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Payment delay in workfare programmes and household welfare: Theory and some evidence from India

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Abstract

Using the lens of a life cycle model, we argue that an administrative failure of a wage payment delay in a workfare programme could adversely affect the welfare of the poor through two channels. First, it imposes an implicit consumption tax on the household. Second, it changes the status of labour from a "cash" to a credit" good and encourages workers with negative net worth to work harder to clear off the debt. The loss of welfare persists even when the worker has outside employment options. The model's prediction accords well with India's flagship National Rural Employment Guarantee Act (MGNREGA), where payment delay to workers participating in the programme has been endemic. Our empirical evidence suggests that, contrary to conventional wisdom, worker participation in the MGNREGA programme is positively associated with a wage payment delay. However, such increased worker participation instead of signalling success of the programme points to a deeper problem of this workfare programme because of the welfare loss suffered by asset-poor households.

KEYWORDS
credit good, India, labour supply, public works programme, wage payment delay

JEL CLASSIFICATION
H53, O11, J43

1 | INTRODUCTION

Anti-poverty programmes in developing countries are typically in the form of cash transfers or workfare programmes (Ravallion, 1999). There has been considerable debate on the efficacy of cash transfer versus workfare programmes in reaching the poor (Banerjee et al., 2017; Ravallion, 2018). One oft-cited advantage of workfare programmes is that in the absence of a sophisticated administrative machinery to identify the poor, these programmes tend to be more effective in reaching out to the intended beneficiaries (Besley & Coate, 1992; Ravallion, 1991). This is because the self-targeting nature of these programmes prioritizes those who are more in need of government relief from those less in need. While a growing literature questions the effectiveness of such programmes to smooth poor households' consumption and provide adequate food security (Beegle et al., 2017), there is limited understanding of the behavioural and welfare implications of workfare programmes when there are widespread administrative failures in these programmes.

One such administrative failure is the delay in processing the payment to beneficiaries. As Subbarao et al. (2013) note in their comprehensive review of public works programmes, "*public works programmes hire hundreds or thousands of workers in different locations, and each must be paid several times over the course of the programme. The result* can *be a transaction-heavy operation with a high overhead cost, prone to inefficiencies and delays*" (p. 126). At the same time, getting payments to beneficiaries on time is crucial to the income smoothing objective of a public works programme. In this paper, we examine the labour supply response of beneficiaries in response to such payment delay and the consequent welfare implications.

The empirical context of the paper is the Mahatma Gandhi National Rural Employment Guarantee Act (NREGA hereafter) of the Indian government, the world's largest workfare programme. The NREGA programme guarantees 100 days of unskilled work to the poor and provides wages at a government-stipulated rate. In the context of India, NREGA has received increasing attention in recent years as an anti-poverty programme (Lal et al., 2010; Subbarao et al., 2013). The NREGA, unlike other public works programmes in the global south, has generated tremendous interest among academics. Lately, there has been an exponential rise in studies examining the welfare effects of the programme. Studies largely highlight the significant welfare gains of NREGA participation. It has been shown that the programme has a huge potential to increase consumption and to reduce poverty if rigorously implemented (Deininger & Liu, 2019; Garcia, 2022; Jha et al., 2012; Klonner & Oldiges, 2022). That way, it acts as a safety net for beneficiaries against several adverse effects of seasonal drops in employment and income (Imbert & Papp, 2015; Klonner & Oldiges, 2022; Ravi & Engler, 2015). This was evident during the Covid-19 pandemic, when the programme effectively shielded people against job losses and in aiding recovery from a negative economic shock (Afridi et al., 2022). MGNREGA as a safety net is also exemplified by the observation that it discourages short-term distress migration (Das, 2015; Imbert & Papp, 2019). A number of studies based on field survey findings also emphasized the importance of income earned through MGNREGA-related activities in addressing the issues of hunger, coping with illness, sending children to school and avoiding distress-driven migration (Drèze & Khera, 2009). Various studies have also shown that MGNREGA participation has helped in improving food intake and nutrition, and health status (Narayanan & Gerber, 2017). NREGA has also been found to reduce female and overall infant mortality (Banerjee & Maharaj, 2020) and influence investments in human capital (Foster & Gehrke, 2017).

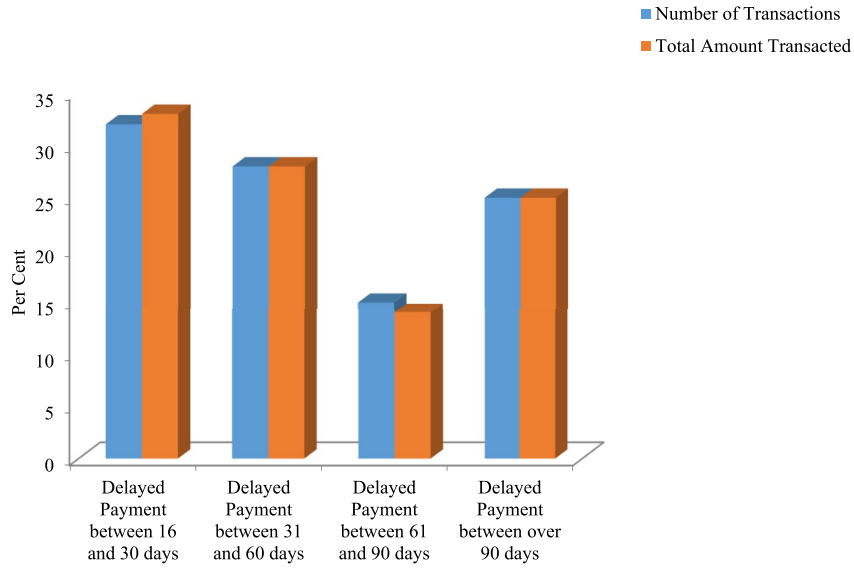

FIGURE 1 Wage payment delays, all India 2016–17. *Source*: Authors' construction, using data from NREGA.nic.in. [Colour figure can be viewed at wileyonlinelibrary.com]

Studies have also drawn attention to some important issues related to MGNREGA implementation. Kumar et al. (2021) show that many poor households have remained outside the programme and that there was a pronounced capture of the programme by elites. In a recent study based on ethnographic observations and stakeholders' interviews, Natesan and Marathe (2021) examine the issues and challenges in the implementation of MGNREGA in Tamil Nadu. The study found that labour productivity measures are not adequate enough to protect the interest of the beneficiaries of the scheme. Based on district-level data, Kumar (2022) draws attention to the importance of effective last-mile bureaucracy in delivering substantial welfare outcomes. However, while much of the large literature on NREGA has been on the welfare effects of the programme itself, very little attention is devoted to understanding the welfare effects of poor implementation of the NREGA programme. In this paper, we focus on a key implementation failure - the delay in the payment of wages to NREGA beneficiaries.

A key institutional bottleneck in NREGA has been the significant delay in processing wage payments to rural household workers. The Act mandates that every worker must receive their wages within 15 days of completion of the public work project (Government of India, 2013). However, in practice, workers face formidable delays in payment of wages ranging from 16 to more than 90 days. Figure 1 provides a snapshot of the payment delay in this programme for the financial year 2016–17. We also find considerable inter-state variation in payment delay, with more than 80% of the transactions delayed in Nagaland and Arunachal Pradesh and more than half of the transactions in West Bengal, Tamil Nadu, Meghalaya, and Jammu and Kashmir (see Table A1 in appendix II). The delays were considerably shorter in the states of Rajasthan, Telengana, Manipur, Kerala, and Jharkand. Further, we calculate the probability of wage payment delay, which is the ratio of total delayed payments to total NREGA payments. We find that about 56% of NREGA payments are delayed, with the probability of delay being over 60% in 40% of the states. These findings suggest that the delay in receiving wage payments is pervasive throughout the country.[1]

[1]Wage payment delay is not the only administrative failure of the NREGA programme. Widespread rationing of NREGA work is also common at the village level, leading to a "discouraged worker" effect (Himanshu et al., 2015).

The massive delays in wage payment to workers is also corroborated by existing studies. The 2013 Public Evaluation of Entitlement Programmes Survey among MGNREGA workers shows that around 66% of the workers waited over 15 days for wage payments. In a comprehensive study covering more than 9 million NREGA wage transactions for 2016–17 in 3446 randomly sampled panchayats across 10 states, Narayanan et al. (2018) found that only 32% of the payments were made on time. It was shown that the delays are more acute during the third and fourth quarter of each financial year due to exhaustion of NREGA budgets (LibTech India, 2020). These payment delays, according to studies, have considerably diminished the interest in MGNREGA jobs (Khera, 2010).

In this study, we examine the welfare effect of the delay in wage payment in the NREGA programme. Using a stationary life cycle model, we demonstrate that a wage payment delay in the NREGA programme changes the status of a household's labour from a 'cash good' to a 'credit good' as the payment is received after a few periods of work. The household can use labour as an asset to smooth consumption. A payment delay impacts the household's labour supply through two channels. First, it reduces the household's present value of labour income flows and thus lowers the value of labour as an asset. In the short run, the household members, therefore, participate more in the programme to offset this fall in human net worth to pay off the existing debt. Second, in the long run, the household can turn its status from debtor to creditor and acquire enough wealth to finance its optimal flow of consumption which means the household works less in NREGA after attaining the creditor status. The findings of our paper go against the conventional wisdom on the endemic wage payment delays in NREGA, which argues that it may lead to a "discouraged worker" effect (see Narayanan et al., 2017).

In terms of welfare, our life cycle model predicts that in the presence of payment delay, the household worker suffers a steep welfare loss in the short run as well as in the long run due to a sharp rise in his labour supply, and an implicit consumption tax resulting from the delay. The welfare assessment of employment guarantee to the poor in the presence of wage payment delay is new to the growing literature on workfare programmes. In this respect, our study is novel.

