Do citizens enforce accountability for public goods provision? Evidence from India's rural roads program

Tanushree Goyal*

20th January 2023

Abstract

This paper investigates voter responsiveness to the world's largest rural roads program, a highly visible development program that improved connectivity for one-third of humanity that previously lacked road access. Investigating 180,000 roads provided across half a million Indian villages aggregated across multiple elections over the last 20 years, the paper finds that road provision fails to boost electoral support for the ruling party. Exploiting population-based implementation rules that partly determine road allocation, instrumental variable regressions show that voters remain unresponsive to exogenous road provision. Exploiting subnational variation in implementation and political alignment, analysis shows that factors that breakdown the accountability chain, such as quality, salience, myopia, corruption, or attribution concerns, do not explain these results. The findings suggest that weak accountability presents a more enduring challenge to democracy than assumed in theoretical models and policy interventions.

*Assistant Professor, Princeton University. Email: tgoyal@princeton.edu.

Introduction

Citizens in low- and middle-income countries overwhelmingly report the provision of public goods and services such as roads, water, and electricity as their top policy issue (Grossman and Slough, Forthcoming). Yet it is unclear whether citizens use elections to enforce accountability for service delivery by punishing incumbents who under-provide these crucial services while rewarding those who improve access.[1] Studies that investigate electoral accountability focus on cash transfers or financial grants that are targeted at individuals (Blattman, Emeriau and Fiala, 2018; Pop-Eleches and Pop-Eleches, 2012; Manacorda, Miguel and Vigorito, 2011), despite the fact that politicians often play no role or lack discretion to enable such transfers (Imai, King and Velasco Rivera, 2020). Other scholars have investigated policies that are lower priorities for voters (Boas, Hidalgo and Toral, Forthcoming), or have studied citizens' responses to audits that have generated unique media sensations (Ferraz and Finan, 2008; Larreguy, Marshall and Snyder, 2020). Even if voters respond to policies such as cash transfers or audits, this does not necessarily mean that they will be similarly receptive to signals of everyday provision of public goods and services that often do not make sensational headlines and are provided at the community level.

This paper conducts the largest investigation of voters' electoral responsiveness to public goods provision at an unprecedented time, population, and geographic scale using the case of India's 41 billion dollars rural roads program, the *Pradhan Mantri Gram Sadak Yojna* (Prime Minister's Rural Roads Program or PMGSY). The PMGSY program improved connectivity for one-third of humankind by constructing close to 180,000 rural roads, making it the largest visible change in India's rural corridors. PMGSY is also a strong case for observing electoral accountability in a developing context. The scale of road construction alone makes it impossible to ignore. An average Indian village has a diameter of 2.1 kilometers, and the average road built through this program is 4.4 kilometers long. Additionally, this highly visible development program included accountability and transparency features

[1] Harding (2015) and de Kadt and Lieberman (2017) are notable exceptions to the rule when it comes to investigating accountability for public service delivery in Africa.

to improve widespread access to high-quality program information. Like the provision of most other public goods and development schemes in India, subnational state governments were responsible for implementing PMGSY. PMGSY formally included events where politicians could claim credit for providing roads, and evidence confirms political influence in road allocation (Bohlken, 2017). At the same time, rich qualitative evidence from a variety of sources underscores voters' awareness of and their political attribution of this program to state governments. Furthermore, existing studies exploit exogenous variation in road provision to provide causal evidence that voters have benefited economically and socially from PMGSY roads (Adukia, Asher and Novosad, 2019; Aggarwal, 2018, 2021; Asher and Novosad, 2020). This paper enables knowledge accumulation in this research agenda by investigating voters' electoral response to this program and improving our understanding of the political consequences of large-scale development programs that have proliferated in the Global South.

Studying electoral accountability for providing basic services is important for two reasons. First, multi-billion dollar programs to provide basic services have proliferated in the developing world (World Bank, 2004). However, lacking electoral incentives, politicians are more likely to abandon these programs or invest their effort in high-visibility tasks that may not necessarily align with citizen welfare or priorities (Harding and Stasavage, 2014). Second, governments have invested sparse state resources in transparency and accountability initiatives, which are increasingly built into development programs to improve citizen accountability (Gaventa and McGee, 2013). The logic is that such initiatives can increase aggregate access to credible, localized, high-quality information alongside visible service provision, strengthening the complex chain of conditions that link the provision of services to accountability. So, it is important to ask if these costly, state-led efforts are getting the job done.

