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Money versus Kudos

The Impact of Incentivizing Local Politicians in India

Ghazala Mansuri
Nethra Palaniswamy
Vijayendra Rao
Slesh A. Shrestha

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Abstract

Despite growing awareness of the various limitations of electoral democracy, there is a relative lack of evidence on effective policy interventions to improve the performance of elected officials and motivate them to act more equitably. This paper reports the results from an experiment in which elected presidents of village governments in Tamil Nadu, India, were randomly assigned to one of two incentive schemes (or a control group): a financial incentive that rewarded better performing presidents with a higher public budget, and a nonfinancial incentive that awarded them a certificate demonstrating their achievement with an information campaign to disseminate it. The findings show that both incentives improved access to public investments and private transfers in the villages of incentivized presidents. The nonfinancial incentive also led to a more equitable between-hamlet allocation of resources within the village, and this effect was more acute with officials who faced potentially more competitive elections. The paper shows that the results are consistent with a theoretical model where imperfect voter information drives inequities in resource allocation, and interventions that provide credible information on politician quality motivate elected representatives to act more equitably.

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Money versus Kudos: The Impact of Incentivizing Local Politicians in India

Ghazala Mansuri, Nethra Palaniswamy, Vijayendra Rao, and Slesh A. Shrestha*

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*Mansuri: Global Practice on Poverty and Equity and Development Research Group, The World Bank, gmansuri@worldbank.org. Palaniswamy: Global Practice on Poverty and Equity, The World Bank, npalaniswamy@worldbank.org. Rao: Development Research Group, The World Bank, vrao@worldbank.org. Shrestha: Kosi Collaborative, sleshshres@gmail.com. A large number of people contributed to the design, implementation, and supervision of this research project, especially Kevin Crockford, Samik Das, Manivannan Govindaraj, Smriti Sakhamuri, Shobha Shetty, Makiko Watanabe and from the State Government of Tamil Nadu: RV Shajeevana, P Amudha, and Mythili Rajendran. This paper is a product of the World Bank's Social Observatory. We are grateful to participants in seminars at the Asian Development Bank, Institute for Economic and Social Research Jinan University, International Food Policy Research Institute, Paris School of Economics, Stanford University, the World Bank, and especially to Berk Özler, for valuable comments. We gratefully acknowledge financial support from SAFANSI trust fund, the World Bank's Research Support Budget, and the National University of Singapore research grant. The views expressed herein are those of the authors and should not be attributed to the World Bank, its executive directors, or the countries they represent.

1 Introduction

There is an increased awareness, both in the scholarly literature and in popular perception, of the shortcomings of electoral democracy, particularly because of what can be called the three Cs: capture—elite domination and manipulation of elections (Acemoglu and Robinson, 2008), corruption (De Vries and Solaz, 2017), and clientelism, where goods and services are provided to sub-groups of the electorate for political support (Bardhan and Mookherjee, 2018). A relatively open question is whether these democratic failures can be corrected. Can policy interventions be designed to improve the performance of elected officials and to motivate them to act more equitably?

The literature on motivating politicians to perform better is sparse. An important paper by Ferraz and Finan (2009) on Brazilian municipal governments exploits a discontinuity that increases politician salaries when the municipality's population exceeds a certain size. They find that higher wages for the elected leader results in better performance—more bills proposed and approved, and more resources allocated to publicly funded schools and clinics. This relates to a larger literature on improving the performance of bureaucrats and frontline delivery staff.[1] The results on this have been mixed, partly due to the challenges commonly associated with incentivizing employees of mission-oriented organizations (Besley and Ghatak, 2005) such as the multitasking problem which results in no single effective measure of performance, and with missions that are too broadly defined.

There is a much larger literature on addressing governance failures by strengthening mechanisms for accountability (Ashworth, 2012; Mookherjee, 2015). These include improving the legitimacy of political institutions and expanding franchise (e.g. Baland and Robinson, 2008; Fujiwara, 2015), introducing campaign finance reforms (e.g. Avis et al., 2017), state-led audits (Olken, 2007; Ferraz and Finan, 2011), and grievance redressal mechanisms (Sharan and Kumar, 2021). All these have been found to improve government performance. Another strand of literature examines the impact of bottom-up approaches by strengthening community participation and citizen accountability (Olken, 2007; Mansuri and Rao, 2013; Rao et al., 2017; Giné and Mansuri, 2018), which broadly shows mixed effects, partly dependent on the nature of the intervention and whether it is permanent or ad hoc.

[1] The literature also spans work on incentives for teachers (Muralidharan and Sundararaman, 2011; Duflo et al., 2012; Gaduh et al., 2012), health care workers (Ashraf et al., 2014; Bjorkman Nyqvist et al., 2019), community leaders (Olken et al., 2014), government officials (Bó et al., 2013; Khan et al., 2015), microcredit officers (Giné et al., 2022), and police (Banerjee et al., 2021). A large literature finds generally favorable effects on strengthening the role of the media and improving voter information (e.g. Besley and Burgess, 2002; Gerber et al., 2008; Banerjee et al., 2011; Aker et al., 2017).

Our paper reports on an experiment that motivates elected politicians not by increasing their salaries, but by randomly assigning better graded politicians with either a higher public budget, or with kudos—a nonfinancial incentive in the form of a public certificate that they can use in election campaigns, or to a control group. The sites of our experiment are democratically elected presidents of village governments in the state of Tamil Nadu in southern India. We develop a theoretical model where different voter groups differ in the degree of accuracy with which their members can observe politician quality. In such conditions, our model shows that public financial and nonfinancial incentives can both work by increasing total resources available to the village and by providing credible information on politician quality to different voter groups within the village. The latter, in particular, improves electability by making within-village resource allocation more equitable.

Our empirical findings are consistent with these theoretical predictions. We find that both financial and nonfinancial incentives improve the performance of village presidents, including expanding the access to private transfers and public investments in their villages. Nonfinancial incentives, in particular, also show sharper effects on improving within-village equity in resource allocation during the presidents' tenure in office, and such equity effects are correlated with their future electoral incentives (i.e. incentivized village presidents who were eligible for re-election show more equitable allocation of resources than those who were not eligible for re-election). These results indicate that public incentive schemes—especially those designed to improve the observability of politician quality—can improve the performance of electorally-motivated agents and make them act more equitably.

Our paper, like much of the literature on improving elected government performance, focuses on local governments. In large countries such as Brazil and India, where each local government represents a different electoral unit, municipal and village governments offer enough variation in the quality of electoral democracy and its attendant failures to study them rigorously with large enough samples.

Local governments have also long been perceived, at least since John Stuart Mill, as "training grounds for democracy" where democracy is likely to work better because (a) the proximity of leaders and their constituents leads to better information, (b) there are sharper electoral incentives due to a more direct mapping between performance and votes, and (c) there is potential for better monitoring of politician performance by citizens. Variants of this logic, and a related belief that communities are best suited to have control over decisions that have an impact on their lives, have

led to a sharp increase in locally managed development funding and assistance (Mansuri and Rao, 2012).

In India the 73rd amendment to the Indian constitution passed in 1992 mandated the formation of independently elected village councils known as gram panchayats (henceforth GPs). In the years since, several national and state governments, across political parties, have directed that safety net programs, public assistance, and public goods construction projects be managed by GPs. This has made GPs a central player in the development agenda in India—in efforts to reduce poverty and inequality, in local infrastructure development, and the management of common property resources. There is a large scholarly literature on the political economy of GPs, and much of it has demonstrated that "government failure" at the local level is widespread (Mookherjee, 2014). There is evidence that presidents of GPs favor their home village and caste (Besley et al., 2012), and that elite capture and clientelist arrangements are pervasive (e.g. Bardhan and Mookherjee, 2012; Anderson et al., 2015).

In section 2 of this paper we will sketch the context of the Indian gram panchayat system, and of the Pudhu Vaazhvu project in Tamil Nadu within the rubric of which our experiment took place. Section 3 explains our experimental design. Section 4 exposits the theoretical framework that we use to underpin our empirical analysis. Section 5 outlines our sources of data and spells out the empirical strategy we use. Section 6 describes our results and section 7 concludes the paper.

2 Context

In 1992, the 73rd amendment to the Indian Constitution transferred responsibility for the delivery of several public goods and services to a three-tier local government, collectively called Panchayati Raj Institutions (PRI). This amendment tasked the third and lowest tier of this government, the Gram Panchayat or the GP with serving as an "executive" elected village council for a group of 5-10 villages or hamlets (in our sample a GP has an average of 8 hamlets). A president, who is elected by all eligible voters within the GP by a popular vote, heads the GP council; and independently supervised elections are held on a regular basis with political reservations for women and lower caste groups. In addition, the amendment also mandated that a "legislature" be formed by a Gram Sabha to which every citizen of the village would be a member, with meetings held at least four times a year to discuss key issues of local importance, including the allocation of public funds and the selection of beneficiaries for public programs. While this amendment provided a common

institutional structure nationwide for local governance, it also provided states with considerable leeway in determining which functions and funds would be devolved; and in the degree to which these would be devolved (Besley et al., 2012).

2.1 Gram Panchayats in Tamil Nadu

In the state of Tamil Nadu, the functions of the GP are defined by the Tamil Nadu Village Panchayat Raj Act of 1994. This act delineates functions that are devolved to GPs, and it stipulates a rule and guideline-based process that assigns specific roles to the three tiers of local government (the GP, the block, and the district), and governs the allocation of local financial resources. With limited institutional capacity to collect own revenues, GP investment funds are financed primarily through rule-based grants and programs that determine the total resources invested during the president's tenure.[2] The main source of funds that is fully devolved to the GP is the GP general fund. This fund is determined by the total population in a GP with a fixed equalization component; and it finances operations and maintenance of public goods related to sanitation, drinking water infrastructure, and streetlights. This general fund accounts for 75 percent of total GP expenditures, with the remainder coming from program-specific grants from the federal and state governments. Investments in new local infrastructure are financed almost entirely from these grants. At the time of this experiment, all new infrastructure investments in the GP were financed out of funds allocated under the Tamil Nadu Village Habitations Improvement (THAI) Scheme. GP-level allocation from this fund was determined by the number of hamlets in GPs; and the role of GP presidents in this scheme was limited to making decisions on the exact location of these infrastructure investments within their GP. Presidents had no say over the types of investments (which were determined by guidelines applied by the block government); and they had no direct access to their allocated funds, as these require approvals from the district governments for the release of funds.[3]

GPs in Tamil Nadu therefore function, in effect, as democratically elected distribution agencies, similar to other states in India (Chauchard, 2017); and with investment budgets that are fully financed through formula-bound funds. In this context, GP presidents fulfill two key functions.

[2] On average, the total GP budget in Tamil Nadu in 2013/14 was INR 2,539,041 (approximately USD 35,976). Slightly more than 13 percent of this was funded by the Thirteenth Central Finance Commission Grant, while the remaining 87 percent by the Fourth State Finance Commission Grant.

