Having it at Hand: How Small Search Frictions Impact Bureaucratic Efficiency

Eric Dodge, Yusuf Neggers, Rohini Pande and Charity Troyer Moore*

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Abstract

Can small search costs that constrain information acquisition and monitoring across the administrative hierarchy provide a substantive explanation for poor bureaucratic performance in the developing world? In collaboration with the Indian Ministry of Rural Development and the state of Madhya Pradesh, we conducted a field experiment in which a random sample of bureaucrats were given access to an internet- and mobile-based management and monitoring platform for wage payments associated with a workfare program. The platform did not make new information available, but lowered costs of accessing information about the status of wage bills and officers who needed to take action. Our experiment also randomly varied which level of the administrative hierarchy had e-platform access. Lower costs of information acquisition reduce payment processing time by up to 22 percent. We document the importance of informed managerial oversight in multiple ways. First, using detailed usage data, we show payment delays decrease only when search costs are reduced at both intermediate and senior management levels. In addition, usage rates at the intermediate management level are much higher when senior management also has e-platform access. Second, using data from two months when data outages reduced information available on the platform, we show that simply having better information on which employees are responsible for different activities and increased ease of contacting them did not improve performance as measured by payment delays.

*The authors are from Evidence for Policy Design (Dodge and Troyer Moore), Brown University (Neggers), and Harvard University (Pande). We thank Kartikeya Batra for field work and research assistance, and the J-PAL Governance Initiative and Gates Foundation for financial support.

1 Introduction

While a variety of constraints can hamper public service delivery, particularly in resource-constrained settings, some of these challenges may relate to the design of the implementation structure itself. A defining feature of government bureaucratic structures is that they are hierarchical, with clearly ordered levels of management, where lower levels are subordinate and answerable to higher levels. The top bureaucrat often holds the purse strings but relies on a local administrator to implement a program. As a result, bureaucrats at intermediate levels of the hierarchy are often both information intermediaries and monitors for local administrators.

Economists typically model such bureaucracies as networks of overlapping principal-agent relationships – the simplest vertical structure would have three layers: principal/supervisor/agent. The principal or supervisor's inability to directly observe the agent's actions creates opportunities for shirking by the agent. If, as is typically the case, the supervisor has a better technology than the principal to obtain information on agents' actions, then there is the possibility that the supervisor may choose to either collude with the agent or simply shirk and not collect information on agents' actions.

While these problems of asymmetric information in bureaucratic hierarchies have been widely modeled (Tirole 1986, Dixit 2002), we have limited empirical evidence on the relative importance of asymmetric information at different levels of the hierarchy in affecting bureaucratic performance. As the costs of information acquisition can potentially be reduced through new data and technology, those asymmetries may be more easily addressable than in the past, and examining the effects of such innovations may allow us to learn how service delivery relates both to the bureaucratic structure and costs of monitoring within that structure. In this paper, we exploit the randomized rollout of a mobile app that reduced search costs for identifying which agent is delaying the pro-

cessing of wages for a workfare program. We experimentally varied whether search costs were lowered for just the principal, just the supervisor, or both. We find evidence of significant complementarities in reduction of search costs – specifically, improved monitoring by the principal is important but effective only when the supervisor faces lowered search costs. Only lowering search costs for the supervisor has limited benefits.

The costs of bureaucratic inefficiency are particularly salient in poor areas, where information acquisition may be more costly, resources more constrained, and the poor more reliant on the delivery of benefits from government safety net systems. An important example is India's workfare program, based on the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), which provides up to 100 days of annual unskilled labor employment per rural household. In 2014-15, 41 million rural households benefited from the program at a cost of approximately US $5.9 billion, and multiple studies document MGNREGA's positive impact on rural households' well-being (Deininger and Liu 2013, Imbert and Papp 2014, Klonner and Oldiges 2014). Average time to payment for beneficiaries, however, was 53 days after completing work, despite government stipulations that these participants be paid within 15 days, and a supervisory system dedicated to monitoring and decreasing payment delays. These delays reduce poor rural households' ability to manage economic uncertainty (Basu and Sen 2015), and are recognized both at the highest levels of government and in the national press as a critical challenge for the program (Anand 2016). While MGNREGA has recently transitioned to electronic payment systems, the evidence of how e-governance reduces payment delays is mixed (Banerjee et al. 2016, Muralidharan 2016). In this paper, we take a more theoretically motivated approach to the question of bureaucratic efficiency.

Our research contributes to the growing body of evidence on how the inner workings of government administration can influence quality of public service delivery (Finan,

Olken, and Pande 2015), and highlights the role of convenience (lowering the cost of information acquisition) on outcomes of importance to program beneficiaries. While several studies have considered the impacts of increasing information and monitoring, to the best of our knowledge this project is the first to experimentally examine the potential for multiplier effects across the bureaucratic hierarchy. Further, despite evidence from the private sector that poor management hinders productivity in India (Bloom et al. 2013), evidence on the impacts of tools that may facilitate better management is lacking for public sector settings.

The remainder of the paper is organized as follows. Section 2 provides background and describes our conceptual framework. The PayDash intervention and its randomized provision are detailed in Section 3, while Section 4 describes the data and identification strategy and performs randomization checks. Section 5 presents the results and Section 6 concludes.

2 MGNREGA payment delivery background and conceptual framework

We conceptualize the administration of MGNREGA as a vertical three-tier hierarchy. The principals (district officers) wish to ensure that villagers have access to paid work. The majority of payments process substeps are carried out by local-level MGNREGA officials and engineers – these are the agents. These agents may shirk or be involved in the theft of funds allocated for wage payments. The second tier of hierarchy - block officials - are the supervisors. They are responsible for monitoring the agents and releasing wage payments. They also report on their performance to the principal.

Multiple steps precede transfer of funds to MGNREGA workers. First, local-level

officials enter MGNREGA worker names on attendance lists and government leaders at the local, Gram Panchayat (GP), level approve the lists once filled. Second, engineers travel to each project site and verify work completed. Third, project details and funds requests are uploaded to the online management information system (MIS) by local-level officials; and fourth, following two approvals from block officials, banks release payment. The district official (principal) and block official (supervisor) are therefore the key government actors overseeing two sets of agents – local-level officials and engineers – who must take specific steps to process each payroll, known as a muster roll. The principal (district officer) has an overarching administrative role and is a step removed from the funds flow process. As shown in Figure 1, block officers, in addition to managing field-level workers, evaluate and provide approvals for funds requests. Approved funds transfer orders are submitted directly from the block office to the government-approved bank controlling state-level funds. Payments are then transferred directly to beneficiary accounts. We focus in our subsequent analysis on the time taken to complete the steps in the payment delivery process within the purview of district- and block-level MGNREGA officials, as opposed to falling to GP-level elected leaders or banks.