Theoretically, there is a higher likelihood of observing accountability for road provision, relative to more complex services like education or healthcare (Mani and Mukand, 2007;

Harding, 2015). However, recent research on information and accountability in developing countries yields opposing conclusions as to whether citizens will hold politicians accountable for providing access to crucial services even when conditions are favorable (Dunning et al., 2019). One strand concludes that the current theoretical models should be revised, while the other concludes that there are breaks in the information chain that make performance-based voting harder but does not question the current theoretical paradigm.

A growing body of work challenges the straightforward logic underlying performance-based voting. Ethnicity or partisanship can moderate whether voters update their beliefs when exposed to new information about incumbent performance (Adida et al., 2017), while weak institutional context can render performance signals less meaningful (Jensenius and Suryanarayan, 2020; Martin and Raffler, 2021). Voters may prefer challengers regardless of the incumbent's quality, which manifests as an incumbency disadvantage in contexts with weak accountability (Weaver, Forthcoming). Others find that policy salience can override policy attribution (Goyal and Harding, 2021). These meta issues raise sobering concerns about *any* informational or policy effort aimed at increasing accountability, regardless of its execution, design, or source. Other scholars have questioned whether the design of information interventions or a failure to supply relevant and credible information can explain these null results. These studies find that correcting for potential design issues by, for example, providing information about services voters care about (Boas, Hidalgo and Toral, Forthcoming), or providing widespread information to communities does improve accountability (Adida et al., 2020).

The PMGSY program, by providing roads at an unprecedented scale, provides a unique opportunity to advance the research on accountability. After discussing in detail how the PMGSY roads program offers a compelling theoretical opportunity of observing accountability for service delivery in India, this paper investigates the electoral response to this program. To do so, I leveraged data on 180,000 all-weather rural roads in India built between 2001 and 2017, which I have merged with constituency-level data on national and state

elections. This dataset covers more than 90 percent of India's population and a significant duration of the road program. Crucially, rich data on road quality and cost enables me to investigate whether corruption moderates voter response, which is a key explanation behind weak accountability and incumbency disadvantage (Klašnja, 2015). I begin by estimating first difference Ordinary Least Squares (OLS) regression. To improve inference, I analyze the *change* in the incumbent party's vote share at the state constituency-level, *within* the district-administration level at which the roads plan are prepared and construction contracts are sanctioned. Because voters may reward program launch, I also investigate voter response in national elections.

Using first difference OLS regressions, this paper finds that road provision does not boost electoral support for the ruling party. This null result holds across India, at various electoral levels, and across different time periods. As first deployed in Aggarwal (2018, 2021) and Asher and Novosad (2020), I exploit the population-based implementation rules that partly determine road allocation to identify the effects of road provision at the constituency level using an instrumental variables regression. These existing studies provide evidence for the robustness of using population thresholds for the purpose of identifying the effects of road provision at the village and district level. I exploit the same design to construct an eligibility instrument that determines road provision at the constituency level. Data lends strong support for the exclusion restriction. IV results reinforce the null findings from the OLS analysis, suggesting that the results are robust to endogeneity concerns. Results from the village-level analysis in India's most poorly connected and populous state, Uttar Pradesh (UP), confirm that constituency-level results do not average out over positive and negative spillover effects.

The main objective of this paper is to provide a test of the sharp null hypothesis of real-world electoral accountability at scale. Additionally, I follow the literature to rule out key reasons for accountability failures that may explain why road provision does not have electoral effects. While investigating theoretical challenges to the political agency model is

outside the scope of this paper, I focus on explanations where there is breakdown within the accountability chain, such as lack of information, corruption, or poor attribution. Exploiting subnational variation in implementation and political alignment, I find that key explanations that center on quality or salience concerns, myopia, information- and media-rich environments, or a lack of clarity of responsibility are not the roadblocks that lead to failures in the accountability chain. Road provision, despite being visible and a top priority for voters, is unlikely to be a factor in their voting decision.

