work as wage workers on lands owned by large landowners. The salient features of these markets are as follows. First, prior research has shown that these markets are oligopolistic in nature where employers enjoy what Bowles (2009) terms as *short-side power* by virtue of their landownership and social status (Basu, 2002).<sup>29</sup> The implication of this market power is that labor markets do not clear as some workers who would like to work at the going wage are excluded from the market (Bowles, 2009). Second, since excluded workers would be willing to work at a lower wage, the market wage depends not only on demand and supply but on factors like labor effort regulation and the fallback position of workers.<sup>30</sup> Finally, NREGA is expected to improve the fallback position of workers but if its provision is erratic and insufficient, its impact would depend upon the power of landlords to keep wages depressed by controlling labor demand for private employment.

This model draws heavily on the field research undertaken by the author in north India. During November 2016 and February 2017, I conducted a field study in thirteen village assemblies (*gram panchayats*) of Halia Block in Mirzapur district of Uttar Pradesh. I collected household level information from 950 NREGA workers. This study was designed to understand the labor market response of NREGA and how its provision impacts employment contracts and wage negotiations between workers and employers. This region is characterized by high land inequality and historically

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<sup>28</sup>The implementation of NREGA is further complicated by the hostility of successive governments to the scheme which is manifested in the reduction of its budgetary allocation since the financial year 2010-2011.

<sup>29</sup>When markets do not clear then power vests in those agents which desire the least number of transactions (Bowles, 2009). If land is concentrated then large landowners would exercise power over their workers.

<sup>30</sup>Fallback position is defined as the next best alternative available to an individual so that she may be indifferent between retaining her job or opting out of it.

had the *zamindari* system of land revenue settlement. During my research, I questioned landless workers and small and medium farmers on how NREGA was implemented at the local level. Who decides when work will be implemented and what role do local elites like the elected head of the village assembly (*Gram Pradhans*) play in determining their access to NREGA employment.

In the dry season of agriculture, landless workers and small and marginal farmers seek private employment as daily wage or contractual workers in the fields of large landowners. During this time, labor demand is low and several workers are unable to find work and they rely on NREGA for subsistence. My fieldwork also explored how workers' dependence on large landlords for employment and livelihoods continued even after NREGA was implemented as its provision was erratic and insufficient. In addition, payment for work done under NREGA was often delayed and workers are often paid for fewer work-days than what they actually worked. Finally, workers are unable or unaware of their legal entitlements under NREGA which dilutes its impact on the bargaining position of workers. For instance, most workers in my study knew the minimum wage rate in their districts but almost nobody demanded that their private employers adhere to the legal wage as they were not aware that minimum wages also applied to private employers. In some cases where people demanded higher wage, employers could easily avoid compliance as workers could not collectively enforce the minimum wage norms on large landlords. Correspondingly, any individual who demanded higher wage was denied employment as several other workers continued to accept a lower wage since private employment was critical for their survival. I incorporate these insights into a theoretical model which is based on Basu (2013) and Bowles (2009).

### 3.1 NREGA Employment and Access

Consider an agrarian economy with  $L$  large capitalist farmers who hire labor for agricultural production and who own equal plots of all commercially viable agricultural land in the economy. Since the quantity of land is fixed,  $L$  determines how equitably agricultural land is distributed. A large  $L$  implies that a higher proportion of the population owns agricultural land. If land ownership is diffused between several members of the community then the oligopolistic nature of agricultural labor markets would be weakened. This economy also includes  $N$  wage workers and marginal farmers.<sup>31</sup> The official guidelines require NREGA works to be undertaken whenever fifteen or more people demand it. However, in practice local political economy factors like the willingness of the head of the village assembly (*Gram Pradhan*) and ability of workers to get their rights enforced play a major role in determining the timing and duration of NREGA works. In districts where landownership is concentrated, workers bargaining power  $\theta$  is weaker as they depend upon a few large landlords for employment so  $\theta = L/N$ . NREGA works pay an exogenously determined minimum wage  $w^g$  and the amount of NREGA employment undertaken in the economy depends on the demand for public

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<sup>31</sup>Wage workers may also own small plots of land but wage employment is their main source of income.

works. Since NREGA is undertaken in the lean period of agriculture when private labor demand is low, I assume that all landless workers and marginal farmers demand NREGA. Therefore, time spent by a worker in NREGA employment is given by the following equation.

$$r = EG(k, \theta)/N \quad (1)$$

where employment guarantee  $EG = EG(k, \theta)$  and  $(EG_k > 0, EG_\theta > 0)$  determines the supply of NREGA employment.  $k$  is exogenously determined and depends on the availability of funds and political will at the state and central government level to implement NREGA. As mentioned above,  $\theta$  is the bargaining position of workers at the local level. Since, bargaining position of workers is determined by the prevailing land distribution in an economy, it also impacts the provision of NREGA as greater equality in land-ownership also allows people collectively bargain for their entitlements under the program as has been shown in the case of public investment in agriculture by [Banerjee, Iyer, and Somanathan \(2005\)](#). Thus, the availability of funds and local political economy factors determine the supply of NREGA work days in the economy. In practice, almost all workers ( $N$ ) participate in NREGA but the time spent in public programs is less than what many would want. I assume that the total NREGA work-days sanctioned is divided between workers and therefore,  $r$  in equation 1, defines the time spent working in public employment by each worker.

### 3.2 Labor

In the lean season, workers may allocate their time working as wage workers in private employment  $Lh_p/N$  where  $h_p$  is the labor time demanded by each of the  $L$  large capitalist farmers and  $N$  is the total labor supply. Since workers are identical, it is assumed that total labor demand is distributed between workers. Recall that  $\theta = L/N$  so  $Lh_p/N = \theta h_p$ . Additionally, workers may also engage in self-farming in agriculture  $h_s$ .<sup>32</sup> Workers can alter time spent in self-employment depending on the availability of private employment.<sup>33</sup> Finally, as mentioned above time spent by workers in NREGA employment is  $r$ . Workers can alter the time spent in different kinds of unemployment based on changes in payoffs associated with each employment type. Thus, I can present labor supply decisions of workers as follows.

$$\Gamma = \theta h_p + h_s + r \quad (2)$$

where  $\Gamma$  is the total amount of labor time in a season. For each combination of wage rate  $w_p$  workers choose their level of effort  $e \in (0, 1)$ . In addition, effort also depends upon the probability of being

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<sup>32</sup>Self employment could also include domestic work or non-agricultural self-employment but for simplicity I assume that self-employment only includes work on family owned land.

<sup>33</sup>As mentioned in Section 1, some members of the household can substitute time away from self-employment without reducing the output on family owned farms.



terminated by the landlords  $t$  so that  $e = e(w_p, t)$ . The probability of termination in turn, depends upon the level of effort exerted by workers and landlords may use termination as a disciplining method based on their market power so that the following equation holds.<sup>34</sup>

$$t = (1 - e)(1 - \theta) \quad (3)$$

and the workers utility function is given by  $u = u(\theta h_p w_p, e)$  with  $u_1 \geq 0$  and  $u_2 \leq 0$  and the worker varies  $e$  to maximize her lifetime utility over an infinite horizon at a rate of time preference  $i$ . It is important to note that worker's utility depends on her *total income* from private wage employment as opposed to the wage rate. This is because of the peculiar nature of agricultural production which depends upon factors like climatic conditions. Therefore, landless workers and small farmers would prefer to work as wage workers over self-employment to ensure steady income during the lean season. The life-time utility of wage workers at the beginning of the first period is given by the following

$$W = \frac{u(h_p w_p, e) + (1 - t)W + tZ}{1 + i}$$

which can be re-arranged as follows (4)

$$W = \frac{u(h_p w_p, e)}{i + t} + \frac{tZ}{i + t}$$

where  $(1-t)$  is the probability of retaining private employment as  $t$  is the probability of being terminated. In which case, the worker gets the utility associated with  $Z$ , the fallback position of workers. The life-time utility associated with the fallback position at the beginning of the first period is given by the following

$$Z = \frac{\phi(Ah_s) + rw^g + \theta h_p W + (1 - r - h_p)Z}{1 + i}$$

which can be re-arranged as follows (5)

$$Z = \frac{\phi(Ah_s) + rw^g}{i + r + \theta h_p} + \frac{\theta h_p W}{i + r + \theta h_p}$$

where  $A$  is the endowment of assets or land by small and marginal farmers and  $\phi(Ah_s)$  is the utility associated with self-employment with  $\phi' \geq 0$ . Recall from Equation 2 that  $\theta h_p = Lh_p/N$  is the time-spent in private employment since  $Lh_p$  is the total demand for private labor assuming that each landlord owns the same amount of land and hires  $h_p$  workers and  $N$  is the total labor supply.

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<sup>34</sup>I am assuming that monitoring of effort is costless as it is not directly relevant to the main results of the paper. Since this model emphasizes on the role of the 'power' of large landlords to discipline workers.



Equation 4 and equation 5 can be solved simultaneously using Cramer's Rule so that.<sup>35</sup>

$$W = \frac{1}{\Psi} [(i + r + \theta h_p)u(h_p w_p, e) + t(i + t)(\phi(Ah_s) + r w^g)] \quad (6)$$

$$Z = \frac{1}{\Psi} [\theta h_p u(\theta h_p w_p, e) + (i + t)(\phi(Ah_s) + r w^g)]$$

where

$$\Psi = (i + t)(i + r) + i\theta h_p$$

If the wage and employment contract offered by the landlord has to be accepted, the lifetime utility of an individual working in private employment must be at least as high as the utility of her fallback position. Assuming that this condition is satisfied as an equality.

$$W - Z = 0$$

which can be written as (7)

$$(i + r)u(\theta h_p w_p, e) - (i + t)(\phi(Ah_s) + r w^g)(1 - t) = 0$$

### 3.3 Landlords

$L$  large landlords owning equal amount of commercially viable land produce for the market and face exogenously determined prices (normalized to unity). As mentioned above,  $L$  determines how a fixed amount of agricultural land is distributed between landlords. Since labor is the only variable factor of production, the production function for the large capitalist farmer is  $y(h_p e(w_p, t))$  with  $y' > 0$  and  $y'' < 0$ . Output depends upon the labor time spent  $h_p$  and the effort exerted  $e(w_p, t)$  by workers. Each landlord faces the following maximization problem.

$$\begin{aligned} & \max_{h_p, w_p} y(h_p e(w_p, t)) - w_p h_p \\ & \text{subject to} \\ & (i + r)u(\theta h_p w_p, e) - (i + t)(\phi(Ah_s) + r w^g)(1 - t) = 0 \end{aligned} \quad (8)$$

The first order conditions with respect to  $h_p, w_p$  and the Lagrangian multipliers ( $\lambda$ ) are given below.

$$y' e - w_p - \lambda \left[ (i + r)\theta w_p \frac{\partial u}{\partial h_p} + A(i + t)(1 - t) \left( \phi'_{h_s} \frac{\partial \phi}{\partial h_p} + w^g r_{EG} \frac{dr}{dh_p} \right) \right] = 0 \quad (9)$$

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<sup>35</sup>The derivation is shown in the appendix.

$$y'(h_p(e_{w_p} + e_t \frac{\partial e}{\partial w_p})) - h_p - \lambda \left[ (\phi + rw^g)(2t + i - 1) \frac{dt}{dw_p} + (i + r)(\theta h_p \frac{\partial u}{\partial w_p} + u_e \frac{de}{dw_p}) \right] = 0 \quad (10)$$

$$(i + r)u(\theta h_p w_p, e) - (i + t)(\phi(Ah_s) + rw^g)(1 - t) = 0 \quad (11)$$

This completes the formalization of the model. The optimization process can be described as follows. Landlords know workers' utility maximizing level of effort and correspondingly determines the level of  $t$ . He then chooses  $w_p$  and  $h_p$  to maximize profits. For optimal value of effort ( $e^*$ ), time spent working in NREGA ( $r$ ) and the termination schedule ( $t$ ), we can solve the above system of equation as follows. First, I can substitute the value of  $\lambda$  from equation 9 into equation 10. Second, by substituting the values of  $h_s$  from equation 2 and  $t$  from equation 3 the model can be solved for unique values of the two unknowns  $h_p, w_p$  using equations 10 and 11.<sup>36</sup>

### 3.4 Assumptions

I make the following assumption in this model. First, and I assume that  $u = u(\theta h_p w_p, e) \geq \phi(Ah_s)$  as self-employment on may not be commercially viable and there is greater uncertainty associated with it. Second, ( $t < \frac{1-i}{2}$ ). This imposes a restriction on the termination schedule and is necessary for two reasons. First, probability of termination discourages workers to exert effort and second, high termination probability also imposes a cost on employers of replacing workers frequently.

### 3.5 Impact of NREGA: Comparative Statics

Let the optimal values of wage rate and employment  $h_p, w_p$  be given by  $w_p^*$  and  $h_p^*$ , then this model makes the following propositions about the impact of land inequality on private labor market and time spent in self-employment and access to NREGA employment.<sup>37</sup>

**Proposition 1** *An increase in  $L$  raises private wage  $w_p^*$  and reduces the effort exerted by workers*

The intuition for this proposition is as follows. If land is more equitably distributed, the bargaining power of workers  $\theta$  is higher and workers can better enforce their right to work under NREGA. In addition, large  $L$  reduces the threat associated with termination of private employment for two reasons. First, the presence of several employers increases the probability of finding private work

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<sup>36</sup>Appendix 1 shows that a unique solution to the model exists using the Implicit function theorem which states that for a system of two equations (say  $F^1(h_p, w_p) = 0, F^2(h_p, w_p) = 0$ ) which have continuous partial derivatives with respect to all endogenous variables namely  $(h_p, w_p)$  in this case, then the Jacobian of the system of equations is non zero and a unique solution exists for the system. I show in the appendix that the Jacobian of the system is negative.

<sup>37</sup>This section discusses the intuition behind these propositions and the formal proofs are presented in the Appendix.

even after being fired by one employer. Second, the termination schedule  $t$  itself depends upon the short-side power exercised by landlords. As the number of employers increase, the oligopolistic market set-up changes and the ability of workers to bargain for higher wages increase. These increase the fallback position  $Z$  of workers and for the incentive compatibility condition of equation 7 to hold, wages must rise. Therefore, since  $\frac{\partial Z}{\partial L} > 0$ , and  $\frac{\partial W}{\partial L} > 0$  from which, it follows that  $\frac{\partial w_p^*}{\partial L} > 0$

From this result, it follows that  $\frac{\partial e(w_p, t; Z)}{\partial L} > 0$ . This implies that a reduction in the market power of landlords reduces the probability of job termination and the level of effort exerted during private employment. This implies that greater land equality not only improves wages for workers but also lower the effort demanded by their employers. It is important here to distinguish between the number of work hours of private employment  $h_p^*$  and the effort exerted by workers. The latter refers to the dis-utility of working for a private employer who may impose arduous working conditions. Therefore, any expansion in landownership would also improve the working conditions of workers.

**Proposition 2** *An increase in  $L$  raises self-employment in agriculture and reduces  $h_p^*$*

Proposition 2 indicates that as land gets more equitably distributed, more households can engage in agricultural production not just for consumption but for sale in the markets. If households own larger plots of land which are commercially viable, they would devote greater labor time to self-farming as  $\phi(Ah_s)$  would increase. This would also increase the fallback position of workers and exert an upward pressure on wages.

However, as land gets distributed more equally, the few large landowners  $L$  in the economy are replaced by several small and medium farmers. Households would substitute away from private employment and increase their participation in self-farming as small farms use greater labor inputs than larger farms (Vergopoulos, 1978). This is consistent with existing studies, for instance Carter (1984) finds that small farms in India use up to 36 percent more labor input than the optimal values for a profit maximizing employer. This is because greater land ownership would raise the utility associated with self-employment in agriculture and reduce the supply of labor for private employment. Therefore, labor used on small farms is largely family labor as opposed to hired labor. This reduces the demand for private labor and alters its relative price. Therefore, it follows that  $\frac{\partial h_p^*}{\partial L} < 0$ . An increase in  $L$  would imply redistribution of agricultural land so that workers who are currently landless and marginal farmers can get access to land. This would increase time spent by these groups in self-farming as they may now own commercially viable plots of land.

**Proposition 3** *If  $L$  is large, then an increase in  $k$  increase  $w_p^*$  and reduces  $h_p^*$ . Alternatively, if  $L$  is small then the effect of an increase in  $k$  on  $w_p^*$  and  $h_p^*$  is ambiguous.*

If there are several employers in the economy, then as mentioned before the short-side power of employers would be low and access to NREGA would increase for workers. In this scenario, if there is an increase in  $k$ ; say through an increase in fund allocation to NREGA, then there would

be an increase in the fallback position of workers and wages will rise.<sup>38</sup> This would imply that  $\frac{\partial w_p^*}{\partial k} > 0$ . The intuition behind this proposition is that an increase in access to NREGA makes it a credible alternative to private employment. This would force employers to raise wages as labor would otherwise substitute private employment by NREGA employment. Since,  $\frac{\partial r}{\partial L} > 0$  and  $\frac{\partial t}{\partial L} < 0$ , therefore it follows that  $\frac{\partial w_p^*}{\partial k} > 0$  if  $L$  is large.

However, as mentioned in proposition 2 above, greater equality in landownership also implies lower private employment and this effect would persist even when  $k$  is high. This is because greater probability of access to NREGA also increases labor time spent under public works and together with an increase in self-employment in agriculture, it reduces the time available for private employment.

This mechanism however, would depend on the market power of landlords ( $1 - \theta$ ). If  $L$  is small, then workers would still depend heavily on private employment for subsistence as they do not own commercially viable plots of land to undertake agriculture. This would imply that large landowners would continue to exercise short-side-power and keep wages depressed and retain their pre-NREGA level of employment. The intuition for this proposition comes from field studies that show how local political economy factors determine the number of days for which NREGA is implemented at the village level. In highly unequal villages, local landlords have considerable influence in controlling the access to NREGA and use their influence and market power to ration jobs to workers so that they can perpetuate their wage-setting power. These mechanisms also ensure that the fallback position of workers does not rise in response to NREGA.