We assume that both district and block officers incur search costs to identify whether the agents have done their job in a timely manner (which requires exerting effort). Search costs potentially cause the supervisor and principal to underinvest in information acquisition. Consider first a benchmark non-corrupt setting. We hypothesize that in a multi-tiered administrative environment such as MGNREGA, weak information flows worsen program management and thereby contribute to payment delays. Specifically, officers are unable to correctly identify the sources of problems and determine which subordinates to hold accountable. In this case, the provision of a technology that reduces the cost of information acquisition for block officers could improve management and reduce payment delays. A potential barrier, however, may be that block officers of

certain types (e.g. low intrinsic motivation) are not incentivized strongly enough to take costly action even when provided management-relevant information. In such cases, additionally facilitating monitoring through information provision to district officers, who have influence over the extrinsic incentives of block officials, may be necessary to improve outcomes. At the other extreme, giving block officers higher powered incentives to reduce delays through strengthened monitoring may be insufficient if they lack the information needed to do so. Therefore, important complementarities may exist in strengthening the flow of information at multiple points in the bureaucratic hierarchy. In addition, it may be that the supervisor colludes with the agent in order to engage in corrupt behavior. This will not necessarily increase payment delays but implies worse targeting of payments.

3 PayDash intervention and randomization

Our intervention, PayDash, is a mobile- and web-based application for district and block MGNREGA officers. PayDash relies on timestamped data noting when each sub-step occurs in the payment process to help officials more quickly process pending wage payments. Importantly, this process is automated and not prone to tampering. It is built on APIs that feed real-time information on details of delayed payments, with linked information on employees responsible for each administrative step at GP and block levels, to MGNREGA administrators. The login page for the online version of PayDash is shown in Figure 2, and illustrations of the mobile phone version of PayDash (also known as PayDroid) are shown in Figures 3 and 4. As we observe that officers nearly always use the mobile version of PayDash, we focus on mobile-related usage characteristics in our subsequent analysis.

PayDash decreases the cost (in staff time and effort) of information acquisition to

help administrators identify and monitor poorly performing sub-regions and employees. While information relevant to payment delays is accessible to program officials through the MGNREGA website, it is not provided in a format tailored to the needs of these officers. For example, pending muster rolls can be viewed online, but they are displayed on a different page for each GP. Therefore, an officer must visit 20 or more individual web pages to understand which muster rolls are pending in his/her block, for example. PayDash packages this information on a single page, making information actionable by grouping pending muster rolls according to the employee responsible for the pending step.

PayDash clearly identifies where and at what payment steps delays are originating and who could help address the delay. For each step in the payment process, the block officers' version of Paydash provides real-time lists of pending documents along with contact information of responsible employees, allowing block officials to easily send information on delayed documents to field staff via WhatsApp or follow up with a direct phone call. A "contact" button next to the employee's name serves to nudge the officer to take immediate action on the delayed documents by either calling or sending a message via WhatsApp that is pre-filled with details of the relevant documents. The version of PayDash provided to district officials is similar to the version provided to block officials, but focuses on providing block-level summaries on time to payment and number of documents delayed at each step along with a "contact" function that allows district officials to get in touch with the appropriate block official via phone or WhatsApp message.

Access to PayDash is randomized at the district level; log-ins are user-specific so officers can only log into the platform using their own credentials, and they view summary information on payment delays for areas under their jurisdiction. Treatment arms are designed as follows: (1) Control – District and block-level MGNREGA administrators do not have access to PayDash; (2) TD – PayDash provided to district-level MGNREGA

administrators only; (3) TB – PayDash provided to block-level MGNREGA administrators only; (4) TDB – PayDash provided to both district and block-level MGNREGA administrators. The four treatment categories were randomly assigned across 50 districts (which exclude the pilot district) in approximately equal proportions at the district level (Control: 13, TD: 12, TB: 13, TDB: 12), stratifying by above/below the district-levle median values across the state for average monthly person days worked and average monthly days to payment over the period April 2015 to April 2016. Within each level of the hierarchy, PayDash was provided to two officers. The first of these officials is the Chief Executive Officer (CEO), who is the highest ranking bureaucrat at the District or Block level and is responsible for overseeing a number of other schemes in addition to MGNREGA. The second is the Program Officer (PO), who is the highest ranking officer solely responsible for oversight of the MGNREGA and reports to the CEO.

PayDash was rolled out across Madhya Pradesh during February and March 2017. The introduction of the tool required individual app installations and small group-based trainings for all treatment officials, while a parallel training session (without an introduction to PayDash) was conducted with control officers. In May 2017, the Indian central government shut down all APIs accessing government data, including that underlying the PayDash platform. This reason for this outage was entirely unconnected to PayDash and stemmed from a realization by the government that a large amount of biometric data under its Aadhaar initiative was exposed and available online to the public (Indian Express 2017). During the outage period, PayDash no longer provided real-time information on pending documents or summary statistics on average time to payment by sub-region or subordinate employee. However, the in-app contact features were still functional. Where relevant, we describe below how we adjust our empirical strategy to account for this exogenous shock to PayDash functionality, which lasted into July 2017.

4 Data and identification check

4.1 Data sources

We use data on the time to completion for each step in the MGNREGA administrative payments process and the overall payment process time averaged at the level of the gram panchayat and date of completion, including the standard deviation and number of transactions processed. As each step is completed at the block or gram panchayat office, an electronic timestamp is registered in the centralized MGNREGA MIS. A data API provided to us by our government partner allows us to access aggregated cuts of this transaction data. The analysis presented in this paper uses data for the state of Madhya Pradesh beginning in April 2016, the start of the 2016-2017 fiscal year, through June 2017 that we aggregate up to the level of the administrative block on a monthly basis.

To understand how officials are using the platform we use Google Analytics data for the mobile (Android) and web applications. This usage data shows how many sessions each user had on each date (as session is a grouping of individual pageviews within a specific timeframe), the duration of each session, how many employee "cards" users viewed on the mobile app on each date and whose card they viewed, when users used the call function on the mobile app, the duration of the call, and who they called. The usage data contains a unique identifier that we use to link with data on each trained official.

We take month-wise MGNREGA outcome data on the number of person-days worked in the program and wage expenditures in the program at the level of the administrative block from the MGNREGA public website. In addition, we track which officials are posted in different locations around the state by completing a series of calls to a contact person within each district on a monthly basis. Newly inducted officials are identified

and given in-person PayDash training and surveying, officials who leave have their login information deactivated, and the region information shown on the app is updated for officials who are transferred to a different treated region and they are notified via phone call and text message of the change to their PayDash content.