This study contributes to the literature on the political economy of accountability in several ways. First, the findings improve our understanding of the scale of the accountability problem in developing countries. Surprisingly few studies investigate the electoral effects of large-scale public-goods programs that also are among voters' priorities (Grossman and Slough, Forthcoming). Second, an advantage of this aggregate analysis is the ability to use large-scale administrative data and real-world voting outcomes to test a sharp null hypothesis, complementing ongoing field experimental research. On the one hand, field experiments require fewer identifying and ecological assumptions and are better suited to investigate mechanisms that require individual-level data, such as voters' ethnic or partisan identities.[2] However, they have a shorter time and geographic span, and a majority rely on self-reported survey data to measure voting intentions since real-world voting behavior is never directly observed (Dunning et al., 2019). This study bolsters support for the null finding from this agenda by showing that a local infrastructure provision program deploying transparency initiatives—arguably a highly powered information treatment—remains insufficient for increasing accountability. Third, this paper contributes to the study of the multibillion dollar infrastructure development programs that have proliferated in developing

[2]Studies that interpret voter behavior from any real-world electoral data, which is never observed at the voter level, require some level of ecological inference. Such inference is often necessary and is made by politicians and governments in electoral and policy analysis. Road access, in particular, is highly desirable but uneven, and has been shown to improve voter prosperity. As a result, it is less problematic to anticipate that roads will have positive incumbency effects on the net, as discussed in Harding (2015) and de Kadt and Lieberman (2017).

countries. Research investigating these programs shows that state coordination failures lead to half-finished and abandoned projects (Williams, 2017). This paper offers an explanation as to why politicians ignore these failures: Voter unresponsiveness discourages the type of costly political oversight that improves program implementation (Gulzar and Pasquale, 2016; Raffler, Forthcoming). As they stand, the findings bolster concerns about the prospects for electoral accountability and suggest that in-built transparency initiatives common to development programs worldwide remain insufficient for increasing accountability.

1 Accountability and public goods provision

A key goal of democracy is to ensure all people have access to the basic goods and services necessary to live a dignified life. Despite decades of economic growth and democratically elected governments, many developing countries have failed to provide the majority of their citizens with equitable and high-quality access to basic necessities such as water, roads, and electricity (Pande, 2020). Perhaps unsurprisingly, the provision of basic public goods and services also consistently ranks as a top concern for citizens. Reviewing cross-national survey data, Grossman and Slough (Forthcoming) find that: "*sizable shares—in some cases even a majority—of the population in many countries cite public goods and services as their top issues.*"

The chronic lack of basic services in the face of high voter demand raises concerns about the health of democratic accountability. Yet, despite these pressing concerns, the question of whether voters hold politicians accountable for providing local public goods and basic services in the real world remains understudied.[3] Studying this question is urgent because

[3]Unlike in the case of relatively well-studied cash transfers program and audits, corruption and endogeneity concerns have hindered progress on investigating voter responsiveness to public goods and services, limiting what we can learn from the few existing studies. de Kadt and Lieberman (2017) find that widespread corruption in South Africa has lead citizens to respond negatively to public goods provision, leaving it open whether voters will reward public services when both corruption concerns are less pronounced (or vary) and voters benefit from service provision. Harding (2015) is an exceptional study, finding that Ghanian voters reward incumbents for improvements in roads quality, despite the prevalence of patronage or identity politics, and even when politicians do not influence road maintenance. The findings bolster the expectation that voters are more likely to reward public goods provision in cases where politicians do actually influence outcomes.

a lack of voter responsiveness to welfare programs can divert politicians' attention to high-visibility tasks that are not in line with voter welfare (Ashworth and Mesquita, 2006; Harding and Stasavage, 2014).

Theoretically, recent research on information and accountability has also complicated the political agency model's straightforward expectation that voters should reward or punish politicians for providing or under-providing basic public services (Ashworth, 2012). As per the standard political agency model, voters observe performance signals and then evaluate whether the politician is a good or bad type. Voters may rationally rely on shortcuts such as a candidate's ethnic identity to inform their vote choice when they lack information on politicians' competence and performance and candidates cannot commit to improving citizens' well-being. Conversely, when voters receive clear performance signals, they are more likely to respond electorally; this feedback loop ensures that politicians remain attuned to voters' needs. Building further on this insight, theoretical models conclude that highly visible and easy-to-evaluate public goods such as roads, electricity, or water provide clear performance signals and, therefore, are particularly favorable to accountability. (Mani and Mukand, 2007). Yet, a multi-site and preregistered meta-analysis of the effects of voter information campaigns conducted in six vastly different countries concluded that the overall effect of providing standardized performance information is weak (Dunning et al., 2019).

Scholars have responded to these unexpected findings in two ways, yielding opposite conclusions regarding whether voters will enforce accountability for public goods provision when performance signals are clear. On the one hand, scholars have raised concerns about the premise of political agency models. Indeed, if citizens are unresponsive to new facts and reluctant to update their beliefs, it suggests that these traditional models are incorrect regarding citizens' appetites for information and their propensity to use performance signals in exercising their voting choice. Adida et al. (2017) challenge the view that ethnicity is a heuristic that substitutes for a lack of information, demonstrating that ethnically motivated reasoning conditions how voters process new political information. Using rich data from

quasi- and field experiments, Boas, Hidalgo and Toral (Forthcoming) find that voters punish high quality education signals in Brazil because voters hold politicians accountable not only for their competence but also for their representation of potentially conflicting interests.