The positive relationship between NREGA wage payment lag and participation in NREGA is a robust theoretical prediction that endures when the household supplies labour at an intensive margin as well as when the household has an outside employment option. When the worker has an outside non-NREGA employment opportunity, the wage payment delay in NREGA causes two opposing effects on households' labour supply to the NREGA sector. The substitution effect tilts labour more to the non-NREGA sector while the adverse income effect increases labour supply in both sectors. For plausible parameter values, the income effect swamps the substitution effect. Despite the presence of an outside employment option, an indebted household worker may still increase participation in NREGA.

A key counter-intuitive prediction of our theoretical model is that a wage payment delay in a public work programme could induce poor households to become more tied to the programme. We provide empirical evidence in support of this prediction using a rich primary individual-level data that we have collected on NREGA participation and wage payment delay in the states of Sikkim and Tripura. We find a strong positive relationship between wage payment delay and NREGA participation, controlling for other factors that may determine NREGA participation, and possible endogeneity. We check the external validity of our results by examining the relationship between NREGA participation and wage payment delay by using the all India administrative data at the district level for 2014/15 to 2017/18. We find that our district level results complement our individual level results.

The paper makes two contributions to the literature. First, it contributes to the literature on the efficacy of workfare programmes using the lens of a simple life cycle model that the welfare gains of workfare programmes may be substantially reduced if there are administrative failures of the programme. Second, it shows in the context of the world's largest public works programme, NREGA,

that higher worker participation in the programme may not be seen as an indicator of the programme's success when there is persistent wage payment delay. This suggests that the usual measure of success that has been used in impact evaluation studies (such as Imbert & Papp, 2015)—worker participation in NREGA—needs to be taken with some caution.

The rest of the paper is organized as follows. In Section 2, we give a brief historical sketch of the origin of wage payment delay in NREGA. In Section 3, we motivate our theory and present an intuitive explanation of the key predictions. In Section 4, we lay out our baseline model. In Section 5, we present two extensions of our baseline model. Section 6 provides empirical evidence of the key theoretical prediction of our model regarding worker's labour supply response to payment delay. Section 7 concludes.

2 | EVOLUTION OF WAGE PAYMENT DELAY IN NREGA

NREGA is India's main welfare programme for the rural poor and the largest workfare programme in the world, covering 11% of the world's population (Muralidharan et al., 2016). The programme started in the financial year 2005–06 and was rolled out in phases. Initially restricted to the 200 poorest districts of India in 2006, it was extended to 130 more districts in 2007 and to all districts in 2008. In its 2020–21 budget, the Government of India allocated roughly USD 8.22 billion, or 2.02% of its annual budget, to NREGA. The programme has uneven success across the country (Desai et al., 2015).

Since there is no eligibility requirement for the NREGA programme because of the manual nature of the work involved, the poor participates more in this programme (Besley & Coate, 1992). Participating households obtain job cards, which are issued by the local Gram Panchayat (GP, or village office). Once issued a job card, workers can apply for jobs at will at the local GP or block office, the lowest and next lowest units in the administrative hierarchy. Officials are legally obligated to provide work on projects within 5 km of the worker's home. The projects vary greatly, though road construction and irrigation earthworks predominate. Households work in NREGA projects at stipulated wages set at the state level. The supply of labour from the household for NREGA projects occurs mostly in the lean (dry) season, when alternative private sector casual jobs are not available, while it tails off in the peak (rainy) season (Imbert & Papp, 2015).[2] The administration of the projects is run by the key officials of the GP, who could be the elected Sarpanch (or village leaders), the appointed Panchayat secretaries, or an independent set of functionaries.

In the first 2 years of the programme, payments to workers were often made in cash in several states in India. Under the system of cash payments, wages were paid by the same agency that was responsible for implementing the NREGA (that is, the GP), leading to the embezzlement of funds, with corrupt officials able to inflate muster roll entries and retain the funds that were supposed to be paid to workers (Khera, 2010). However, in response to widespread media coverage of corruption in NREGA, in 2008, the Government of India instructed state governments to move to a system of wage payments through bank or post office accounts set up for workers (Adhikari & Bhatia, 2010). The immediate rationale for the shift to payments through banks and post offices was to make sure that an independent financial institution is responsible for payments to workers without any outside interference.

The processing of payment of wages is initiated when the NREGA work is completed and physically verified, at which point a digital Fund Transfer Order (FTO) is generated (Narayanan et al., 2019). The FTO is approved at the local level, and required two digital signatures by block/panchayat officials. The FTO is subsequently approved by the central government, who provides the

[2]According to the 2007–08 National Sample Survey of the Government of India, rural adults spend on average 1.5 per cent of their time on public works during the lean season and less than 0.5 per cent of their time during the peak season.

instruction to payment intermediaries to transfer payments to workers' accounts. Since 2015, wages are paid directly from the central government to the workers' bank accounts through the National Electronic Financial Management System known as N-eFMS (Dhorajiwala, 2018).

The delay in wage payments occurs at two stages of the payment approval and disbursement process. The delay in the first stage occurs due to the time it takes for the two digital signatures for FTOs to be approved by local level officials (Narayanan et al., 2019). The delay in the second stage occurs at the central government level, in the signing of pay orders by the Ministry of Rural Development and crediting of the money into beneficiaries' bank accounts by the payment agencies (*ibid*).[3] According to Narayanan et al. (2019), Stage 2 delays alone exceeded 50 days.

3 | WHY IS WAGE PAYMENT DELAY LIKELY TO INCREASE LABOUR SUPPLY? A BASIC INTUITION

A longer payment lag by turning labour into a credit good lowers the net worth of the household. To see it clearly in terms of a simple example, think of a household with Rs 1000 of debt. Its only earning option is to work at a NREGA-fixed wage of Rs 25 per hour. In the absence of any payment delay, the household works 40 hours to clear its debt. If there is a one-period payment lag and the one-period interest rate is 10%, the present value of the wage declines to Rs 22.72 which we call the effective wage. The household must then work 44 hours to pay off its debt of Rs 1000. The longer the payment lag the harder the household needs to work to clear off the debt burden. If the household is not required to repay all the debt soon, it can mix leisure with work depending on the relative strength of income and substitution effects.

This heuristic argument assumes that labour supply is divisible, and leisure is a normal good. In other words, the labour is supplied at an intensive margin. However, the same argument holds if the household supplies labour at an extensive margin. If the household must work a fixed number of hours to get paid, then the household will respond to payment delay by sending more members to NREGA to recoup the loss of the decline in effective wage.

In the presence of an outside employment option, a substitution effect will be at work to induce worker to switch from NREGA to the non-NREGA sector subject to no payment delay but the adverse income effect will promote labour supply in both sectors. If the income effect dominates, our key result still holds.

In the following sections, we formalise these intuitions using a life cycle model.

4 | THE MODEL

The model is a simple extension of the multi-period model of Blundell and Macurdy (1999). Consider a stationary rural economy in which the household receives utility from consumption, c_t^i and suffers disutility from work, l_t^i supplied to a workfare programme which we call NREGA hereafter. In this baseline model, we assume that, besides NREGA, there is no private labour market option available to the household.[4] Let the instantaneous utility function be quasi-linear: $\ln(c_t^i - \bar{c}) - Al_t^i$, where $\bar{c}$ is

[3]In a recent study, Misra (2022) finds that 71 per cent of respondents report a delay of more than two weeks in receiving their NREGA wages, which suggests that payment delays have remained persistent over time.

[4]We relax this assumption in the next section.

subsistence consumption.[5] There is a k period delay in the wage payment for the NREGA service that the household offers at date t. This makes labour a 'credit good'. If $k = 1$, then there is no delay indicating that labour is a 'cash good'. At date t, b_t^i is the amount of debt the household has accumulated from the previous period, which it pays back at a fixed interest rate r, and b_{t+1}^i is the new borrowing.[6] If b_t^i is negative, the household is a net creditor at date t. We assume that the household's subjective discount factor β is $1/(1+r)$. We rule out the possibility that the household can play a Ponzi game of borrowing indefinitely to repay outstanding debt.[7] We also rule out the possibility of the household defaulting on its loan. If the household member defaults, all potential lenders shun him, and he loses access to the credit market. Given the deterministic nature of our model, we assume that the length of the payment delay (k) is known to the household. We assume that this delay is systemic and predictable. In practice, the delay is also not predictable thus causing uncertainty in wage payment. We abstract from such wage payment uncertainty and focus on a predictable payment lag.[8]

Since NREGA wage payment is credited to the household's account, in principle all households have access to the credit market to borrow or lend at an agreed upon interest rate r. The *ith* household chooses the sequence $\{c_t^i\}$ and $\{l_t^i\}$ that solves the following maximization problem:

$$Max \sum_{t=0}^{\infty} \beta^t \left[\ln\left(c_t^i - \bar{c}\right) - Al_t^i\right] \tag{1}$$

$$\text{s.t } c_t^i + b_t^i(1+r) = wl_{t-k+1}^i + b_{t+1}^i \tag{2}$$

$$c_t^i \geq \bar{c}, \bar{l} \geq l_t^i \geq 0, b_o^i > 0$$

where $\bar{l}$ is the the upper bound of the labour supply. Given the surplus labour feature of the rural economy of India, the assumption of an interior solution for labour supply is not unreasonable. The consumption and labour supply functions are given by the following proposition.[9]

Proposition 1. *In an interior solution, the optimal consumption and labour supply, when the payment lag is k, are given by:*

$$\mathrm{c_t^i}(k) = \left[\bar{\mathrm{c}} + \mathrm{A}^{-1}\beta^{\mathrm{k}-1}\mathrm{w}\right] \tag{3}$$

[5]We assume that labour is supplied at an extensive margin, which means that l_t^i is the number of household members participating in the NREGA programme supplying a fixed number of work hours. Higher household participation takes household members away from home production, which lowers the household's direct utility. This explains why labour appears with a negative sign in the direct utility function. Such a quasi-linear utility function can be microfounded by using the indivisible labour argument as in Hansen (1985). A similar utility function without subsistence consumption is used by Kollmann (2002). We also present the case of labour supply at an intensive margin in Section 4.