4.2 Experimental balance

As a check of experimental validity, in Table 1 we examine for a set pre-treatment characteristics related to MGNREGA administration (average and standard deviation of person days worked and days to payment over the previous fiscal year) and district composition (percent rural population and number of blocks) whether significant differences exist across districts assigned to different treatment arms. Column (1) presents the means and standard deviations of each variable for districts receiving District PayDash. Column (2) gives this information for districts assigned Block PayDash, while Column (3) does so for districts receiving District+Block PayDash and Column (4) for control districts. Columns (5) through (7) present the coefficients and standard errors from a single district-level regression of each variable on separate indicators for assignment to each PayDash treatment arm. Of the 18 differences considered, only 1 is statistically significant (at the 10 percent level).

We additionally consider characteristics of the district and block officers working at the time of intervention roll-out in treatment and control districts in Tables 2 and 3. Our variables of interest for these individuals are years of age, gender, college graduation, SC/ST/OBC status, and number of months at their current rank of office. The values for these characteristics are taken from short surveys with officers that were administered prior to the training sessions we conducted with all officers described above. Officers in each position tend to be between 40 and 50 years of age, are almost all college

graduates, and the majority are male. In additional, sizeable proportions of officers fall into the SC/ST/OBC categories. Across the four officer types and four program arms, we observe no systematic patterns of differences in characteristics, where of 60 differences considered, only 4 are statistically significant (at the 10 percent level).

4.3 Identification

Given the random assignment of treatments to district, our empirical strategy is straightforward. We use the following basic empirical specification:

$$Y_{bdt} = \theta_b + \theta_t + \beta_1 TD_{dt} + \beta_2 TB_{dt} + \beta_3 TBD_{dt} + \varepsilon_{bdt} \tag{1}$$

where b is a block in district d in month t, θ_b and θ_t are block- and month-level fixed effects, and Y is an outcome of interest. TD is an indicator variable equal to 1 if only District PayDash has been provided to the district in which block b falls and 0 if the block falls in a control district, TB is an indicator taking a value of 1 if only Block PayDash is provided to all blocks in district d, and TBD is an indicator taking a value of 1 if both District and Block PayDash have been provided to district d. Standard errors are clustered by district, the level of treatment assignment. This design allows us to evaluate the impacts of district- and block-level provision of PayDash separately, as well as complementarities that may exist between them. In Section 5.1.2, we also examine how effects evolve over time using an event study framework.

5 Results

5.1 Impacts on time to payment

5.1.1 Reduced-form effects of PayDash provision

We start by considering the impacts of providing access to PayDash at the district, block, or both levels of the MGNREGA administrative hierarchy. Column (1) of Table 4 shows that while the coefficients are negative for all variants of PayDash, it is only significantly so for District+Block PayDash, where a reduction in time to completion of the steps under officer purview of 2.4 days, or 22 percent, is observed. In addition, the equality of the District+Block coefficient with both the District and Block coefficients can be rejected, suggesting that a key component of the platform's effectiveness is that it be provided, in the language of our conceptual framework, at both the principal and supervisor levels. We code each of the treatment indicators as zero during the online data outage period, but consider the potential remaining value of PayDash during the outage period in Section 5.4. As a robustness check of the reduced-form effects of PayDash provision on time to completion, column (2) restricts the sample to only pre-outage periods. We see that the significant reduction in time to completion resulting from District+Block PayDash provision remains, and the magnitude of the coefficient is little changed.

5.1.2 Event-study analysis

To examine time-to-completion patterns in the months leading up to and following PayDash rollout, we estimate the following equation:

$$Y_{bdt} = \theta_b + \theta_t + \sum_{\tau=-6}^{2} [\beta_{1,\tau} TD_{\tau,dt} + \beta_{2,\tau} TB_{\tau,dt} + \beta_{3,\tau} TDB_{\tau,dt}] + \varepsilon_{bt} \tag{2}$$

where, as before, Y_{bdt} is an outcome of interest in block b in district d at month t, and θ_b and θ_t are block and month fixed effects. $TD_{\tau,dt}$ is a vector of indicator variables for whether month t in district d falls τ months relative to District PayDash provision. $TB_{\tau,dt}$ and $TDB_{\tau,dt}$ are the analogous vectors for Block and District+Block PayDash provision. Observations which fall in the month prior to PayDash provision serve as the reference category. Given the exogenous interruption of all PayDash treatment that occurred in May 2017 described previously and the staggered rollout of PayDash across districts in February and March 2017, we restrict our sample of post-treatment-period observations in this exercise through April 2017.

Figure 6 plots the period-specific estimated coefficients and 95 percent confidence intervals from Equation 2, and Table 5 presents the coefficients and standard errors for the post-treatment periods. Examining first the pre-treatment periods, reassuringly, for none of the three PayDash treatments are significant impacts observed. Similar to the results from Table 4, a downward shift in average time to completion is observed for each of District, Block, and District+Block PayDash provision, but significant impacts are only consistently observed for the District+Block treatment. In terms of the persistence of treatment effects, as shown in Figure 6 and Table 5, the impact of District+Block PayDash becomes stronger in the periods following treatment rollout, with an average reduction in time to completion of roughly 4.8 days.

5.2 Variation in usage by officer type and treatment arm

Having identified significant impacts of the provision of District+Block PayDash on average time to completion of the MGNREGA administrative steps under officer purview, we take advantage of our unique ability, given the online/mobile nature of our intervention, to examine not just whether but also how officers of each type (Block CEO,

Block PO, District CEO, District PO) use the PayDash platform, and if this differs significantly by whether treatment is provided to that level of the hierarchy alone or at both the district and block levels concurrently. In Table 6 we consider the following officer-month-level metrics of platform usage: (i) total user sessions on the platform; (ii) total minutes of platform usage; (iii) number of pending document/responsible employee "cards" viewed; (iv) number of calls to subordinate responsible employees made using the in-app direct contact feature; and (v) number of Whatsapp messages sent to these employees (or groups of these employees with a single message).

Two clear patterns emerge upon examination of the results. First, as might be expected, within each level of the hierarchy, usage is systematically higher by the lower-ranking official (program officer – PO) tasked full-time to MGNREGA versus the higher-ranking official (CEO) who is responsible for overseeing a number of additional government schemes as well. Block POs are the heaviest users of PayDash, with an average of roughly 6 sessions per month totaling approximately 1 hour in duration and with more than 150 cards viewed.