In addition, recent research highlights novel ways in which weak institutional context lowers the likelihood of observing accountability. A key explanation centers on the nature of challengers and the lack of incumbency advantage in developing countries. Voters' strong preference for challengers regardless of incumbent quality, which is often a result of weak institutional accountability in non-electoral institutions, can weaken the electoral accountability relationship. Weaver (Forthcoming) finds that mayors face a significant incumbency disadvantage in Peru, and shows that neither good performance nor voters' access to performance information enables mayors to overcome it. Voters prefer challengers regardless of incumbent quality, but it is voter trust in accountability institutions that attenuates incumbency disadvantage. Uppal (2009) also report a strong and rising incumbency disadvantage in India, but find that this disadvantage is higher in states with lower provision of public goods. Klašnja (2015) suggest that corruption can hinder performance-based voting as voters prefer inexperienced challengers over experienced but corrupt incumbents. Eggers and Spirling (2013) argue the opposite: incumbency disadvantage can arise if narrowly-elected incumbents are less appealing and lower quality than challengers on average. They argue that these scenarios are particularly likely in developing countries. If voters prefer challengers over incumbents for reasons such as corruption, a lack of access to basic services, or a lack of trust in state institutions that hold politicians accountable for their corrupt behaviour, places where corruption is (less) rampant and services less (more) accessible should see a (lower) greater incumbency disadvantage.

Recent research has further called into question the veracity of the political agency model. Martin and Raffler (2021) highlight an additional dimension that moderates accountability: citizens allocating responsibility between politicians and bureaucrats. Using survey experiments in Uganda, they demonstrate how, when citizens believe that politicians have limited

capacity to control bureaucrats, they are less likely to believe that government performance is a good signal of the incumbent's quality. Frey (2020) raises new concerns about the accountability logic in Brazil's clientelistic setting, where he finds that development programs, by permanently boosting voters' incomes, reduced the voters' likelihood to vote for incumbents. In summary, this body of research suggests we should revisit our expectations about *any* informational or other policy effort aimed at increasing electoral accountability, regardless of its execution, design, or source.

On the other hand, particularly in the light of null results (Dunning et al., 2019), research using field experiments to study accountability has also raised concerns about the design of commonly used informational interventions. Studies have argued that the complex chain of conditions linking information to accountability makes it impossible to determine whether voters do not process information or whether the way information is supplied challenges dissemination. In other words, this line of argument theorizes that, if execution challenges did not exist, we would observe voters acting to hold politicians accountable, thus confirming the theoretical predictions from the political agency model. Bhandari, Larreguy and Marshall (Forthcoming) find that Senegalese voters care principally about such local outcomes as projects and transfers, rather than information on legislative efforts or attribution. They show that voters find temporally benchmarked local performance outcomes particularly informative, as these help voters to parse out common shocks that affect everyone as well as update about the absolute quality level of other politicians who resemble challengers. Boas, Hidalgo and Toral (Forthcoming) find Brazilian voters receptive to non-partisan information about education quality provided in partnership with the state accountability institution. Adida et al. (2020) demonstrate voters react strategically to information, and that salience and coordination are necessary for information to influence voter behavior. In summary, this research illustrates how widely disseminated policy information concerning goods and services voters care about can enable accountability.

To summarize, the literature yields mixed expectations about whether voters enforce ac-

countability for the provision of public goods and services. Political agency models suggest voters are likely to respond to the provision of public goods and services. Theoretically, local public goods provision, and roads in particular, is a favorable case for observing accountability. Harding (2015) shows that accountability for road provisions occurs even in contexts where patronage or ethnic politics remains pervasive. Voter responsiveness can align a politician's incentive to remedy the lack or poor quality of a good or service. However, weak institutional context can remain an impermeable barrier, lowering the likelihood that voters respond electorally to performance signals. Investigating voter response to public service delivery can delimit the accountability problem more precisely and improve our understanding of why politicians implement or abandon development programs.