[6]For simplicity, we assume that the borrowing and lending rates are the same. We have made this assumption to focus on the effect of payment delay on labour market participation. Introduction of an imperfect credit market will give rise to complicated interlinkage between credit and labour markets which is interesting but could be a subject matter for future research.

[7]Formally, a no Ponzi game condition means that $Lim_{T\to\infty} \frac{b_T^i}{(1+r)^T} = 0$. This condition enables us to get a stationary labour supply function presented in Appendix I.

[8]Basu and Ghosh (2001) analyse the effect of wage income uncertainty on labour supply.

[9]We restrict the parameter space such that an interior solution is ensured. We also set the NREGA wage w at a sufficiently high level which ensures that the household can meet its subsistence consumption. This is not an unreasonable assumption since MGNREGA wage is administered by the government to ensure minimum wage.

$$l_t^i(k) = \frac{\bar{c}}{(1-\beta)}\frac{\beta\left(\beta^{-k}-1\right)}{w} + \frac{1-\beta^k}{(1-\beta)A} + \frac{b_t^i\left(\beta^{-k}-1\right)}{w} \tag{4}$$

where $c_t^i(k)$ and $l_t^i(k)$ are consumption and labour supply at date t, respectively. The proof of this proposition is relegated to the Appendix AI. A few clarifications are in order. Notice that by construction, the household's consumption is stationary, and time invariant. It depends only on the fixed payment lag k, not time. Due to the assumption of a quasi-linear utility function, consumption in Equation (3) is independent of the contemporaneous stock of debt, b_t^i. The labour supply in Equation (4), on the other hand, depends on the contemporaneous debt that the household inherits.

4.1 | Effect of a payment delay on consumption and labour supply

It immediately follows from Equation (4) that a deferred wage payment (higher k) unambiguously lowers consumption. A payment delay acts as a consumption tax on the household. Note that the labour supply in Equation (4), $l_t^i(k)$ is rising in k.[10]

Proposition 2. *If the contemporaneous $b_t^i > 0$, a household participates more in the NREGA programme in response to a longer payment delay.*

To see the underlying intuition, note that given the payment lag k, the present value of labour income from date t onward is given by:

$$\frac{wl_t^i(k)}{(1+r)^{k-1}}\left[1 + \frac{1}{(1+r)^k} + \frac{1}{(1+r)^{2k}} + \frac{1}{(1+r)^{3k}} + \ldots\infty\right] \tag{5}$$

A longer payment lag (k) means that the present value of the wage income flow is lower. If the worker has an outstanding debt b_t^i to repay, he or she has to exert greater work effort to clear debts.

It can be seen that the permanent income hypothesis is driving the key results here. The permanent income hypothesis dictates that a household's current consumption cannot exceed the present value of its lifetime income (which actually determines its permanent income). The NREGA household's income arises only from labour. A payment delay lowers its permanent income because the present value of wage income falls as seen in (5). An adverse wealth effect makes the household work more to recoup the loss.[11]

4.2 | Dynamics of debt and labour supply

Given that the household starts off with an initial stock of debt, a wage payment delay gives the household an opportunity to turn labour into an asset. This happens because labour is a credit good.

[10]To see it clearly note that $\frac{\partial l_t^i(k)}{\partial k} = -ln\,\beta\left[\frac{b_t^i}{w}\beta^{-k} + \frac{\bar{c}}{w(1-\beta)}\beta^{1-k} + \frac{\beta^k}{(1-\beta)A}\right] > 0$.

[11]Our model has no borrowing constraint. Introducing a borrowing constraint such as at date t (where is the credit limit) will complicate the loan Euler equation as follows: where MU denotes marginal utility. If the borrowing constraint binds, it means that marginal utility from borrowing exceeds the discounted next period marginal loan servicing cost. In other words, the household will be better off if the credit limit is relaxed. The bottom-line is that in addition to a NREGA payment delay, a binding borrowing constraint makes the household further worse off by depressing his consumption even more. In our paper, we do not bring in such borrowing constraint because our focus is exclusively on payment delay.

The household member by supplying labour today can ensure a future payment to clear its debts. The evolution of debt can be summarized by plugging Equations (3) and (4) into the flow budget (Equation (2)) to get:

$$b^i_{t+1} = \beta^{-1} b^i_t + \left(1 - \beta^{-k}\right) b^i_{t+1-k} + \left[\frac{\bar{c}\left(1-\beta^{1-k}\right)}{(1-\beta)} - \frac{w}{A}\left(\frac{1-\beta^{k-1}}{1-\beta}\right)\right] \tag{6}$$

When there is no payment delay ($k = 1$), the debt is stationary, $b^i_{t+1} = b^i_t$ and indeterminate.[12] Based on Equation (4), the labour supply is given by,

$$wl^i = \bar{c} + rb^i \tag{6a}$$

Since labour supply is bounded, there is an upper bound on the initial debt. Every period the household works just enough to pay the interest on this existing debt and finance subsistence consumption. The labour supply thus responds positively to the contemporaneous stock of debt. The household has no opportunity to clear off the entire debt burden.

If a payment delay is in place ($k > 1$), the household gains an opportunity to attain a debt-free creditor status by turning labour into an asset due to its credit good status. A unique steady state exists as seen in the following proposition.

Proposition 3. *If $k > 1$, the steady state level of debt ($\bar{b}$) is given by:*

$$\bar{b}(k) = \frac{-\beta c(k)}{1-\beta} < 0 \text{ and } \bar{l} = 0; \tag{7}$$

Proof: It is straightforward to verify this by evaluating the fixed point of (6) at $b^i_{t+1} = b^i_t = b^i_{t+1-k} = \bar{b}(k)$. We plug the steady state value of the debt in Equation (4), and set the steady state labour supply as zero.[13]

The steady state debt is negative implying that the household by working more turns its status from a debtor to a creditor. The household ceases to work in the steady state and consumes the interest income on the accumulated assets. Although the household becomes a net creditor in the steady state, the steady state net worth of the household, |b|, is lower for longer delay. This happens because the consumption is permanently lower in response to a longer payment lag.

Figure 2 through 5 plot the dynamics of debt and labour supply of a household for alternative payment lags (k). We start off from a steady state where there is no payment delay, and the household has a stock of debt equal to 100 ($b^i_0 = 100$). The other parameters are fixed at: $w = 2$, $\bar{c} = 1$, $\beta = 0.95$ and $A = 0.1$.[14] The time paths of labour supply and debt are traced out using Equations (4) and (6). The initial labour supply is fixed at the level where there is no payment lag. When there is a one-period lag in payment ($k = 2$), it takes 4 periods to reach a creditor status as opposed to 2 periods when there is a two-period payment lag ($k = 3$) (see Figures 2 and 3). In case of a one-period payment lag, labour supply jumps to 24 in the second period and tapers off thereafter and reaches zero after 100 periods. In case of a two-period payment lag, labour supply climbs to 34 in the second period and then reverts

[12]This is the consequence of a quasilinear utility function. In Section 4, we relax this assumption.

[13]The details of the algebra are available from the authors upon request.

[14]These parameter values are chosen purely for illustrative purposes. The basic dynamics of debt and labour supply are quite robust to alternative choices of parameter values in a plausible range.

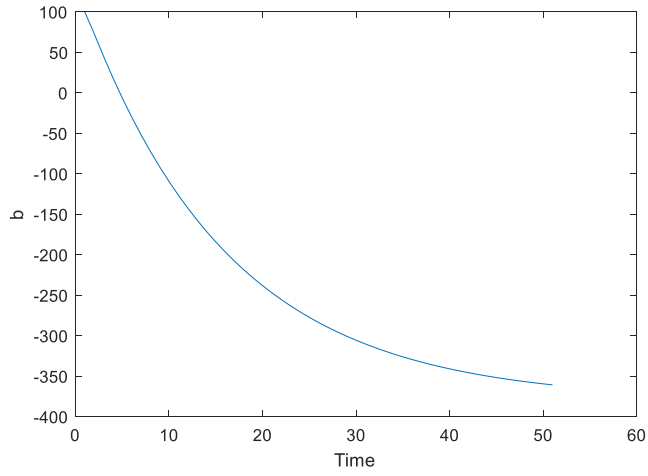

FIGURE 2 Debt dynamics, (when $k = 2$). [Colour figure can be viewed at wileyonlinelibrary.com]

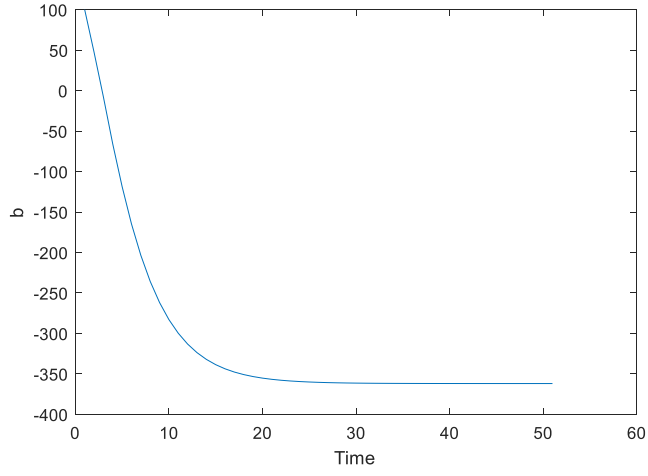

FIGURE 3 Debt dynamics, (when $k = 3$). [Colour figure can be viewed at wileyonlinelibrary.com]

to zero after 50 periods (See Figures 4 and 5). A longer payment lag sharply increases the labour supply of the household immediately. This enables the household to pay off its debt quickly and attain a creditor status. This explains why for a shorter payment lag, it takes longer for the labour supply and debt to reach the steady state.