[3] For each transaction over INR 2,000 (and all transactions after exceeding the total expenditure of INR 5,000 in a year), the District Collector—who is a government bureaucrat based in the district office—has to approve the release of funds, after they receive a proposal from the GP on how the funds would be used.

First, they are responsible for the targeting of new public good investments within the GP; and for the maintenance and provision of public goods that are under their direct control. This includes four types of public infrastructure: (1) internal roads; (2) streetlights; (3) water, which includes wells, ponds, tanks and other forms of water supply for the GP; and (4) sanitation, mainly street drains and public latrines.[4] However, even for these public goods, technical approvals are needed for meaningful investments (above USD 150) in provision and repairs.[5]

Second, GP presidents identify eligible households for various national and state-level private transfer schemes and help facilitate access to these schemes. These include long-running pension schemes for the elderly, differently abled, and widows; and the implementation of a cash-for-work program, the National Rural Employment Guarantee Scheme (NREGS).[6] Access to these recurring transfers requires households to obtain a government-issued card, and the GP president is responsible for forwarding the applications to the block, and providing follow-up assistance for approval. At the time of the study, a national rural housing program (known as Indira Awaas Yojana, or IAY at the time)[7] that provided disadvantaged households with a one-time transfer between USD 4,000 and USD 8,000 to build a house made of solid construction materials, was rolled out. GP presidents were responsible for selecting IAY recipients within their GPs, although the number of IAY grants per GP were fixed based on population criteria by the block government.

2.2 Padhu Vaazhvu Project

In Tamil Nadu, as in other states, GPs also implement flagship programs of the Ministry of Rural Development, including the National Rural Livelihoods Mission (NRLM). In Tamil Nadu, the NRLM was originally initiated as a World Bank assisted state-level livelihoods project known as the Padhu Vaazhvu Project (PVP) which targeted 10 million women in the poorest areas of the state.

PVP was launched in 2005 in 2,300 GPs drawn from 70 blocks (a sub-district administrative

[4]The GP is also responsible for the maintenance of cremation and burial grounds. There is typically one cremation and burial ground per GP, and this public good is not the main focus of this study. Additionally, in Tamil Nadu the resources and responsibilities for improving access to and quality of other public goods like education and health care fall under the purview of the upper tier local governments, at the level of the block and the district.

[5]As per Tamil Nadu Panchayat rules, presidents can spend up to INR 600 for repairs of water hand-pump and INR 7,500 for motor-pump maintenance without an approval from engineers. Funds from the THAI scheme are subjected to additional THAI-specific guidelines.

[6]Under NREGS, all rural households are eligible for 100 days of paid work every year.

[7]The IAY is now known as the Pradhan Mantri Awas Yojana. In this paper, we refer to this rural housing scheme by its name during the time of this study.

unit that is made up of a cluster of GPs) across 16 districts of Tamil Nadu. In 2012, the project expanded to cover an additional 1,661 GPs in 50 blocks in 14 districts. Out of these, 10 districts (with a project coverage of 46 blocks) received the project for the first time in this second phase of PVP.

PVP's two main activities included: (1) connecting poor and excluded households to the statewide network of Self Help Groups (SHGs) of Women—which provide access to credit and other livelihood trainings for women; and (2) organizing skills training and placement of the village youth with the private sector. Apart from these livelihoods related activities that make up its core mandate, PVP also placed significant emphasis on making local governance work for the poor. To fulfill this central goal, PVP had a formal partnership with the GP; and key elements of PVP's project design were focused on making local government more responsive to citizens' needs, and on improving transparency in its use of public resources. Formally, the GP president served as the ex-officio president of the Village Poverty Reduction Committee (VPRC)—which was the core institution through which PVP implemented its interventions.

The VPRC was tasked with two key mandates that related to the goal of improved local governance. First, it provided facilitation services in partnership with the GP president, to improve access to private benefits from existing state and national programs. To provide this service, the VPRC identified the excluded, assisted them with filling application forms, and forwarded them to the GP president who provided political mediation services with the block. Second, the VPRC played an important intermediary role between the citizen and the state. In principle, citizens could approach their GP presidents for assistance with access to formal documents and to seek actions from block and district governments. For instance, GP citizens may have required assistance with accessing birth and death certificates; those who had been approved for IAY benefits may have faced significant delays in the release of these funds (from the block); or they may have approached the president for issues related to public services such as failures in the electronic payments for NREGS or in the public food distribution system. The VPRC was tasked with facilitating this interaction by bringing these issues directly to the attention of the GP president; or indirectly by improving participation in Gram Sabha meetings (GP-wide public meeting) where such individual-specific and general issues that related to the allocation of public investments across the GP were discussed and debated.

2.2.1 Evaluation of GP presidents under PVP

In order to incentivize GP presidents to work with the VPRC to improve responsiveness and transparency in local governance, the design of the PVP project also included a program-wide performance-based financial incentive in its first phase of implementation. To implement this performance-based scheme, each GP president was assessed on a range of indicators that related to their performance on the overarching function of the GP, i.e. the delivery of public services and targeted safety net programs, and their role in overseeing the activities of the VPRCs.

To assess performance, PVP developed evaluation criteria based on project monitoring data. A team of external evaluators used a combination of project monitoring data, and random field verification visits to implement the evaluations. To avoid any semblance of bias in the evaluation process, the evaluation teams were always from a different district from the GP that they were assigned to evaluate which makes it very unlikely that they were familiar to the GP prior to visiting it. Evaluators also consisted of people intimately familiar with the functioning of GPs—such as retired local bureaucrats and PVP members. A team of 5-6 such evaluators visited the GP for a period of 2-4 days to conduct this evaluation.

A predetermined scoring system was then used to convert these indicators or evaluation criteria into scores; with a maximum possible score of 100. An absolute score was used to determine the threshold for the performance incentive, with cutoffs of 70 and higher, 69-55, and less than 55 used to assign letter grades A, B, and C, respectively. In this first phase, GPs with a letter grade A qualified for a financial incentive from the project.

Project monitoring data used in these evaluations were collected by the VPRC, which delivered all interventions under the PVP project; and they were verified through a multi-stage process. These data were collected through standardized reporting formats and informed a range of project functions from the identification of target and beneficiary populations to the tracking of expenditures and process-related outcomes. All monitoring data was also validated through a 3-step process which involved local social audit committees, PVP project staff, and international third-party monitoring and audit firms. The third-party verification included visits to a rotating random sample of GPs so that every GP was reviewed at least once in a calendar year, and audits of financial statements on an annual basis. Any data that related to private transfers was also required to be publicly disclosed through regular Gram Sabha meetings and public notice boards. Appendix B provides more details on the types of monitoring data collected and the data verification procedures

used.

3 Experimental design

In the second phase of PVP, we worked with the State Government of Tamil Nadu to evaluate the effectiveness of providing GP presidents with public incentives based on their evaluation grade. The experiment was designed to use the evaluation scheme that was already in place during the first phase of PVP and test the added effectiveness of financial and nonfinancial incentives on the performance of elected GP presidents.

3.1 Sample and randomization

In the second phase, the project was rolled out in 10 new districts (and 4 blocks in each district), which had not previously received the project in Phase 1. From those 10 districts we selected one block in each district, and randomly selected 25 GPs from each block.[8] For blocks that had less than the target number of GPs, all GPs in the block were selected.[9] This gave us a total sample of 198 GPs across 10 blocks in 10 districts.[10] In each block, we randomly divided the GPs into three groups (two treatment and one control). The randomization was done by the authors privately using Stata, and this resulted in 67 GPs each in the two treatment groups, and 64 GPs in the control group. The GP presidents in the treatment group received one of two incentives—a financial or nonfinancial-based one.

[8] In each district, the number of blocks covered by PVP was determined by the available budget, and the PVP- blocks were selected based on their backwardness score. This score comprised of SC/ST share of the block population, share of below poverty line households, and other measures that included poor infrastructure, poor public services, and industrial backwardness. All blocks within each district were ranked according to this score, and 4 blocks starting from the highest score (most backward) were chosen first for PVP. The PVP-blocks chosen for this study comprise of the last block chosen to receive the project in each district. Appendix Table A1 compares the means of block-level demographic and infrastructure characteristics between PVP-blocks in our sample and PVP-blocks not in our sample. Across all outcomes, we do not find any statistically significant pair-wise difference in the means between sample and non-sample PVP blocks. Additionally, we cannot reject that all means are not jointly different between the two groups at conventional level of statistical significance.

[9] Six out of 10 study-sample blocks had all their GPs included in the study sample.

[10] The total sample size was therefore determined by a combination of operational feasibility and budget constraints.

3.2 Financial and nonfinancial incentives

The financial incentive rewarded presidents with a one-time cash grant that could be used for any public investment or program in the GP, at the president's discretion. The financial reward would be remitted directly to the official bank account of the GP president, and would also be announced in a Gram Sabha meeting. Before these funds could be accessed, the president was required to discuss local investment priorities in the Gram Sabha and submit a formal, Gram Sabha-approved investment proposal to PVP. The presidents who received an A grade in the evaluation at the end of the second project phase were promised INR 600,000 (about USD 10,000) in an untied public grant.[11] Presidents who received a B grade were promised INR 300,000 (about USD 5,000). These public grants are significant both relative to the total GP budget (on average, USD 36,000 per year); and the cost of providing local public goods. For instance, the construction of a public bore-well would cost approximately INR 150,000; the construction of an internal road would cost in the range of INR 100,000 to INR 200,000; and a small reverse osmosis system typically used to increase drinking water supply costs around INR 600,000.

The nonfinancial incentive or kudos advertised the achievement of high performing GP presidents to their constituents. For each president who received either an A or a B grade, his/her grade was announced in a special Gram Sabha that was convened for this purpose. In this meeting, the VPRC members would acknowledge the president's efforts in implementing the project activities and supporting their efforts to target the excluded and the poor, announced the president's grade, and awarded him/her with a certificate of recognition from the State Government of Tamil Nadu. In addition, in GPs with A grade presidents, an information campaign that highlighted his/her achievements was also organized in the GP. As part of the campaign, a large poster—comparable to large political advertisements that are commonly used in the state that acknowledged the performance of the president and displayed his/her grade was put up next to the GP office. The poster also included the logo of the State Government of Tamil Nadu to strengthen the credibility of the information provided. In addition, 100 smaller posters of similar design were provided to the GP president, and these could be put up in the GP or distributed at the presidents' discretion across the hamlets in the GP. A sample of the campaign poster is presented in Appendix Figure A1.

[11] This amount was in line with the financial incentives under the first phase of PVP. The average exchange rate during the evaluation period (2013-2015) was USD 1 = INR 60.62.

3.3 Evaluation criteria and timeline

The process of evaluating GP presidents and assigning grades based on their performance was already part of the project in its first phase (prior to this study, as described in section 2.2.1). The grading criteria were developed by the PVP management team for this second phase, and they were very similar to the criteria used in the first phase. The criteria emphasized process measures related to participation, inclusion, and transparency (e.g. inclusion in SHGs, functioning of social audit committees, participation of the GP president in VPRC meetings, etc.); and included local development outcomes (e.g. processing of applications for NREGS, IAY, pensions, and youth training etc.). Appendix Table A2 provides detailed grading criteria used in the study.