2 India's rural roads program

Before PMGSY, one-third of the world's people who lacked access to an all-weather road lived in India. From 2000 to 2018, India built over 180,000 all-weather roads spanning over 550,000 kilometers at a cost of more than US$ 41 billion. Indian media has widely documented the program's success and positive impact on rural citizens. Building on existing scholarship, this section describes the multiple compelling features that make PMGSY a favorable case for observing accountability.

Theoretical research suggests that voters are most likely to be electorally responsive to the provision of policies that are desirable, visible, easy-to-evaluate, and benchmarked (Mani and Mukand, 2007). Evidence shows that rural road provision exemplifies these features (Harding, 2015). Roads are highly desirable and important to Indian voters. Evidence from the largest pan-India voter survey (N= 2,50,000) conducted in 2013 by the Association for Democratic Reforms indicates that voters rate roads as highly important with an average rating of 7.79 (scale of 0-10), closely behind employment (7.94) and drinking water (7.8). Indian media also documents citizens' demand for roads and their positive response to PMGSY.[4] Lack of access to roads is a recurring problem for which citizens are known to

[4]See *"Ningthi finally gets connected by PMGSY road,"* Hueiyen News Service, December 20 2012.

reach out to state politicians and seek help.[5] In areas that are poorly connected, citizens indicate the lack of roads as the reason for strong electoral punishment.[6] Some have issued cash incentives to politicians to visit their villages.[7] Citizens have literally taken matters into their own hands, carving roads to connect their villages to main roads.[8] Such events have inspired a blockbuster Bollywood movie called 'Manjhi – The Mountain Man', further increasing the salience of road provision. Politicians are aware of voters' strong desire for roads. In the early 2000s most parties' electoral campaigns promised roads, evidenced in the popular campaign slogan: "*Bijli, sadak, pani*" or "*Electricity, roads, water.*"

Roads are visible and lead to large geographic changes in regions previously isolated. Because new roads are built where none existed before, it is much easier to benchmark the incumbent's performance on road provision relative to challengers as well as relative to, for example, incremental improvements in school or road quality. Appendix Figure A2 presents a before and after image of villages that receive roads and illustrates the ease with which it is possible to benchmark road provision. Bhandari, Larreguy and Marshall (Forthcoming) find that information signals that can help voters to temporally benchmark incumbent's performance are particularly effective. Specifically investigating citizens' response to PMGSY, Sitapati (2014) further illustrates how voters are indeed able to temporally benchmark building of new roads under two different Chief Ministers (Head of State Government) in Bihar:

> "*'During Lalu's times, I would fear my [car] suspension would be ruined by the mud roads, he says. I was worried I would be stopped and robbed...' Bittu's greatest joy now is speed driving, 'sometimes...even 70 [km per hour].' This is because of Nitish, he adds. 'He ended Lalu raj.'*"

[5]See, *"On 124 km walk to demand roads, Sirmaur villagers reach Shimla to meet CM Jai Ram,"* The Hindustan Times, October 20 2018.

[6]See, *"Pasighat villagers demand road before vote —Lack of connectivity over the years has hampered development in Arunachal, feel activists,"* Telegraph India, April 3 2014.

[7]See, *"Desperate Uttar Pradesh village offers cash for a visit by MLA or MP,"* NDTV, September 12 2012.

[8]See, *"Another Dasrath Manjhi: Odisha man carves mountains to send kids to school,"* The Hindustan Times, January 10 2018.

Evidence suggests that Indian voters attribute the responsibility for implementing the PMGSY program to the state ruling party.[9] India's political context helps explain why: While central governments provide funding for large-scale programs, state governments implement them. Consequently, voters attribute responsibility for the provision of local goods and services to state ruling parties, reaching out to state legislators to benefit from development programs and schemes (Bohlken, 2016). Evidence shows that quality of attribution is reasonably high in India (Goyal and Harding, 2021), mainly due to the institutionalized and straightforward division of responsibilities between levels of governments. Furthermore, ruling-party politicians influence service delivery because they have high degree of leverage over bureaucrats (Gulzar and Pasquale, 2016). Ruling parties' stronger oversight over bureaucracy explains why voters attribute PMGSY to ruling-party politicians (Martin and Raffler, 2021).