Second, the usage patterns within a given officer type vary across treatment arms in a manner consistent with the differential effects of PayDash provision shown above, where the District+Block treatment has significantly stronger impacts on time to completion than either the District or Block treatments alone. For each officer type, column (4) reports the results of a regression of a usage outcome on an indicator for District+ Block PayDash availability, where the comparison group is officers of that same type in areas receiving either District or Block PayDash treatment, and month fixed effects. Panel A shows that monthly usage sessions increase on average from roughly 0.5 to 4.3 for District CEOs in District+Block PayDash areas as compared to those in District PayDash areas. Total usage duration also borderline significantly (p-value = 0.122) increases for these officials. Average total sessions and usage duration roughly double

for District POs, though these differences are only borderline statistically significant (p-values = 0.137 and 0.118, respectively). Turning to officers at the block level of the MGNREGA administrative hierarchy, we see no increases in usage for Block CEOs. However, usage significantly increases for Block POs when PayDash is provided to both District and Block officials. Average monthly sessions rise from 4.8 to 8.6, minutes of usage from 43 to 72, cards viewed from 120 to 207, and messages sent more than triple from 0.7 to 2.7.

5.3 Impacts of platform usage on time to completion

The previous results demonstrate that concurrently providing PayDash access to both district and block MGNREGA officials significantly reduces average days taken to complete the steps under their purview related to payment delivery, and that platform usage by officials at both levels of the administrative hierarchy is significantly higher in such areas. In this section, to improve our understanding of the channels through which PayDash is impacting the MGNREGA payments administration process, we examine directly whether higher usage of PayDash is associated with reductions in average time to completion.

Columns (1) through (5) of Table 7 present the results of regressions of block-month-level average days to completion on each of the five usage metrics considered previously, together with month and block fixed effects. In Panel A, we include usage measures summed across officers within each level of the administrative hierarchy, while Panel B further disaggregates the usage measures to the officer-type level. We observe at both levels of the hierarchy that sending of messages is associated with significant reductions in time to completion. We also see within the block level of the bureaucracy that higher usage by block officers is consistently associated with quicker processing times,

where significant effects are observed both for the number and duration of PayDash sessions, as well as the number of cards viewed. While the estimates in this section do not have a causal interpretation, they provide suggestive evidence that usage of the PayDash application is at least in part responsible for the observed reductions in time to completion driven by access to the platform.

5.4 Exogenous shock to online data availability

In this section, we take advantage of the online data outage which provided an exogenous shock to the functionality of the PayDash platform to further examine the channels through which PayDash provision improved time to payment performance. While officer users were no longer able to access real-time data on lists of pending documents and summary information on the performance of the sub-regions and subordinate officials under their supervision in the outage period, the in-app direct call and Whatsapp message functionality remained operational. We can therefore examine whether the observed reductions in time to payment were driven solely by the increased ease of communicating with subordinates provided by PayDash, or if the reduced costs of acquiring information related to time to payment itself were also relevant to the improvements in bureaucratic performance seen earlier.

We estimate a version of equation (1) which additionally includes interactions of the treatment arm indicators (which take value one in all periods following platform rollout in a district) with an indicator taking value one during months in the online data outage period. If the utility of the PayDash platform to officer users is primarily through its in-app contact features, then we should observe insignificant impacts of the online data outage. However, if the availability of real time information on payment processing times is important as well, significant positive coefficients, signaling an attenuation of

the impacts of the PayDash platform in the online data outage period, may be observed on the interaction terms. In Table 8, we see that the coefficient on the interaction of District+Block PayDash with the outage period dummy is statistically significantly positive and of the same magnitude as the negative coefficient on the main District+Block PayDash term, suggesting that the availability of time-to-payment performance information was critical to the value of the PayDash platform.

6 Conclusion

Poor delivery of government services, notably payments, is endemic in developing country settings. We examine here two potential constraints to effective service delivery outside of more frequently discussed issues such as low human resource capacity, inadequate infrastructure, or insufficient financing: implementation by a multi-tiered bureaucratic structure and small inconvenience costs that hamper effective monitoring by supervisory officials within that system.

Our field experiment, conducted in collaboration with the Indian Ministry of Rural Development and the government of the state of Madhya Pradesh, provided a random sample of bureaucrats access to an internet and mobile-based management and monitoring platform to track and more easily monitor wage payments associated with the world's largest workfare program. The platform lowered the costs of accessing information about the status of wage payment processing and helped supervisors easily identify subordinate officials who needed to take action to address pending payments. We also randomly varied the level of the administrative hierarchy that received access to the e-platform to ensure that only principals, and then both principals and direct supervisors of implementing agents, received this information useful to program monitoring.

We find that lower costs of information acquisition reduced payment processing time

by up to 22 percent. Using detailed platform usage data, we find that easier access to information and improved managerial oversight by both higher-level principals and directly monitoring supervisors are important to effective service delivery. Specifically, significant reductions in payment delays occur only when search costs, which constrain capacity to monitor direct subordinates, are reduced at both the intermediate and senior management levels. In addition, usage rates at the intermediate management level—a proxy for efforts to improve the speed of wage payments—increase by a large amount when senior-level officials also have access to the e-platform. The results of this study point to the practical importance of both reducing small costs of information acquisition to monitor program performance, and of ensuring monitoring occurs at the multiple levels of bureaucracy involved in program oversight rather than that simply of senior overseers or direct supervisors. In future extensions of this work, we plan to examine the longer term impacts of PayDash on both payment processing time and demand for the workfare program, and to examine how the impacts of the platform may be mediated by officer-level personality characteristics.

References

[1] Anand, Utkarsh (2016). "Supreme Court pulls up Centre over delay in payment under MGNREGA." Indian Express, May 14.

[2] Banerjee, Abhijit, Esther Dulfo, Clement Imbert, Santosh Mathew, and Sandip Sukthankar (2016). "E-governance, Accountability, and Leaking in Public Programs - Experimental Evidence from a Financial Management Reform in India." Working Paper.

[3] Basu, Parantap and Kunal Sen (2015). "Welfare Implications of India's Employment Guarantee Programme with a Wage Payment Delay." IZA Discussion Paper No. 9454.

[4] Bloom, Nicholas, Ben Eifert, David McKenzie, Aprajit Mahajan, and John Roberts (2013). "Does management matter? Evidence from India." *Quarterly Journal of Economics* 128(1): 1-51.

[5] Deininger, Klaus and Yanyan Liu (2013). "Welfare and Poverty Impacts of India's National Rural Employee Guarantee Scheme." World Bank Policy Research Working Paper 6543.

[6] Dixit, Avinash (2002). "Incentives and Organizations in the Public Sector: An Interpretative Review." *Journal of Human Resources* 37(4): 696-727.