All GPs in our study, including control GPs, were evaluated and scored; and their grades were announced in a regular Gram Sabha. For treatment GPs, however, financial and nonfinancial rewards were additionally assigned to the grades. Both treatment and control GP presidents were not explicitly informed about the details of the evaluation criteria in order to avoid multitasking problems, where the effort allocated towards the targeted measure could come at the expense of non-incentivized indicators (Holmstrom and Milgrom, 1991). Instead, all GP presidents were told at the start of the study that they would be assessed on "a range of outcomes related to their performance in Phase 2 on the delivery of public goods and targeted programs, and their role in facilitating the program interventions under PVP."

The evaluation covered a period of 26 months, from the beginning of Phase 2 in January 2013 till July 2015, when the project activities started to wind down for formal closure in September 2016. All GP presidents were informed of the evaluation process through an official communication from the PVP district offices in April 2013, and a written letter with this information was mailed to the GP president soon after.[12] The wording of the letter and verbal communication describing the evaluation process was identical for both treatment and control GP presidents, except that treatment GP presidents were also informed about the incentives assigned to their evaluation grades in the same communication.

The grades were announced to all GP presidents on 1 May 2016 by the VPRC in a regular Gram Sabha. For eligible treatment presidents, the financial grant was transferred to the official bank account of the VP office on 3 June 2016, after they submitted formal proposals. Special Gram Sabhas were organized for the formal announcement of grades for A and B grade politicians

[12] Official letters were sent from the state project office to their district units, and these units dispatched the letters to individual GP presidents.

who received nonfinancial incentives on 12 June 2016, and posters for the A grade presidents were distributed on the same day. These formal announcements took place approximately 3 months prior to the scheduled 2016 GP elections.[13] The timeline of the study is presented in Appendix Figure A2.

4 Theoretical framework

Different voting models outline how political institutions and accountability, or the lack thereof, shape the incentives of political agents and their policy decisions (see Persson and Tabellini, 2000 for a general review of the literature). Across these models, insofar as politicians benefit from getting elected, whether intrinsically from holding public office or from future rent extractions, voters can use elections to improve politician action and affect their policy choices. Under imperfect information, intertemporal voting models of electoral accountability (as in Besley and Case, 1995) also highlight the role of state-led audits (Ferraz and Finan, 2011), expansion in media (Besley and Burgess, 2002), and informational campaigns (similar to the nonfinancial rewards in our study) in keeping the equilibrium rents down by increasing extraction costs. In such retrospective voting models, an increase in politician salary (Ferraz and Finan, 2009) or public budget (similar to the financial rewards in this study) can also discipline politicians due to the higher value of future office and future rents, respectively.

At the same time, electoral incentives have been shown to induce inequities in equilibrium policy with certain types of electoral rules (Myerson, 1993; Lizzeri and Persico, 2001; Finan and Mazzocco, 2021); in the presence of private media and special-interest groups (Grossman and Helpman, 1996; Strömberg, 2004); and with ideological politics where different voter groups vary in within-group homogeneity (Lindbeck and Weibull, 1987). These models help provide insights into the trade-offs that political agents face between equity and electability. Moreover, when voters have imperfect information on politician quality, such information asymmetry can itself underlie within-group heterogeneity.

Therefore, in the context of our study where the quality of a GP president matters to voters, and its visibility differs by hamlets within a GP, a simple model of probabilistic voting can help

[13] Political uncertainty in the state following the unanticipated death of the sitting Chief Minister of the state in December 2016 led to the postponement of the elections. While several interim dates were announced, these dates were not adhered to by the state government/election commission. The elections were finally held in December 2019.

provide insight on how interventions that expand public budget or reduce information asymmetry (in line with our financial and nonfinancial rewards) may or may not redress electorally-driven inequities in resource allocation across different hamlets inside the GP.

For this purpose, we develop a theoretical framework where hamlets differ in the degree of accuracy with which their residents can observe politician quality, with σ_s describing the level of "noise" in the realized signal among residents of hamlet s. The candidates' policy commitments are assumed to be binding, and the policy vector is defined by $Z = \{z_s\}$, where z_s is the amount of public resource that they would allocate to each hamlet $s = s_1, s_2, \ldots, s_S$. The total GP budget is fixed at G, and the set of feasible policy platforms is $Z = \{z \in \Re_+^S : \ \Sigma z_s \leq G\}$. The detailed setup and derivations of the model is presented in Appendix C.

In this section, we highlight three key insights from this model. First, the inequities in equilibrium allocation across hamlets deviate from the utilitarian optimum. This inequity deviation exists as long as $\sigma_{s_1} \neq \sigma_{s_2}$ for any hamlets s_1, s_2. Second, a convergence in σ_ss leads to a reduction in differences in the equilibrium resource allocation between hamlets, such that if σ_{s_1}=σ_{s_2} for all hamlets s_1, s_2, then $z^*_{s_1} = z^*_{s_2} = \bar{z}$. Third, an increase in GP budget, G, will increase the equilibrium resource amount allocated to hamlet s, z^*_s, for all hamlets s, but it will not change the relative resource inequities between hamlets s_1 and s_2, for all s_1, s_2.

5 Data and empirical strategy

5.1 Data sources

The data that we use in our analysis come from multiple sources. First, baseline data was collected prior to the rollout of the second phase of the PVP project between December 2012 and January 2013. The baseline survey covered all 198 GPs in our sample and collected data on demographics and household characteristics of GP presidents through a GP president module; and hamlet-level information on new public investments in roads, streetlights, water, and sanitation. The latter also included data on the hamlet-wise provision of any new IAY grants—which are the most significant private transfers in terms of magnitude, during the current president's tenure.

A second key data source used in this analysis is project monitoring data generated by the PVP project. These data included information on the identification of target beneficiaries, delivery of program benefits, and the implementation of key project processes related to participation,

inclusion, financing, and transparency. The evaluation and performance data used in this study, as well as by the PVP management team for GP presidents' evaluations, were based on a subset of this monitoring data, with an additional layer of verification conducted by the research team. For this additional verification, an independent survey firm was deployed to collect data from VPRC records, GP office records, focus group discussions. Section 2.2.1 and Appendix B provide more details on the collection and verification of project monitoring data.

In addition, at the end of the evaluation period the survey team also collected hamlet-level data for the four types of public infrastructure investments most commonly delivered through GPs, and the IAY housing scheme. This data was similar to the baseline data, except they included information on new investments and IAY transfers that were implemented after the intervention was announced (during the evaluation period). As in the baseline, this data was also verified through a village focus group meeting, and on-site verification in three randomly selected hamlets per GP.

We supplement this survey and monitoring data with three rounds of the Indian Census, and GP election data from the Tamil Nadu State Election Commission that we compiled and digitized. These data sets allow us to identify reservation status of the contested seat for all GP elections, including the reservation status for the next GP election scheduled for 2016.

5.2 Key outcomes and multiple hypothesis testing

We first examine GP presidents' response to our incentives by estimating the average treatment effect (ATE) on their overall GP-level performance metrics. For this purpose, we use the evaluation score (and the letter grades) received by GP presidents, based on which their eligibility for rewards was determined, as the primary outcome of interest.

In addition, we also estimate ATEs on two sets of secondary outcomes, each related to one of the two key functions of a GP president: (1) expanding access to private transfer schemes for eligible beneficiaries in the GP; and (2) targeting new and maintaining existing local public infrastructure goods. These secondary outcomes are directly related to the PVP project's main goals related to inclusion and public service delivery and the analysis helps shed more light on the role of our incentives in improving these core GP functions.

On private transfer schemes, we focus on new beneficiary enrollment on various PVP as well as non-PVP schemes. These include two PVP-specific schemes—youth skill development and women's

SHGs, along with long-running national pensions schemes (for old age, widow, and differently-abled) and a cash for work program (NREGS). We also include total number of new beneficiaries for IAY housing scheme. Since the number of IAY beneficiaries per GP is fixed and GP president's role is to select IAY recipients from their GP (as previously discussed in section 2.1), we additionally include the share of hamlets with new IAY recipients to measure the spatial coverage of the program within the GP.

On public infrastructure, we focus on the local infrastructure investments most commonly delivered through GPs—internal roads, streetlights, water supply, and sanitation. As described in section 2.1, the GP's role in the delivery of these public infrastructure goods is limited to determining the exact location of new investments within the GP. Therefore, the outcome variables used in the analysis measure the spatial distributions of new investments made by the GP president during the evaluation period.

To ensure correct inference with multiple tests, we first aggregate information over multiple outcomes within each of the two family of private transfer and public investment outcomes. The private transfer and public investment indices are constructed using the standardized inverse-covariance weighted average of indicators based on generalized least-square method proposed by Anderson (2008). In addition to this, we adjust the p-values for multiple comparisons within each outcome as well as across three outcomes (one primary outcome and two indices of secondary outcomes) using the Westfall and Young (1993) step-down procedure for the family-wise error rate.

5.3 Identification strategy

We estimate ATEs of the financial and nonfinancial incentives by estimating OLS with the following specification:

$$Y_{g,1} = c + \eta_b + \gamma\ F_g + \delta\ NF_g + \theta\ Y_{g,0} + \Gamma(F_g * \bar{X}_g)\ + \Gamma'(NF_g * \bar{X}_g)\ + \epsilon, \tag{1}$$

where $Y_{g,1}$ is the post-treatment outcome of interest for GP g in block b; and F_g and NF_g are binary indicators for whether the GP president received financial and nonfinancial incentives, respectively. $Y_{g,0}$ is the pre-treatment outcome for GP g, η_b are block-level region dummies, and $\bar{X}_g$ is a vector of these covariates as deviations from the subsample average of the control group. Because we randomized at the GP-level, the variables F_g and NF_g should be uncorrelated with the GP-specific error term, ϵ. The coefficients of interest in equation (1) are γ and δ, which estimate the ATE

of the financial and nonfinancial incentives, respectively. Moreover, including the interactions of deviations on covariates with F_g and NF_g gives the ATEs that are unbiased and consistent even in the presence of heterogeneity along these covariates including the pre-treatment outcome (Lin, 2013).

5.4 Secondary analysis on within-GP inequity

We use the design of the two incentive schemes to also test the predictions from the theoretical framework in section 4 on electorally-driven policy inequities. While the proposed equity analysis was not the primary goal of the study, it provides useful insights on the mechanisms that might underly the effects of our financial and non-financial rewards on GP presidents, who are also electorally motivated.

The hypotheses derived from the theoretical insights in section 4 are as follows. First, disseminating credible information on president quality to voters across all hamlets as part of our nonfinancial reward, should redress within-GP inequity in resource allocations made by GP presidents during their tenure (in anticipation of receiving such a reward prior to their next election). Second, similar equity effects are not likely to exist, on the other hand, for GP presidents who received financial incentives, insofar as such a reward does not provide credible information on president quality to voters.