This model amalgamates insights from existing literature with information collected through field research designed to understand the impact of NREGA in wage negotiations with private employers in agriculture. We now focus on empirically testing the predictions of the model using national level representative sample data.

## 4 Data and Descriptive Evidence

### 4.1 Data

The main source of data used in this paper comes from the Employment and Unemployment Rounds of the National Sample Survey Organization (NSSO) of India. In each round, the NSSO collects data over four sub-rounds in a year from July to June. This allows us to estimate the effect of NREGA between the agricultural lean sowing (dry) and peak harvest (rainy) season. Each round has a sample size of about 120,000 households spread between urban and rural areas. I use several rounds of NSSO data covering a decade from 1999 to 2010 in different sub-sections of this paper.

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<sup>38</sup>Recall that  $r = EG(k, \theta)/N$  is the probability of NREGA employment where  $k$  depends on factors like political will and fund allocation to NREGA.

In the main specification of this paper, I use two ‘thick’ rounds covering the period from 2004-05 to 2007-08. The 61st Round from July 2004 to June 2005 forms the pre-program period and data from the 64th Round of NSSO spanning July 2007 to June 2008 forms the post-program period.<sup>39</sup>

In addition, for the falsification tests in Section 6, I use the 55th round of NSSO data which covers the period 1999-2000 and the 61st Round for 2004-2005. Finally, in the analysis of participation rates and demand rates of section 8, I use the 66th Round of NSSO data from July 2009 to June 2010 as questions about NREGA participation, number of days worked under NREGA and demand for public employment are asked only in this round. In addition, district level controls are created using various sources of data described in Appendix 2. The Primary Census Abstract and the Village Directories of the Census of 2001 are used for computing district level controls like literacy rate, proportion of Scheduled Castes and Scheduled Tribes, labor force participation, proportion of agricultural labor, population density and fraction of irrigated land. In Table 1 the mean values of controls at baseline and their source are listed.

## A Districts with Landlord Based Land Tenure System

The first important step in this analysis is to match NREGA districts to districts of British India. Banerjee and Iyer (2005) provide information about the land revenue system for the territory under British India.<sup>40</sup> This provides us with 169 districts according to district boundaries of 1960. The geographical boundaries of districts under colonial rule are significantly different from those today as districts have been divided, renamed, or merged with other districts. Kumar and Somanathan (2009) document the changes in district boundaries from 1961 to 2001. Using these changes in district boundaries over time, I use their analysis to map 169 districts of 1960 to 289 districts according to the Census boundaries of 2001. This gives me a panel of 289 rural districts with data on land revenue system.<sup>41</sup> Of these, 130 districts had *zamindari system* and 159 districts had other forms of land revenue systems. Table 2 provides the break-up of these districts by state, land revenue system and the phase of NREGA implementation. I assign a dummy variable for landlord district if it was under landlord based revenue system or if it belonged to Oudh provinces where a higher proportion of villages were under the *zamindari system* (Banerjee and Iyer, 2005).

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<sup>39</sup>Thick rounds are quinquennial rounds of surveys with a sample size of round 120,000 households. Thin rounds are conducted in the intervening period and its sample size is around 40 percent of the thick round.

<sup>40</sup>They exclude the princely states (those under the rule of Indian kings and princes), and parts of Pakistan, Bangladesh and Myanmar.

<sup>41</sup>This excludes districts like Mumbai and Chennai which are totally urban and therefore NREGA is not optional in these districts.

## B Employment and Wage Variables

The web-portal of **NREGA** provides information about phase-wise implementation of NREGA for each of the 289 districts used in this paper. Labor market outcomes like wages and employment are my main variables of interest. The NSSO documents the amount of time spent by each member of the household in various economic activities and records their wages over the last seven days. By using these questions to construct my employment variables, I calculate the percentage of time spent in public and private employment where the latter includes self-employment, domestic work and private wage employment following the methodology of [Imbert and Papp \(2015\)](#). In addition, I also construct variables for time spent in agricultural production like self-employment and private wage employment in agriculture.

For all employment types, the NSSO also records data on total earnings over a period of seven days. For the present analysis, I calculate the daily wage rate for casual labor working in public or private employment in agriculture and elsewhere by dividing the total wages received by the number of days worked. Further, these wages are deflated using the monthly consumer price index for rural labor from the Indian Labor Bureau. As NREGA works only in rural areas, I drop districts that are completely urban and keep individuals who are in the 15 to 60 year age bracket. Since, NREGA is a demand driven scheme in which individuals choose to participate so individual level characteristics like age, years of schooling, gender, marital status, caste, religion and household type are also included in this analysis.

## C Descriptive Evidence

Existing studies find that NREGA has had a considerable impact on rural labor markets and between 2004-05 to 2007-08. However, there is a significant difference in its impact between landlord and no-landlord districts. [Figure 3](#) shows the mean of (real) casual wages in landlord and non-landlord districts before and after NREGA during the dry season. This figure shows that real casual wages in landlord districts were much lower than those in non-landlord districts in 2004-2005. While both landlord and non-landlord districts see an increase in average casual wage after NREGA, the latter see a more significant improvement. Even though wages were higher in non-landlord districts, NREGA still had a greater impact in these districts which points to a paradox that NREGA may not be successful in landlord districts which needed it the most.

In order to fully understand the dynamics of post-NREGA rural labor markets, I next consider the provision of public employment in the dry season before and after NREGA in [Figure 4](#).<sup>42</sup> We see

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<sup>42</sup>Public employment in the period before NREGA refers to employment generated by other public programs (like the Jawahar Gram Razgar Yojna) undertaken by the government to provide livelihood support or to build rural households (like the Indira Awas Yojna). However, after NREGA was enacted, most of these programs were merged into it.

that starting from very low levels of public employment, it rises in both landlord and non-landlord districts over the period 2004-2005 and 2007-2008. The rise is higher in landlord districts which had greater provision of public works even before NREGA. As government programs aim to provide livelihood support to people, it is not surprising that landlord districts had greater provision of public employment as they had a higher incidence of income poverty. However, once I control for district-level factors, I find that the increase in public employment post-NREGA has been *higher* in non-landlord districts as shown in the empirical results below.

Existing literature finds that public employment generated under NREGA crowds-out private employment which decreases sharply (Imbert and Papp, 2015). In Figure 5, I find that in the dry season, private employment falls in non-landlord districts and remains unchanged in landlord districts. This suggests that the effect of NREGA in changing labor market outcomes is more pronounced in non-landlord districts as the implementation of the program is better in these districts.

## 5 Identification Strategy and Empirical Estimation

I now turn to empirically estimating our hypothesis that NREGA has been more successful in non-landlord districts as opposed to landlord districts. The assignment of NREGA was not random and was based on a poverty criteria.<sup>43</sup> In the first phase of its roll out, it was implemented in the 200 poorest districts of the country by February 2006. In the second phase, another 130 districts were brought under its ambit by April 2007. Finally in the third phase all districts of India were covered by NREGA by April 2008. For this analysis, districts that got NREGA in the first two phases would be considered ‘early’ or ‘treatment’ districts as NREGA was operational in these districts by April 2007 and phase three districts would be ‘late’ or ‘control’ districts as our pre-period data comprises of 2004-2005 and post-period data is for 2007-2008. Another factor that may have played a role in determining which district gets NREGA in the early phases was whether it was affected by left-wing insurgency (Zimmermann, 2012). As of 2000, around 55 districts of India were effected by these movements so this paper includes a dummy for these districts in my estimation.

Using NSSO data for the dry season (January to June) from 1999 to 2010, Figure 6 shows the trends in log deflated wages in landlord and non landlord regions before and after NREGA was implemented. This figure shows that in landlord districts, wages were almost identical between early and late districts. However, in non-landlord districts, early districts had lower wages in comparison to the late districts. While wages had an upward trend in both districts, in non-landlord districts the gap between early and late districts narrowed sharply after NREGA. This is primarily because, wages in non-landlord early districts rise more significantly in comparison to early districts which

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<sup>43</sup>The Planning Commission of India used data from mid-1990s to rank districts on the basis of poverty to determine the roll-out of the program. This poverty index was based on the poverty head-count ratio, proportion of marginalized communities (Scheduled Castes and Scheduled Tribes), agricultural wages and output per-worker.

had landlord based land revenue system. This figure underscores the importance of including district level controls in my estimation as district level characteristics could impact the treatment effect of the program in landlord and non-landlord districts. Therefore, I find that early districts which had non-landlord based land revenue system benefit more from NREGA.

Correspondingly, figure 7 shows trends in public employment. It can be seen that in the pre-program period (before 2007), the provision of public employment remained constant from 2000 to 2005 in both landlord and non-landlord districts. However, there is a sharp discontinuity in this trend post-NREGA as can be expected since NREGA provides guaranteed public employment. After NREGA was implemented, there is a steep rise in public employment for both landlord and non-landlord districts. However, this rise is more pronounced in the case of non-landlord districts as seen from the gap between early and late districts for this group.

Finally, figure 8 shows trends in private employment between 1999-2010. I find that in non-landlord districts, private employment falls significantly in early districts as workers substitute NREGA for private employment. This explains crowding-out of private employment in these districts. However, there is no impact on time spent in private employment in landlord districts that received the program early (i.e. districts that received the program by 2007). The gap between early and late landlord districts is much smaller than that for non-landlord districts. This indicates that the effect of the program on private employment was muted in landlord districts. Since the provision of NREGA was higher in non-landlord districts, it is not surprising to find that its effect on time spent in private employment is also larger in these districts. I now turn to empirically estimating differences in labor market responses to NREGA between landlord and non-landlord districts.

## 5.1 Differences-in-Difference

This section first estimates the causal impact of NREGA on labor market outcomes of landlord and non-landlord districts using the differences-in-difference methodology. The next step is to compare the differences between these labor markets using the triple-difference estimator. Both these are described below.

Our objective is to compare changes in labor market outcomes under NREGA in landlord districts and non-landlord districts. This paper uses the difference-in-differences methodology to estimate the impact of NREGA. The conventional difference-in-differences estimator requires that, in the absence of treatment, the average outcomes for the treated and control groups would have followed parallel paths over time. This means that the treatment (NREGA), should be assigned randomly across the population (Heckman, Ichimura, and Todd, 1997). This random assignment ensures that any unobservable characteristics that affect the outcome are controlled for as these may be present in both groups. However, the conventional difference-in-difference strategy may not be appropriate in



this case as the assignment of treatment was based on a poverty criteria.<sup>44</sup> Therefore, districts in the treatment group were poorer than the control group. I address this concern by including district level time-invariant controls using the [Imbert and Papp \(2015\)](#) methodology. Thus, the differences-in-difference estimator will capture the causal impact of NREGA if my estimation controls for factors that may cause treatment districts to trend differentially from the control districts. Impact of NREGA on labor market outcomes like the log daily casual wage, percentage of time devoted to public and private employment can be estimated using equation 12 below.

$$Y_{idt} = \beta_1 NREGA_d \times post_t + \lambda_1 Z_d \times post_t + \lambda_2 X_{dt} + \sigma H_i + \eta_t + \mu_d + \epsilon_{idt} \quad (12)$$

where  $Y$  is the variable of interest (say log deflated wages) for an individual  $i$  in district  $d$  and during year-quarter  $t$ .  $NREGA$  is a dummy equal to 1 if the district got NREGA in the first two (early) phases and  $post$  is a dummy equal to one if the observation is after 2006.  $Z_d$  contains the time invariant controls which are interacted with a post-treatment dummy to capture trends correlated with the controls. Time-invariant controls include proportion of marginalized communities, poverty head-count ratio, dummy for whether the district was affected by left-wing movements among others.  $X_{dt}$  are time varying district controls like normalized deviation from mean rainfall and the length of road constructed in a year. All district controls are listed in [Table 1](#).  $H_i$  are individual controls listed in [Table 3](#),  $\eta_t$  is year-quarter fixed effects,  $\mu_d$  are the district fixed effects and all estimates are adjusted for correlation in  $\epsilon_{idt}$  overtime within districts by clustering at the district level. We estimate this equation for landlord and non-landlord districts in the dry season of agriculture. A major concern in this specification is that landlord and non-landlord districts may not have a common time trend as I show in [Figure 6](#). By virtue of being characterized by higher investment in agriculture and greater productivity, wages and private labor demand may be systematically different in non-landlord districts.

## 5.2 Triple Difference

In order to address the challenge of differential time trends between the landlord and non-landlord districts, this paper constructs a triple difference estimator (DDD) which compares the labor market impacts in the treatment districts which had non-landlord based land revenue system with the treatment group having landlord based system. This estimation allows districts to simultaneously follow different time trends and allows us to estimate the impact of NREGA by accounting for the impact of *zamindari* in landlord districts. By using a dummy variable  $NL$  which takes a value of 1 if the district did *not* have the *zamindari* system I create a triple interaction term of NREGA, post

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<sup>44</sup>As a robustness check of my estimates, I formally incorporate criteria used to rank districts by poverty to conduct propensity score matching and use the matched data to re-estimate the model.

and NL for the DDD estimation. The estimated model is given in equation equation 13 below.

$$Y_{idt} = \beta_1 NL_d \times NREGA_d \times post_t + \gamma_1 NL_d \times post_t + \gamma_2 NREGA_d \times post_t + \lambda_1 Z_d \times post_t + \lambda_2 X_{dt} + \alpha H_i + \eta_t + \mu_d + \epsilon_{idt} \quad (13)$$

where  $Y$  is the variable of interest (say wages) for individual  $i$  in district  $d$  having a historical land settlement pattern  $NL$  and during year-quarter  $t$ . The coefficient of interest is  $\beta_1$  which can be interpreted as the difference in the changes in outcome (say wages) after NREGA in non-landlord districts in comparison to the corresponding changes in landlord districts. Since the implementation of NREGA is governed by local political economy institutions at the district level, and the administrative capacity, its impact varies considerably between districts. For this reason I continue to include district level controls. All other terms are explained above in equation 12.

Coefficients  $\gamma_1$  and  $\gamma_2$  capture the interaction terms.<sup>45</sup> The other controls are those defined above in Table 1. The NSSO provides sampling weights as it may over-sample certain type of households which are used to calculate summary statistics. However, since both, NREGA and the institution of *zamindari* are district level phenomena, these estimates should not be biased by smaller districts which may have fewer number of observations. Therefore, I re-weight the data to ensure that sum of all weights within a district-quarter is constant over time for each district and proportional to the rural population according to [Imbert and Papp \(2015\)](#). However, the results do not change significantly even with the sampling weights provided by NSSO.

### 5.3 Results and Analysis

This section will first discuss the descriptive evidence of the role of land revenue system on conditioning the impact of NREGA and present the summary statistics for the variables of interest. Finally, it will discuss estimation results for the differences-in-differences specification of equation equation 12 and the triple difference specifications of equation 13.

#### A Descriptive Statistics by Land Revenue System

Table 1 provides the summary statistics of the pre-program controls and their source. We see that landlord and non-landlord districts differ significantly in terms of the proportion Schedule Caste population, the fraction of literates, proportion of population engaged in agriculture and the poverty head-count ratio. For instance, the proportion of literate population in landlord districts was only 46 percent while the corresponding figure was only 54 percent in non-landlord districts. These

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<sup>45</sup>note I do not include the third interaction term  $NL_d \times NREGA_d$  as these are both time-invariant.

differences justify their inclusion as controls and correct for differential trends in outcomes. Table 3 presents individual level controls used in this paper and Table 4 presents the baseline means for labor market outcomes like log deflated wages, and percentage of time spent in public employment and private sector employment which includes self employment, domestic employment and private wage employment. Since this paper is interested in differential impact of NREGA due to the historical land revenue system, all summary statistics are reported for both landlord based and non-landlord based districts.

Table 4 shows the baseline means of our main labor market outcomes like wages and employment. Before the introduction of NREGA, people allocated close to 0.02 percent of their labor time in public employment in non-landlord districts. The corresponding proportion was 0.2 percent for landlord districts. Therefore, private work was the major source of employment for people in which they spent more than 80 percent of their time in both districts.<sup>46</sup> I now present the results of the empirical estimation described above.

## **B Results: Changes in Log Deflated Wages**

Table 5 presents the estimation of equation 12 and equation 13 for log deflated casual wages during the dry season. Each regression equation includes district and year-quarter fixed effect. Columns (1) - (3) report the estimates of the impact of NREGA on log deflated casual wages in landlord districts and columns (4) - (6) estimates the corresponding estimates for non-landlord districts. Finally columns (7) - (9) reports the results of the triple-difference estimation. Each column presents a different specification and controls as mentioned in the Table. Columns (3),(6) and (9) report the preferred specification including all district and individual level controls for the double difference and triple-difference estimations.

First, I find that log deflated casual wages actually decline in landlord districts when year-quarter fixed-effects and district and individual-level controls are included (columns (1) - (3)) however, this result is not statistically significant. This is counterintuitive as public employment should increase casual wages which include both public and private wages. However, as mentioned above, in these districts collective bargaining power of workers is low which allows landlords to reduce wages instead of cutting back on private employment after NREGA. This lends credence to the main hypothesis of this paper that in landlord districts, NREGA has not been successful in improving wages for casual workers. The situation in non-landlord districts was quite different. Log of casual wages increased by around 6.3 percent in these districts (columns (3) - (6)). This shows that NREGA has been far more successful in these districts and is in accordance to proposition 1 of the theoretical model in Section 3. These estimates are comparable to the wage impact of NREGA in best performing states

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<sup>46</sup>As NREGA requires beneficiaries to undertake casual manual labor and pays the minimum wage so individuals with salaries or formal employment are not included in this paper.

Andhra Pradesh, Chattisgarh, Himachal Pradesh, Madhya Pradesh, Rajasthan, Uttarkhand and Tamil Nadu which saw a wage increase of around 9 percent (Imbert and Papp, 2015).<sup>47</sup> Finally, in the triple difference estimation column (6) - (9), I find that in comparison to wage change in landlord districts, there has been an 18 percent increase in non-landlord districts. This result is robust to all the specifications presented in Table 5. We now turn to examining the employment dynamics in these districts post-NREGA.