[7] Finan, Frederico, Benjamin A. Olken, and Rohini Pande (2015). "The Personnel Economics of the State." forthcoming in Abhijit Banerjee and Esther Duflo eds., *Handbook of Field Experiments*.

[8] Imbert, Clément, and John Papp (2015). "Labor Market Effects of Social Programs: Evidence from India's Employment Guarantee." *American Economic Journal: Applied Economics* 7(2): 233-63.

[9] Indian Express (2017). "Aadhaar data of over 13 crore people exposed: New report." May 3.

[10] Klonner, Stefan, and Christian Oldiges (2014). "Safety Net for India's Poor or Waste of Public Funds? Poverty and Welfare in the Wake of the World's Largest Job Guarantee Program." AWI Discussion Paper Series No. 564.

[11] Muralidharan, Karthik, Paul Niehaus, and Sandip Sukhtankar (2016). "Building State Capacity: Evidence from Biometric Smartcards in India." *American Economics Review* 106(1): 2895-2929.

[12] Tirole, Jean (1986). "Hierarchies and Bureaucracies: On the Role of Collusion in Organizations," *Journal of Law, Economics, & Organization* 2: 181–214.

Figures and tables

Figure 1: MGNREGA payment process

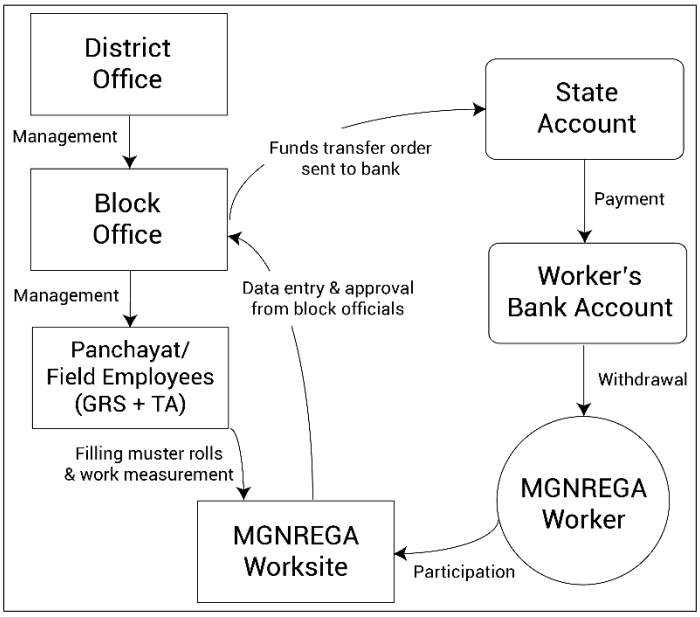
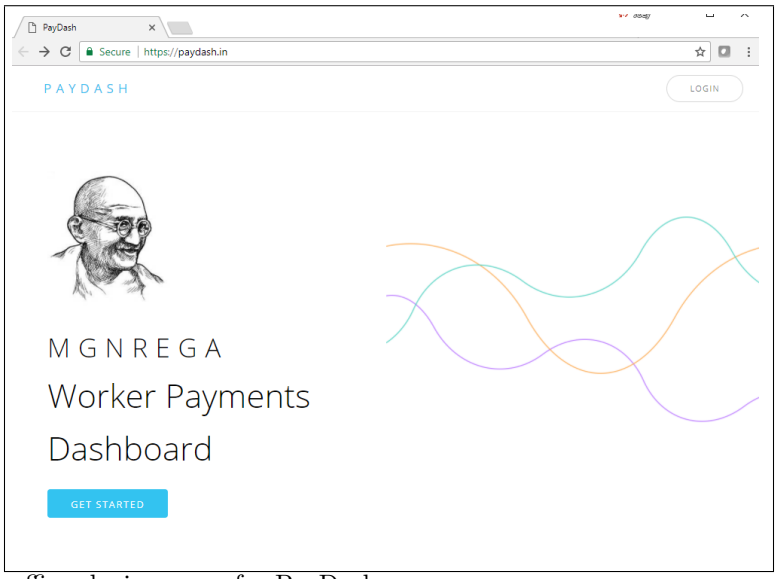
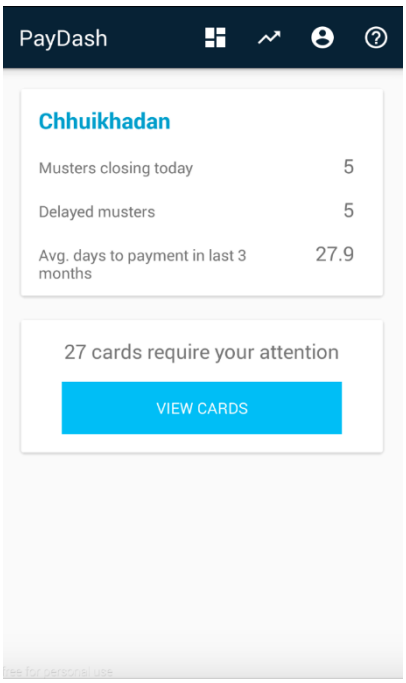


Figure 2: PayDash screenshot example 1



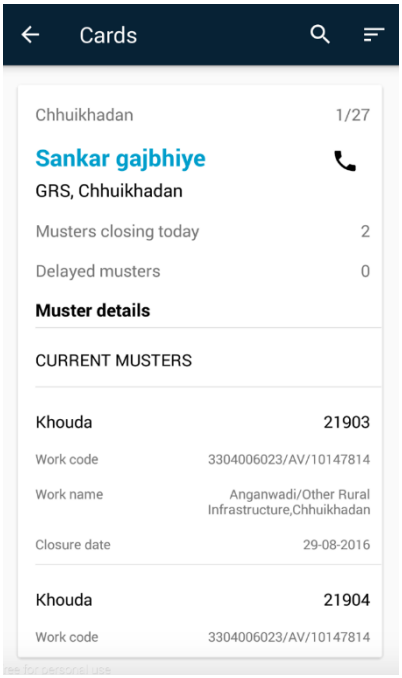
Notes: The online officer login screen for PayDash.