For this purpose, we focus on new investments made by the GP president during the evaluation period across four public infrastructure goods and the IAY scheme. We examine the effects on within-GP resource allocation across different types of hamlets that differ in the ability of hamlet residents to accurately observe their GP president's quality, which—in the context of our study—are likely to be correlated with hamlet residents' physical proximity to the GP president. We use hamlet-by-program level data to estimate OLS with the following specification:

$$\begin{aligned} Y_{gsp,1} =& c + \kappa_g + \rho_p + \pi P_s + \beta(F_g * P_s) + \psi(NF_g * P_s) \\ &+ \Omega Y_{gsp,0} + \mu \bar{H}_s + \vartheta(F_g * \bar{H}_s) + \varsigma(NF_g * \bar{H}_s) + \epsilon. \end{aligned} \tag{2}$$

$Y_{gsp,1}$ is an indicator variable that takes the value of one if hamlet s in GP g received program p during the evaluation period, and zero otherwise. P_s is a dummy variable that equals one if hamlet s is the GP president's hamlet of residence, henceforth referred to as pres-hamlet. $\bar{H}$ is the vector of hamlet-level characteristics—that specifies the location of the GP office and hamlet population size.

This specification allows us to identify electorally-driven inequities (based on president's residential hamlet) that may arise from information asymmetry, which are not confounded by other types of inequities from informational capture (that are typically correlated with proximity to the GP office, as examined by Baird et al., 2013); or that are associated with the economies of scale in the provision of public goods in larger hamlets.

We also include program-level fixed effects (ρ_p) and GP-level fixed effects (κ_g). This allows us to exploit within-GP variation in access to programs to estimate the effect of incentives on the preferential targeting of resources based on the physical proximity to the GP president. We cluster our standard errors at the GP level. The coefficients β and ψ in equation (2) estimate the effects of the financial and nonfinancial incentives, respectively, on within-GP inequities on the allocation of resources between pres- and nonpres-hamlets.

5.5 Baseline characteristics and balance test

Table 1 presents means of GP and GP president characteristics in our study sample. GP presidents are on average 43 years old, roughly one-third are female, and slightly more than one-fourth of them belong to scheduled castes (SCs) or scheduled tribes (STs). The average tenure in elected office is 2.4 years, with only one-fifth of them having served more than one term. More than four-fifths of GP presidents report being affiliated with a state or a national political party.

The cohort of GP presidents in our data were elected in September 2011. Almost half of them were elected on a reserved seat. The voter turnout in the 2011 GP election was high, with an average of 85.6 percent for the study sample GPs, and the average number of candidates contesting for a GP president seat was four. This suggests a fairly competitive election for GP presidents, with a high rate of citizen participation in the electoral process.

GPs have on average 3,300 households. Out of them, approximately one-fourth belong to the ST/SC caste groups. Each GP, on average, is made up of 8 hamlets.

Table 2 reports means of hamlet-specific characteristics for the study sample GPs. Column 1 includes all hamlets, while Columns 2 and 3 include only pres- and nonpres-hamlets, respectively (defined based on the GP president's location of residence). Column 4 reports means of the within-GP difference in means between pres- and nonpres- hamlets.

In our sample, an average hamlet is made up of 230 households, but pres-hamlets are larger in size than nonpres-hamlets. We find significant differences in resource allocation between pres- and

nonpres-hamlets. For example, 58.2 percent of GP presidents' own hamlets (based on residence) received at least one public investment in roads during their current tenure prior to the intervention, compared to 46.8 percent of nonpres-hamlets that received investment in roads during the same period. The average within-GP difference in road investment between pres- and nonpres-hamlets is statistically significant at the 1 percent level. We also find similar differences in investments on other types of public infrastructures (streetlights, water, and sanitation), as well as in the selection of IAY beneficiaries.

We estimate the system of equations across all five baseline covariates on public investments and IAY beneficiaries jointly using seemingly unrelated regression (SUR), to conduct the Wald test of joint significance of the difference in resource allocation between pres- and non-pres hamlets. The p-value from the joint test, reported at the bottom of Column 4, is 0.000, thereby providing evidence for a preferential allocation of resources (prior to the intervention) towards the GP president's hamlet of residence.

Appendix Tables A3 and A4 report the GP-level and hamlet-level means, respectively, by different groups: Control GPs, GPs with financial incentive, and GPs with nonfinancial incentive in Columns 1, 2, and 3 respectively. Columns 4-6 report the p-value of the t-test of the difference in means between these groups: control vs. financial; control vs. nonfinancial; and financial vs. nonfinancial respectively. Across all the variables, we cannot reject that the means are equal for any pairwise comparison at conventional level of statistical significance. As indicated by the p-value of joint significance from SUR estimation at the bottom of Columns 5-8, we again cannot reject that all means are not jointly different between the groups.

6 Results

6.1 Average treatment effects

Table 3 and Appendix Tables A5, A6, and A7 report the estimated coefficients γ and δ from equation (1) on various GP-level primary and secondary outcomes of interest.

6.1.1 Evaluation score

Table 3, Column 1 estimates the average treatment effect on the evaluation score (out of 100) received by GP presidents. Appendix Table A5, Columns 1, 2, and 3 estimate the effect on the

three dependent dummy variables, each indicating whether the GP president received grades A, B, or C, respectively.

The results in Table 3 show that GP presidents with financial incentives scored 3.24 points higher compared to the control. The estimate is statistically significant at the 1 percent level. In comparison, nonfinancial incentives raised the GP president's evaluation score by 1.56 points. This estimate is not statistically significant at the conventional level. The p-value of the F-tests (also presented in Table 3) indicate that the estimated effect for the incentivized GP presidents are not different between financial and nonfinancial incentives at conventional levels of statistical significance (the p-value is 0.125).

Similarly, GP presidents with financial and nonfinancial incentives are 12.5 and 5.7 percentage points more likely to receive an A grade, respectively, compared to the control (Appendix Table A5, Column 1). The former estimate is statistically significant at the 5 percent level. Additionally, we find negative (or zero) effects of either incentive on the likelihood of receiving grades B or C (though not statistically significant), suggesting that the positive effect on grade A comes from improvements from both (would-be) B and C grades.

6.1.2 Private transfer schemes

Table 3, Column 2 examines the effects of the incentives on the private transfer index. The results show that both financial and nonfinancial incentives expanded the access to private transfer schemes in the GP (an improvement of 0.355 and 0.363 standard deviations on the index). Both estimates are statistically significant at the 5 percent level. In addition, the p-value of the F-tests show that the estimated effect is not different between financial and nonfinancial incentives at conventional levels of statistical significance.

Appendix Table A6 reports the effects of the incentives on the individual private transfer outcomes that make up the index. The results show that both incentives were effective in improving access to various private transfer schemes in incentivized GPs, including access to non-PVP specific schemes (though these effects on individual schemes are not always precisely estimated). On the two PVP schemes, incentives improved the absolute number of beneficiaries. For other schemes like pensions and NREGS, which are long-running schemes with extensive state-wide coverage (Dutta et al., 2012), we find positive but muted improvement in access to these programs. More importantly, incentives led to a broad-based targeting of the IAY scheme within a GP. This expansion in spatial coverage of the IAY scheme inside a GP is particularly interesting, given local politicians

typically use their power to restrict access to such schemes to only a subset of the electorate who supports them in the election (Bardhan and Mookherjee, 2012). In this context, the results suggest that the incentives could have weakened hamlet-specific bias in allocation policies implemented by incentivized GP presidents, and reduced within-GP inequality in access to private transfers. We explore this in section 6.2.

6.1.3 Local infrastructure investments

Table 3, Column 3 estimates the impact of incentives on the public investment index; Appendix Table A7 presents the estimated effects on the spatial distribution of new investments across the four public infrastructure goods separately. Both financial and nonfinancial incentives improved the public investment index by 0.342 and 0.309 standard deviations, respectively (and both estimates are statistically significant at the 5 percent level). These effects on local public infrastructure goods are particularly striking within a status quo that is typically characterized by a strong policy preference for private transfers, and weak incentives to deliver public goods in the presence of clientelism (Bardhan and Mookherjee, 2018). Given the central role that GP presidents play in determining the location of new public investments within GPs, the above results suggest that the incentives led to a more broad-based targeting of such investments, and also perhaps, to a more equitable allocation across different types of hamlets within the GP. We explore the equity effects, and how these results relate to the theoretical predictions of the model in section 6.2.

6.1.4 Robustness checks

The positive results on private transfers and public investments are striking given that the funds available to a GP are fixed and formula-bound. However, if funds were reallocated from control GPs to the incentivized GPs following our intervention, such negative spillover effects on the control GP funds could bias the causal effects of the incentives estimated above. Appendix Table A5 investigates the impact of incentives on total budget allocation per GP and the fund utilization rate. Columns 1 and 2 report the total budget allocated to the GP under the youth skill development scheme and the utilization rate of this fund, respectively. We find that both financial and nonfinancial incentives had no statistically significant effect in the amount of funds allocated to a GP, but they improved the utilization rate of this fund by 11.3 and 9.7 percentage points, respectively. The latter two estimates are statistically significant at the 1 percent and 10 percent levels, respectively. These results highlight one of the ways in which incentivized GP presidents are able to improve outcomes

related to the youth skill development scheme, which is funded by a rule-bound formula, not unlike most other private and public programs that we examined earlier. Moreover, the results also show that the fund allocation-rules were strictly adhered to, and that our incentives did not negatively affect the funding in the control GPs.

The results are also robust to adjusting for multiple hypotheses testing. At the bottom of Table 3, we report the adjusted p-values calculated using the Westfall and Young (1993) step-down procedure for the family-wise error rate. The effect of the financial incentive on the evaluation score as well as on the private transfer and public investment indices is statistically significant at conventional level. The multiple-hypothesis-corrected p-values are 0.062, 0.062, and 0.072, respectively. Similarly, the multiple-hypothesis-corrected p-values for the estimated effect of the non-financial incentive on the two indices are 0.058 and 0.091.

6.2 Within-GP resource allocation

Table 4 uses the hamlet-program level data to examine the impact on within-GP inequity across hamlets based on their physical proximity to the GP president,[14] and reports the estimated coefficients π, β, and ψ from equation (2).

We find that among control GPs, pres-hamlets were 5.9 percentage points more likely to receive program-specific resources from the GP president compared to nonpres-hamlets in the GP. Nonfinancial incentives reduced this within-GP inequity in resource allocation between pres- and nonpres-hamlets by 8.7 percentage points. Both estimates are statistically significant at the 5 percent level.

In comparison, financial incentives reduced within-GP inequity in access to resources by only 4.4 percentage points, and the estimate is not statistically significant at conventional levels. Additionally, the equity effect of nonfinancial incentives on within-GP resource allocation is also statistically significantly larger from that of financial incentives: the p-values of the F-test of this difference is 0.097.