4.3 | Welfare

What is the effect of a payment delay on household welfare? A payment lag lowers consumption via consumption tax as seen in Equation (3). On the other hand, its impact on labour supply is positive. This implies that the household suffers a welfare loss in the short run as it must work harder to clear the debts. However, the household's labour supply falls during the intermediate phase after the household attains the creditor status. While the consumption loss resulting from a payment delay lowers the welfare throughout the transition path, the decline in labour supply after the household reaches the

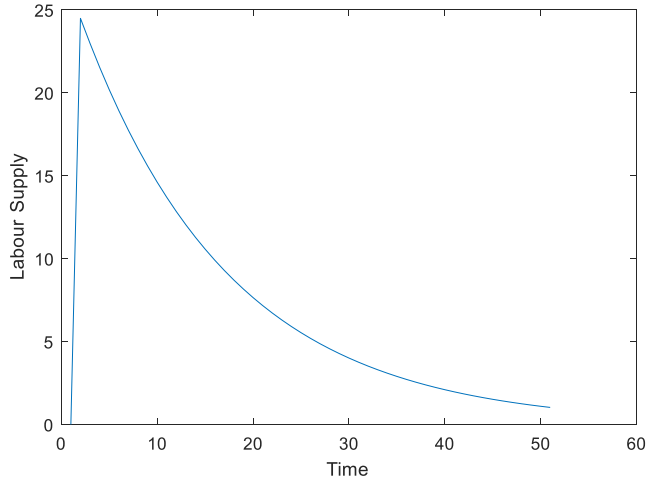

FIGURE 4 Dynamics of labour supply (when $k = 2$). [Colour figure can be viewed at wileyonlinelibrary.com]

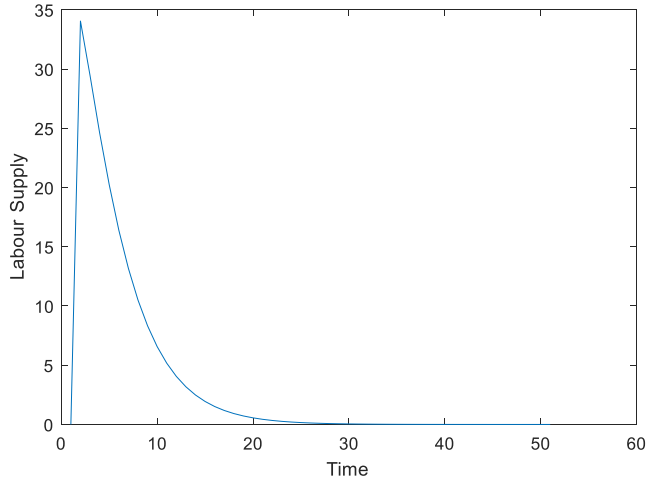

FIGURE 5 Dynamics of labour supply (when $k = 3$). [Colour figure can be viewed at wileyonlinelibrary.com]

creditor status positively impacts the welfare during the transition phase. Figure 6 illustrates the time path of welfare of the household for a payment lag of two periods ($k = 3$). Starting from a scenario of no payment delay ($k = 1$), when the household unit confronts a payment lag of two periods ($k = 3$), it suffers an immediate loss of 22.22% in welfare. Although the welfare then recovers along the path when the household cuts back labour supply, it ends up in a lower welfare state in the long run due to the implicit consumption tax resulting from payment delay.

5 | EXTENSIONS

5.1 | Labour supply at an intensive margin and rationing

Until now we have assumed that household supplies labour at an extensive margin which implies that a household member works either a fixed number of hours in NREGA or may opt out. In this section,

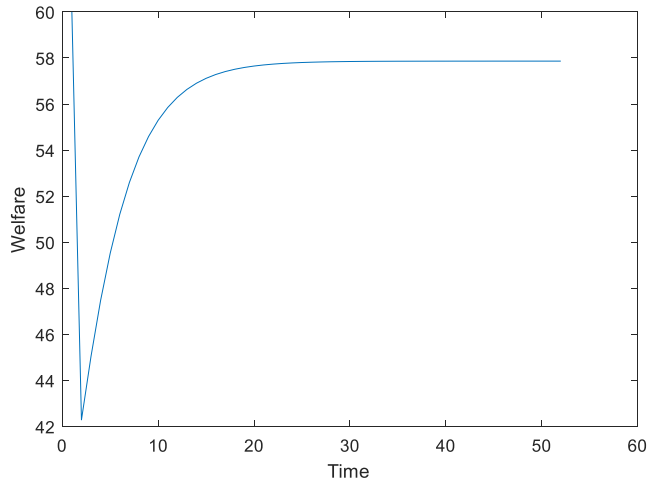

FIGURE 6 Welfare dynamics, (when $k = 3$). [Colour figure can be viewed at wileyonlinelibrary.com]

we consider the case in which the household supplies labour at an intensive margin. The household now solves the following maximization problem:

$$\text{Max} \sum_{t=0}^{\infty} \beta^t \left[\ln\left(c_t^i - \bar{c}\right) + B\ln\left(1 - h_t^i\right)\right]$$

s.t.

$$c_t^i + b_t^i(1+r) = wh_{t-k+1}^i + b_{t+1}^i \tag{8}$$

$$h_{t-k+1}^i \leq \bar{h}, \tag{9}$$

$$c_t^i \geq \bar{c}, b_0^i > 0$$

where h_t^i is work hours and $\bar{h}$ is the upper limit to work hours set by NREGA (say 100 days of work).

The Lagrangian of the problem is given by:

$$L_1^p = \sum_{t=0}^{\infty} \beta^t \left[\ln\left(c_t^i - \bar{c}\right) + B\ln\left(1 - h_t^i\right)\right] + \sum_{t=0}^{\infty} \gamma_t \left[wh_{t-k+1}^i + b_{t+1}^i - c_t^i - b_t^i(1+r)\right] + \sum_{t=0}^{\infty} \nu_t \left[\bar{h} - h_{t-k+1}^i\right]$$

where $\{\gamma_t\}$ is the sequence of Lagrange multipliers associated with the flow budget constraints (Equation 8) and $\{\nu_t\}$ is the sequence of Lagrange multipliers associated with the inequality constraints (Equation 9).

The first-order conditions are given by:

$$\frac{\partial L_1^p}{\partial c_t^i} = \frac{\beta^t}{c_t^i - \bar{c}} - \gamma_t = 0 \tag{10}$$

$$\frac{\partial L_1^p}{\partial h_t^i} = \frac{-\beta^t B}{1 - h_t^i} + \gamma_{t+k-1} w - \nu_{t+k-1} = 0 \tag{11}$$

$$\frac{\partial L_1^p}{\partial b_{t+1}^i} = -\gamma_t + \gamma_{t+1}(1+r) = 0 \tag{12}$$

Assuming an interior solution, given that $\beta(1+r)=1$, it is easy to verify from the Euler Equation (12) that the steady-state consumption and labour supply depend only on the payment lag k and are subject to the following restriction:

$$c_t^i(k) = \overline{c} + \beta^{k-1} B^{-1} w\left(1 - h_t^i(k)\right) \tag{13}$$

Substitution of Equation (13) in the lifetime budget constraint of the household with a no-Ponzi game condition yields:

$$-b_t^i \beta^{-1} + \beta^{k-1} w h_t^i(k)\left[1 + \beta^k + \beta^{2k} + \beta^{3k} + \ldots..\infty\right] = \left[\overline{c} + \frac{\beta^{k-1} w\left(1 - h_t^i(k)\right)}{B}\right](1-\beta)^{-1} \tag{14}$$

which after simplification yields the following labour supply function:

$$h_t^i(k) = \frac{\beta^{-k}\left(\beta^k - 1\right)\left(b_t^i B(1-\beta) + B\beta\overline{c} - w\beta^k\right.}{\left(B\beta + \beta^k - B - 1\right)w} \tag{15}$$

Note that

$$\frac{\partial h_t^i}{\partial k} = \frac{\beta^k \, ln\beta}{\{B(1-\beta)\}\left[\frac{1}{1-\beta^k} + \frac{1}{B(1-\beta)}\right]} - \frac{\beta^k \, ln\beta\left[b_t^i + \overline{c}\,\frac{\beta}{(1-\beta)} + \frac{w\beta^k}{(1-\beta)B}\right]}{w\left(1-\beta^k\right)^2\left[\frac{1}{1-\beta^k} + \frac{1}{B(1-\beta)}\right]^2} \tag{16}$$

Thus, a longer payment lag has now ambiguous effect on labour supply depending on the relative strengths of substitution and income effects. The substitution effect is represented by the first term in Equation (16), which is negative meaning that a longer payment delay via lowering the effective wage depresses labour supply at an intensive margin. The adverse income effect is picked up by the positive second term which tends to dominate if the household has substantial debt (b_t^i). For a rural household with large indebtedness (b_t^i), a payment delay is likely to increase labour supply.