Figure 3: PayDash screenshot example 2



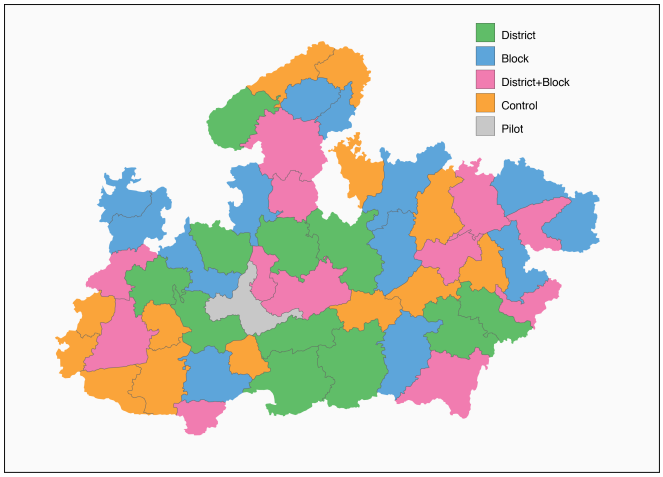
Notes: The mobile landing screen of Block PayDash provides an overview of block performance.

Figure 4: PayDash screenshot example 3



Notes: "Cards" show documents pending and offers the option of directly contacting the employee responsible for processing the document.

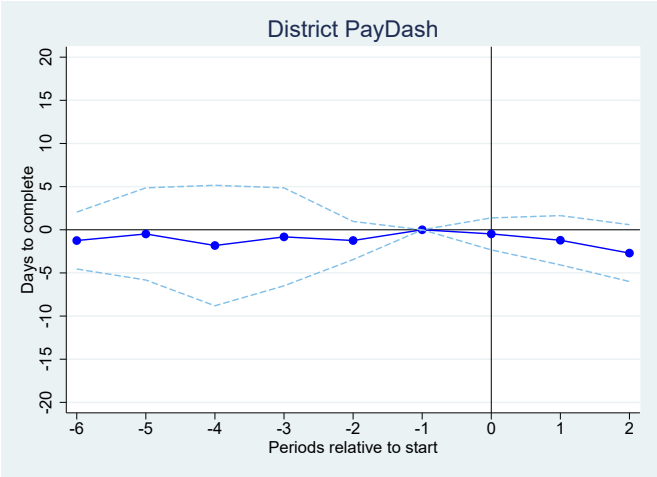
Figure 5: District-level treatment assignments



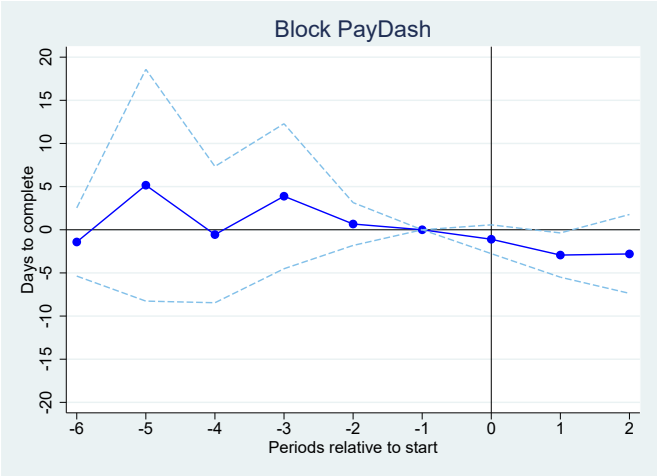
Notes: Figure shows randomized assignment of PayDash variants across districts in the state of Madhya Pradesh.

Figure 6: Event-study plots

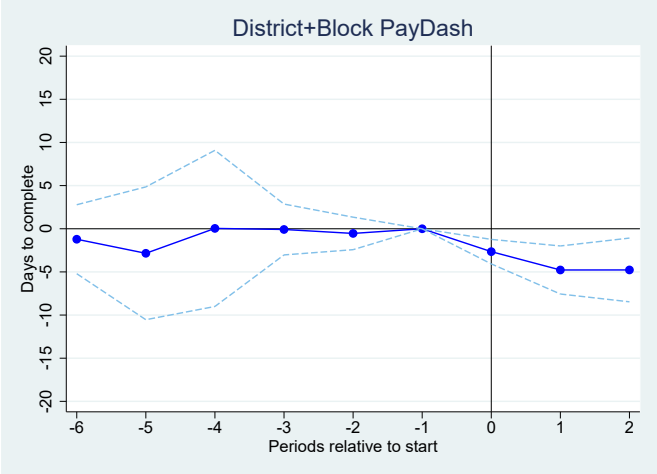
a. District PayDash



b. Block PayDash



c. District+Block PayDash



Notes: Each panel plots the coefficients and associated 95% confidence intervals corresponding to the estimates of Equation 2.

Table 1: Balance tests

	District PayDash (1)	Block PayDash (2)	District + Block PayDash (3)	Control (4)	Diff. (1-4) (5)	Diff. (2-4) (6)	Diff. (3-4) (7)	Obs. (8)
Average person days	34.27	33.80	34.56	30.33	3.94	3.46	4.22	50
worked (x1000)	[15.92]	[16.89]	[17.88]	[14.01]	(6.02)	(6.10)	(6.45)	
Std. dev person days	32.78	29.05	31.56	24.42	8.35	4.63	7.14	50
worked (x1000)	[17.21]	[15.90]	[19.35]	[10.94]	(5.82)	(5.36)	(6.35)	
Average days	41.32	43.00	42.31	44.97	-3.65	-1.97	-2.66	50
to payment	[13.20]	[8.66]	[10.79]	[15.07]	(5.66)	(4.83)	(5.22)	
Std. dev days	28.59	26.53	27.82	29.66	-1.07	-3.13	-1.84	50
to payment	[9.02]	[3.78]	[8.28]	[5.77]	(3.05)	(1.92)	(2.87)	
Percent rural	77.72	75.85	73.85	75.71	2.01	0.14	-1.87	50
population	[9.35]	[12.31]	[18.58]	[19.58]	(6.07)	(6.43)	(7.63)	
Total blocks	7.25	5.46	6.25	5.77	1.48*	-0.31	0.48	50
	[2.56]	[2.11]	[3.22]	[1.69]	(0.88)	(0.75)	(1.04)	

Notes: Column (1) presents the means and standard deviations of each variable for districts receiving District PayDash. Column (2) gives this information for districts assigned Block PayDash, while Column (3) does so for districts receiving District+Block PayDash and Column (4) for control districts. Columns (5) through (7) present the coefficients and standard errors from a single district-level regression of each variable on separate indicators for assignment to each PayDash treatment arm.