Overall, these results—in line with the theoretical predictions in section 4—show that resources are preferentially targeted to hamlets in which the GP president resides. More importantly, we find that our incentives reduced these within-GP inequities (that were prevalent in the status quo).

[14]This is in line with Chauchard (2017), who finds that GP presidents in the Indian state of Rajasthan build vote-buying structures with preferential targeting on different types of group identities, one of which is based on location.

The sharper equity effect of the nonfinancial incentive is not surprising, given that the associated reward was designed to reduce information asymmetry on GP president quality. On the other hand, positive (though muted and statistically insignificant) equity effect of the financial incentive suggests that such a reward, or the accompanying additional public investments, could also provide credible information on president quality to voters, even in absence of explicit state mechanisms to disseminate such information.

6.2.1 Differential effects by eligibility to run for office

If such within-GP inequities are, in some part, driven by GP presidents' re-election incentives, we should expect the underlying within-GP inequities as well as the equity effect, to be more concentrated among GP presidents with relatively greater future electoral incentives. To investigate whether our incentives redressed electorally-driven within-GP inequities, we examine the heterogeneity in the equity effects by GP president's eligibility to run for office in the next GP election.

While there are no term limits for GP presidents in principle, the state's constitutional policy of mandated representation for ST/SC caste and women could impose de-facto limits (although GP presidents can run for other offices, including those in the upper tiers of local governments).[15] We use the assignment rule for the mandated rotation of reserved seats to identify GP president seats that would be reserved in the (the upcoming) 2016 GP election.[16] For these seats, the gender or caste of the current GP president can make him/her ineligible to run again for the office of the GP president. In our study sample, 45.5 percent of GP presidents would not be eligible to run for GP president's office (Table 1).[17] Appendix Table A8 presents the means of GP president characteristics for the two subgroups.[18]

[15] In Tamil Nadu, the GP president seats can be reserved for women, for ST/SC caste group, or both; and the reservation status of the seat rotates every two election cycles, with the next round of rotation scheduled before the (then upcoming) 2016 GP election.

[16] In effect these elections were not held until 2019 because of political circumstances that shifted with the death of the Chief Minister of the state in 2016, but at the time of our experiment everyone (including the research team) expected the elections to be held on time—consistent with Tamil Nadu's past election history.

[17] Among those who are not eligible to run for the GP president's office in the 2016 GP election, 52.2 percent of them are not eligible to run based on their caste, and 47.8 percent are ineligible to run based on their gender.

[18] GP presidents who are not eligible to run are, on average, more likely to be male and of a non-ST/SC caste group compared to those who are eligible to run. The former subgroup is also more likely to have a graduate degree and slightly older. However, we do not observe significant differences between the two subgroups on other key characteristics such as their tenure in office and party affiliation. The p-value of joint significance test from SUR estimation at the bottom of Column 4, that all means are not jointly different between the eligible and ineligible groups is 0.000.

In Appendix Table A9, we report the differential effect by the GP president's eligibility to run for office on within-GP resource allocation across pres- and nonpres-hamlets. Not surprisingly, this analysis lacks adequate power for us to draw key statistical inferences. We present these results as an exploratory analysis. The results provide highly suggestive evidence that the underlying inequities, as well as the equity effect of both our incentives are correlated with the GP president's future electoral incentives. None of the p-values of the F-tests of these differences by eligibility are however statistically significant.

7 Conclusion

Governance failures—broadly categorized as capture, corruption or clientelism—are endemic to electoral democracies, particularly in developing countries. This paper adds to a growing literature on attempts to correct such failures. It reports on the result of an experiment conducted among 198 village governments (gram panchayats or GPs) in rural Tamil Nadu in South India, which randomly assigned incentivizes to elected village presidents to improve their performance in two arms—either by increasing the public funds available to high performers, or by publicly identifying high performers with certificates awarded to them at a village ceremony.

We develop a theoretical model to show how imperfect voter information on the performance of elected representatives can result in inequities in resource allocation. The model provides insights into the trade-offs that political agents face between improving their election prospects and allocating resources equitably. The model derives testable hypotheses that show an increase in village budgets will increase resources allocated to electoral constituencies (hamlets) within a governance unit (GPs), but not change the relative resource allocation across hamlets. Non-financial incentives, on the other hand, by disseminating credible information on politician quality should redress inequities in resource allocation across hamlets. Finally, the model shows that politicians who face re-election should demonstrate more acute effects across both types of incentives.

Our results are consistent with our theoretical model. Overall, both financial and non-financial incentives had a positive effect on politician performance. Both resulted in more efficient performance —private transfers to village citizens that are under the direct control of the president sharply increased in comparison to the control group. Public goods such as village roads, streetlights, water supply, and sanitation—where the president can control the spatial allocation but not its amount—showed much more equitable allocation across hamlets in the treatment group,

but only the non-financial incentive had a statistically significant effect. We also find evidence consistent with the hypothesis that these effects are driven by electoral incentives—incentivized village presidents who were eligible for re-election had more equitable allocations across hamlets than those who were not eligible for re-election.

Our results are, thus, consistent with the interpretation that both financial and non-financial performance incentives can reduce capture and clientelism among elected leaders, and have similar overall effects. However, non-financial incentives—the public awarding of certificates to high performers—have sharper effects on reducing spatial inequity in resource allocation. This has important implications for policy. Relatively inexpensive performance incentives can have significant effects on the performance of elected leaders—if the assessment of performance is done in a way that is perceived as relatively accurate and unbiased.

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Table 1: Descriptive statistics

	Mean (1)	[Std. Dev.] (2)
Panel A: Gram Panchayat president characteristics		
Female	0.374	[0.485]
Age	43.25	[9.714]
SC/ST caste	0.283	[0.452]
Graduate/diploma degree	0.217	[0.413]
Served multiple terms	0.223	[0.417]
Tenure as GP president *(in years)*	2.425	[3.254]
Member of a political party	0.839	[0.368]
Panel B: Gram Panchayat characteristics		
Total population of GP	3296	[2159]
% ST/SC caste	0.248	[0.161]
Literacy rate	0.684	[0.078]
Number of hamlets in GP	8.091	[6.715]
Panel C: Political participation and electoral outcomes		
Attendance in Gram Sabha	134.4	[55.42]
% female attendees in Gram Sabha	0.529	[0.101]
Voter turnout in 2011 GP president election	0.856	[0.120]
Number of candidates in 2011 election	3.747	[1.799]
Seats reserved in 2011 election[a]	0.460	[0.500]
Not eligible to run in 2016 election[b]	0.455	[0.499]

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. GP population characteristics are constructed from 2011 India Census; 2011 GP election data comes from the Tamil Nadu State Election Commission; and GP president and hamlet data is collected as part of the baseline survey of the study. [a]The GP president seat can be reserved/mandated to be filled by specific social groups such as women or ST/SC caste. [b]*Not eligible to run in 2016 election* is constructed using the population reservation rule, combined with the rotation rule.

Table 2: Within-GP differences across hamlets at baseline

	All hamlets (1)	Pres-hamlets (2)	Nonpres-hamlets (3)	Diff. *(2)-(3)* (4)
No. of households in hamlet	186.85	324.54	143.51	181.03***
Distance from the GP office *(in Km.)*	1.602	1.097	1.745	-0.648***
% of hamlets with public investments in:				
Internal roads	0.496	0.582	0.468	0.114***
Streetlights	0.515	0.609	0.492	0.116***
Water supply	0.440	0.522	0.422	0.100***
Sanitation	0.257	0.370	0.226	0.144***
% of hamlets with IAY recipients	0.634	0.723	0.613	0.110***
Joint test of equal resource allocation (p-value)				*0.000*

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. Hamlet-level data is collected as part of the baseline survey. Hamlet-level data on public investments and IAY recipients covers the first year of the GP president's current tenure in office, starting from September 2011 (the last GP election) up until the baseline survey (January 2013). p-value at the bottom of Column 4 shows joint significance of the coefficients (on the four public investments and IAY recipient outcomes) in the given column from SUR estimation. *p<0.1, **p<0.05, ***p<0.01.

Table 3: Average treatment effects

Dependent variables:	Evaluation score (1)	Private transfer index (2)	Public investment index (3)
Financial incentive	3.24***	0.355**	0.342**
	(1.140)	(0.1420)	(0.1450)
Nonfinancial incentive	1.56	0.363**	0.309**
	(1.209)	(0.1410)	(0.1560)
p-value of F-test:			
Financial = Nonfinancial	*0.125*	*0.940*	*0.779*
Observations	198	198	198
Mean dep. var. (control)	58.54	0.000	0.000
Multiple-hypothesis-corrected p-value:			
Financial incentive	*0.062*	*0.062*	*0.072*
Nonfinancial incentive	*0.194*	*0.058*	*0.091*

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. All specifications control for block dummies, and additionally in Column 3 the baseline value of the dependent variable. Multiple-hypothesis-corrected p-values are calculated using the Westfall and Young (1993) step-down procedure for the family-wise error rate. The robust standard errors are reported in parentheses; *p<0.1, **p<0.05, ***p<0.01.

Table 4: Impact on within-GP resource allocation

	Coeff.	(Std. Error)
	(1)	(2)
Financial incentive x P	-0.044	(0.0290)
Nonfinancial incentive x P	-0.087***	(0.0334)
President hamlet: Residence of GP president (P)	0.059**	(0.0256)
p-value of F-test:		
Financial x P = Nonfinancial x P	*0.097*	
GP and program fixed effects	Yes	
Observations	7,875	
Mean dep. var. (control)	0.798	

Notes: The sample includes hamlet-program level observations on 5 programs from 1,575 hamlets in 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. All specifications control for Gram Panchayat (GP) dummies, program dummies, the baseline value of the dependent variable, and hamlet characteristics (and their interactions with treatment). The robust standard errors are clustered at the GP level, and are reported in parentheses; *p<0.1, **p<0.05, ***p<0.01.

A Appendix: Additional tables and figures

Table A1: Selection of PVP blocks into the study sample

	All PVP blocks (1)	PVP blocks: In study sample (2)	PVP blocks: Not in study sample (3)	*p*-value *(2)=(3)* (4)
Total population	97311	88992	99622	*0.337*
% SC/ST caste	0.235	0.243	0.233	*0.696*
% of GPs with public facilities				
Education	0.923	0.926	0.922	*0.894*
Medical	0.774	0.764	0.777	*0.839*
Bank	0.206	0.202	0.207	*0.909*
Bus stop	0.904	0.909	0.903	*0.858*
Number of blocks	46	10	36	-
p-value for joint test of significance	-	-	-	*0.949*

Notes: The observations include 46 blocks in 10 districts that received PVP for the first time in the second phase of the project. In each district, the number of blocks that would be covered by PVP was defined by the available budget, and the eligible-blocks were selected based on a backwardness score, which comprised of ST/SC share of the population, share of below poverty line households, and other measures that included poor infrastructure, poor public services, and industrial backwardness. Blocks within each district were ranked based on their backwardness score, and they were selected starting from the highest score until the PVP budget was exhausted. The blocks in our study sample comprise of the last block selected in each district.The block-level data on block-level demographics and public infrastructure comes from the 2001 India Census. *p*-value at the bottom of the table shows joint significance of the coefficients from SUR estimation.