Substitution of Equation (15) in Equation (13) yields the optimal consumption policy. Unlike the previous model of labour supply at an extensive margin, in this case, the consumption is not invariant to income. Since $h^i(k)$ is increasing in k, $c^i(k)$ is decreasing in k. Thus, the steady-state welfare is decreasing in k. The key conclusion that a payment delay increases the NREGA participation is thus a robust result that continues to hold in the case when the household supplies labour at an intensive margin.

5.2 | Alternative employment option

How does the labour supply behaviour of an adult change when he/she has an option to work at a non-NREGA job that has no payment delay? An outside employment option may exist in the rural private labour market, such as working for a rich neighbour as a casual labourer. We assume that the worker is given a 'take it or leave it' wage and employment contract by a monopsonist, non-NREGA employer. Given such a wage-employment contract, he decides how much to work for NREGA sector

subject to payment delay. Unless the worker has a high disutility for work (parameterized by A), it is likely that the worker would accept this outside employment option because it boosts his income. We assume in our model that it is the case.

We stick to our baseline model with labour supply at an extensive margin. Let the labour supply for a non-NREGA job be n_t^i. The production function facing this sector is given by a simple Cobb–Douglas form, $zn_t^{i\alpha}$ with $0 < \alpha < 1$ and z is the exogenous total factor productivity (TFP) in the non-NREGA sector. The wage $\tilde{w}_t^i$ earned by the ith household in a non-NREGA job is determined by Nash bargaining which is given by the following surplus maximization:

$$\tilde{w}_t^i = argmax\left[\left(y_t^i - \tilde{w}_t^i n_t^i\right)^{\theta}\left(\tilde{w}_t^i n_t^i - \beta^{k-1} w n_t^i\right)^{1-\theta}\right]$$

where θ is the bargaining strength of the non-NREGA producers vis-à-vis the workers whose outside option is the delayed wage from NREGA work. The Nash bargaining wage is given by:

$$\tilde{w}_t^i = \theta\beta^{k-1} w + (1-\theta) z\, n_t^{i\alpha-1}$$

In other words, the equilibrium wage is the weighted average of the present value of the delayed wage (effective NREGA wage) received by the worker in NREGA project and the average productivity of labour in the non-NREGA sector where the weight is the bargaining strength of the worker vis-à-vis the non-NREGA employer. Not surprisingly, the longer the payment lag (k) in the NREGA sector, the lower the wage in the non-NREGA sector.

It is straightforward to verify that the equilibrium employment in the non-NREGA sector is given by:

$$\text{Non-NREGA} : n_t^i(k) = \left\{\frac{\alpha z}{\tilde{w}_t^i}\right\}^{1/(1-\alpha)} \tag{17}$$

In other words, the equilibrium non-NREGA employment is driven by the labour demand dictated by the monopsonist private employer based on the Nash bargaining wage rate, $\tilde{w}_t^i$. Using the same line of reasoning as before, the NREGA labour supply in Equation (4) under an extensive margin changes to:[15]

$$l_t^i(k) = \frac{\left(\bar{c} - \tilde{w}^i n^i(k)\right)\beta\left(\beta^{-k} - 1\right)}{(1-\beta)w} + \frac{1-\beta^k}{(1-\beta)A} + \frac{b_t^i\left(1-\beta^k\right)}{\beta^k w} \tag{18}$$

We characterize lean and peak seasons as low and high TFP (z) due to agro-climatic shocks. As a result, the labour demands in the non-NREGA sector are low and high in lean and peak seasons respectively as in Basu et al. (2009). Since $n^i(k)$ in (17) is rising in k, the wage income from non-NREGA is likely to be increasing in k. This gives rise to a substitution effect that discourages NREGA participation in response to a higher k. A countervailing income effect due to lower present value of deferred wages from NREGA pushes the indebted worker to work more in both sectors. The relative strengths of these income and substitution effects now depend on the initial debt $b^i{}_0$ and the TFP z in the non-NREGA sector.

For the sake of illustration, Figures 7 and 8 compare the household's short run labour supply responses in lean and peak seasons in the case of labour supply at an extensive margin. The values of

[15]See Appendix I for proofs of Equation (17).

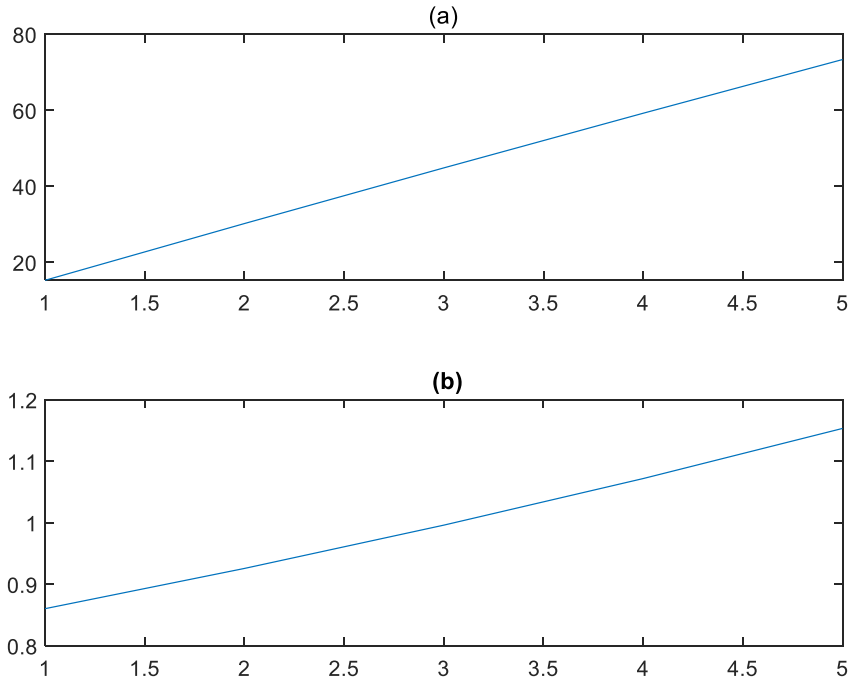

FIGURE 7 (a) Payment delay and NREGA labour supply in a lean season. (b) Payment delay and non-NREGA labour supply in a lean season. [Colour figure can be viewed at wileyonlinelibrary.com]

z are fixed at 3.0 and 4.0 for lean and peak seasons respectively. The bargaining parameter θ is fixed at 0.8 and NREGA wage w is fixed at unity. Other parameters are fixed at the same levels as in the earlier simulations. In response to a longer lag, labour supply increases mildly in non-NREGA sector in both lean and peak periods. On the other hand, the NREGA participation continues to respond positively to a longer payment delay even when alternative employment opportunity exists.[16]

6 | EMPIRICAL STRATEGY AND RESULTS

In this section, we discuss the empirical strategy employed to test the key prediction of our theoretical model that wage payment delays lead to higher worker participation in the NREGA programme. We test this relationship using the household-level data.[17] Before we discuss the method and data employed in the study, we test this relationship using the all-India nationally representative administrative data. The visual presentation captured through the scatter plot in Figure 9 clearly demonstrates the positive relationship between worker participation and payment delay.

6.1 | Empirical specification

The baseline regression model that we estimate takes the following form:

$$WP_{i,j,d,s} = \beta_0 + \beta_1 DELAY_{i,j,d,s} + \gamma Z^W_{i,j,d,s} + \mu Z^V_{j,d,s} + \delta_d + \epsilon_{i,j,d,s} \tag{19}$$

[16]For these parameter values, non-NREGA wage remains 4 percent higher than the NREGA wage for the longest payment lag. This wage differential increases by 16 percent when TFP is higher in the NREGA sector.

[17]More details on the dataset are presented in Section 6.2.

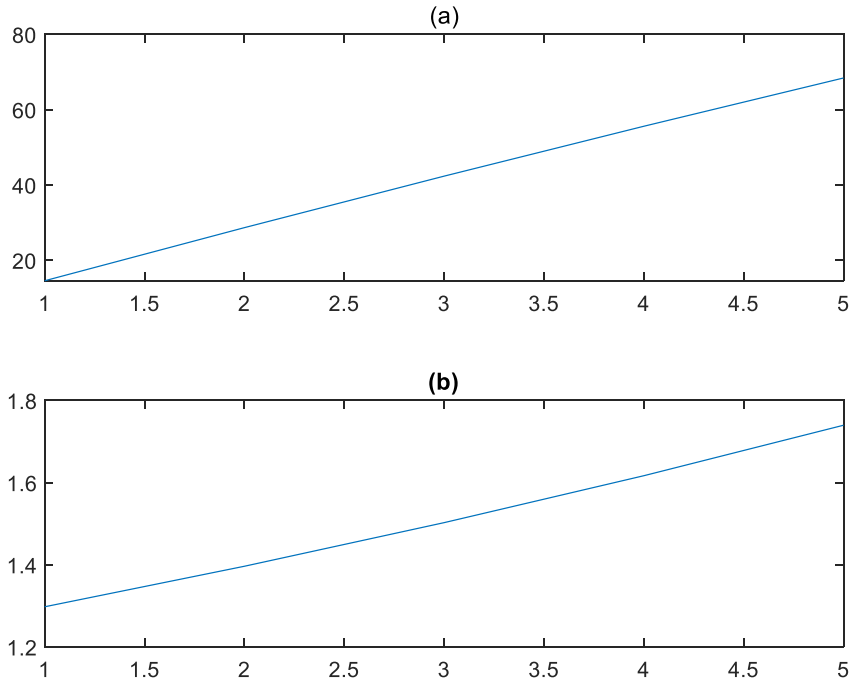

FIGURE 8 (a) Payment delay and NREGA labour supply in a peak season. (b) Payment delay and non-NREGA labour supply in a peak season. [Colour figure can be viewed at wileyonlinelibrary.com]