### C Results: Change in Public Employment

Table 6 presents the estimation of equation 12 and equation 13 for percentage of time spent per day in public employment during the dry season. In all the specifications, there is a positive but insignificant impact on public employment in the landlord districts. This is an important result as these districts were poorer than non-landlord districts and NREGA was intended to provide livelihood to landless workers and marginal farmers in poor districts. As will be shown in Section 8, in landlord districts time spent in public employment does not increase because of weak implementation of the program. This also explains why casual wages did not rise in these districts. Alternatively, there is a positive and statistically significant increase in public employment in the non-landlord districts. In these districts, time spent by workers in public employment rose by around 1 percentage points in 2007-2008 from 0.02 percent in 2004-2005. This is important since these results are for the dry season of agriculture when private labor demand is low.

The difference in time spent under public employment between landlord and non-landlord districts is insignificant but positive when I analyze the coefficients on the triple difference estimation. This result shows how NREGA employment forms a very minor part in the total labor force participation in the countryside and in comparison to the landlord districts and this difference is not significant. In order to better understand how NREGA helps in raising wages, this paper next test the impact of NREGA in creating private employment.

### D Results: Change in Private Employment

We now turn to private employment in Table 7.<sup>48</sup> I find that the coefficient of private employment is positive but insignificant for landlord districts. In these districts, private employment actually increased by around 1 percent which is consistent with a decline in casual wages reported in Table 5 above. Alternatively, in non-landlord districts time spent in private employment decreased by around 3 percentage points from its baseline value of 81 percent in 2004-2005. This implies that in 2007-2008,

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<sup>47</sup>Since this paper is interested in the performance of NREGA between landlord and non-landlord districts it does not contain several districts from these states as they were parts of Princely States and not under direct British Rule.

<sup>48</sup>As mentioned above, percentage time allocated to private employment includes self-employment, private wage employment and unpaid domestic employment (Imbert and Papp, 2015).

workers were spending only around 78 percent of their time in private employment in non-landlord districts and this change is significant at the 1 percent level. This result is similar to those shown by [Imbert and Papp \(2015\)](#) for their best performing states, which implies that non-landlord districts have been better at implementing NREGA than landlord districts. However, when I compare the change in private employment in these districts, relative to landlord district in the triple-difference specification, the results show a 3.5 percentage point decline in private employment but this is not statistically significant.

To better understand the impact of NREGA on time allocation to private employment, [Table 8](#) decomposes it by its components, namely, self-employment, domestic work and private wage employment. In both landlord and non-landlord districts, people see an increase in time spent in self-employment (including agricultural and non-agricultural self-employment) with the former being larger (4.5 percentage points) than the latter (1.8 percentage points). However, this change is statistically insignificant. In rural India, almost all households are involved in some form of self-employment to augment their incomes. The large increase in self-employment in landlord districts can be attributed to a fall in domestic and private wage employment. On the other hand, in non-landlord districts, people increase self-employment after-NREGA since public works may increase overall productivity of agriculture ([Berg, Bhattacharyya, Durgam, Ramachandra, et al., 2012](#)).

Further, domestic employment also falls in both labor markets. This result indicates that after NREGA, women may be substituting public employment for unpaid work since they disproportionately shoulder responsibility of domestic work. This is consistent with [Khera and Nayak \(2009\)](#) and [Zimmermann \(2012\)](#) who show that women benefit more from NREGA. The decline in unpaid domestic work is statistically significant in non-landlord districts indicating that women may be participating more in these districts in comparison to their counterparts in landlord districts. This shows that while private employment as a whole may have fallen in non-landlord districts, the most significant share of this decline can be attributed to change in labor time for unpaid domestic work.

In conclusion, I show that wages have risen substantially in non-landlord districts and this increase is significant in comparison to landlord districts. Likewise non-landlord districts show substitution away from domestic work and private wage work. This points to the role of existing institutions in conditioning the impact of NREGA. These two labor markets possibly differ in their political economy characteristics like land inequality, number of people below the poverty-line and class antagonism between few large hand-owners and landless workers. These differences account for the differences in the performance of NREGA between them. In the next section I will conduct some robustness checks for these estimates.

## 6 Robustness Checks

The primary concern for any causal inference is that changes that are observed post the intervention are not caused by the program but instead due to other changes happening in the economy over-time. In the context of this study, landlord and non-landlord districts may be systematically different and therefore the former may not be valid counter-factual for the latter. I address these concerns in this section by conducting two robustness checks to assess the validity of the results shown in the previous section. First, I re-estimate equation 13 using data from the pre-program period 1999-2005 for a falsification test and second, I use propensity scores to match the treatment and control districts and I restrict my sample to districts that have common support. The results are described below.

### 6.1 Placebo Treatment

In Table 9, I re-estimate equation 13 using data from two thick rounds of NSSO data, namely the 55th and the 61th rounds of NSSO which correspond to the period of 1999-2000 and 2004-2005 respectively. Since the first phase of NREGA was implemented in 2006, this data reports labor market dynamics prior to treatment. I assign a program dummy for early districts and use data from 2004-2005 as the post period for this placebo test. In these estimations all district and individual level controls are included along-with district and year quarter fixed effects. The results for log of casual wage, public and private employment are reported in columns (1), (2) and (3) respectively. As expected, there is no effect of the placebo treatment for any of the specifications. The increasing trend in log wages that was shown in Figure 6 does not hold when district and individual level controls are included. These results show that even though different characteristics which may have affected their selection into treatment and control, the district level controls used in my empirical specifications control for these differences and the estimates in section 5 are indeed measuring the causal impact of NREGA in landlord and non-landlord districts.

### 6.2 Propensity Score Matching

#### A Empirical Strategy

My second robustness check employs propensity score matching to test the robustness of the main results presented in this paper. This method is used when selecting a subset of comparison units similar to the treatment units is difficult because units must be compared across several pretreatment characteristics. Matching is based on the concept of contrasting the outcomes of program participants with the outcomes of ‘comparable’ nonparticipants. Only when similar control and treatment districts are used, can differences in the outcomes between the two groups be attributed to the program (Dehejia and Wahba, 2002). To estimate a treatment effect for each treated person the outcome

(like wage or private employment) is compared to an average of the outcomes for matched persons in the untreated sample. Matching on the propensity score is essentially a weighting scheme, which assigns a higher weight to similar comparison units when computing the estimated treatment effect to ensure that unbiased estimates of the treatment (Dehejia and Wahba, 2002). Another advantage of this method is that it enables me to use individual level information available in the NSSO data and doesn't restrict us to use district-level averages.

This method is particularly attractive in cases like NREGA as it allows us to match observations across multiple dimensions. We know that the program was implemented in the early districts based on the poverty criteria. Zimmermann (2012) notes that the criteria for selecting the first 200 poorest districts and the subsequent 130 districts was based on a backwardness index created by the Planning Commission of India in 2003. This included agricultural wage, fraction of Scheduled Castes and Scheduled Tribes in the population of a district, the fraction of agricultural workers, the poverty head-count ratio and agricultural productivity per worker. I use these district level criteria to match treatment districts with control districts using non-replacement matching with the nearest neighbor and keep only matched districts. Correspondingly, the number of districts with a common support reduces from 289 in the original estimation to 180 in the matched estimation.

## B Results

Figure 9 shows the histogram for the estimated propensity score for the treatment and control districts. I find that the first bin of treated districts has no comparison units and there are fewer controls that are matched to treatment districts in bins 0.7 to 1. The matching estimation will therefore, drop the treatment districts that do not have comparable control districts. Table 10 provides the summary statistics for the matched controls and Table 11 provides the changes in the number of individual observations before and after matching.

In Table 12, I present the regression results for equation 12 and equation 13 for the major labor market outcomes, namely log deflated wages, public and private employment. All regressions include district and individual controls mentioned in Table 1 and Table 10. In addition, district and year-quarter fixed effects have been applied to all specifications. I find that the triple difference coefficient for log wages continues to remain positive and significant at the 5 percent level. When I compare the double difference coefficients, I find that wages increased by around 5 percent in non-landlord districts and fell by around 7 percent in landlord districts. However, these results are not statistically significant.<sup>49</sup> However, contrary to earlier results, there is an increase in public employment in landlord districts which is significant at the 10 percent level. The corresponding increase for non-landlord districts is not statistically significant. Finally, private employment has fallen by around 2.5 percent in non-landlord districts (significant at the 5 percent level) while it has

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<sup>49</sup>The results remain unchanged when kernel matching is used.



fallen by around 1 percent in landlord districts which is not statistically significant.

These results show that even when I control for all baseline factors that may have contributed to a district's inclusion in the treatment group, the differences between the impact of NREGA in landlord and non-landlord districts remains significant. The institution of *zamindari* continues to play a major role in determining the success of NREGA. Districts that did not have this exploitative system continued to show greater improvement in rural wages under NREGA even when I control for economic indicators of poverty and caste composition. In the next section, I focus exclusively on agricultural labor markets as ownership of agricultural land is the main basis for socio-economic domination of the landlords in the *zamindari system*.

## 7 Agricultural Labor Markets

So far the results derived above describe rural labor market dynamics post-NREGA. However, agriculture forms a major component of rural livelihoods so it is important to estimate the impact of NREGA in agricultural markets. In particular, the changes in deflated casual wages described in Table 3 correspond to casual wages earned in public or private employment. However, it may be the case that the increase in casual wages is driven solely by NREGA wages. In order to address these concerns, Table 13 re-estimates the differences-in-difference and triple-difference estimates for the agricultural labor market. In this section, I evaluate the impact of NREGA on 'private' casual wages, and time spent in self-employment and private agricultural markets in the dry season.<sup>50</sup>

### 7.1 Private Agricultural Wages

In Panel A of Table 13, I find that in non-landlord districts there is an increase in agricultural wages by around 5 percent but this increase is not statistically significant. Second, I find that in landlord districts, agricultural wages actually *fall* by around 11 percent and this result is also not statistically significant. Correspondingly, the differential wage increase in non-landlord districts in comparison to landlord districts is around 20 percent. The fall in agricultural wages in landlord districts is a surprising result as NREGA is expected to improve wages for casual workers. Two factors may explain this result. First, workers employed as private agricultural labor during this period are those engaged in permanent contracts with their employers. Basu (2013) shows that workers in permanent contracts are paid less during the lean season as this reduction in payment is compensated by job security over the year.

Evidence suggests that tied-labor contracts (with accompanying involuntary unemployment) still exist in rural India. While states like Bihar, Jharkhand, Uttar Pradesh and Uttarakhand historically

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<sup>50</sup>The results for the rainy season are also reported in Table 16 in appendix 3.



had some of the highest incidence of attached or tied-labor arrangements (Bardhan, 1983), more recently evidence of tied-labor is found in Andhra Pradesh, Madhya Pradesh, Rajasthan and Punjab as well (Basu, 2002). In Andhra Pradesh attached laborers are mainly men between the ages of 10-70 and are on yearly contracts (Deshingkar and Farrington, 2006). Attached labor contracts are also observed amongst the lower caste landless households in Rajasthan (Bhasin, 2004), as well as amongst migrant laborers in Punjab who are on annual contracts. Incidentally in Punjab, although the ratio of attached labor to casual labor is less than one, this ratio increases with the size of land holdings (Singh, Singh, Ghuman, et al., 2007). Finally, village level studies in the Telangana region of South India (Motiram, 2007) and (Rawal, 2006) in rural Haryana also point to the existence of tied and attached laborers in these regions.

Second, since these results are derived for the dry season of agriculture when labor demand is low, large employers can depress wages further, so that their wage bill remains constant. Since NREGA provides some income support to workers, large land-owners may use their wage-setting power to reduce private wages as a part of workers' subsistence is met by public works. As landlord districts are poorer than non-landlord districts, workers may have fewer outside options and rely mostly on agricultural employment for their survival. While NREGA is meant to address this power-imbalance between workers and employers by providing lean-season employment to workers, This result shows that the success of NREGA is limited in landlord districts. In non-landlord districts, workers may resist wage cuts as greater provision of NREGA enables them to bargain with private employers for higher wages. I find that the change in the log of private casual *agricultural* wages in non-landlord districts is much higher than the corresponding increase in the landlord districts as seen from the regression coefficient on the triple-difference estimation in Panel A of Table 13 which reports a 22 percent increase.

## 7.2 Self-Employment in Agriculture

Turning next to self-employment reported in Panel B of Table 13. I find that in non-landlord districts workers increase time spent in self-farming but this change is not statistically significant. On the other hand, in landlord districts, workers *reduce* time spent in self-farming by around 1.7 percentage points and this result is significant at the 5 percent level. This result is consistent with proposition 2 of the theoretical model in Section 3. Since landlord districts are characterized by high land inequality, small and marginal farmers are 'effectively landless' and they may actively substitute labor away from self-farming to either NREGA employment or other private employment. Since, very small plots of land do not allow farmers to sustain their livelihoods, as Basole and Basu (2011) show, most people own less than one acre and are therefore, effectively landless. This is consistent with existing evidence that demand for NREGA is lower in areas with irrigation-intensive cultivation as such agriculture is more labor intensive and has higher wage rates and crop productivity (Vakulabharanam and Motiram, 2011). Table 1 shows that productivity per-worker is higher in non-landlord districts.

This makes agriculture more remunerative and employment generating and workers may prefer to work in agriculture than under NREGA.

### **7.3 Private Wage Employment in Agriculture**

Finally, panel C of Table 13 looks at the private labor market. I find that there is a sharp decline in the percentage of time spent in private employment during the lean season. In both landlord and non-landlord districts people reduce the time spent in private agricultural employment by around 5 percentage points and the latter change is statistically significant. This is consistent with results presented above in Table 7 which show that private employment in non-landlord districts is indeed ‘crowded-out’ by public employment during the dry season. However, since these works are undertaken for a few days and payment is erratic, they are still not a credible alternative to private employment, even in the dry season, particularly for landlord districts.

This section shows that there has been a decrease in private agricultural employment and wages have increased by around 4 percentage points in non-landlord districts. In landlord districts, agricultural wages and self-farming have declined significantly after NREGA. These results underscore two important inferences about agricultural labor markets. First, in non-landlord districts, casual agricultural workers may be able to resist wage cuts because of higher provision of NREGA but they see a reduction in labor demand as employers cut back on employment in response to higher wages. Second, agricultural workers in landlord districts may be worse-off on both counts. Landlords in these districts are able to depress wages and cut back private agricultural employment. This is a cause of concern as landless agricultural workers may be most in need of income support from NREGA but its inadequate provision in these districts allow landlords to retain their position as main employers of agricultural labor. In the next section, I show how landlords use their economic and political power to control the implementation of NREGA at the district-level.

## **8 Analysis of NREGA Implementation at the District Level**

This section will discuss how NREGA is implemented at the district level to better understand the political economy factors that affect its functioning at the local level. There are two opposing factors which may influence how NREGA is implemented between landlord and non-landlord districts. First, landlord districts have a greater incidence of poverty and therefore, the demand for public employment would be higher in these districts. Second, large capitalist farmers control local political economy institutions like village assemblies and can subvert implementation of NREGA. If people are able to enforce their demand for public works under NREGA, then the difference between their demand and actual participation in NREGA would be smaller. However, if local elite can control the implementation of the program to safeguard their position as primary employers of rural labor, then

there would be higher unmet demand for NREGA. This section will first discuss existing evidence on differential implementation of NREGA across states and then show how historic inequality explains district level variations in NREGA implementation.

## 8.1 Existing Evidence

Existing literature identifies several loopholes in the implementation of NREGA. These include untimely wage payments, lack of awareness and implementation capacity, corruption and collusion between the bureaucracy and local level elected officials. For instance, in Bihar, 38 percent of payments are delayed by more than 60 days (Ravallion, van de Walle, Dutta, and Murgai, 2015). Dutta, Murgai, Ravallion, and Van de Walle (2012) attribute the low participation rates in NREGA in Bihar, Jharkhand and Odisha to low information and awareness. In addition, in several districts of Jharkhand, local body elections have not been held since 1978 and the capacity of local institutions to implement NREGA is diminished (Bhatia and Dreze, 2006). The absence of village assemblies seriously dilutes the legal entitlement of NREGA as these assemblies are pivotal in ensuring that NREGA is implemented when people demand employment from the state. In most cases, this lack of administrative capacity is also reflected in the delay in appointment of officials at the village and block level.<sup>51</sup> In fact, these deficiencies in public personnel and institutional capacity allows public officials to restrict the number of job cards and regulate the supply of NREGA workdays Bhatia and Dreze (2006). As a result of these factors, the actual provision of NREGA is not sufficient to meet the demands of all workers who need it (Dutta, Murgai, Ravallion, and Van de Walle, 2012).

Another major problem related to the local level implementation of NREGA is corruption. Corruption in the form of fudging of muster rolls, flawed work measurement, non-payment of minimum wages and delays in wage payments is widespread (Adhikari and Bhatia, 2010). For instance, public employment to create wells was undertaken in Jharkhand and corruption and bribery were rampant during the construction process (Bhagat, 2012). Several instances of collusion between local elected body and bank officials to reduce payments received by workers have been recorded by Adhikari and Bhatia (2010). However, better implementation of the program can help in minimizing corruption and increasing transparency in NREGA. For instance, creating correct incentives for officials reduces theft by around 64 percent (Niehaus and Sukhtankar, 2013). Better implementation of NREGA can increase private market wages by around 6 percent and decrease days without work by 7 percent (Muralidharan, Niehaus, and Sukhtankar, 2016).

There are several factors that may explain district and state-level variation in NREGA implementation. However, the power of large capitalist farmers in influencing decisions about NREGA at the local level may play a critical role in reducing its potential to guarantee employment.

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<sup>51</sup>Officials at the local level include panchayat sevaks or panchayat mitras and gram rozgar sevaks and block level officials include supervisors, engineers etc.