Table 2: Balance tests - district officer characteristics

	District PayDash (1)	Block PayDash (2)	District + Block PayDash (3)	Control (4)	Diff. (1-4) (5)	Diff. (2-4) (6)	Diff. (3-4) (7)	Obs. (8)
Panel A. District CEO								
Age	40.667	49.636	41.778	42.3	-1.633	7.336*	-0.522	39
	[9.772]	[9.223]	[9.148]	[9.476]	(4.418)	(4.103)	(4.268)	
Female	0.091	0	0.222	0.3	-0.209	-0.300*	-0.078	42
	[.302]	[0]	[.441]	[.483]	(0.178)	(0.152)	(0.211)	
College graduate	1	1	1	0.909	0.091	0.091	0.091	43
	[0]	[0]	[0]	[.302]	(0.091)	(0.091)	(0.091)	
SC/ST/OBC	0.364	0.417	0.111	0.333	0.03	0.083	-0.222	41
	[.505]	[.515]	[.333]	[.5]	(0.225)	(0.223)	(0.199)	
Months current rank	27.5	32.273	18.429	54.222	-26.722	-21.949	-35.794	33
	[19.887]	[21.392]	[11.4]	[81.464]	(28.432)	(28.087)	(27.640)	
Panel B. District PO								
Age	44.273	41.923	45.5	46.833	-2.561	-4.91	-1.333	48
	[7.322]	[8.077]	[7.949]	[9.301]	(3.470)	(3.502)	(3.532)	
Female	0.1	0.077	0	0.167	-0.067	-0.09	-0.167	46
	[.316]	[.277]	[0]	[.389]	(0.150)	(0.137)	(0.113)	
College graduate	1	1	0.833	0.833	0.167	0.167	0	48
	[0]	[0]	[.389]	[.389]	(0.112)	(0.112)	(0.159)	
SC/ST/OBC	0.636	0.231	0.455	0.5	0.136	-0.269	-0.045	47
	[.505]	[.439]	[.522]	[.522]	(0.214)	(0.194)	(0.218)	
Months current rank	85.364	85.417	61	52.7	32.664*	32.717	8.3	43
	[36.478]	[42.204]	[44.764]	[50.515]	(19.351)	(20.081)	(21.262)	

Notes: Column (1) presents the means and standard deviations of each variable for district officials in districts receiving District PayDash. Column (2) gives this information for districts assigned Block PayDash, while Column (3) does so for districts receiving District+Block PayDash and Column (4) for control districts. Columns (5) through (7) present the coefficients and standard errors from a single district-level regression of each variable on separate indicators for assignment to each PayDash treatment arm.

Table 3: Balance tests - block officer characteristics

	District PayDash (1)	Block PayDash (2)	District + Block PayDash (3)	Control (4)	Diff. (1-4) (5)	Diff. (2-4) (6)	Diff. (3-4) (7)	Obs. (8)
Panel A. Block CEO								
Age	50.384	46.373	50.19	48.288	2.095	-1.915	1.902	262
	[8.939]	[9.115]	[7.651]	[7.668]	(1.823)	(1.723)	(1.461)	
Female	0.135	0.09	0.065	0.153	-0.017	-0.063	-0.088	262
	[.344]	[.288]	[.248]	[.363]	(0.067)	(0.064)	(0.065)	
College graduate	0.961	0.941	0.984	1	-0.039	-0.059*	-0.016	266
	[.196]	[.237]	[.126]	[0]	(0.025)	(0.031)	(0.014)	
SC/ST/OBC	0.542	0.552	0.517	0.544	-0.002	0.008	-0.027	254
	[.502]	[.501]	[.504]	[.503]	(0.116)	(0.106)	(0.107)	
Months current rank	151.474	135.364	155.475	142.259	9.215	-6.895	13.217	261
	[94.751]	[93.107]	[87.417]	[86.598]	(11.970)	(10.795)	(11.972)	
Panel B. Block PO								
Age	40.337	40.58	39.986	40.708	-0.371	-0.129	-0.722	301
	[5.598]	[6.531]	[6.067]	[5.749]	(1.052)	(1.183)	(1.105)	
Female	0.235	0.176	0.137	0.186	0.05	-0.009	-0.049	296
	[.427]	[.384]	[.346]	[.392]	(0.085)	(0.068)	(0.070)	
College graduate	0.988	1	1	1	-0.012	0	0	303
	[.108]	[0]	[0]	[0]	(0.011)	0.000	0.000	
SC/ST/OBC	0.683	0.552	0.634	0.544	0.139	0.008	0.09	288
	[.468]	[.501]	[.485]	[.502]	(0.115)	(0.137)	(0.137)	
Months current rank	105.595	105.493	105.507	110.739	-5.144	-5.246	-5.232	288
	[26.766]	[30.359]	[26.289]	[20.886]	(3.797)	(4.844)	(5.735)	

Notes: Column (1) presents the means and standard deviations of each variable for block officials in districts receiving District PayDash. Column (2) gives this information for districts assigned Block PayDash, while Column (3) does so for districts receiving District+Block PayDash and Column (4) for control districts. Columns (5) through (7) present the coefficients and standard errors from a single block-level regression of each variable on separate indicators for assignment to each PayDash treatment arm.

Table 4: Reduced-form impacts of PayDash provision

	Average days to complete	
	Full sample	Pre-outage
	(1)	(2)
District PayDash	-0.381	0.033
	(1.175)	(1.483)
Block PayDash	-0.715	-0.925
	(0.944)	(1.194)
District+Block PayDash	-2.382**	-2.452**
	(0.913)	(1.123)
Test for equality of coeffs., p-value:		
District = Block	0.763	0.495
District = District + Block	0.066	0.068
Block = District + Block	0.029	0.123
Observations	6,394	5,778
Control outcome mean [SD]	10.766	12.349
	[8.739]	[9.343]

Notes: All columns report OLS estimates from block-month-level regressions of the listed variable on indicators for PayDash treatment availability, weighted by the total number of transactions. Additionally included are block and month fixed effects. Standard errors clustered at the district level in parentheses. Significant at *10 percent, **5 percent,***1 percent.

Table 5: Event-study results

	Average days to complete (1)
District PayDash	
($\tau = 0$)	-0.478
	(1.458)
($\tau = 1$)	-1.213
	(1.458)
($\tau = 2$)	-2.700
	(1.680)
Block PayDash	
($\tau = 0$)	-1.098
	(0.850)
($\tau = 1$)	-2.930**
	(1.308)
($\tau = 2$)	-2.800
	(2.332)
District+Block PayDash	
($\tau = 0$)	-2.651***
	(0.725)
($\tau = 1$)	-4.777***
	(1.421)
($\tau = 2$)	-4.772**
	(1.884)
Observations	5,778

Notes: Column reports OLS estimates from block-month-level regressions for the listed outcome corresponding to the event-study specification detailed in Equation 2, weighted by the total number of transactions. Not shown in the table are the coefficients from pre-treatment periods, which Figure 6 demonstrates are insignificantly different than zero in all cases. Additionally included are block and month fixed effects. Standard errors clustered at the district level in parentheses. Significant at *10 percent, **5 percent,***1 percent.