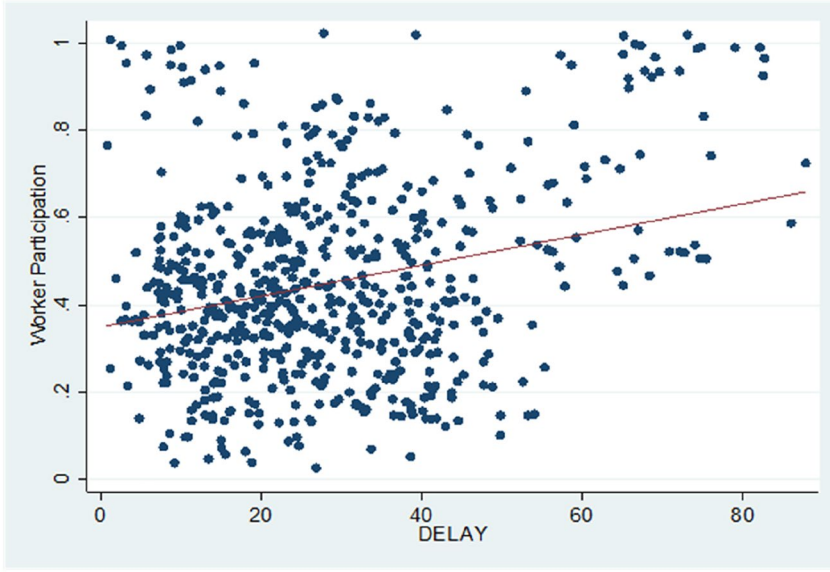

FIGURE 9 Scatter plot: worker participation and delays in wage payment. DELAY is the average time to wage payment in NREGA and WP is the proportion of households demanding NREGA work in total registered households. *Source*: authors' construction, using data from nrega.nic.in. [Colour figure can be viewed at wileyonlinelibrary.com]

where WP is the number of days of worker participation in the NREGA programme. The subscript i stands for worker, j for village, d for district, and s for state. The district fixed effects (δ_d) are included to control for the unexplained differences in NREGA participation across districts, potentially related to differences in the competencies of district administrations to implement the NREGA (Narayanan et al., 2017). DELAY captures the delay in NREGA wage payments. The sign of the coefficient of DELAY (β_1) is of central interest in this paper. A positive coefficient of β_1 will confirm our theoretical prediction that payment delays result in higher worker participation in NREGA. Z^W is a vector representing the individual- and household-level attributes that may affect an individual's participation decision and γ is a vector of corresponding coefficients. Individual-level control variables include a male dummy (MALE), age (AGE), social group represented by three dummy variables for Other Backward Caste, Scheduled Caste, and Scheduled Tribe, number of years of education (EDNL) and a dummy for financial literacy. Household-level control variables include family size (FAMSIZE), land ownership (OWNLAND), and a dummy variable for income shock in the family (SHOCK). We also include a control for alternate employment options, as captured by the difference between the NREGA wage and the market wage, which is denoted by the variable WD. We expect that this difference will be negative, given that the NREGA wages is administratively set below the market wage. Therefore, the coefficient on WD will be positive indicating that the larger the gap between the NREGA wage and the market wage, the lower will be the NREGA participation by the household member.

Z^V is a vector of control variables representing the location characteristics of the area where the household lives and μ is a vector of corresponding coefficients. We consider three village-level control variables, namely the distance to the nearest town from the village (DISTOWN), the presence of social and physical infrastructure in the villages (INFRASTRUCTURE), and the availability of water sources in the villages (WATERSOURCE). We capture remoteness of the villages through DISTOWN, as we believe that remote villages tend to have lower levels of economic activity and access to services; hence the demand for NREGA work is likely to be higher in these areas. More information on the control variables are provided in Table A2 in appendix II.

We also estimate a specification with outstanding loan amount (LOAN) as an additional variable. There is a possibility that the outstanding loans may be driving the workers to participate in the NREGA-related activities even when there are significant wage payment delays. If this is true, the coefficient of DELAY is likely to capture the effect of the prevailing stock of debt on worker participation in addition to its own effect on participation. Hence, LOAN is introduced as a separate variable.

The coefficient of DELAY in Equation (19) is likely to be affected by the presence of reverse causality as increases in worker participation in the NREGA may lead to congestion in the payment infrastructure, leading to payment delays. To circumvent this problem, we use the instrumental variable (IV) estimation method. This methodology of course requires one to identify appropriate instruments that are correlated with DELAY, but uncorrelated with NREGA participation. We identify two such instruments that we believe represent the village-level administrative (in)efficiency. Although channelling wage payments through banks and post offices has helped in curbing corruption substantially, weak and limited banking and disbursement infrastructure has restricted the capacity of banks and post offices. The limited expansion of disbursement infrastructure has led to long delays in payment of wages, and compelled workers to travel long distances or wait for hours in overcrowded banks to withdraw wages (Adhikari & Bhatia, 2010; Bhatti, 2012). The instruments that we have identified for DELAY capture these supply-side constraints and, in particular, measure the availability of wage disbursement agencies in areas where the workers live as well as the distance the workers will have to travel to reach these agencies.

Our first instrument is constructed based on a question to the NREGA participants in the field survey schedule. Each respondent is asked about the distance to the nearest bank branch or post office

from his/her place of residence. We make use of this information and construct a variable DISTANCE that measures the distance (in kilometres) of the wage disbursement agency from the participant's place of residence.[18]

Our second instrument is an indirect measure of the presence of a wage disbursement agency in the village where the household is located. This measure is constructed using the data on village amenities obtained from the Population Census 2011. The census provides detailed information on the amenities available in the villages of the Indian Union. We construct a dummy variable for the presence of post offices in the surveyed villages, given that post offices are the key partners in wage payments (Planning Commission, 2011). We denote this variable POSTOFF, which takes the value 1 for villages with a post office and 0 for villages without a post office. We believe that the length of delays in wage payment experienced by the workers to a large extent depends on the absence of wage disbursement agencies where they live. Further, both DISTANCE and POSTOFF will meet the necessary exclusion criterion as IVs as they are not expected to influence workers' decisions to participate in NREGA, except through the wage payment delays that they face. In any case, we test for the suitability of DISTANCE and POSTOFF as instruments in the first-stage regressions of the two-stage least squares estimation method.[19]

6.2 | Data

Our household data come from a well-designed primary survey conducted in selected locations in the states of Sikkim and Tripura. These two states topped the country in 2016–17 in providing jobs under NREGA. Tripura has consistently figured among the states that have provided the highest number of days of employment to households through NREGA over the period 2006–07 to 2013–14 (Kumar, 2013). However, the percentage of households with 100 days of employment in the state was significantly lower at 20% (Kumar, 2013). As for wage payment delays, the state turned out to be one of the better-performing states as only 10% of the transactions were delayed by more than 15 days. Similarly, Sikkim continued its superior performance in employment generation under NREGA and retained third position in the same fiscal year. However, compared to Tripura, in Sikkim, the programme has been less effective in terms of provision of employment for 100 days and payment of wages within the stipulated time period. Available estimates suggest that only 3% of households have been provided with 100 days of work (based on the data available from nrega.nic.in) in Sikkim. There have been significant delays in the payment of wages across most districts in Sikkim and, within districts, across GPs. Our computations for the financial year 2016–17 suggest that more than one-quarter of the wage payments in Sikkim are delayed by more than 15 days, and in the district of West Sikkim alone, about 40% of the wage payments are delayed by more than 15 days.

6.3 | The survey

The survey instrument included questions that seek information pertaining to the socio-demographic characteristics of the NREGA participants and their family members, household spending on food and

[18]A concern might arise related to the randomness of the instrument DISTANCE, where one could argue that families may choose to relocate, especially once banks and post offices become important for programme participation. But such relocation is very unlikely as the Act mandates that the jobs are to be provided within a 5 km radius of the village where the card holder lives. If the worksite is more than 5 km from the village, the worker will be entitled to a travel and subsistence allowance. Still, we also control for individual and household characteristics to rule out the possibility of this concern influencing our main findings.

[19]We also ran IV regressions using variables capturing the presence of bank branches in villages as instruments for DELAY and found no change in the results.

non-food items, asset endowments, investments in land, time spent and income earned in NREGA and non-NREGA activities, delay and other details relating to wage payments, income shock and informal group risk-sharing mechanisms, savings and accounts, access to and availability of wage disbursement mechanism, and credit and borrowing.

The target population for the survey comprised all households who have registered with the programme and obtained job cards. The survey covered all districts in the selected states of Tripura and Sikkim. A three-stage stratified sampling procedure was employed to identify the final list of households for the survey. The first stage involved the selection of GPs from each district. We ranked the GPs in all the districts using a backwardness indicator, namely the number of households below the poverty line. We then constructed four quintiles based on the ranking, and randomly selected two GPs from the bottom two quintiles of each district. The second stage involved selection of village councils (VCs) from the GPs. Our survey focused on all VCs of the selected GPs. In all, the survey covered 86 VCs—42 from Sikkim and 44 from Tripura. The final stage involved selection of households from the selected VCs. We set a target of not fewer than 50 households from the selected GPs, which are distributed among the villages of the respective GPs. These households were identified based on the list of households obtained from the selected GPs. The data collection was carried out between September 2017 and March 2018.[20]

6.4 | Variable construction

The dependent variable, NREGA participation (WP), is the average number of days worked over the past 12 months under NREGA, and is generated from the respondents' reported number of months worked over the last year and average number of days worked per month. We take the average of the days worked per month and the months worked per year, and multiply them by each other to get the average number of days worked in a year. A concern that is usually expressed about the length of the reporting period is that a longer recall period can affect the accuracy of the information collected. In other words, the shorter the reporting period, the more likely are respondents to accurately recall the number of days that they worked. Our choice of 30 days (1 month) as the recall period for collecting data on the number of days worked is based on the possibility that a shorter recall period, say, a week, might yield 'zero' days as the answer. That could then skew the estimate for the entire year for those persons. This may not necessarily be the case because they were not available for work, or there was no work available under the NREGA programme, but could simply be a matter of timing. A short recall period is most effective in situations in which the respondent is asked to recall frequent, routine events. Our field survey was carried out during the agricultural off-season, when NREGA jobs are most in demand. We believe this would make it less difficult for the respondents to recall the number of days they had worked, making recall bias less likely to affect the quality of the data collected. Wherever possible, we have also cross-verified the number of workdays reported in the survey with the employment details recorded in the job cards of the workers. Further, the 30-day recall period is the standard recall period for the National Sample Survey Organisation's Consumption Expenditure surveys. Finally, we have also compared the workdays reported in the survey to the average workdays from official administrative data sources available in the public domain (the NREGA portal). These comparisons did not reveal significant bias in data collection due to a longer recall period.