Table A2: Evaluation grading criteria

No.	Indicators	Range of achievements	Scores	No.	Indicators	Range of achievements	Scores
1.	Identified target poor reached by the project	Above 95% 50-95% Below 50%	5 3 0	23.	Percentage of identified differently-abled persons give ID cards for eligible benefits	100% 80-99% Below 80%	5 3 0
2.	30% SC/ST VPRC representatives	Yes No	3 0	24.	Percentage of all eligible differently-abled persons included in special SHGs	90 and above 90% 70-89% Below 70%	5 3 0
3.	No. of very poor household who are VPRC representatives	Above 50% 50% Below 50%	5 3 0	25.	Percentage of special SHGs given initiation funds	90-100% Below 90%	5 0
4.	No. of women members in the VPRC	Above 60% 50-60% Below 50%	5 2 0	26.	Percentage of differently-abled persons who had access to individual loans and other benefits	Above 90% 50 to 90% Below 50%	5 3 0
5.	Is a scheduled tribe (ST) representative selected if the GP has more than 10 ST HHs	Yes No Not applicable	3 0 3	27.	Eligible differently-abled persons getting maintenance grants	Yes No	2 0
6.	Is one very poor person selected as office bearer	Yes, two person available Yes, one person available Nobody	5 3 0	28.	MGNREGS identify card applications processed (100%)	Yes No	2 0
7.	No. of VPRC meetings in a year	Above 22 13-21 10-12	5 3 0	29.	MGNREGS ID cards applications processed for differently-abled persons (100%)	Yes No	2 0
8.	Average no. of representatives participating in VPRC	above 70% 60-70% Below 60%	5 3 0	30.	Percentage of applications processed for Green house/IAY housing scheme (100%)	Yes No	2 0
9.	Percentage of representatives who had knowledge of the minutes and the resolutions passed	80-100% 60-79% Below 60%	5 3 0	31.	Percentage of applications processed for the CM Medical insurance program (100%)	Yes No	2 0
10.	Was the procurement sub-committee formed as per project rules?	Yes No	3 0	32.	Percentage of applications processed for the Old Age Pension scheme (100%)	Yes No	2 0
11.	Were all procurement decisions made with the recommendations of the procurement sub-committee?	Yes No	3 0	33.	Any eligible person given Marriage Benefits, Sewing Machine, Transgender monthly benefit, Pregnant Women Welfare Benefit through social welfare depart.	Yes No	2 0
12.	Was the business and monitoring sub-committee formed?	Yes No	3 0	34.	Were utilization certificates issued for all funds released to Community Based Organizations (CBOs)	Yes No	5 0
13.	Percentage of target persons affiliated with SHGs	100% 80-99% Below 80%	10 1 0	35.	Number of Social Audit Committee meetings over the last one year	12 and above 12 8 to 11 Below 8	5 3 0
14.	Was the bookkeeper selected from among the target groups (including differently-abled)?	Yes No	5 0	36.	Do all beneficiary and fund details show in the display board	Yes No	5 0
15.	Was a bookkeeper appointed and at work throughout the project period?	Yes No	3 0	37.	Percentage of eligible youth trained	Above 30% 20-29% Below 20%	5 3 0
16.	Was all VPRC information up to date and available on the display board?	Yes No	5 0	38.	Utilization rate of VPRC's Youth Skill Development fund	100% 80-99% Below 80%	5 3 0
17.	Was the project fund utilized as per the project rules (40:40:20 ratio)?	Utilized as per the rules Utilized not as per the rules	2 0	39.	Percentage of target household youths among total youth trained	Above 80% 80% and below	5 0
18.	Percentage of the VPRC funds received	96-100% 80-95% Below 80	5 3 0	40.	Common Livelihoods Group (CLG) formed from among target group persons	Yes No	5 0
19.	Books of accounts maintained till date?	SHG and individual loans Either SHG or individual loans Neither SHG nor individual loans	3 2 0	41.	VPRC's cooperation with Pachayat President	Very good Good Not bad	5 3 0
20.	Were the expenditure statement, the bank reconciliation statement, and the bank pass-book available?	Yes No	2 0	42.	Development activities for target people through Gram Panchayat	Very good Good Not bad	5 3 0
21.	Did the internal audit happen once in six months and was any action taken, if needed?	Yes No	2 0	43.	Participation of Panchayat President in the last one year of meetings	90-100% 70-89% Below 70%	5 3 0
22.	Did the external audit happen once in a year and was action taken based on the auditor's report/ recommendation?	Completed ext. audit & rectified all reco. Completed axt. audit but not rectified all reco. Not completed ext. audit	3 2 0	44.	Finance/Cash-mishandling		-20
				45.	Benefits given to non-target people		-5

Notes: The above evaluation criteria was developed by the PVP project management team. The total points is converted into 100, and this absolute score (out of 100) was used to determine the thresholds for grades, with cutoffs of 70 and higher for grade A, 65-55 for grade B, and less than 55 for grade C.

Table A3: Summary statistics and balance test (GP-level)

	Control	Financial	Non-financial	*p*-value		
				(1)=(2)	*(1)=(3)*	*(2)=(3)*
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Gram Panchayat president characteristics						
Female	0.344	0.388	0.388	*0.603*	*0.603*	*1.000*
Age	42.00	43.10	44.58	*0.516*	*0.130*	*0.379*
SC/ST caste	0.281	0.269	0.299	*0.874*	*0.828*	*0.704*
Graduate/diploma degree	0.219	0.224	0.209	*0.944*	*0.893*	*0.835*
Served multiple terms	0.190	0.258	0.219	*0.364*	*0.704*	*0.598*
Tenure as GP president *(in years)*	2.349	2.364	2.562	*0.980*	*0.714*	*0.729*
Member of a political party	0.825	0.833	0.859	*0.903*	*0.605*	*0.689*
Panel B: Gram Panchayat characteristics						
Total population of GP	3303	3293	3295	*0.979*	*0.984*	*0.995*
% ST/SC caste	0.242	0.259	0.244	*0.546*	*0.943*	*0.590*
Literacy rate	0.694	0.681	0.677	*0.369*	*0.233*	*0.765*
Number of hamlets in GP	8.000	8.075	8.194	*0.950*	*0.870*	*0.919*
% of hamlets with public investments in						
Internal roads	0.548	0.514	0.481	*0.619*	*0.319*	*0.613*
Streetlights	0.541	0.582	0.473	*0.561*	*0.342*	*0.122*
Water supply	0.402	0.521	0.426	*0.087*	*0.731*	*0.165*
Sanitation	0.297	0.275	0.300	*0.746*	*0.971*	*0.716*
% of hamlets with IAY recipients	0.668	0.677	0.599	*0.885*	*0.299*	*0.232*
Panel C: Political participation and electoral outcomes						
Attendance in Gram Sabha	132.3	138.5	132.3	*0.524*	*0.999*	*0.518*
% female attendee in Gram Sabha	0.541	0.530	0.516	*0.542*	*0.152*	*0.406*
Voter turnout in 2011 GP president election	0.870	0.836	0.862	*0.113*	*0.711*	*0.217*
Number of candidates in 2011 GP election	3.953	3.642	3.657	*0.324*	*0.348*	*0.962*
Seat reserved in 2011 GP election[a]	0.391	0.552	0.433	*0.065*	*0.628*	*0.628*
Not eligible to run in 2016 GP election[b]	0.391	0.448	0.522	*0.513*	*0.132*	*0.388*
Number of Gram Panchayats (GPs)	64	67	67	-	-	-
p-value for joint test of significance	-	-	-	*0.316*	*0.453*	*0.513*

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. GP population characteristics are constructed from 2011 India Census; 2011 GP election data comes from the Tamil Nadu State Election Commission; and GP president and hamlet data is collected as part of the baseline survey of the study. [a]The GP president seat can be reserved/mandated to be filled by specific social groups such as women or ST/SC caste. [b]*Not eligible to run in the upcoming election* is constructed using the population reservation rule, combined with the rotation rule. *p*-value at the bottom of the table shows joint significance of the coefficients in the corresponding column from SUR estimation.

Table A4: Summary statistics and balance test (Hamlet-level)

	Control	Financial	Non-financial	*p*-value		
				(1)=(2)	*(1)=(3)*	*(2)=(3)*
	(1)	(2)	(3)	(4)	(5)	(6)
No. of households in hamlet	129.8	138.5	129.3	*0.641*	*0.978*	*0.619*
Public investments in:						
Internal roads	0.424	0.421	0.379	*0.963*	*0.511*	*0.496*
Streetlights	0.460	0.474	0.368	*0.836*	*0.212*	*0.103*
Water supply	0.367	0.440	0.374	*0.206*	*0.911*	*0.296*
Sanitation	0.181	0.166	0.190	*0.760*	*0.874*	*0.622*
Hamlets with IAY recipients	0.576	0.571	0.514	*0.947*	*0.441*	*0.449*
Number of hamlets	507	525	543	-	-	-
p-value for joint test of significance	-	-	-	*0.767*	*0.699*	*0.489*

Notes: The sample includes 1,575 hamlets from 198 Gram Panchayats (GPs) across 10 districts in Tamil Nadu. Hamlet-level data is collected as part of the baseline survey. Hamlet-level data on public investments and IAY recipients covers the first year of the GP president's current tenure in office, starting from September 2011 (the last GP election) up until the baseline survey (January 2013). *p*-values in Columns 4, 5, and 6 are adjusted for within-GP correlations across hamlets, and *p*-value at the bottom of the table shows joint significance of the coefficients in the corresponding column from SUR estimation.

Table A5: Impact on additional outcomes

Dependent variables:	Dummy indicating whether GP presidents received			*Youth skill development scheme*	
	Grade A	Grade B	Grade C	Total funds received	Utilization rate
	(1)	(2)	(3)	(4)	(5)
Financial incentive	0.125**	-0.056	-0.070	6,660	0.112***
	(0.0531)	(0.0732)	(0.0585)	(10,704)	(0.0363)
Nonfinancial incentive	0.057	-0.065	0.007	82	0.077*
	(0.0549)	(0.0762)	(0.0616)	(10,653)	(0.0417)
p-value of *F*-test:					
Financial = Nonfinancial	*0.241*	*0.909*	*0.205*	*0.504*	*0.407*
Observations	198	198	198	198	198
Mean dep. var. (control)	0.094	0.625	0.281	165,008	0.631

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. All specifications control for block dummies. The thresholds for grades A, B, and C are as follows: 70 and higher for grade A; 65-55 for grade B; and less than 55 for grade C. The robust standard errors are reported in parentheses; *p<0.1, **p<0.05, ***p<0.01.