## 8.2 Role of Local Political Economy

In this section, I analyze differences in NREGA implementation at the local level to shed some light on the mechanisms by which local elites may control its impact on labor supply and wage rate. In theory, the number of days for which work is generated under NREGA should reflect its demand. One can estimate the anticipated demand for NREGA in a district by examining the proportion of households with NREGA job-cards. Every household that intends to work under NREGA in a given year is expected to apply for a NREGA job-card that records details of number of days worked and payments received under the program.<sup>52</sup> In Figure 10, I plot the proportion of households with NREGA job cards between landlord and non-landlord districts using NSSO data from 2009-2010 when all districts were covered under the program. As expected, I find that a significantly greater proportion of people have NREGA job-cards in *zamindari* districts than their counterparts in non-landlord districts. This shows that there is a greater demand for NREGA employment in these districts as they have a greater incidence of poverty and a higher proportion of marginalized communities.

The success of NREGA depends upon its ability to generate public employment in response to its demand. However, in panel (b) of Figure 10, I show, that the average number of days worked by households under NREGA were *fewer* in landlord districts. Panels (a) and (b) of Figure 10 show that there may be greater demand for NREGA in landlord districts but in comparison to non-landlord districts, fewer workdays are generated under the program in these districts. I now proceed to empirically estimate differences in NREGA provision between landlord and non-landlord districts by looking at differences in demand and participation rates between these districts.

## 8.3 Empirical Estimation and Results

In this section, I construct three indicators to test district level variations in demand and participation in NREGA to formally test the hypothesis that local political economy factors may responsible for better implementation of NREGA. Districts where NREGA is implemented as a demand driven program should witness a convergence between demand and supply of public employment and be characterized by low levels of unmet demand.

Following the methodology in [Dutta, Murgai, Ravallion, and Van de Walle \(2012\)](#), I construct the following three measures using the 66th Round of NSSO data from July 2009 to June 2010 to analyze the implementation of NREGA between landlord and non-landlord districts. These are demand rates, participation rates and the *excess demand* of NREGA employment. First, demand rate is the number of households that demanded NREGA as a proportion of the total households in

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<sup>52</sup>These job cards are issued by the head of the village assembly and households are not charged for applying for it.

a district.<sup>53</sup> Second, participation rate is the proportion of households that worked in NREGA.<sup>54</sup> Finally, I compute excess demand of NREGA as a difference between demand and participation rates.<sup>55</sup> The relation between excess demand ( $ED$ ), demand rate ( $DR$ ) and participation rate ( $PR$ ) can be written as follows.

$$ED = DR - PR \quad (14)$$

Therefore, excess demand will be low if the proportion of households who actually participate in NREGA is close to the proportion who want public employment under the program. If however, only few households get to participate in the program even if a larger proportion demand NREGA employment, there would be unmet or excess demand. This would imply that the program is not responsive to the demands of workers.

Table 14 provides the district level means of these variables for both groups of districts. There is a significant difference in excess demand of NREGA between landlord and non-landlord districts. In landlord districts, 26 percent of the households demand work but are not provided employment under NREGA while the corresponding figure is only 17 percent for non-landlord districts. Further, around 53 percent households demand NREGA in landlord districts while the corresponding figure for non-landlord districts is only 41 percent. However, the proportion of households participating in NREGA is similar between landlord and non-landlord districts (28 and 24 percent respectively). This shows that supply of NREGA employment in landlord districts does not respond to greater demand in these districts. However, these differences in demand could simply reflect differences in poverty-ratios or differences in the proportion of marginalized communities in these districts. In order to formally test the hypothesis that there is greater unmet demand for NREGA in landlord districts, I now estimate the following equation.

$$Y_{dt} = \beta_1 NL_d + \beta_2 Z_d + \eta_t + \epsilon_{dt} \quad (15)$$

where  $Y_{dt}$  is the rate in question, (say excess demand) for district  $d$  during year quarter  $t$ .  $NL$  is a dummy for non-landlord districts equal to 1 if the district did not have the *zamindari* system and 0 otherwise.  $Z_d$  contains the time invariant district level controls and  $\eta_t$  are year-quarter fixed effects. All estimates are adjusted for correlation  $\epsilon_{dt}$  overtime within districts by clustering at the district level. I do not use district level fixed-effects as  $NL$  is fixed at the district level overtime (Banerjee and Iyer, 2005).

Panel A of Table 15 shows the result of this regression for excess demand. Each column reports

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<sup>53</sup>Note that NSSO only asks questions on whether the household wanted work and got work under NREGA. They do not record the number of days for which households would *like* to work under NREGA.

<sup>54</sup>A household is counted in participating household even if it got work under NREGA for one day.

<sup>55</sup>This measure of excess demand does not capture differences in demand and actual participation as questions about actual demand are not asked in the NSSO data.

the results for a different specification. Column (1) shows the results of a naive regression including year quarter fixed effects and without district-level controls. Column (2) includes all district-level controls except the date of conquest by the British. As mentioned in Section 5, the date of conquest by the British is also an important determinant of the power of local elites. [Banerjee and Iyer \(2005\)](#) argue that early British rule was more exploitative for peasants which may create a greater divide between the interests of landlords and workers and weaken the latter's ability to demand their entitlements under NREGA. Therefore, column (3) includes the date of conquest by the British as an additional control in the estimation. In my preferred specification of column (3), I find that excess demand is 6.3 percent *less* in non-landlord districts. This shows that in comparison to landlord districts, non-landlord districts are able to generate public employment for a larger proportion of households demanding it. I now turn to differences in demand and participation rates between these districts.

Column (3) of Panel B in Table 15 shows that households in non-landlord districts rely less on NREGA. This is because the proportion of households that demand NREGA employment is around 12.5 percent less than that in landlord districts. This could be because people in these districts may have greater alternative employment opportunities that reduces their reliance on NREGA. This result is further corroborated by Panel C of Table 15 which confirms that low demand in NREGA is complemented by lower participation in these districts. Around 6 percent fewer households participate in NREGA in non-landlord districts.

Therefore, if we evaluate the implementation of NREGA on how successful it is in meeting the demand for public employment, non-landlord districts may be performing better than landlord districts. [Dutta, Murgai, Ravallion, and Van de Walle \(2012\)](#) identify three factors that may impact the program's implementation at the local level. First, poorer states may have limited resources to implement the program well. However, according to the Ministry for Rural Development 90 percent of the cost of the program is borne by the federal government and states are primarily required to bear the administrative cost of the program.<sup>56</sup> Second, they argue that poorer states may lack in terms of the administrative capacity necessary to implement NREGA. However, even within the group of low income states there is considerable heterogeneity in NREGA participation. As this paper analyzes differences in implementation between landlord and non-landlord districts, *state-level* differences in administrative capacity may not be relevant. This is because landlord districts are present in both better and worse performing states. For instance [Dutta, Murgai, Ravallion, and Van de Walle \(2012\)](#) shows that among poor income states; Chhattisgarh, Madhya Pradesh and West Bengal show better participation in NREGA when compared to Bihar, Jharkhand and Odisha. As seen from Table 2 most of these states have both landlord and non-landlord districts. Therefore, differences in state level administrative capacity cannot fully explain differences in NREGA implementation between landlord and non-landlord districts.

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<sup>56</sup>More details about cost sharing under NREGA can be found here <http://tnrd.gov.in/schemes/nrega.html>.

Finally, Dutta, Murgai, Ravallion, and Van de Walle (2012) argue that workers demanding NREGA may be poor and less empowered to enforce their legal entitlements under NREGA. This difference in the level of political empowerment of landless workers and marginal farmers is a result of the economic and political imbalance of power created by the historic land revenue system of *zamindari*. High inequity leads to greater class-conflict between landed elite and landless workers and weakens the ability of workers to confront the local elite and demand their rights under NREGA as they depend upon these large landowners for employment and survival. This result should be seen in the context of existing research that shows that the provision of public goods like roads and schools is lower in landlord districts (Banerjee, Iyer, and Somanathan, 2005). Therefore, higher unmet demand for NREGA in landlord districts suggests that the local elites may have been successful in subverting the implementation of the program.

## 9 Policy Implications

Public employment programs like NREGA have huge potential in alleviating poverty and by providing guaranteed employment to workers, it can alter labor market outcomes in regions where agricultural land is concentrated. This can correct the social and economic imbalance of power in developing countries like India. While the net impact of the scheme at the national level is positive and encouraging, considerable regional heterogeneity exists in performance between regions and social groups. In a marked departure from existing research which identifies lack of awareness, corruption and delayed wages as explanations for the poor performance of this scheme, this paper presents an institutional explanation for regional heterogeneity of NREGA. I argue that the colonial land revenue system of *zamindari* has a considerable impact in keeping wages depressed even after NREGA was implemented in these districts. High land inequality and the associated wage-setting power of large capitalist farmers in landlord districts has resulted in poor economic performance and reduced public investment in these districts. Therefore, landlord and non-landlord districts should be treated as different labor markets.

This paper finds that the the number of employment days created under NREGA in landlord districts has been lower than that in non-landlord districts. Therefore, the ability of NREGA to provide alternative employment and change the oligopolistic nature of rural labor markets is stymied in these districts. Further, in comparison to the landlord districts, there is a 3 percent decline in private employment in non-landlord districts. However, this change is primarily driven by a reduction in time allocated to unpaid domestic labor. In terms of agricultural labor markets, this paper finds that private agricultural wages have actually fallen in landlord districts and there is no impact on private agricultural wages in non-landlord districts. While, private labor demand has fallen in both landlord and non-landlord districts, but agricultural workers are particularly worse-off, in landlord districts as they have fewer employment options outside agriculture and NREGA provision is



inadequate to provide them livelihood support. Therefore, this paper shows that historic inequalities that NREGA had the potential to address, are actually dampening its impact in districts that need it the most. In comparison to their counterparts in non-landlord districts, workers in landlord districts may be at a twin disadvantage. First, since these districts have a greater incidence of poverty and a higher proportion of marginalized groups like the Scheduled Castes and Scheduled tribes, insufficient provision of NREGA adversely impacts their livelihoods. Second, since land in these districts is concentrated in the hands of a few large capitalist farmers, limited provision of NREGA may force small and marginal farmers to rely on self-farming on commercially unavailable plots of land for their subsistence needs.

Finally, this paper shows that the provision of public employment under NREGA is lower in landlord districts. In these districts, large landlords can successfully subvert the implementation of public works by using their political and economic power which is a consequence of the historic land revenue system. I show that while landlord districts are poorer than non-landlord districts, the supply of NREGA in the former is lower as landed elites have considerable influence in local decision-making. This dampens the effect of NREGA in improving the material living conditions of people. By controlling the number of workdays for which NREGA provides people with employment, local elites can also ensure that wages in *zamindari* districts remain depressed and dependence of workers on their employers continue unabated even after NREGA. The fact that there is greater demand for public jobs and inadequate supply may be conditioning the performance of NREGA in landlord districts.

NREGA provides an unprecedented opportunity to address historic inequalities of land and political privilege. However, it must be augmented with measures to improve people's access to it and efforts must be made to fulfill the government's promise of 100 days of employment if the scheme has to achieve its true potential. As India completes one decade of this historic legislation, it is distressing to see that the political commitment to this scheme stands diluted. The first step towards strengthening NREGA would include increasing the administrative capacity at the grassroots level including village assemblies and block level officials. Second, steps should be taken to ensure greater democratization of local decision-making to ensure that the participatory nature of the scheme is not diluted. Third, NREGA should actually be implemented as a *right* of workers and elected representatives must be held accountable for its inadequate provision and timely compensation must be paid if work cannot be provided under the program. Finally, steps must be taken to increase collective bargaining power of workers by strictly enforcing minimum wage laws and curbing the wage setting power of large landlords. Emphasis must be laid on strengthening institutions of political participation and local governance to ensure that NREGA emerges as a viable alternative to low wage private employment.



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Figure 1: Distribution of Land Revenue System

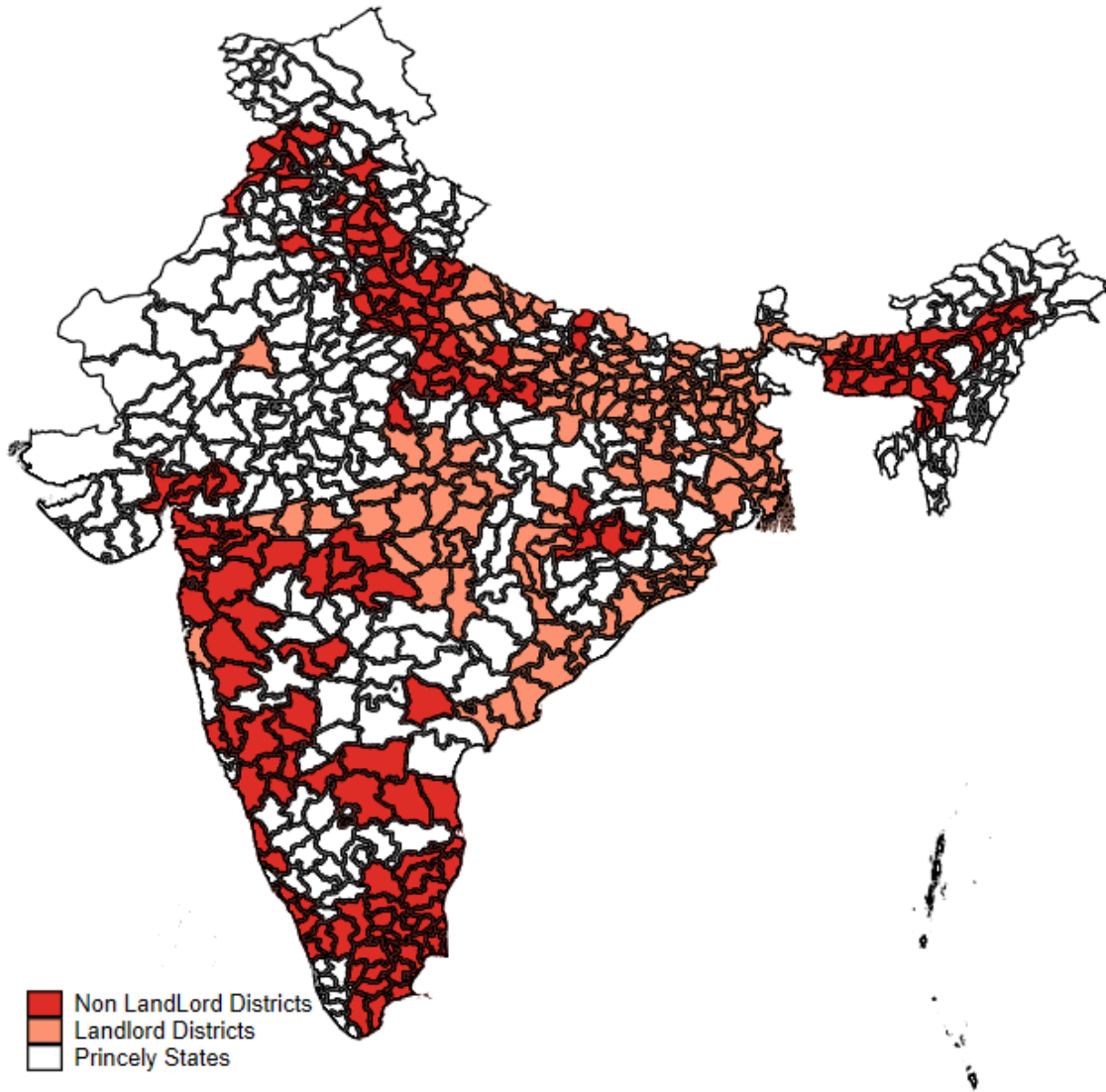


Figure 2: Change in Deflated Casual Wage 2004 - 2010 (in INR)