Our main independent variables of interest are delays in wage payment (DELAY) and loan amount (LOAN). DELAY represents the average delay experienced by the respondents and refers to the

[20]More details on the survey are provided in Appendix III.

number of additional days the wages were delayed beyond the specified 15 days. The DELAY variable measures the actual delays in wage payments—the number of days it takes, beyond the stipulated 15 days, to credit the wages to the bank account of the NREGA worker. A worker gets an automatically generated SMS alert when wages are credited to his or her bank account and thus knows clearly the actual number of days the wages were delayed. In other words, it includes both the Stage 1 and Stage 2 delays, as discussed in Section 2, and is a more accurate measure of wage payment delay than that reported in the administrative data, which only reports the Stage 1 delay (see Narayanan et al., 2019).[21] LOAN represents the outstanding loan commitments of the NREGA participants.

A brief summary of the variables and their construction is presented in Table A2 in appendix II, and descriptive statistics are presented in Table A3 in appendix II. On average, the beneficiary households have received employment for far fewer than the stipulated 100 days. An average participant has received only 38 days of employment, which is about two-fifths of the workdays promised by the programme. When it comes to payment of wages to beneficiaries, our survey data suggest substantial delays. As per our estimates, on average, it took about 44 days beyond the stipulated 15 days to disburse wages to the beneficiaries.

6.5 | Empirical results

Table 1 reports the regression results from the estimation of equation (19). Seven different model specifications are estimated; four specifications for the full sample, and two for a sub-sample of NREGA participants. In model 1, we include only the DELAY variable. We bring in worker- and village-specific control variables in model 2. We then introduce district fixed effects in model 3. In specifications 4 and 5, we add LOAN as an additional variable. These two specifications are estimated for a sub-sample of participants as not all NREGA participants had outstanding loan commitments at the time of the survey. While we use the DELAY variable measured at the individual level in all these specifications, in column 6 we use the DELAY variable averaged at the village level. In column 7, we present the results for the estimation carried out at the village level. Our analysis is based on households with non-zero NREGA work.[22]

Our results clearly suggest that wage payment delay and NREGA participation are positively related. The DELAY variable exhibits statistically significant coefficients in all specifications, estimated for the full sample as well as the sub-sample of participants with outstanding loan commitments, suggesting that wage payment delay encourages worker participation in the NREGA programme. The coefficient value of the DELAY variable in the full sample with controls and district fixed effects suggests that the average days of participation increases by about 0.070 man-days for each day that wages are delayed (column 3 of Table 1). To be more specific, assuming an eight-hour workday, for every additional day that wage payments are delayed, the participation in the programme increases by more than half an hour (approximately 34 min).[23]

[21]Our measure of delay excludes any delays on the part of the workers in collecting their wages from the disbursement agency, as our survey records the time to receive the wage payment from the 16th day after work is completed to the date when the payment is made to the worker's bank account.

[22]As the target population for the survey comprised all households who have registered with the programme and obtained job cards, it is possible that the results may be overstated due to the self-selection bias. We, therefore, employed a Heckman procedure as a robustness test to account for the possible influence of this selection bias and found consistent results to the ones reported here. The results are presented in the Table A4 in appendix II.

[23]The theoretical proposition that wage delays leads to greater demand for MGNREGA work may not be adequately validated by the empirical evidence, given the cross-sectional nature of the field survey data. Since the dependent variable is the

TABLE 1 Payment delay and worker participation: regression results (dependent variable: WP).

	Individual level						Village level	IV results
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
DELAY	0.044** (0.021)	0.049** (0.023)	0.070* (0.028)	0.114*** (0.036)	0.125*** (0.046)	0.539*** (0.071)	0.533*** (0.166)	1.025** (0.428)
WD		0.004 (0.008)	−0.009 (0.008)	−0.006 (0.016)	−0.020 (0.018)	−0.010 (0.007)	0.016 (0.051)	−0.019 (0.016)
LOAN				1.970* (1.129)	0.887 (1.050)			
AGE		−3.222 (2.414)	−3.608 (2.323)	−8.540 (5.509)	−0.032 (5.867)	−3.566 (2.277)		−7.809** (3.878)
Gender		−0.956 (1.333)	−0.236 (1.262)	2.660 (3.057)	−0.018 (2.878)	0.215 (1.235)		1.076 (2.254)
FAMSIZE		0.606 (0.424)	0.790** (0.361)	1.115 (0.872)	0.961 (0.791)	0.759** (0.344)		−0.533 (0.805)
EDNL		−0.360 (0.449)	0.624 (0.436)	−1.479 (1.081)	1.284 (1.097)	0.818** (0.420)		0.225 (0.919)
FINLIT		3.143 (1.980)	3.065 (2.206)	17.860*** (4.992)	9.526** (4.520)	3.122 (2.220)		1.246 (3.520)
OWNLAND		2.176*** (0.248)	0.680*** (0.273)	2.161*** (0.411)	0.275 (0.488)	0.501* (0.269)		−0.040 (0.539)
SHOCK		4.760*** (1.576)	3.062** (1.444)	3.569 (2.846)	1.200 (2.740)	2.635* (1.412)		1.147 (2.700)
INFRASTRUCTURE		0.733 (0.572)	−0.302 (0.587)	−0.809 (1.196)	−2.302* (1.263)	−0.685 (0.559)	−0.834 (1.735)	−1.191 (1.112)
WATERSOURCE		−5.548*** (0.740)	−4.417*** (0.918)	−7.076*** (1.738)	−6.481*** (2.056)	−4.908*** (0.902)	−5.311*** (2.093)	−5.493** (1.573)
DISTOWN		−0.299*** (0.058)	−0.277*** (0.058)	−0.453*** (0.082)	−0.374*** (0.113)	−0.320*** (0.060)	−0.390** (0.172)	−0.391*** (0.120)
OBC		−8.068*** (1.999)	−2.698 (1.974)	−4.894 (4.492)	2.219 (4.657)	−3.027 (1.866)		2.676 (4.488)
SC		−9.425*** (1.829)	−3.018 (1.945)	−1.530 (4.491)	−1.256 (4.633)	−2.274 (1.829)		0.964 (4.151)

(Continues)

TABLE 1 (Continued)

	Individual level						Village level	IV results
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
ST		−2.507 (1.920)	−2.661 (1.892)	−1.891 (4.518)	0.201 (4.632)	−2.719 (1.837)		−0.965 (3.895)
District effect?	No	No	Yes	No	Yes	Yes		Yes
Constant	37.963*** (0.854)	55.756*** (9.466)	57.090*** (9.001)	61.822** (21.286)	39.073 (21.860)	46.144*** (8.948)	42.555*** (7.638)	56.494*** (15.367)
Rsquared	0.005	0.163	0.317	0.306	0.412	0.372	0.532	-
F	4.54	27.30	123.30	15.90	31.43	113.97	18.92	22.52
N	1532	1240	1240	326	326	1240	79	1240
Coefficient Value of Instruments								
POSTOFF								−2.088 (1.617)
DISTANCE								0.596** (0.252)
Tests for Validity of the Instrument								
Under Identification Test								
Kleibergen-Paap rk LM statistic (Chi2 *p*-value)								7.709 (0.021)
Weak Identification Test								
Kleibergen-Paap rk Wald F statistic								10.460
Stock-Yogo weak ID test critical values:								
10% maximal IV size								19.93
15% maximal IV size								11.59
20% maximal IV size								8.75
25% maximal IV size								7.25

TABLE 1 (Continued)

	Individual level						Village level	IV results
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Overidentification of all Instruments								
Hansen J Statistic (Chi2 *p*-value)								0.375 (0.540)

Note: (a) ***, ** and * indicates significance at 1%, 5% and 10% levels respectively; (b) Figures in parentheses are standard errors (c) in column 6, we use delay variable averaged at the village level; and (d) in column 7, we estimate the specification at the village level.

Source: Authors' estimates.