Table A6: Impact on access to private transfer schemes

Types of schemes:	*PVP schemes*		*National pensions & NREGS*	*Indira Awaas Yojana (IAY)*	
	Youth skill development	*Self help* groups			
Dependent variables:	No. of youths trained & employed	No. of new members added	No. of new cards issued	No. of new recipients	% of hamlets w/ new recipients
	(1)	(2)	(3)	(4)	(5)
Financial incentive	5.65	11.69	10.04	-1.14	0.076**
	(3.623)	(26.55)	(25.40)	(3.18)	(0.0298)
Nonfinancial incentive	6.28*	11.32	-1.46	0.20	0.076**
	(3.529)	(24.25)	(23.73)	(3.10)	(0.0311)
p-value of F-test:					
Financial = Nonfinancial	*0.846*	*0.989*	*0.614*	*0.631*	*0.997*
Observations	198	198	198	198	198
Mean dep. var. (control)	28.48	278.30	179.20	13.84	0.899

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. All specifications control for block dummies. The robust standard errors are reported in parentheses; *p<0.1, **p<0.05, ***p<0.01.

Table A7: Impact on public infrastructure investments

Dependent variables:	% of hamlets with public investments in			
	Internal roads	Streetlights	Water supply	Sanitation
	(1)	(2)	(3)	(4)
Financial incentive	0.087**	0.071**	0.034	0.097**
	(0.0376)	(0.0311)	(0.0484)	(0.0440)
Nonfinancial incentive	0.042	0.038	0.068	0.092**
	(0.0435)	(0.0379)	(0.0495)	(0.0462)
p-value of F-test:				
Financial = Nonfinancial	*0.193*	*0.266*	*0.481*	*0.879*
Observations	198	198	198	198
Mean dep. var. (control)	0.871	0.889	0.516	0.837

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. All specifications control for block dummies, and the baseline value of the dependent variable. The robust standard errors are reported in parentheses; *p<0.1, **p<0.05, ***p<0.01.

Table A8: GP president characteristics, by eligibility to run for office in the next election

	All GP presidents (1)	GP presidents who are: Eligible to run (2)	GP presidents who are: Not eligible to run (3)	*p*-value *(2)=(3)* (4)
Female	0.374	0.593	0.111	*0.000*
Age	43.25	41.96	44.79	*0.041*
SC/ST caste	0.283	0.398	0.144	*0.000*
Graduate/diploma degree	0.217	0.139	0.311	*0.003*
Served multiple terms	0.223	0.234	0.209	*0.688*
Tenure as GP president *(in years)*	2.425	2.402	2.453	*0.913*
Member of a political party	0.839	0.822	0.860	*0.477*
No. of GP presidents	198	108	90	-
p-value for joint test of significance	-	-	-	*0.000*

Notes: The sample includes 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. GP president's eligibility to run for office in 2016 election is determined based on the population reservation and the rotation rules, combined with the gender and caste characteristics of the current GP president.

Table A9: Differential impact on within-GP resource allocation, by eligibility to run for office

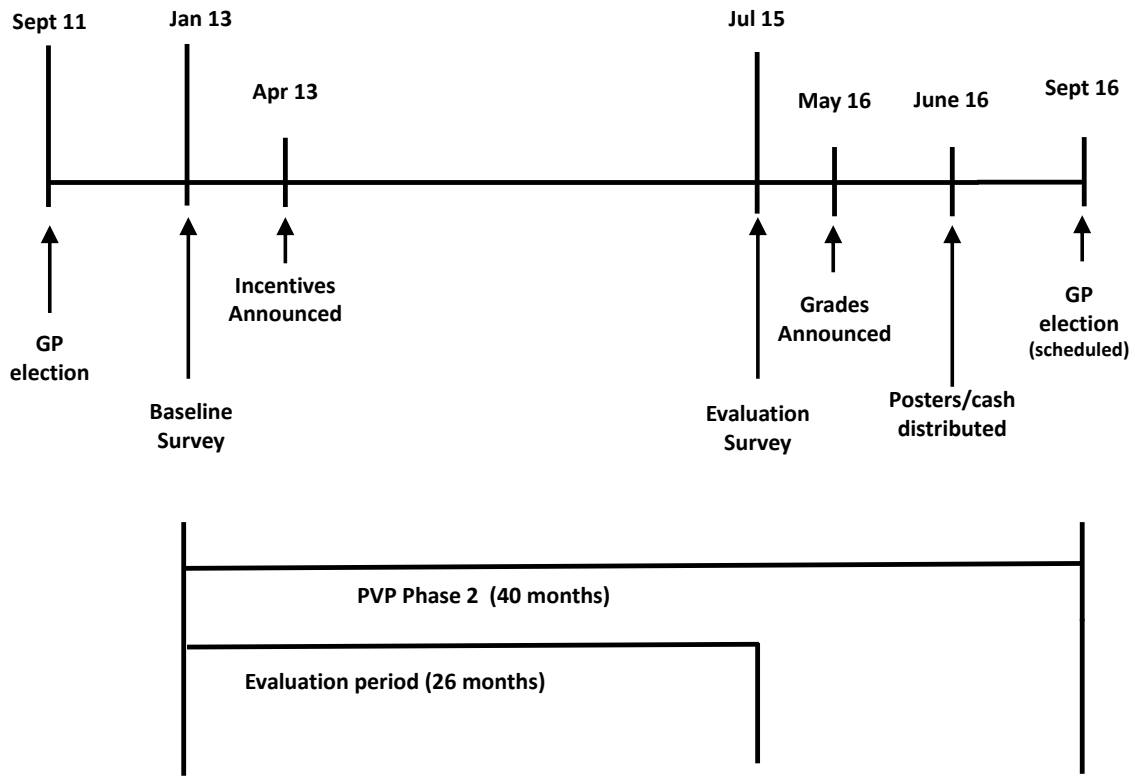
	GP presidents who are:	
	Eligible to run for re-election	Not eligible to run for re-election[a]
	(1)	(2)
Financial incentive x P	-0.079**	0.005
	(0.0367)	(0.0470)
Nonfinancial incentive x P	-0.093**	-0.070
	(0.0436)	(0.0520)
President hamlet: Residence of GP president (P)	0.080**	0.026
	(0.0318)	(0.0420)
p-value of F-test:		
Financial x P = Nonfinancial x P	*0.683*	*0.046*
GP and program fixed effects	Yes	Yes
Observations	4,365	3,510
Mean dep. var. (control)	0.791	0.808
p-value of F-test (No diff. in coef. between (1) and (2)):		
President hamlet (P)	*0.302*	
Financial x P	*0.159*	
Nonfinancial x P	*0.740*	

Notes: The sample includes hamlet-program level observations on 5 programs from 1,575 hamlets in 198 Gram Panchayats (GPs) from 10 districts in Tamil Nadu. All specifications control for Gram Panchayat (GP) dummies, program dummies, the baseline value of the dependent variable, and hamlet characteristics (and their interactions with treatment). [a]The GP president seat can be reserved/mandated to be filled by specific social groups such as women or ST/SC caste. The eligibility to run in the upcoming election is determined based on the population reservation and the rotation rules, combined with the gender and caste characteristics of the current GP president. The robust standard errors are clustered at the GP level, and are reported in parentheses; *p<0.1, **p<0.05, ***p<0.01.

Figure A1: Sample of an information poster for A grade GP presidents

Notes: The logo on the top left corner is the offical logo of the Tamil Nadu State Government; and the one on the top right corner is the PVP project logo. English translation of the main script: President of [District Name] [Block Name] [Panchayat Name] is commended for excellent performance in her/his functions related to the PVP program, and in facilitating access to the program benefits for the poor, vulnerable and others in the village.

Figure A2: Timeline of the study



B Appendix: Data collection and validation

Project monitoring data under the PVP project were collected to inform a range of functions that included the identification of the target and beneficiary populations for interventions, detailed income and expenditure reports, and data on outcomes related to the implementation of key project processes focused on participation, inclusion and transparency. The identification of target and beneficiary populations was implemented based on data from a census of households in all project GPs.

As the first official activity of the PVP project, the GP was required to facilitate a census of all households in the village. This census collected basic data on demographics, livelihoods and assets, and it was followed by a participatory identification of the target poor (following a process similar to Alatas et al., 2012). This census generated a paper-based register of all households and their target status and formed the base data for all PVP interventions. In addition, the identification of beneficiaries for and the implementation of each PVP intervention was also tracked through a customized monitoring format. For example, for its skills intervention the VPRC was required to generate a register of all youth (with their education, age, and gender); to use this data to identify appropriate links to trainings or job fairs for target youth; and track job placements (up to 6 months). Similarly, registers were also maintained to track applications for private benefits such as the NREGS, pensions, IAY, etc.

All monitoring data reported by the VPRC were collected following standardized verification protocols, and they were entered into standard digitized reporting formats. For example, for data on youth training and placement, the numbers reported on the youth register would be verified with invoices for training from service providers, and the invoices would then be matched with entries in the VPRCs bank statements. For placements with firms, copies of employment letters had to be placed on file and verified. Similarly, for data on the number of applications facilitated for the NREGS, pensions, or IAY, the reported monitoring numbers had to be cross verified with photocopies of the cards/authorizations issued that the VPRC is required to maintain on file.

All reported monitoring data was also validated through a standardized 3-step process which involved local social audit committees, PVP project staff, and (international) third party monitoring and audit firms. In the first step, the Social Audit Committee (SAC) was tasked with reviewing expenditures, monitoring public disclosures on private benefits provided by the VPRC, and presenting a report of expenditures and activities in the Gram Sabha meetings four times a year. Second, the data was regularly reviewed by project functionaries, as part of the block, and state reviews of project performance indicators, which took place on a monthly basis. Third, third-

party monitors reviewed the data and reports, as well as the processes underlying the generation of this data regularly. For this purpose, an international process-monitoring firm (Mott MacDonald) visited a rotating random sample of GPs so that every GP was reviewed at least once in a calendar year. Financial statements were audited by another third-party firm (Pricewaterhouse Coopers), on an annual basis.

The design and implementation of these data validation and audit procedures was a key area of focus in the first phase of PVP, which started in 2009; and the system as a whole was rolled out to over 2,500 GPs by the time second phase of the project was rolled out. In our study-sample GPs, which were covered under the second phase of the project, these systems were in place from the time of project initiation in 2012.

C Appendix: Theoretical model

Consider a GP with citizens i residing across number of $S > 1$ hamlets. The GP population is normalized to 1, and n_s is the fraction of citizens who reside in each of the hamlets, indexed by s (so that $\Sigma n_s = 1$). Two candidates, A and B, competing in the GP president election announce their policy platforms Z^A and Z^B, simultaneously and noncooperatively. The candidates' policy commitments are assumed to be binding, and the policy vector is defined by $Z = \{z_s\}$, where z_s is the amount of public resource that they would allocate to each hamlet $s = s_1, s_2, \ldots, s_S$. The total GP budget is fixed at G, and the set of feasible policy platforms is $Z = \{z \in \Re_+^S : \Sigma z_s \leq G\}$. Candidates A and B may also differ in their quality. Candidate quality—that relates to his/her ability to carry out effectively the overarching function of the GP—is defined by a scalar $q^j \in \Re$, $j = A, B$.