Table 6: Heterogeneity in officer PayDash usage

	District (1)	Block (2)	District+Block (3)	Difference (4)	Obs. (5)
Panel A. District CEO					
Sessions	0.46		4.25	3.78**	52
	[0.84]		[7.96]	(1.60)	
Usage duration (min)	1.84		16.87	15.12	52
	[4.64]		[47.83]	(9.60)	
Cards viewed	7.14		8.75	2.57	52
	[17.93]		[17.91]	(4.63)	
In-app calls made	0		0	.	52
	.		.	.	
In-app messages sent	0.07		0	-0.08	52
	[0.38]		.	(0.08)	
Panel B. District PO					
Sessions	4.32		8.57	4.18	59
	[7.33]		[12.61]	(2.77)	
Usage duration (min)	16.19		40.97	24.91	59
	[43.17]		[68.79]	(15.70)	
Cards viewed	22.29		43.89	21.99	59
	[63.56]		[97.00]	(22.97)	
In-app calls made	0.03		0	-0.03	59
	[0.18]		.	(0.03)	
In-app messages sent	2.19		4.75	2.52	59
	[8.08]		[11.23]	(2.21)	
Panel C. Block CEO					
Sessions		3.66	3.60	-0.05	316
		[7.63]	[6.42]	(0.79)	
Usage duration (min)		19.68	14.20	-5.25	316
		[65.97]	[35.37]	(5.89)	
Cards viewed		46.03	27.00	-18.61	316
		[192.22]	[89.66]	(16.74)	
In-app calls made		0.08	0.02	-0.06	316
		[0.57]	[0.18]	(0.05)	
In-app messages sent		0.24	0.04	-0.19*	316
		[1.29]	[0.34]	(0.10)	
Panel D. Block PO					
Sessions		4.82	8.57	3.74***	364
		[9.07]	[12.87]	(1.14)	
Usage duration (min)		42.96	71.59	28.43*	364
		[147.09]	[177.98]	(16.81)	
Cards viewed		119.82	207.31	87.04*	364
		[461.08]	[510.56]	(50.20)	
In-app calls made		0.70	0.18	-0.53	364
		[5.24]	[1.39]	(0.41)	
In-app messages sent		0.69	2.69	1.96**	364
		[3.50]	[11.94]	(0.88)	

Notes: Columns (1) through (3) report variable means with standard deviations in brackets for officers in each position within the listed treatment arm, for the pre-outage period (February-April 2017). Column (4) reports the coefficient from an OLS regression of the listed outcome on an indicator for District+Block PayDash. Also included are month fixed effects. Significant at *10 percent, **5 percent,***1 percent.

Table 7: Platform usage and time to completion

Usage measure:	Average days to complete				
	Sessions	Usage duration (min)	Cards viewed	In-app calls made	Messages sent
	(1)	(2)	(3)	(4)	(5)
A. Level-specific usage (sum across positions)					
District	0.005	-0.000	-0.000		-0.087***
	(0.042)	(0.0045)	(0.004)		(0.028)
Block	-0.099***	-0.007**	-0.002**	-0.013	-0.016***
	(0.030)	(0.003)	(0.001)	(0.089)	(0.001)
Observations	5,655	5,655	5,655	5,655	5,655
B. Position-specific usage					
District CEO	-0.097**	-0.004	0.010		-1.842***
	(0.040)	(0.019)	(0.025)		(0.314)
District PO	0.036	0.001	-0.002		-0.086***
	(0.055)	(0.006)	(0.005)		(0.028)
Block CEO	-0.075*	-0.010**	-0.001	-0.958	0.086
	(0.040)	(0.004)	(0.001)	(0.620)	(0.143)
Block PO	-0.099***	-0.006**	-0.002*	0.019	-0.016***
	(0.031)	(0.003)	(0.001)	(0.058)	(0.001)
Observations	5,655	5,655	5,655	5,655	5,655

Notes: All columns report OLS estimates from block-month-level regressions of the listed variable on variables reflecting PayDash usage by hierarchy level or specific position, weighted by the total number of transactions and for the pre-outage period. Additionally included are block and month fixed effects. Standard errors clustered at the district level in parentheses. Significant at *10 percent, **5 percent,***1 percent.

Table 8: Impacts of online data outage

	Average days to complete
	(1)
District PayDash	0.204
	(1.460)
Block PayDash	-0.983
	(1.173)
District+Block PayDash	-2.389**
	(1.116)
District PayDash * Online data outage	1.515
	(1.051)
Block PayDash * Online data outage	0.096
	(1.190)
District+Block PayDash * Online data outage	2.234**
	(0.972)
Observations	6,394
Control outcome mean [SD]	10.766
	[8.739]

Notes: All columns report OLS estimates from block-month-level regressions of the listed variable on indicators for PayDash treatment status interacted with an indicator for the online data outage period, weighted by the total number of transactions. Additionally included are block and month fixed effects. Standard errors clustered at the district level in parentheses. Significant at *10 percent, **5 percent,***1 percent.

Appendix

PayDash training details

To introduce officers to PayDash, we invited all relevant government officials in the study area - typically a permanent district officer overseeing multiple development schemes in their district, the contract district worker specifically overseeing MGNREGA, a permanent block officer overseeing multiple development schemes in the block, and a contract block officer specifically overseeing only MGNREGA in the block - to a half-day session.

Both control and treatment officials go through the same roll-out process, with the exception that only treatment officials are introduced to and provided PayDash. First, we collect baseline survey data from all officials through a self-administered, paper survey.[1] Then we conduct a session outlining data-based management tools available to officials in the MGNREGA MIS and ask officials to share about their work and professional challenges they face. After this, control officials are dismissed. In sessions with treatment officers, the training continues with an additional 1.5 hour session where officers are introduced to PayDash and its mobile platform, and they download the app and conduct preliminary exercises on the platform to ensure it is functional and they understand how to use it.

To avoid treatment contamination, officers from treatment areas were trained on separate days and/or locations from those in control areas. To encourage survey response and PayDash coverage, we make extensive efforts (by calling up to 5 times, and the state sends a letter telling all officials to report for this official training) to ensure all officers are present at the training session during the state roll-out. For those officials that do not attend the group-based training, we conduct individual surveying and onboarding to PayDash (when relevant). To avoid sensitivities related to officials' seniority, we conducted sessions separately not simply for treatment and control officials, but also for block and district-level officials within these groups.

[1] For the most senior group of officials, we sometimes administer a shortened version of the baseline survey in-person, either because the official is too busy to fill out the entire survey or because s/he has a strong preference not to fill out the survey personally.