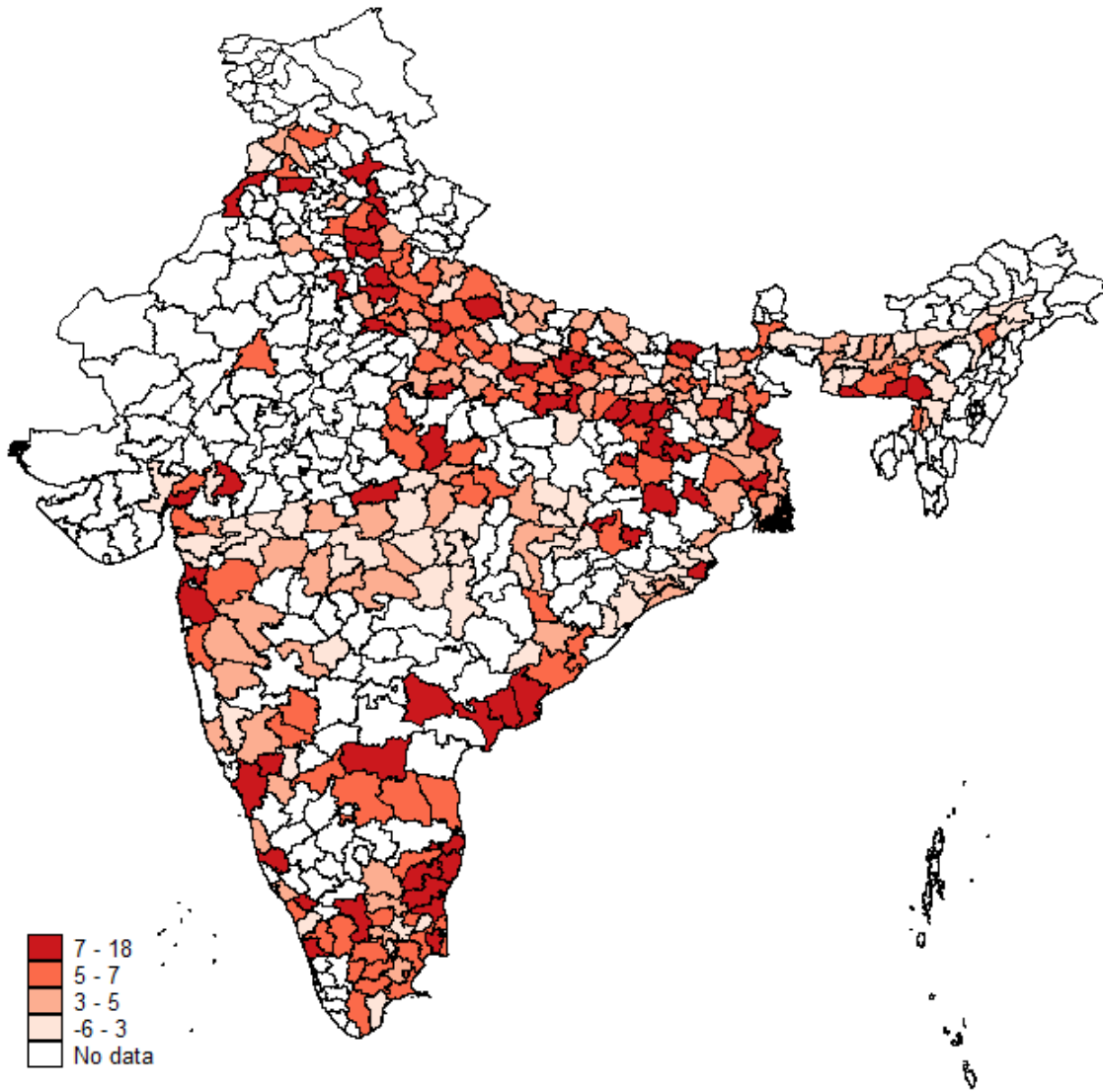
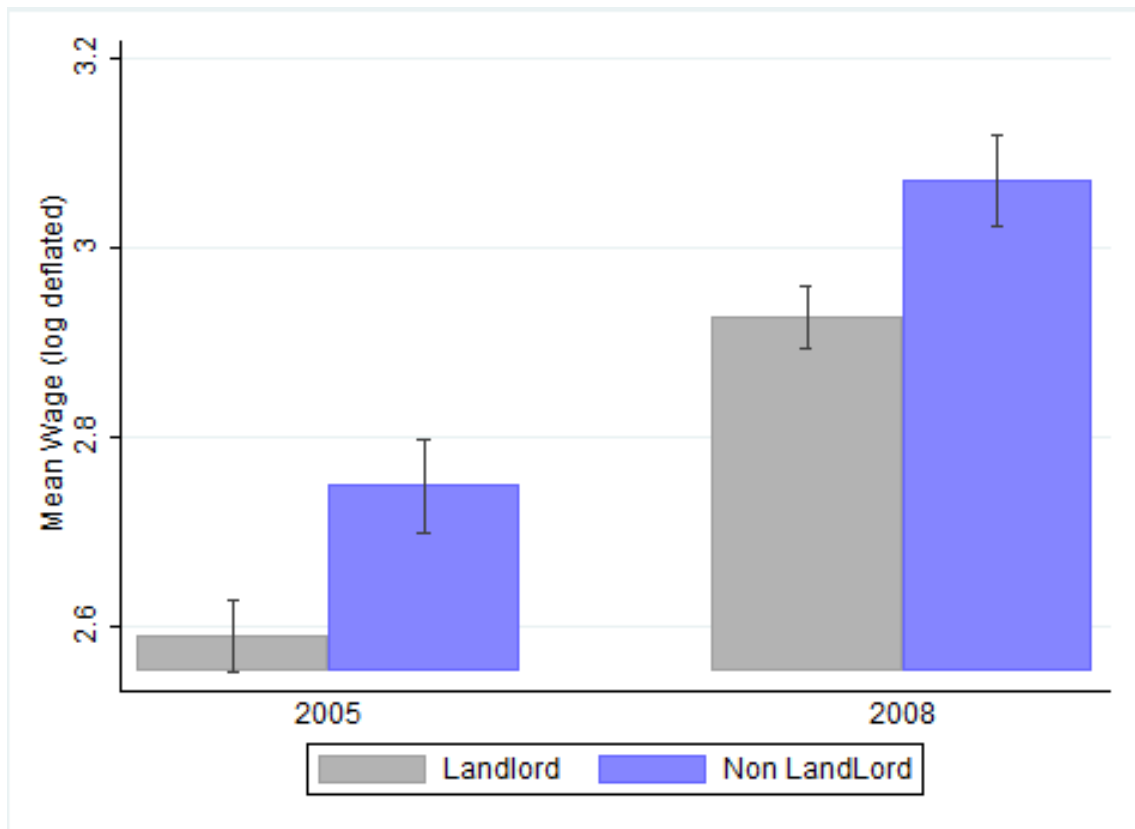
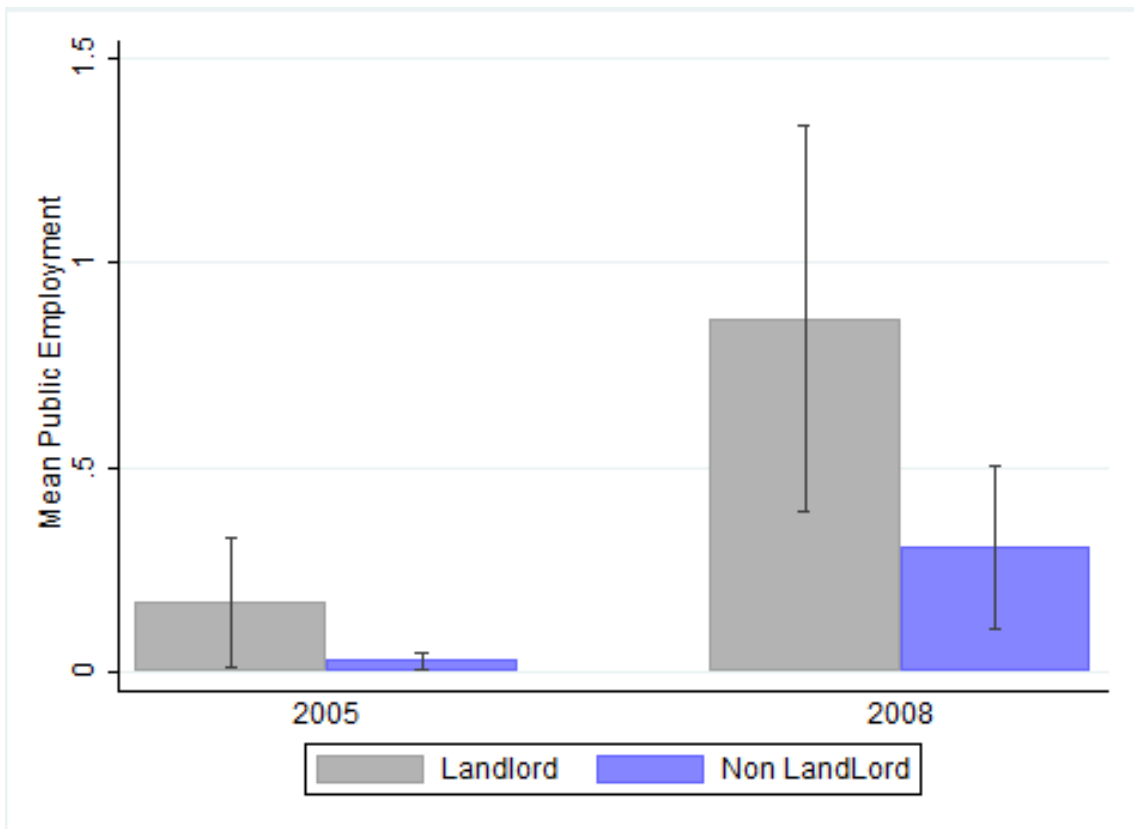


Figure 3: Change in Casual Wage by Land Revenue System



Source: NSSO Employment and Unemployment Survey 2004 -2005 and 2007 - 2008

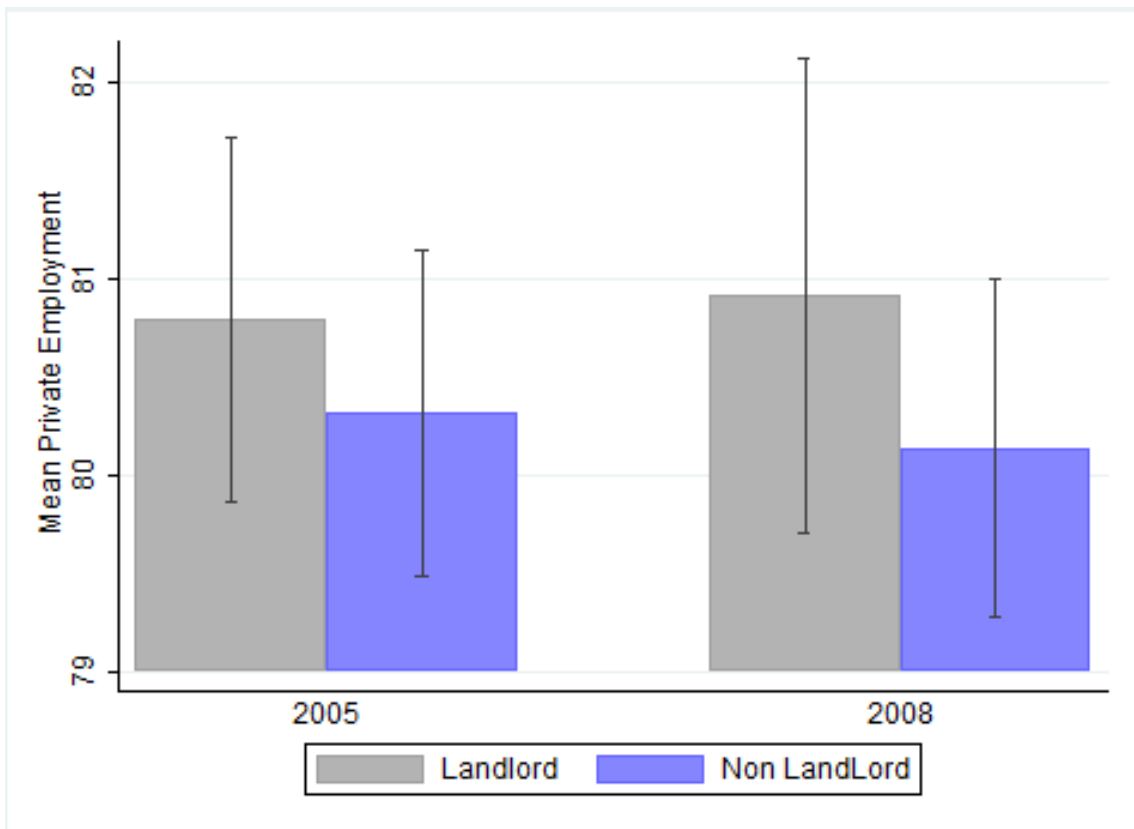
Figure 4: Change in Public Employment by Land Revenue System



Source: NSSO Employment and Unemployment Survey 2004 -2005 and 2007 - 2008

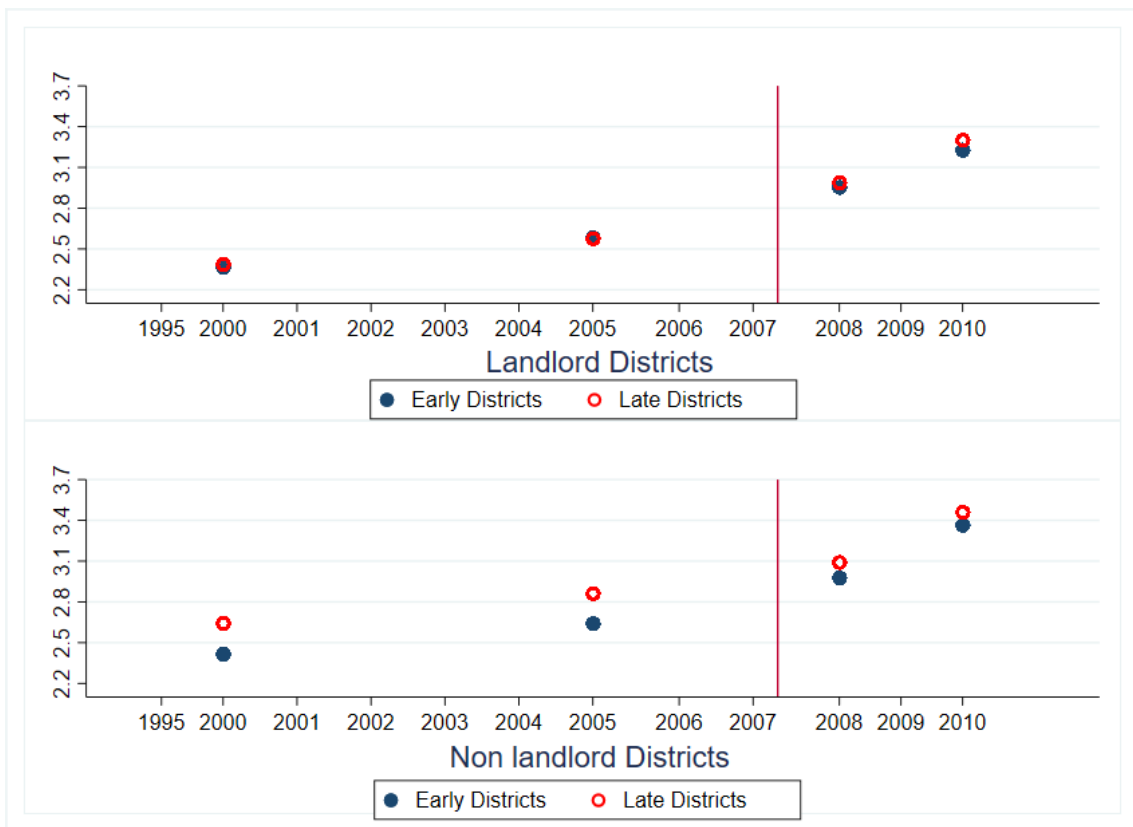


Figure 5: Change in Private Employment by Land Revenue System



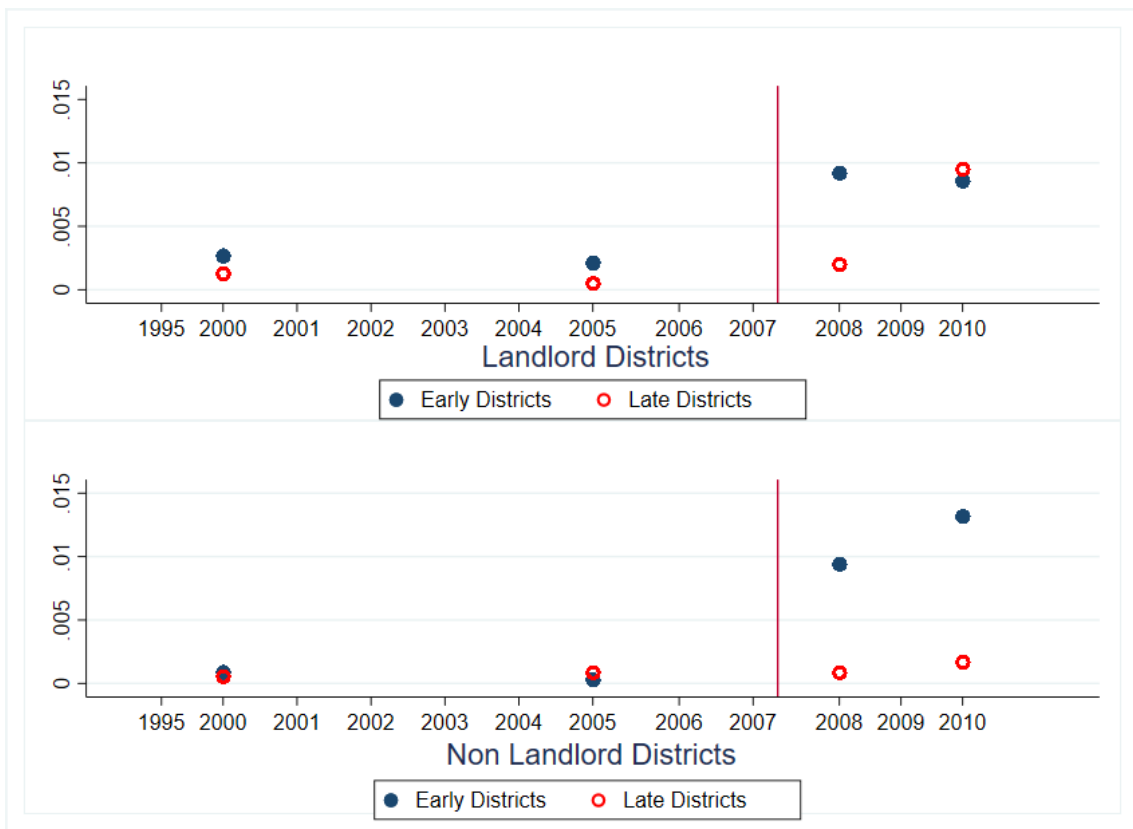
Source: NSSO Employment and Unemployment Survey 2004 -2005 and 2007 - 2008