Citizens only benefit from resources that are allocated to their *own* hamlet. A citizen i residing in hamlet s derives utility $u(z_s^A)$ and $u(z_s^B)$ from the policy platforms of candidates A and B, respectively.[19] Following Lindbeck and Weibull (1987), among others, we assume that the total utility of each citizen i in hamlet s is given by $u(z_s^A) + w(q^A)$ if candidate A wins the election, and by $u(z_s^B) + w(q^B)$ if candidate B wins, where $w(\cdot)$ is the utility that all citizens derive from the quality of their elected GP president. For expositional simplicity, we assume $w(q^j) = q^j$.

Candidate quality q^A and q^B is not perfectly observable to citizens. Instead, prior to the election, each citizen i in hamlet s receives signals, a_i^s and b_i^s, of two candidates' quality. At the time of the election, citizen i will vote for candidate A if $u(z_s^A) + a_i^s > u(z_s^B) + b_i^s$. The voting decision for every citizen i is deterministic, and it is a discontinuous function of the utility difference between the two candidate policy platforms, given the realized signals a_i^s and b_i^s. All citizens with signals $b_i^s - a_i^s < u(z_s^A) - u(z_s^B)$ would vote for candidate A, and the rest would vote for candidate B.

Candidates A and B, however, do not observe the individual-specific signals a_i^s and b_i^s, but treat them as random variables, with only the distribution of $b_i^s - a_i^s$ known to both candidates, when selecting their policy platforms.[20] In line with the standard probabilistic voting models, $b_i^s - a_i^s$ introduce uncertainty—from the candidates' viewpoint—about how their policy platform maps into electoral votes.

[19] All citizens have identical preferences for hamlet-specific public spending i.e. $u_i(\cdot)$=$u_j(\cdot)$=$u(\cdot)$. In addition, $u(\cdot)$ is a concave, well-behaved function such that $u'(\cdot) > 0$ and $u''(\cdot) < 0$). To avoid corner solution, we assume that u' falls from infinity to zero as z_s rises from zero to infinity.

[20] Unlike the elected candidate's decisions on hamlet-specific resource allocation during his/her tenure, which are easily observable to all GP citizens, the day-to-day activities of the GP are harder to observe. Therefore, neither candidate can make credible/binding policy commitments related to these overarching GP functions, prior to being elected.

In each hamlet s, residents' individual signals a_i^s and b_i^s are drawn from the hamlet-specific distributions f_s^a and f_s^b, respectively. Both probability density distributions—characterized by the Gumble distribution—are assumed to be unimodal, with highest density at their respective accurate values q^A and q^B, and standard deviations $\sigma_s^a = \sigma_s^b = \sigma_s > 0$. Hence, hamlets differ in the degree of accuracy with which their residents can observe candidate quality q^A and q^B, with σ_s describing the level of "noise" in the realized signals a_i^s and b_i^s among residents of hamlet s.

Given our distributional assumptions of a_i^s and b_i^s, it can be shown that the density distribution of $b_i^s - a_i^s$ (f_s) is unimodal and symmetric, centered at $q^B - q^A$, with standard deviation σ_s.[21] All hamlets s are identical in terms of their residents' expected value of $b_i^s - a_i^s$, which also equals to the actual quality difference between the two candidates ($E_s[b_i^s - a_i^s] = q^B - q^A$, for all s). But hamlets differ in one key aspect: the degree of "stochastic heterogeneity" in the individual signal received by residents about candidate quality (since $\sigma_{s_1} \neq \sigma_{s_2}$ for all hamlets s_1, s_2). As a result, both candidates A and B face different levels of uncertainty in the mapping of their policy into aggregate votes in different hamlets.

Each candidate selects the policy platform that maximizes the expected vote, taking the other candidate's policy platform as given, and that satisfies the budget constraint ($\Sigma z_s \leq G$).[22] The expected number of votes for candidate A is given by $\Pi_A = \Sigma_s n_s F_s[u(z_s^A) - u(z_s^B)]$, and for candidate B it is given by $1 - \Pi_A$, where F_s is the cumulative distribution function associated with the density distribution f_s.

The best response functions of candidate A are then described by $n_s f_s[u(z_s^A) - u(z_s^B)]u'(z_s^A) = \lambda^A$, for all s and $\lambda^A > 0$. Correspondingly, the best response functions of candidate B are described by $n_s f_s[u(z_s^A) - u(z_s^B)]u'(z_s^B) = \lambda^B$ for all s and $\lambda^B > 0$. Given these, the ratios $\frac{u'(z_s^A)}{u'(z_s^B)}$ are equal for all s in equilibrium (equal to $\frac{\lambda^A}{\lambda^B}$). This, together with the budget constraint, implies that both candidates A and B converge to the same policy platform $z_s^A = z_s^B = z_s^*$ for all s.[23] And, the Nash Equilibrium candidate policy platform Z^* that emerges from the game in which two candidates A

[21] This follows from $a_i^s \sim$ Gumble $(\bar{a}, \sigma_s\sqrt{6}/\pi)$ and $b_i^s \sim$ Gumble $(\bar{b}, \sigma_s\sqrt{6}/\pi)$. If a_i^s and b_i^s are independent, then $b_i^s - a_i^s \sim$ Logistic $(\bar{b} - \bar{a}, \sigma_s\sqrt{6}/\pi)$.

[22] Assume that $u'(0)$ is sufficiently large so that the solution to the candidate's maximizing problem (given the other candidate's policy platform) is always an interior solution.

[23] For the proof of uniqueness and existence of a pure strategy Nash Equilibrium in the game of two candidates maximizing expected votes, see Lindbeck and Weibull (1987) and Strömberg (2004). The sufficient conditions for the existence of a pure strategy NE are: (1) compactness; (2) convexity of individual strategy sets; (3) continuity; and (4) concavity of the pay-off functions, which require sup $|f_s^{'}(t)|/f_s(t) \leq$ inf $|u^{''}(z_s)|/(u^{'}(z_s))^2$ for all s. Given the logistic distribution f_s, the left-hand side equals $\pi/\sigma_s\sqrt{6}$. Hence, the above condition is likely to be satisfied with a larger value of σ_s. In other words, this condition could be thought of as requiring the candidates to be sufficiently uncertain about how their policy maps into electoral votes in all hamlets, i.e. sufficiently large noise in the perceived voter beliefs about candidate quality difference.

and B maximize their expected votes must satisfy

$$n_s f_s(0) u'(z_s^*) = \lambda^* \tag{3}$$

for all s (and for some $\lambda^* > 0$). Similarly, the relative resource allocation between hamlets in equilibrium is described by the ratio

$$\frac{u'(z_{s_1}^*)}{u'(z_{s_2}^*)} = \frac{n_{s_2} f_{s_2}(0)}{n_{s_1} f_{s_1}(0)} \tag{4}$$

for all hamlets s_1, s_2.

The equilibrium allocation to hamlet s, z_s^*, increases in hamlet population n_s (given $u''(\cdot) < 0$). This policy bias arises because both candidates can win more votes per marginal increase in z_s in larger hamlets; and every citizens derive the same utility from per unit z_s regardless of hamlet size (n_s). However, this policy bias related to hamlet size is consistent with the utilitarian optimum achieved when maximizing the social welfare function $\Sigma_s n_s u(z_s)$ subject to $\Sigma z_s \leq G$.[24] So, to illustrate inequalities in equilibrium resource allocation that deviate from the utilitarian optimum, consider hamlet size to be equal across all hamlets i.e. $n_{s_1} = n_{s_2}$ for all s_1, s_2. In this context, the utilitarian optimum allocation would allocate equal amount of resources across all hamlets, $\bar{z} = G/S$. Similarly, the relative resource allocation between hamlets that emerge from the electoral process is defined by

$$\frac{u'(z_{s_1}^*)}{u'(z_{s_2}^*)} = \frac{f_{s_2}(0)}{f_{s_1}(0)} \tag{5}$$

for all hamlets s_1, s_2.

Proposition 1 *An increase in total GP budget, G, will increase the equilibrium resource amount allocated to hamlet s, z_s^*, for all hamlets s. However, this change does not affect the relative resource allocation described in equation (3) between hamlets s_1 and s_2, for all s_1, s_2.*

Proof. λ^*, which is also the shadow price of GP resource, is decreasing in the total GP budget ($\partial\lambda^*/\partial G < 0$, since $\partial\Pi/\partial z_s \partial z_s < 0$ and $\partial\Pi/\partial z_{s_1}\partial z_{s_2} = 0$). This, together with equation (3), implies that for all hamlets s, its equilibrium resource allocation z_s^* is increasing in G, since z_s^* is decreasing in λ^*, which in turn is decreasing in G. On the other hand, the equilibrium relative resource allocation between hamlets as stated in equation (3) is independent of the total GP budget G; it depends only on the relative densities of residents between hamlets.

[24] The utilitarian optimal policy is described by the following equation: $n_{s_1} u'(z_{s_1}^*) = n_{s_2} u'(z_{s_2}^*)$, for all hamlets s_1, s_2.

Proposition 2 *The equilibrium resource amount allocated to hamlet s, z_s^*, is increasing in the density of hamlet residents at and around the equilibrium, $f_s(0)$. For the case $q^A \approx q^B$, i.e. any nonzero candidate quality difference observed by citizens is explained by noise, a decrease in the level of noise, σ_s, will increase z_s^*. Moreover, for any values of q^A and q^B, convergence in $\sigma_s s$ leads to a reduction in differences in the equilibrium resource allocation between hamlets, such that if $\sigma_{s_1} = \sigma_{s_2}$ for all hamlets s_1, s_2, then $z_{s_1}^* = z_{s_2}^* = \bar{z}$.*

Proof. In the case of $q^A \approx q^B$, a decrease in σ_{s_1} increases the density of hamlet residents in the neighborhood of the equilibrium policy, $f_{s_1}(0)$. For all hamlets s, $s \neq s_1$, equation (5) states that $f_{s_1}(0)u'(z_{s_1}^*) = f_s(0)u'(z_s^*)$. These equalities, together with the budget constraint, imply that an increase in $f_{s_1}(0)$ must be followed by an increase in $z_{s_1}^*$(since $u''(\cdot) < 0$) and a decrease in z_s^* for all $s \neq s_1$. Similarly, if $\sigma_{s_1} = \sigma_{s_2}$, then $f_{s_1}(\cdot) = f_{s_2}(\cdot)$ (and $f_{s_1}(0) = f_{s_2}(0)$). Given this, the relative equilibrium resource allocation in equation (5) follows $u'(z_{s_1}^*) = u'(z_{s_2}^*)$, which in turn implies $z_{s_1}^* = z_{s_2}^*$ ($= \bar{z} = G/S$, i.e. the utilitarian optimum allocation).