Our theoretical prediction that a larger loan size leads to greater participation of workers in NREGA activities is also supported by the regression results.[24] Our estimates based on a sub-sample of participants— only one-quarter of NREGA participants had outstanding loan commitments—show that the coefficient of LOAN is positively related to NREGA participation (column 4 in Table 1), endorsing the hypothesis that outstanding loans are driving people to participate more in NREGA-related activities.[25, 26]

As we discussed in Section 2, requests for wage payments are generated at the village level, once work is completed, and the initial approvals for the payments are done by local bureaucrats (at village, panchayat and block levels). Therefore, an important source of delays in wage payments is the time it takes for local bureaucrats to approve the requests. This suggests that the variation in wage payment delay may be more likely to be observed across villages than within villages, and the appropriate measure of wage payment delay should be constructed at the village level. To address this possibility, we implement two additional robustness tests. First, we replace the DELAY variable with the individual wage payment delays averaged at the village level and regress it on WP. Second, we perform the regression estimation at the village level. In the second case, WP, DELAY and WD are averaged at the village level. Results of these two additional exercises are reported in columns 6 and 7 of Table 1 respectively, and they validate the results obtained using the individual level data. Specifically, the coefficient of DELAY is positive and significant at the one percent level, suggesting that delay in wage payment is positively related to higher demand for MGNREGA work.[27]

We also confirm the robustness of our results by estimating an IV model using two instruments. To be specific, we address the possible endogeneity issues associated with the DELAY variable—the positive relationship between DELAY and number of days of participation may be driven by administrative inefficiency due to greater demand for NREGA work and subsequent congestion in the payment process. To address this concern, we employ a two-stage least squares (2SLS) model with POSTOFF and DISTANCE as instruments for DELAY, and estimate the full specification—district dummies, control variables for individual- and household-specific characteristics, and controls for village-level characteristics. We present the IV results in column 8 of Table 1, with the first-stage results and tests for validity of the instruments in the lower panels of the table. The first-stage results show that DISTANCE has a positive and significant relationship to DELAY while the coefficient of POSTOFF yields an expected sign but is insignificant. The various test statistics show that the IV procedure works well for our estimations. The instruments pass the test for weak instruments,

actual number of days worked rather than work demanded and wage delays are observed after the completion of work, it is important to show that workers have a prior knowledge about delays. One solution is to demonstrate whether wage delays are systematically correlated with household characteristics. We find that wage delays are correlated with family size, asset ownership, caste background and income shock in the form of illnesses or contingencies.

[24]The coefficient of LOAN yields a positive sign in the specification where we introduce district fixed effects but is insignificant (column 5 of Table 1).

[25]It is likely that LOAN may be correlated with DELAY as the need to borrow money naturally increases when expected wage payments do not materialize. We checked for this possibility in our analysis and found that there is very low correlation (0.0105) between LOAN and DELAY. As an additional check, we estimated the model specification with and without LOAN variable and the main results are upheld.

[26]It is possible to argue that work participation may be higher among those who have outstanding loans. We check for this possibility by re-estimating the specification after incorporating an interaction term for loan and delay. The regression results returned an insignificant coefficient of interaction term on work participation.

[27]A recent study by Das et al. (2023) investigates the impact of an information dissemination campaign in NREGA using an experimental design. They find that information provision leads to a significant fall in wage payment delays. The study, however, do not find any relationship between wage payment delay and average work days in the treated villages.

implying they are strongly correlated with our DELAY variable. This is indeed important since weak instruments can produce severely biased estimates. Further, the Hansen J statistic for overidentification is insignificant for all the models, confirming that the IVs are indeed exogenous and correctly excluded from the performance equation.

The IV 2SLS estimates reinforce the main findings based on ordinary least squares (OLS) estimates. The coefficient of DELAY is positive and significant at the 5% level, suggesting that delay in wage payment is positively related to higher demand for NREGA work. Our results are thus robust to concerns arising from endogeneity of wage payment delay, and these results unequivocally highlight the positive role of payment delays in NREGA participation.[28]

As we rely on data from two Indian states, which are remote and small, to test the theoretical predictions, there could be concerns on whether the empirics would have backed the theoretical predictions if data from larger states were used.[29] Hence, to assess the external validity of the results, we test our theoretical predictions using district level data drawn from the MGNREGA data portal of the Government of India for the period 2014-5–2017/8. We regress the proportion of households seeking NREGA work out of the registered households on the delay in NREGA wage payments while controlling for the influence of agricultural wages, social backwardness of the district, rainfall and infrastructural availability.[30] Results are presented in Table 2. Our district-level results too confirm the existence of a positive relationship between payment delay and worker participation. Overall, our results support the prediction from the 'labour as a credit good' theoretical mechanism that a longer delay in the payment of wages to NREGA beneficiaries may actually lead them to offer more labour for NREGA work.[31]

[28]As an additional robustness test, we experimented with the Lewbel (2012) Instrumental Variable strategy, which serves to identify structural parameters in regression models with endogenous or mismeasured regressors in the absence of traditional identifying information, such as external instruments. The results, presented in Table A5 in Appendix II, broadly support the findings of the OLS estimates presented in Table 1.

[29]A possible argument could be that in states such as Sikkim and Tripura alternative work options are limited and migration to look for jobs are costly. This, therefore, allows the workfare programme to extract additional hours through payment delays. This may not be the case if data from states like Bihar and Rajasthan were used where seasonal out-migration rates are large and these States are better connected to larger cities through transportation networks.

[30]A brief on the variables and their construction is presented in Table A6 in appendix II, and descriptive statistics are presented in Table A7 in appendix II.

[31]A related study that examines the effect of wage payment delay on MGNREGA participation is Narayanan et al. (2017). This paper uses from two rounds of the National Sample Surveys—2009–10 and 2011–2011—as well as administrative data on wage payment delay obtained from the MIS portal on MGNREGA of the Indian government to look at the possibility of a "discouraged worker effect", due to administrative rationing of MGNREGA work and wage payment delays. The analysis is conducted both at the household and district levels, and the study finds that wage payment delays do not seem to have any significant effect, positive or negative, on MGNREGA participation. In contrast to the Narayanan et al. (2017) paper, the wage payment delay variable in our survey provides a more accurate measure of actual payment delay than the one used in their paper as it takes into account both Stage 1 and Stage 2 delays in the payment process. In contrast, the measure used in the study by Narayanan et al. (2017) is obtained from administrative data and only captures Stage 1 of the delay process (see Section 2 of our paper). Given that a large part of the wage payment delay is occurring in Stage 2 (that is, the time it takes for the central government to disburse funds to the beneficiaries), the positive association between MGNREGA participation and wage payment delay that we find in our empirical analysis may be related to the fact that the actual delay that beneficiaries face in receiving payments is significantly higher than that reported in the administrative data.

TABLE 2 Payment delay and worker participation: District-level results.

	OLS results				
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
DELAY	0.0013*** (0.0002)	0.0011*** (0.0002)	0.002*** (0.0004)	0.001*** (0.0004)	0.002*** (0.0005)
Control variables					
RAINFALL		0.0008*** (0.0001)	0.001*** (0.0001)	0.0003 (0.0002)	0.0005*** (0.0002)
AWAGE				0.026 (0.026)	0.040 (0.035)
SC					0.012*** (0.002)
ST					0.004*** (0.0008)
SCHOOL					0.019 (0.111)
TRANSPORT					0.0003 (0.015)
POWER					0.142** (0.058)
POST					0.173** (0.075)
ROAD					0.042 (0.083)
Constant	0.414*** (0.008)	0.341*** (0.009)	0.238*** (0.017)	0.180 (0.136)	−0.487*** (0.188)
Year effect?	No	No	Yes	Yes	Yes
F	28.41	74.63	146.47	71.46	43.35
N	2460	2460	2460	798	657
Regression	OLS	OLS	OLS	OLS	OLS
R square	0.016	0.07	0.124	0.059	0.278

Note: (a) Our dependent variable in all estimations is the proportion of households demanding NREGA work in total registered households; (b) District is the unit of analysis; (c) Our dataset corresponds to the 4-year period, 2014-15–2017-18; (c) Control Variables: RAINFALL: average monthly rainfall; AGRWAGE: annual average agricultural wage for respective years; SC: proportion of SC households in total households; ST: proportion of households who are STs; SCHOOL: proportion of villages with a primary school in total inhabited villages; TRANSPORT: proportion of villages with bus connection in total inhabited villages; POWER: proportion of villages with electricity in total inhabited villages; POST: proportion of villages with post and telegraph offices in total inhabited villages; ROAD: proportion of villages with paved roads in total inhabited villages; (d) ***, ** and * indicates significance at 1%, 5% and 10% levels respectively; and (e) Figures in parentheses are standard errors.

Source: Authors' estimates.

7 | CONCLUSION

There is no dispute that a workfare programme with an employment guarantee is a potentially useful anti-poverty measure to ameliorate the frictional unemployment arising from private labour markets. What is less obvious is how it helps the poor when such an employment guarantee programme has frictions of its own. In this paper we focus on one such friction: wage payment delay. Using a stylized life cycle model, we demonstrate that an asset-poor household participates more in the programme in response to a deferred wage payment. This happens because a payment delay makes labour a credit good and the value of labour as an asset declines due to a longer payment lag. Both of these adverse effects on the human and non-human net worth make the household members participate more in such a programme with endemic payment delay in the short run to pay off the existing debt obligations. The increased disutility of work and the implicit consumption tax due to a longer payment lag make

the household worker worse off in terms of welfare. We use the Indian NREGA programme as our testbed for this theoretical investigation. Using rich primary survey data, we find suggestive evidence in support of the key prediction of our model that NREGA participation responds positively to a wage payment lag.

Our paper has important policy implications. Firstly, our life cycle model shows that implementation failure in terms of delayed NREGA wage payment has adverse welfare consequences and possibly negates the positive effects that the programme may otherwise have on household welfare if it was implemented well. Secondly, our findings suggest that a conventional measure of performance of an anti-poverty programme—such as higher NREGA participation of rural households—would be misleading because it does not necessarily reveal the welfare loss suffered by the asset-poor households who face a formidable wage payment delay. Thirdly, the paper shows that the adverse welfare effects of the wage payment delay are particularly pronounced when there is no viable outside option for the worker in the labour market. Given that the lack of a viable outside option may be more likely to occur in the poorer districts of the country, it is imperative from a policy point of view to alleviate the delay in wage payments particularly in poorer regions where rural households have limited outside options.

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