Figure 6: Log Deflated Wage 1999 - 2010



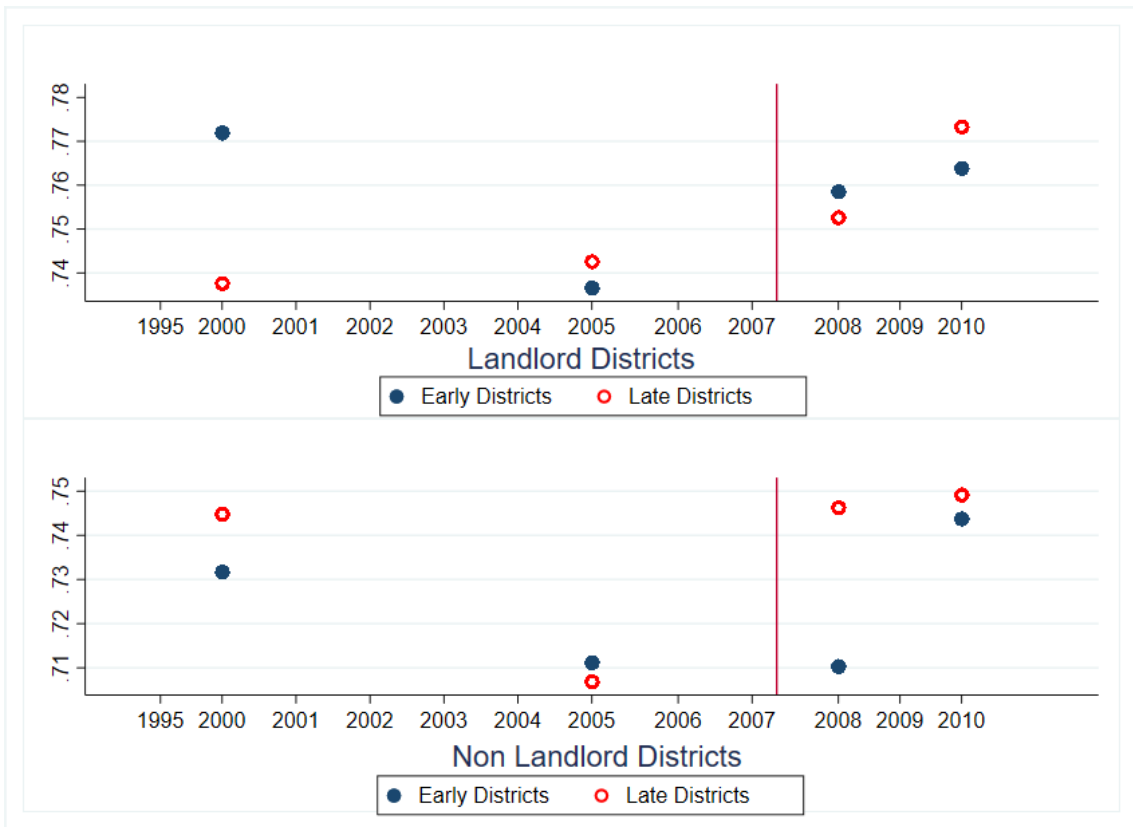
Source: NSSO Employment and Unemployment Survey

Figure 7: Public Employment 1999 - 2010



Source: NSSO Employment and Unemployment Survey

Figure 8: Private Employment 1999 - 2010



Source: NSSO Employment and Unemployment Survey

Figure 9: Distribution of Propensity Scores

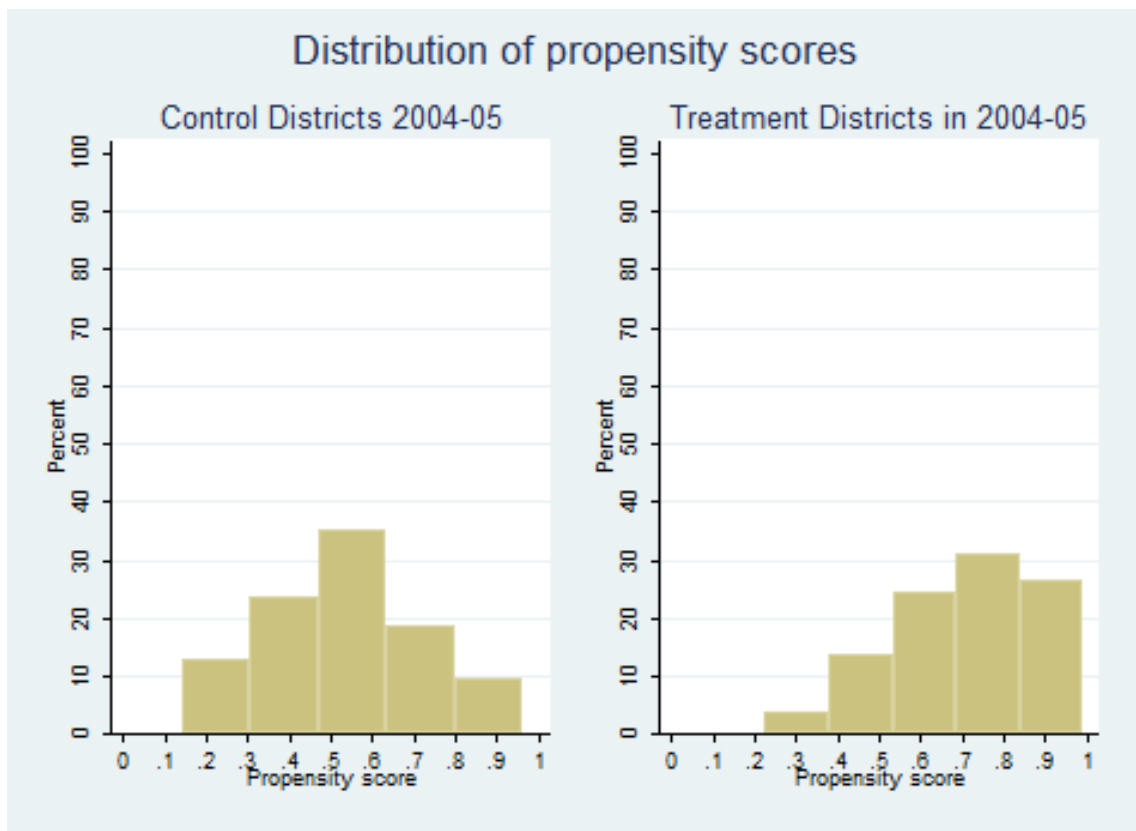
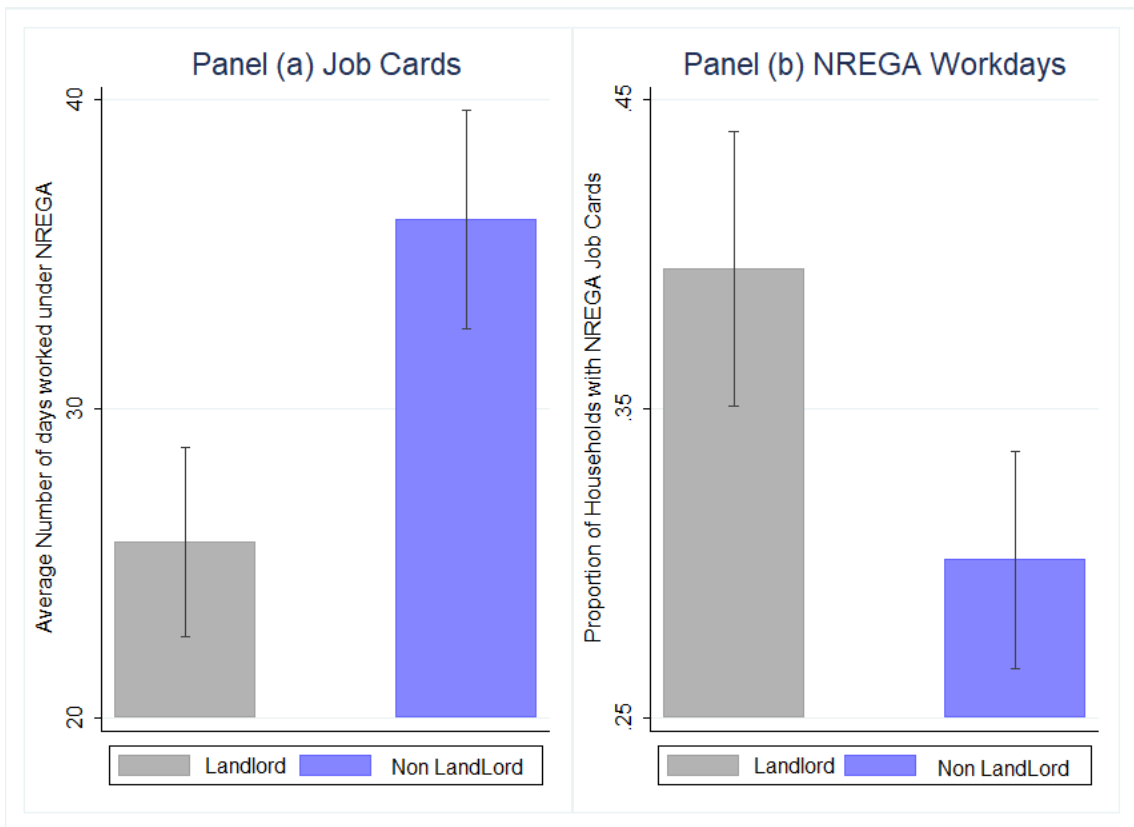


Figure 10: Average number of days worked under NREGA and Proportion of Households with NREGA Job Cards



source: NSSO Employment and Unemployment Survey 2009 -2010

Table 1: Summary Statistics: District Level Controls

Variable	Non Landlord (1)	Landlord (2)	p-value (3)	Source (4)	Time-Varying (5)
Fraction SC	0.17	0.20	0.00	Census 2001	No
Fraction ST	0.08	0.10	0.39	Census 2001	No
Fraction Literate	0.54	0.46	0.00	Census 2001	No
Fraction Male Lab Force	0.66	0.70	0.00	Census 2001	No
Fraction Female Lab Force	0.34	0.30	0.00	Census 2001	No
Fraction Agricultural Labor	0.51	0.51	0.68	Census 2001	No
Population Density	396	643	0.00	Census 2001	No
Fraction Irrigated	0.46	0.48	0.42	Census 2001	No
Fraction Unirrigated	0.54	0.52	0.42	Census 2001	No
Log Agricultural Wage	3.62	3.59	0.77	NSSO (EUS) 2004	No
Fraction Casual Agriculture	0.22	0.20	0.17	NSSO (EUS) 2004	No
Fraction Casual Non-Agriculture	0.07	0.05	0.01	NSSO (EUS) 2004	No
Fraction Cultivators	0.25	0.24	0.67	NSSO (EUS) 2007	No
Fraction Non-Agricultural Business	0.09	0.10	0.11	NSSO (EUS) 2004	No
Fraction Salaried Work	0.05	0.03	0.00	NSSO (EUS) 2004	No
Proportion below Poverty Line	0.24	0.35	0.00	NSSO (CES) 2004	No
Productivity per Worker	0.04	-0.02	0.55	Ministry of Agriculture	No
Left-wing Dist (2004)	0.01	0.23	0.00	Planning Commission	Yes
Deviation rainfall (normalized)	0.14	0.19	0.39	Univ. of Delaware	Yes
Road Construction	32.62	31.06	0.74	PMGSY website	Yes
Election Year	0.43	0.54	0.06	Election Commission	Yes
<b>Number of Districts</b>	159	130			

*Note:* This Table shows the mean values of district level controls used in all estimations. Column 1 and 2 present the mean values of controls for non-landlord and landlord districts respectively. Column (3) presents the p-values of the students t-test of equality of means in columns 1 and 2. Column (4) gives the data source used and column (5) states whether the controls are time varying or not. The 61st Round of NSSO data is used to calculate baseline means reported in this Table. The Employment and Unemployment Survey is used for calculating labor force participation variables and the Consumption Expenditure Survey is used for calculating the proportion of population below poverty line. Proportion of population comes from Census 2001 and information on irrigated land is taken from Village Directory, Census 2001. Productivity per worker (normalized) is calculated using data on output and prices from the Ministry of Agriculture and number of agricultural workers from NSSO. Data on the proportion of districts affected by left-wing insurgency comes from Planning Commission report, 2005 and estimates of deviation of rainfall (normalized) from mean of quarterly rainfall from 1970 - 2010 comes from the University of Delaware Earth System Research Library. Finally, data on annual road construction is taken from the website of the Pradhan Mantri Gram Sadak Yojna and dummies for years preceding state or panchayat election is taken from the Election Commission of India website.

Table 2: Distribution of Districts by Land Tenure System and NREGA Phase

State	District	Phase 1 District		Phase 2 District		Phase 3 District	
		Non Landlord	Landlord	Non Landlord	Landlord	Non Landlord	Landlord
Andhra Pradesh	10	3	1	2	1	0	3
Assam	21	5	1	6	0	9	0
Bihar	30	0	20	0	10	0	0
Chhattisgarh	6	0	3	0	3	0	0
Gujarat	10	3	0	3	0	4	0
Haryana	5	0	0	1	0	4	0
Himachal Pradesh	2	0	0	1	0	1	0
Jharkhand	15	0	13	0	2	0	0
Karnataka	10	0	0	2	0	8	0
Kerala	6	2	0	0	0	4	0
Madhya Pradesh	15	0	8	0	3	0	4
Maharashtra	24	6	4	5	1	7	1
Meghalaya	7	2	0	3	0	2	0
Odisha	19	3	5	1	4	0	6
Punjab	6	1	0	2	0	3	0
Rajasthan	1	0	0	0	0	0	1
Tamil Nadu	27	6	0	4	0	17	0
Uttar Pradesh	60	9	11	6	8	22	4
Uttaranchal	2	0	0	1	0	1	0
West Bengal	13	0	7	0	5	0	1
<b>Total</b>	<b>289</b>	<b>40</b>	<b>73</b>	<b>37</b>	<b>37</b>	<b>82</b>	<b>20</b>

*Note:* This Table shows districts in each state used in this paper. Districts are classified according to their land revenue system and the phase when NREGA was implemented in it. Data on phases is taken from the NREGA website and information about land settlement system by district is taken from [Banerjee and Iyer \(2005\)](#). Districts of British India are matched to boundaries given in Census 2001 using [Kumar and Somanathan \(2009\)](#). Districts for which data on boundaries was not available and those in princely states during colonial rule are excluded from this paper.



Table 3: Summary Statistics: Individual Level Controls

Variable	Non Landlord (1)	Landlord (2)	p-value (3)
Age	33.29	33.07	0.88
Education (years)	4.76	3.76	0.06
Women	0.50	0.50	0.97
Married	0.70	0.74	0.42
ST	0.09	0.10	0.67
SC	0.20	0.23	0.59
OBC	0.46	0.39	0.24
Muslims	0.12	0.14	0.68
Household size	5.63	5.87	0.48
Self-employed (agriculture)	0.37	0.39	0.84
Proportion Agricultural Labor	0.24	0.27	0.65
<b>Individual Observations</b>	67,553	57,989	

*Note:* This Table shows the mean values of individual level controls used in all estimations. Column 1 and 2 present the mean values of controls for non-landlord and landlord districts respectively. Column (3) presents the p-values of the students t-test of equality of means in columns 1 and 2. Column (4) gives the data source used and column (5) states whether the controls are time varying or not. The 61st Round of the Employment and Unemployment Survey of NSSO is used to calculate baseline means reported in this Table.

Table 4: Summary Statistics: Labor Market Outcomes at Baseline

Variable	Non-Landlord (1)	Landlord (2)	p-value (3)
Log Deflated Wage	2.60	2.55	0.32
Public Work	0.02%	0.19%	0.64
Private Sector Work	81%	83%	0.71
Self Employment	33%	31%	0.55
Domestic Work	26%	35%	0.08
Private Wage Work	22%	18%	0.29
Unemployed	6%	5%	0.64
Not in Labor Force	12%	11%	0.85
<b>Observations</b>	57,989	67,553	

*Note:* This Table shows the mean values for labor market outcomes at the baseline level. All values are restricted to persons aged 15 to 60. Log Daily wages are deflated using the monthly, state-level price index for rural laborers from the Indian Labour Bureau. Percentage of time spent in private, self and public employment is calculated using the Employment and Unemployment Round of NSSO data 2004. The second and third column present the mean values of labor market outcomes for landlord and non-landlord districts respectively. Column (3) presents the p-values of the students t-test of equality of means in columns 1 and 2.

Table 5: Changes in Log Deflated Wages Between Landlord and Non Landlord Districts in the Dry Season

VARIABLES	<i>DD: NREGA by Landlord Districts</i>			<i>DD: NREGA by Non Landlord Districts</i>			<i>DDD: By NREGA and Non Landlord</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NREGxNLxpost							0.198*** (0.0615)	0.180*** (0.0630)	0.177*** (0.0638)
NLxpost							-0.137*** (0.0509)	-0.136** (0.0560)	-0.162*** (0.0565)
NREGxpost	-0.0860* (0.0496)	-0.0748 (0.0572)	-0.0608 (0.0597)	0.112*** (0.0368)	0.0629** (0.0306)	0.0636** (0.0293)	-0.0862* (0.0493)	-0.0883 (0.0557)	-0.0809 (0.0576)
Observations	9,437	9,437	9,433	10,940	10,492	10,490	20,377	19,929	19,923
R-squared	0.327	0.336	0.395	0.449	0.459	0.592	0.406	0.411	0.508
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
District Controls x post	NO	YES	YES	NO	YES	YES	NO	YES	YES
Individual Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* This Table shows results for three panels. Columns (1) - (3) show results of a differences-in-difference for landlord districts and columns (4) - (6) for non-landlord districts and column (7) - (9) show results of a triple difference. Each column presents results from a separate specification. Log Daily wages are deflated using the monthly, state-level price index for rural laborers from the Indian Labour Bureau. Data on on employment is calculated using the 61st Round (pre-period) and the 64th Round (post-period) of NSSO data. The NSSO collects data over four sub-rounds in a year and the last two sub-rounds (January to June) comprises of the dry season and the other two quarters are the rainy season. I use weights proportional to the district population and all district level time-invariant controls are interacted with a dummy for the post period. Standard errors in parentheses are clustered at the district level.

Table 6: Changes in Public Employment Between Landlord and Non Landlord Districts in the Dry Season

VARIABLES	<i>DD: NREGA by Landlord Districts</i>			<i>DD: NREGA by Non Landlord Districts</i>			<i>DDD: By NREGA and Non Landlord</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NREGxNLxpost							0.743 (0.750)	0.413 (0.791)	0.472 (0.793)
NLxpost							-0.243* (0.136)	-0.896*** (0.298)	-0.932*** (0.309)
NREGxpost	0.475* (0.274)	0.868 (0.554)	0.825 (0.555)	1.219* (0.700)	0.936** (0.396)	0.936** (0.396)	0.476* (0.273)	0.531 (0.466)	0.506 (0.469)
Observations	59,743	59,743	59,582	63,067	59,458	59,458	122,810	119,201	118,814
R-squared	0.054	0.061	0.066	0.099	0.107	0.107	0.071	0.075	0.078
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
District Controls x post	NO	YES	YES	NO	YES	YES	NO	YES	YES
Individual Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* This Table shows results for three panels. Columns (1) - (3) show results of a differences-in-difference for landlord districts and columns (4) - (6) for non-landlord districts and column (7) - (9) show results of a triple difference. Each column presents results from a separate specification. Public employment is a percentage of time spent by individuals in working on public employment. Data on employment is calculated using the 61st Round (pre-period) and the 64th Round (post-period) of NSSO data. The NSSO collects data over four sub-rounds in a year and the last two sub-rounds (January to June) comprises of the dry season and the other two quarters are the rainy season. I use weights proportional to the district population and all district level time-invariant controls are interacted with a dummy for the post period. Standard errors in parentheses are clustered at the district level.

Table 7: Changes in Private Employment Between Landlord and Non Landlord Districts in the Dry Season

VARIABLES	<i>DD: NREGA by Landlord Districts</i>			<i>DD: NREGA by Non Landlord Districts</i>			<i>DDD: By NREGA and Non Landlord</i>		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
NREGxNLxpost							-4.670*	-4.097	-3.502
							(2.403)	(2.549)	(2.265)
NLxpost							2.964	3.631*	3.432*
							(2.064)	(2.195)	(1.855)
NREGxpost	1.688	1.213	1.272	-2.984**	-3.593***	-2.927**	1.686	1.230	1.262
	(2.070)	(2.606)	(2.264)	(1.230)	(1.202)	(1.146)	(2.065)	(2.362)	(2.057)
Observations	59,743	59,743	59,582	63,067	59,458	59,232	122,810	119,201	118,814
R-squared	0.027	0.028	0.275	0.032	0.034	0.281	0.030	0.031	0.276
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year-Quarter FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
District Controls x post	NO	YES	YES	NO	YES	YES	NO	YES	YES
Individual Controls	NO	NO	YES	NO	NO	YES	NO	NO	YES

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* This Table shows results for three panels. Columns (1) - (3) show results of a differences-in-difference for landlord districts and columns (4) - (6) for non-landlord districts and column (7) - (9) show results of a triple difference. Each column presents results from a separate specification. Public employment is a percentage of time spent by individuals in working on public employment. Data on employment is calculated using the 61st Round (pre-period) and the 64th Round (post-period) of NSSO data. The NSSO collects data over four sub-rounds in a year and the last two sub-rounds (January to June) comprises of the dry season and the other two quarters are the rainy season. I use weights proportional to the district population and all district level time-invariant controls are interacted with a dummy for the post period. Standard errors in parentheses are clustered at the district level.

Table 8: Decomposing the Effect of NREGA on Private Employment

	Landlord DD (1)	Non Landlord DD (2)	Triple Difference (3)
<i>Panel A. Self Employment</i>			
NREGxNLxpost			-3.590 (3.058)
NLxpost			1.274 (2.522)
NREGxpost	4.526 (2.924)	1.754 (1.975)	3.955 (2.646)
Observations	59,582	59,232	118,814
R-squared	0.235	0.185	0.205
<i>Panel B. Domestic Work</i>			
NREGxNLxpost			1.717 (2.247)
NLxpost			2.210 (1.720)
NREGxpost	-2.204 (1.829)	-2.615** (1.285)	-2.541 (1.867)
Observations	59,582	59,458	118,814
R-squared	0.580	0.048	0.522
<i>Panel C. Private Wage Work</i>			
NREGxNLxpost			-1.630 (2.732)
NLxpost			-0.0523 (2.353)
NREGxpost	-1.050 (2.669)	-2.200 (1.647)	-0.152 (2.416)
Observations	59,582	59,232	118,814
R-squared	0.173	0.172	0.173
*** p<0.01, ** p<0.05, * p<0.1			

*Note:* Panel A, Panel B and Panel C report the regression results for Self Employment, Domestic Employment and Private Wage Employment respectively. Each column presents results from a separate specification. Column (1) and Column (2) report the results of a double difference estimation for landlord and non-landlord districts respectively. Column (3) reports the results of the triple-difference estimation. All regressions include district and individual level controls defined in Table (2) and Table (3). All employment variables are calculated using the 61st and 64th round of NSSO data which is spread over four sub-rounds in a year. Sampling weights provided by NSSO are used in these regressions and standard errors in parentheses are clustered at the district level.

Table 9: Parallel Trends - Using Placebo Treatment Between Landlord and Non Landlord Districts in the Dry Season

VARIABLES	(Log Deflated Wage) (1)	(Public Employment) (2)	(Private Employment) (3)
NREGxNLxpost	-0.0122 (0.0690)	-0.374 (0.287)	-0.849 (2.071)
NREGxpost	0.0346 (0.0531)	0.229 (0.275)	-2.415 (1.587)
NLxpost	-0.0570 (0.0539)	0.188 (0.192)	2.836* (1.645)
Observations	16,030	116,521	116,521
R-squared	0.522	0.031	0.185
District FE	YES	YES	YES
Year-Quarter FE	YES	YES	YES
District Controls x post	YES	YES	YES
Individual Controls	YES	YES	YES

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* Each column reports the results for a separate triple difference regression. Column (1) reports the results for log of deflated casual wages when the dummy for post equals 1 for 2004-2005 and similarly, column (2) and column (3) report the results for public employment and private employment respectively. Log Daily wages are deflated using the monthly, state-level price index for rural laborers from the Indian Labour Bureau. Data on employment is calculated using the 55th Round (pre-period) and the 61th Round (post-period) of NSSO data. The NSSO collects data over four sub-rounds in a year and the last two sub-rounds (January to June) comprises of the dry season and the other two quarters are the rainy season. I use weights proportional to the district population and all district level time-invariant controls are interacted with a dummy for the post period. Standard errors in parentheses are clustered at the district level.

Table 10: Summary Statistics: Matched District Level Controls

Variable	Non Landlord (1)	Landlord (2)	p-value (3)
Log Agri Wage	3.68	3.68	0.98
Frac SC	0.17	0.20	0.01
Frac ST	0.06	0.05	0.52
Frac Agri Labor	0.50	0.48	0.33
Frac Below Pov	0.21	0.26	0.03
Prod per Worker	0.03	0.01	0.90
District Observations	126	54	
Individual Observations	55672	27916	

*Note:* This Table shows the mean values of matched district level controls used in all estimations. Column 1 and 2 present the mean values of controls for non-landlord and landlord districts respectively. Column (3) presents the p-values of the students t-test of equality of means in columns 1 and 2. The Employment and Unemployment Survey is used for calculating labor force participation variables and the Consumption Expenditure Survey is used for calculating the proportion of population below poverty line. Proportion of population comes from Census 2001 and productivity per worker (normalized) is calculated using data on output and prices from the Ministry of Agriculture and number of agricultural workers from NSSO.

Table 11: Individual Observations before and after Matching

<i>Panel A. Before Matching</i>		
Land Revenue System	Control	Treatment
Landlord	16,983	1,04,478
Non landlord	65,008	61,680
Total	81,991	1,66,158
<i>Panel B. After Matching</i>		
Land Revenue System	Control	Treatment
Landlord	16,983	40,697
Non landlord	65,008	37,391
Total	81,991	78,088



Table 12: Propensity Score Matching: Effect of NREGA on Rural Labor Markets in the dry season

	Landlord DD (1)	Non Landlord DD (2)	Triple Difference (3)
<i>Panel A. Log of Casual Wage</i>			
NREGxNLxpost			0.148** (0.0614)
NREGxpost	-0.0344 (0.0560)	0.0357 (0.0286)	-0.0711 (0.0529)
NLxpost			-0.160*** (0.0486)
Observations	10,015	10,939	20,954
R-squared	0.402	0.597	0.509
<i>Panel B. Public Employment</i>			
NREGxNLxpost			-0.308 (0.649)
NLxpost			-0.736*** (0.238)
NREGxpost	1.169** (0.502)	0.666** (0.294)	0.962** (0.430)
Observations	57,276	58,453	115,504
R-squared	0.050	0.073	0.056
<i>Panel C. Private Employment</i>			
NREGxNLxpost			-2.266 (1.869)
NLxpost			2.054 (1.564)
NREGxpost	0.707 (1.777)	-2.459*** (0.907)	0.456 (1.673)
Observations	59,582	59,232	118,814
R-squared	0.289	0.296	0.291
Year-Quarter FE	YES	YES	YES
District Controls x post	YES	YES	YES
Individual Controls	YES	YES	YES

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* This table shows the impact of NREGA on rural labor markets using propensity score matching. Panel A, Panel B and Panel C report the regression results for log of agricultural wage (deflated), public employment and private employment. Each column presents results from a separate specification and includes only districts matched on five criteria of backwardness identified by the Planning Commission in 2003. All rates are calculated using the 61st and 64th Round of NSSO data which is spread over four sub-rounds in a year. All regressions are estimated for the dry season. All regressions include district controls mentioned in Table (9) and individual controls mentioned in Table (3). In addition, each specification includes year quarter and district fixed effects. Re-weighted sampling weights provided by NSSO are used in these regressions and robust standard errors in parentheses are clustered at the district level.

Table 13: Effect of NREGA on Agricultural Labor Markets in the lean season

	Landlord DD (1)	Non Landlord DD (2)	Triple Difference (3)
<i>Panel A. Log of Agricultural Wage</i>			
NREGxNLxpost			0.197*** (0.0742)
NLxpost			-0.211*** (0.0654)
NREGxpost	-0.109 (0.0696)	0.0557 (0.0374)	-0.122* (0.0628)
Observations	5,414	5,733	11,147
R-squared	0.466	0.661	0.564
<i>Panel B. Self Employment in Agriculture</i>			
NREGxNLxpost			0.397 (0.817)
NLxpost			0.285 (0.675)
NREGxpost	-1.693** (0.711)	0.337 (0.479)	-1.050 (0.680)
Observations	59,582	59,232	118,814
R-squared	0.047	0.034	0.037
<i>Panel C. Private Agricultural Labor</i>			
NREGxNLxpost			0.917 (3.863)
NLxpost			0.0389 (3.367)
NREGxpost	-5.411 (3.974)	-4.805** (1.944)	-3.998 (3.569)
Observations	31,287	35,734	66,869
R-squared	0.177	0.130	0.187
Year-Quarter FE	YES	YES	YES
District Controls x post	YES	YES	YES
Individual Controls	YES	YES	YES

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* This Table shows the impact of NREGA on agricultural labor markets. Panel A, Panel B and Panel C report the regression results for log of agricultural wage (deflated), self-employment and private wage casual employment agriculture. Each column presents results from a separate specification. All rates are calculated using the 61st and 64th Round of NSSO data which is spread over four sub-rounds in a year. All regressions are estimated for the dry season. All regressions include district controls mentioned in Table (2) and individual controls mentioned in Table (3). In addition, each specification includes year quarter and district fixed effects. Re-weighted sampling weights provided by NSSO are used in these regressions and robust standard errors in parentheses are clustered at the district level.

Table 14: Demand and Supply of NREGA Employment

Variable	Landlord (1)	Non-Landord (2)	p-value (3)
Excess Demand	0.26	0.17	0.00
Demand Rate	0.53	0.41	0.00
Participation Rate	0.28	0.24	0.14
<b>Observations</b>	128	157	

*Note:* This Table shows the mean values of excess demand, demand and participation rates calculated for rural areas using the 66st Round of NSSO data which is spread over four sub-rounds in a year. Column (3) presents the p-values of the students t-test of equality of means in columns 1 and 2.

Table 15: Effect of Land Revenue Type on District Level NREGA Demand

	No Controls (1)	District Controls (2)	All Controls (3)
<i>Panel A. Excess Demand</i>			
NL	-0.0852*** (0.0198)	-0.0737*** (0.0223)	-0.0629*** (0.0232)
Observations	285	278	278
R-squared	0.068	0.157	0.169
<i>Panel B. Demand Rate</i>			
NL	-0.125*** (0.0252)	-0.125*** (0.0311)	-0.125*** (0.0322)
Observations	285	278	278
R-squared	0.083	0.174	0.174
<i>Panel C. Participation Rate</i>			
NL	-0.0400 (0.0266)	-0.0509* (0.0308)	-0.0617** (0.0313)
Observations	285	278	278
R-squared	0.008	0.189	0.196
Year-Quarter FE	YES	YES	YES
District Controls	NO	YES	YES
Date of British Land Revenue Control	NO	NO	YES
*** p<0.01, ** p<0.05, * p<0.1			

*Note:* This Table shows results for three panels. Panel A, Panel B and Panel C report the regression results for excess demand for NREGA, demand and participation rate in NREGA. Each column presents results from a separate specification. Demand and participation rates are calculated using data on number of days NREGA work demanded and attained by individuals. Excess demand is calculated as a difference between demand and participation rates. All rates are calculated using the 66st Round of NSSO data which is spread over four sub-rounds in a year. Sampling weights provided by NSSO are used in these regressions and standard errors in parentheses are clustered at the district level.

## A Appendix 1: Labor Market NREGA

### A.1 Derivation of Incentive Compatibility Constraint

$$W = \frac{u(h_p w_p, e)}{i+t} + \frac{tZ}{i+t} \quad (16)$$

where  $Z$ , the fallback position of workers is given by the following

$$Z = \frac{\phi(Ah_s) + rw^g}{i+r+\theta h_p} + \frac{\theta h_p W}{i+r+\theta h_p} \quad (17)$$

These equations can be written in matrix notation as follows.

$$\begin{bmatrix} 1 & -\frac{t}{i+t} \\ -\frac{\theta h_p}{i+r+\theta h_p} & 1 \end{bmatrix} \begin{bmatrix} W \\ Z \end{bmatrix} = \begin{bmatrix} \frac{u(h_p w_p, e)}{i+t} \\ \frac{\phi(Ah_s) + rw^g}{i+r+\theta h_p} \end{bmatrix}$$

Which can be solved using Cramer's rule as follows

$$\begin{aligned} W &= \frac{|A_1|}{|A|} \\ Z &= \frac{|A_2|}{|A|} \\ \text{where } |A| &= \frac{(i+t)(i+r) + i\theta h_p}{(i+t)(i+r+\theta h_p)} \\ |A_1| &= (i+r+\theta h_p)u(h_p w_p, e) + t(i+t)(\phi(Ah_s) + rw^g) \\ |A_2| &= \theta h_p u(h_p w_p, e) + (i+t)(\phi(Ah_s) + rw^g) \end{aligned}$$

Which can be simplified as follows.

$$W = \frac{1}{\Psi} [(i+r+\theta h_p)u(h_p w_p, e) + t(i+t)(\phi(Ah_s) + rw^g)] \quad (18)$$

$$Z = \frac{1}{\Psi} [\theta h_p u(h_p w_p, e) + (i+t)(\phi(Ah_s) + rw^g)] \quad (19)$$

$$\text{where } \Psi = (i+t)(i+r) + i\theta h_p$$

## A.2 Effect of NREGA on Labor Markets

The first order conditions from the maximization problem are as follows.

$$y' e - w_p - \lambda \left[ (i+r)\theta w_p \frac{\partial u}{\partial h_p} + A(i+t)(1-t)(\phi'_{h_s} \frac{\partial \phi}{\partial h_p} + w^g r_{EG} \frac{dr}{dh_p}) \right] = 0 \quad (20)$$

$$y' (h_p(e_{w_p} + e_t \frac{\partial e}{\partial w_p})) - h_p - \lambda \left[ (\phi + r w^g)(2t + i - 1) \frac{dt}{dw_p} + (i+r)(\theta h_p \frac{\partial u}{\partial w_p} + u_e \frac{de}{dw_p}) \right] = 0 \quad (21)$$

$$F^1 = (i+r)u(\theta h_p w_p, e) - (i+t)(\phi(Ah_s) + r w^g)(1-t) = 0 \quad (22)$$

Equation 20 can be re-arranged as follows

$$\lambda = \frac{w_p - y' e}{\left[ (i+r)\theta w_p \frac{\partial u}{\partial h_p} + (i+t)(1-t)(A\phi'_{h_s} \frac{\partial \phi}{\partial h_p} + w^g r_{EG} \frac{dr}{dh_p}) \right]} \quad (23)$$

Substituting  $\lambda$  from equation 23 into equation 21 gives us the following.

$$F^2 = y' (h_p(e_{w_p} + e_t \frac{\partial e}{\partial w_p})) - h_p - \frac{(w_p - y' e) \left[ (\phi + r w^g)(2t + i - 1) \frac{dt}{dw_p} + (i+r)(\theta h_p \frac{\partial u}{\partial w_p} + u_e \frac{de}{dw_p}) \right]}{\left[ (i+r)\theta w_p \frac{\partial u}{\partial h_p} + A(i+t)(1-t)(\phi'_{h_s} \frac{\partial \phi}{\partial h_p} + w^g r_{EG} \frac{dr}{dh_p}) \right]} = 0 \quad (24)$$

Totally differentiating the system of equation 22 and equation 24 for the Jacobian gives us the following.

$$|J| = \begin{vmatrix} F^1_{w_p} & F^1_{h_p} \\ F^2_{w_p} & F^2_{h_p} \end{vmatrix}$$

Then the Jacobian can be evaluated as follows.

$$F^1_{w_p} = (i+r) \left[ (\theta h_p \frac{\partial u}{\partial w_p} + u_e \frac{de}{dw_p}) \right] - (\phi + r w^g)(1-i-2t) \frac{dt}{dw_p} > 0 \quad (25)$$

$$F^1_{h_p} = \theta w_p (i+r) \frac{\partial u}{\partial h_p} + \theta (i+t)(1-t) \left[ A \frac{\partial \phi}{\partial h_p} + \frac{w^g}{N} \frac{\partial r}{\partial h_p} \right] > 0 \quad (26)$$

$$F_{w_p}^2 = y''(h_p(\frac{\partial^2 e}{\partial w^2} + \frac{\partial^2}{\partial w \partial t}) + \frac{\partial t}{\partial w_p}(\frac{\partial^2 e}{\partial t \partial w_p} + \frac{\partial^2}{\partial^2 t})) + P \frac{\partial Q}{\partial w_p} + Q \frac{\partial P}{\partial w_p} > 0 \quad (27)$$

$$F_{h_p}^2 = y''(e_{w_p} + e_t \frac{\partial t}{\partial w_p}) - 1 + P \frac{\partial Q}{\partial h_p} + Q \frac{\partial P}{\partial h_p} < 0 \quad (28)$$

Where

$$P = \frac{w_p - y' e}{[(i+r)\theta w_p \frac{\partial u}{\partial h_p} + (i+t)(1-t)(A\phi'_{h_s} \frac{\partial \phi}{\partial h_p} + w^g r_{EG} \frac{dr}{dh_p})]} < 0$$

$$\frac{\partial P}{\partial w_p} = \frac{D(1 - (y'' e + y' \frac{\partial e}{\partial w})) - (w_p - y' e) \left[ \theta(i+r) \frac{\partial u}{\partial w_p} + A(1-i-2t) \frac{\partial \phi}{\partial h_p} \frac{dt}{dw} \right]}{D^2} > 0 \quad (29)$$

$$\frac{\partial P}{\partial h_p} = \frac{D(-y'' e) - (w_p - y' e) [\theta w_p (i+r) \frac{\partial^2 u}{\partial h_p^2} + A(1-t)(i+t)(\phi''_{h_s} \frac{\partial \phi}{\partial h_p} + \phi_{h_s} \frac{\partial^2 \phi}{\partial h_p^2})]}{D^2} > 0$$

$$Q = \left[ (\phi + r w^g)(2t + i - 1) \frac{dt}{dw_p} + (i+r)(\theta h_p \frac{\partial u}{\partial w_p} + u_e \frac{de}{dw_p}) \right] < 0 \quad (30)$$

$$\frac{\partial Q}{\partial w_p} = (\phi + r w^g) \left[ 2 \left( \frac{\partial t}{\partial w_p} \right)^2 + (2t + i - 1) \frac{d^2 t}{dw_p^2} \right] + \left[ (i+r)(\theta h_p \frac{\partial^2 u}{\partial w_p^2} + u_e \frac{d^2 e}{dw_p^2} + u_e'' \frac{de}{dw_p}) \right] > 0$$

$$\frac{\partial Q}{\partial h_p} = \left[ \theta(i+r) \frac{\partial u}{\partial w_p} + u_e'' \frac{de}{dw} \right] + (2t + i - 1) \frac{\partial t}{\partial w_p} \left[ A \frac{\partial \phi}{\partial h_s} + w^g r_{EG} \frac{\partial r}{\partial h_p} \right] > 0$$

Where  $e_i = \frac{\partial e}{\partial i}$  and  $i = (w_p, t)$ . Assumes linear effort and utility functions say,  $e = (\alpha w + \beta t)$  (with  $\alpha, \beta > 0$ ) and  $u = (\theta h_p w_p - \frac{1}{1-e})$ . This implies that  $e = \frac{\alpha w + \beta(1-\theta)}{1+\beta(1-\theta)}$  and  $y = he$ . Further,  $D = \left[ (i+r)\theta w_p \frac{\partial u}{\partial h_p} + (i+t)(1-t)(A\phi'_{h_s} \frac{\partial \phi}{\partial h_p} + w^g r_{EG} \frac{dr}{dh_p}) \right] > 0$

I make the following assumptions to derive the signs above. First, the sign of  $|F_{w_p}^1| > 0$  depends upon the assumption that that  $(t < \frac{1-i}{2})$ . This imposes a restriction on the termination schedule. For employers to have short-side power for any rate of time preference ( $i$ ). Next, I assume that



$P \frac{\partial Q}{\partial w_p} < Q \frac{\partial P}{\partial w_p}$  for the sign of  $|F_{w_p}^2| > 0$ . This implies the following restrictions on the parameters.

$$\beta > \frac{\alpha - 1}{1 - \theta}$$

Finally, it can be seen from equations 25, 26, 27 and 28 that the  $|J| < 0$ . The signs of partial derivatives used in deriving the Jacobian are given below.

$$\frac{dt}{dw} < 0; \quad \frac{d^2t}{dw_p^2} > 0; \quad \frac{\partial \phi}{\partial h_p} > 0; \quad \frac{dr}{d(EG)} > 0; \quad \frac{\partial e}{\partial w} > 0; \quad \frac{\partial e}{\partial t} > 0$$

### A.3 Proof of Proposition 1

Proposition 1 states that  $\frac{\partial w_p^*}{\partial L} > 0$  and  $\frac{\partial e^*}{\partial L} < 0$  where  $e^*$  is the effort exerted by workers in private employment. I first proof the first part of the proposition using the Implicit Function Theorem. We have the following.

$$\begin{pmatrix} F_{w_p}^1 & F_{h_p}^1 \\ F_{w_p}^2 & F_{h_p}^2 \end{pmatrix} \begin{pmatrix} \frac{\partial w_p}{\partial L} \\ \frac{\partial h_p}{\partial L} \end{pmatrix} = \begin{pmatrix} \frac{\partial F^1}{\partial L} \\ \frac{\partial F^2}{\partial L} \end{pmatrix}. \quad (31)$$

Where

$$F_L^1 = \frac{\partial r}{\partial(EG)} \frac{\partial(EG)}{\partial L} [u + (i + t)(1 - t)] - (1 - i - 2t)(\phi + rw^g) \frac{\partial t}{\partial L} + (i + r)u' \frac{h_p w_p}{N} > 0 \quad (32)$$

Since  $\frac{\partial r}{\partial(EG)} \frac{\partial(EG)}{\partial L} > 0$  as can be seen from equation 1 and  $\frac{\partial t}{\partial L} = -(1 - e)/N < 0$  from equation 3 and using the constraint on  $t$  defined above ( $t < \frac{1-i}{2}$ ), then  $F_L^1 > 0$ .

Further,

$$F_L^2 = y'' \left( h \frac{\partial^2 e}{\partial h \partial L} \right) + P \frac{\partial Q}{\partial L} + Q \frac{\partial P}{\partial L} > 0 \quad (33)$$

Since  $P < 0$ ;  $\frac{\partial Q}{\partial L} < 0$  and  $Q < 0$ ;  $\frac{\partial P}{\partial L} < 0$  and using the effort and utility functions described

above. Therefore,

$$\frac{\partial w_p^*}{\partial L} = \frac{|J_1|}{|J|} > 0$$

where

$$|J_1| = \begin{vmatrix} F_L^1 & F_{h_p}^1 \\ F_L^2 & F_{h_p}^2 \end{vmatrix} < 0 \quad (34)$$

We now turn to the second part of the proof namely,  $\frac{\partial e^*}{\partial L} < 0$ . Consider the acceptability condition given by equation 22 and assuming it is satisfied as an equality.

$$F^1 = (i + r)u(\theta h_p w_p, e) - (i + t)(\phi(Ah_s) + rw^g)(1 - t) = 0$$

So I can use the Implicit Function theorem as follows.

$$\frac{\partial e^*}{\partial L} = -\frac{F_L^1}{F_e^{1*}} \quad (35)$$

Where from the first part of the proof I found that  $F_L^1 > 0$  and

$$F_e^{1*} = (i + r)\frac{\partial u}{\partial e} - (\phi + rw^g)(1 - i - 2t)\frac{\partial t}{\partial e} \quad (36)$$

Where  $\frac{\partial u}{\partial e} < 0$  since effort causes workers dis-utility and as effort increases. Further, and  $\frac{\partial t}{\partial e} < 0$  since the probability of termination decreases with increase in effort. Also,  $(1 - i - 2t) > 0$ . Which leads to  $F_e^{1*} > 0$  if the above-mentioned effort and utility functions are used and the following condition holds.

$$(1 + \theta)(1 - i - 2t)(\phi + rw^g) > \frac{(i + r)}{(1 - e)^2}$$

This implies that equation 35 is negative,  $\frac{\partial e^*}{\partial L} < 0$ .

#### A.4 Proof of Proposition 2

Proposition 2 states that  $\frac{\partial h_s^*}{\partial L} > 0$  and  $\frac{\partial h_p^*}{\partial L} < 0$ . Where  $h_s^*$  is the proportion of labor time spent in self employment at profit maximizing levels of wage and private employment. Using the Implicit

Function Theorem, I can test the first part of this proposition.

$$\frac{\partial h_s^*}{\partial L} = -\frac{F_L^1}{F_{h_s}^{1*}} \quad (37)$$

Recall from the first proof of proposition 1, I have  $F_L^1 > 0$ . Further,  $F_{h_s}^{1*} < 0$  as shown below.

$$F_{h_s}^{1*} = -(\phi + rw^g)(1-t)(i+t)\left(\frac{\partial \phi}{\partial h_s}\right)$$

. Since  $\frac{\partial \phi}{\partial h} > 0$  the above equation is negative. Therefore, if  $F_L^1 > 0$  and  $F_{h_s}^{1*} < 0$ , then from equation 37, I can see that  $\frac{\partial h_s^*}{\partial L} > 0$ . As the number of landlords rise, self-employment in agriculture goes up.

Now turning to the second part of the proposition,  $\frac{\partial h_p^*}{\partial L} < 0$ .

$$\frac{\partial h_p^*}{\partial L} = \frac{\partial h_p^*}{\partial h_s} \frac{\partial h_s}{\partial L} \quad (38)$$

Recall from equation 2,  $h_p = \frac{(\Gamma - h_s - r)}{\theta}$ , therefore  $\frac{\partial h_p}{\partial h_s} < 0$  and  $\frac{\partial h_s}{\partial L} > 0$  as shown above. This implies that  $\frac{\partial h_p^*}{\partial L} < 0$ . This completes the proof.

## A.5 Proof of Proposition 3

Proposition 3 states *If  $L$  is large, then an increase in  $k$  increase  $w_p^*$  and reduces  $h_p^*$ . Alternatively, if  $L$  is small then the effect of an increase in  $k$  on  $w_p^*$  and  $h_p^*$  is ambiguous.*

Consider the following relationship between  $k, w_p^*$  using the Implicit Function Theorem.

$$\frac{\partial w_p^*}{\partial k} = \frac{\partial w_p^*}{\partial L} \frac{\partial L}{\partial k}$$

$$\frac{\partial L}{\partial k} = -\frac{F_k^1}{F_L^1}$$

Recall from equation 32 proposition 1 that  $F_L^1 > 0$  and from equation 34,  $\frac{\partial w_p^*}{\partial L} > 0$ . Therefore the sign of  $\frac{\partial w_p^*}{\partial k}$  depends upon the sign of  $F_k^1$  which is given below.

$$F_k^1 = \frac{\partial(EG)}{\partial k} \frac{(u - w^g(i+t)(1-t))}{N} \quad (39)$$

It can be seen that equation 39 would be negative if the following inequality holds.

$$u < w^g(1-t)(i+t) \quad (40)$$

Since  $\frac{\partial(EG)}{\partial k} > 0$ . This inequality can be expanded as follows.

$$\begin{aligned} (i+t)(1-t) &> \frac{u}{w^g} \\ \text{Since } 2t+i &< 1 \\ \implies (i+t) &< (1-t) \\ \therefore (1-t)^2 &> \frac{u}{w^g} \\ t &< 1 - \sqrt{\frac{u}{w^g}} \\ \text{Recall } t &= (1-e)(1-\theta) \\ 1-\theta &< \frac{1}{1-e} \left[ 1 - \sqrt{\frac{u}{w^g}} \right] \\ \theta &> \left[ 1 - \frac{1}{1-e} \left( 1 - \sqrt{\frac{u}{w^g}} \right) \right] \\ \text{Finally } \theta &= L/N \\ \therefore L_{critical} &> N \left[ 1 - \frac{1}{1-e} \left( 1 - \sqrt{\frac{u}{w^g}} \right) \right] \end{aligned} \quad (41)$$

The above equation gives critical values for  $L$ . If the inequality in equation 41 is satisfied then, I find that  $\frac{\partial w_p^*}{\partial k} > 0$ . Since  $[(i+t)(1-t) > \frac{u}{w^g}]$  and  $(i+t) > (1-t)$ , replacing  $(i+t)$  with  $(1-t)$  should not change the inequality. This is because, if the product of two positive numbers is greater than another positive number, the product of two bigger numbers would continue to be greater than that number. Alternatively, if  $(L < L_{critical})$  then the sign of  $F_k^1$  cannot be determined without imposing stringent constraints on the parameters.

We next turn to the impact of change in  $k$  on  $h_p$  in light of the critical values of  $L$  described above.

$$\frac{\partial h_p^*}{\partial k} = \frac{\partial h_p^*}{\partial L} \frac{\partial L}{\partial k}$$

$$\text{where } \frac{\partial L}{\partial k} = -\frac{F_k^1}{F_L^1}$$

Recall from equation 32 proposition 1 that  $F_L^1 > 0$  and from equation 38,  $\frac{\partial h_p^*}{\partial L} < 0$ . If inequality in equation 40 holds, then I find that  $\frac{\partial h_p^*}{\partial k} < 0$ . This shows that if  $L$  is large enough to ensure that

( $L \geq L_{critical}$ ), then an increase in  $k$  decreases private employment ( $h_p^*$ ) ■

## B Appendix 2: Creation of Variables

### B.1 District Boundaries and Date of Conquest

In their data appendix, [Banerjee and Iyer \(2005\)](#) provide detailed information on the date of conquest by the British and historical land revenue system instituted in these districts. However, over time these district boundaries were changed significantly. The geographical boundaries of districts under colonial rule are significantly different from those today as districts have been divided, renamed, or merged with other districts. [Kumar and Somanathan \(2009\)](#) document the changes in district boundaries from 1961 to 2001. Using these changes in district boundaries over time, I create a panel of 289 rural districts with data on land revenue system. Districts for which data was ambiguous or unclear was verified using sources like government websites and if the ambiguity could not be resolved, then those districts were dropped from the sample. Further, data on the date of conquest by the British is an important control as [Banerjee and Iyer \(2005\)](#) show that regions that fell under British rule before 1820 were highly fertile and witnessed greater exploitation and plunder. I also include the date of British land revenue control as a control in my estimations.

### B.2 Productivity of workers

Data on productivity per worker is constructed using data on output for nine major crops and their prices published by the Ministry of Agriculture. These crops include Bajra, Gram, Jowar, Maize, Ragi, Rice, Wheat, Arhar and Barley for 2004-2005.<sup>57</sup> In addition, the prices are taken from the Ministry of Agriculture report on prices.<sup>58</sup> If data on price is missing for any crop is missing for any particular district, I use the state level average as the price for the crop in that district.

### B.3 Rainfall

Data on annual rainfall comes from the The rainfall data set, Terrestrial Air Temperature and Precipitation: Monthly and Annual Time Series (1970-2010) prepared by the Center for Climatic Research at the University of Delaware. I create long term means using quarterly data from 1970 - 2010 and calculate the normalized quarterly deviation from this long term mean.

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<sup>57</sup>Can be accessed here <http://aps.dac.gov.in/APY/Public.Report1.aspx>

<sup>58</sup>Can be accessed here <http://eands.dacnet.nic.in/publications.htm>.

## **B.4 Poverty Headcount Ratio**

Data on poverty headcount-ratio comes from the Consumption Expenditure Survey of the 61st Round of NSSO data. I use state level poverty lines using the monthly per-capita expenditure (MPCE) reported in the data, I compute the percentage of people living below the state level poverty line for every district using the Uniform Recall Period (URP).

## **B.5 Left Wing Movements**

As of 2000, around 55 districts of India were effected by these movements so this paper also including a dummy for these districts in my estimation. Data on districts facing left-wing insurgency before 2005 is taken from the Report of the Inter-Ministry Task Group on Redressing Growing Regional Imbalances prepared by the Planning Commission of India in 2005. Finally, poverty ratios are computed using the 61th Consumption Expenditure Round of NSSO data.

## **C Appendix 3: Impact of NREGA on Agricultural Labor Market in the Rainy Season**

The results in Table 16 shows that NREGA has no impact during the peak or rainy season of agriculture in landlord and non-landlord districts. These results suggest the following. First, there is no impact of NREGA in the agricultural peak season as NREGA is primarily implemented in the dry season. Second, the fact that there is no impact of NREGA during this season further confirms that the main results of the paper indeed estimate the causal impact of NREGA.

Table 16: Effect of NREGA on Agricultural Labor Markets in the rainy season

	Landlord DD (1)	Non Landlord DD (2)	Triple Difference (3)
<i>Panel A. Log of Agricultural Wage</i>			
NREGxNLxpost			0.0795 (0.0689)
NLxpost			-0.0740 (0.0546)
NREGxpost	-0.00358 (0.0653)	0.0480 (0.0463)	-0.0151 (0.0594)
Observations	5,790	5,785	11,575
R-squared	0.443	0.627	0.537
<i>Panel B. Self Employment in Agriculture</i>			
NREGxNLxpost			0.262 (0.827)
NREGxpost	-1.266 (0.841)	-0.314 (0.487)	-0.678 (0.679)
NLxpost			-0.200 (0.604)
Observations	60,389	59,282	119,671
R-squared	0.049	0.052	0.049
<i>Panel C. Private Agricultural Labor</i>			
NREGxNLxpost			0.283 (3.197)
NLxpost			0.103 (2.727)
NREGxpost	0.652 (2.899)	0.199 (1.914)	0.0798 (2.783)
Observations	33,610	36,813	70,243
R-squared	0.175	0.124	0.182
Year-Quarter FE	YES	YES	YES
District Controls x post	YES	YES	YES
Individual Controls	YES	YES	YES

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Note:* This Table shows the impact of NREGA on agricultural labor markets. Panel A, Panel B and Panel C report the regression results for log of agricultural wage (deflated), self-employment and private wage casual employment agriculture. Each column presents results from a separate specification. All rates are calculated using the 61st and 64th Round of NSSO data which is spread over four sub-rounds in a year. All regressions are estimated for the rainy season. All regressions include district controls mentioned in Table (2) and individual controls mentioned in Table (3). In addition, each specification includes year quarter and district fixed effects. Re-weighted sampling weights provided by NSSO are used in these regressions and robust standard errors in parentheses are clustered at the district level.