State governments were fully responsible for PMGSY service delivery. They could decide whether, when, and with what intensity they should implement the program. Consequently, not all states have been equally proactive in implementing PMGSY, with some exceeding their targets and some falling behind. Incumbent politicians and ruling parties promised rural roads in their campaigns; the media assigned their subsequent electoral success to the roads: "*The excellent roads network was one of the principal vote-catching achievements of Nitish Kumar, who managed to beat anti-incumbency to return as chief minister in the state elections last year.*"[10] Within each state, Members of the State Legislative Assemblies (MLAs) jostled at district headquarters to influence bureaucrats to sanction roads in their

[9]Depending on the policy of interest, it is plausible that voters may attribute responsibility to individual candidates. However, empirical evidence from the program suggests that the majority of voters credit the state's ruling party politicians for the PMGSY program (e.g., see Sitapati (2014), Public Affair Centre (2011)). More broadly, evidence indicates that parties are the strongest determinant of vote choice in India's state elections (Goyal, 2020; Bohlken, 2016). For instance, in an exit poll election survey conducted by Lokniti in Uttar Pradesh in 2017, only 10 percent of voters suggested that the individual candidate was the determining factor for their vote. Instead, 60 percent mentioned a party or chief minister, with the rest giving an inapplicable response. Other state election studies also find the party to be the most determinant.

[10]'*Road-building in rural India: From Bihar to Orissa, PMGSY remains a success story*', Economic Times, 15 March 2016.

constituencies. Bohlken (2017) documents political influence in the program; she finds that ruling party MLAs have greater road length in their constituencies. Most crucially, MLAs influence program outcomes beyond the allocation of roads by also overseeing bureaucrats and contractors and ensuring that sanctioned roads are actually constructed.

To ensure politicians could claim credit for road construction, public foundation-laying ceremonies and inaugural town-hall-style meetings were organized with state and national politicians attending. PMGSY funded these ceremonies, and local media widely covered these events. Randomized audits helped ensure compliance with the rules that standardized how to conduct these ceremonies. Politicians used these events to claim credit for road provision (see Appendix Figure A1). Investigating policy attribution for PMGSY in Bihar, Sitapati (2014) finds that rural citizens have credited state governments for constructing PMGSY roads, as the following excerpt highlights.[11]

> "*Every single voter in West Champaran this reporter spoke to knew of the roads revolution, and credited the state government with it. Even Mantu Tiwari, a BJP supporter, grudgingly admits: 'City roads were always fine, but yes. He (Nitish) has changed rural roads here.' Traveling through the district on a burning afternoon, one sees girls in school dress running by freshly tarred roads, a sight unimaginable a decade ago.*"

PMGSY also included transparency initiatives to ensure high-quality program information. From the program's beginning, a distinct sign has marked each PMGSY road to differentiate it from other roads. The program specifies the placement and content of the standardized board, making it easy to spot PMGSY roads while traveling in rural India. Furthermore, each PMGSY road lists the central-level funding department and mentions the state-level government as being responsible for the program's implementation. Internal

[11] This excerpt also highlights that voters can discern the difference in national (BJP) funding and program implementation by the state government, as confirmed in Goyal and Harding (2021).

quality data from PMGSY confirms an overwhelming majority of roads (90 percent) have high-quality information boards.

Evidence indicates that citizens have a high recall for PMGSY roads and report daily usage. The Public Affair Centre (2011) published a detailed citizen-led audit and monitoring report conducted in three different Indian states. This report finds that 94 percent citizen's report high level of perceived and felt benefits from PMGSY roads, and 84 percent claim to use these roads daily. The report also finds that a majority of citizens, ranging from 53 percent to 66 percent, recognize PMGSY roads and attribute them to state governments. Finally, causal evidence shows the positive impact PMGSY has had on variety of social outcomes, from access to healthcare to widening the marriage market and lowering crime(Aggarwal, 2018, 2021; Adukia, Asher and Novosad, 2019; Asher and Novosad, 2020).

3 Data and empirical strategy

3.1 PMGSY roads-constituency dataset

This section describes the process undertaken to build an all-India PMGSY-roads-constituency dataset. The first step was obtaining the road data. I obtained a consolidated PMGSY roads-level dataset directly from India's Ministry of Rural Development. This dataset is not only almost twice as long in coverage years relative to all other studies investigating PMGSY (Asher and Novosad, 2020), it is also the most comprehensive data on road quality. For each road, this data includes all habitations (which are clusters of single-family dwellings; several habitations together form a village) and village names (and populations) a road connects; a road's length, cost, funding date, construction start date, completion status, and date; and a quality rating for various aspects of each road. Although the program mainly built new roads, this data also contains roads that were upgraded and bridges that were built as part of the program. Data from fieldwork conducted during 2016–2018 with the National Rural Roads Development Agency, the centralized bureaucratic department that oversees PMGSY, complements insights from the analysis of the PMGSY data. The fieldwork consisted of shad-

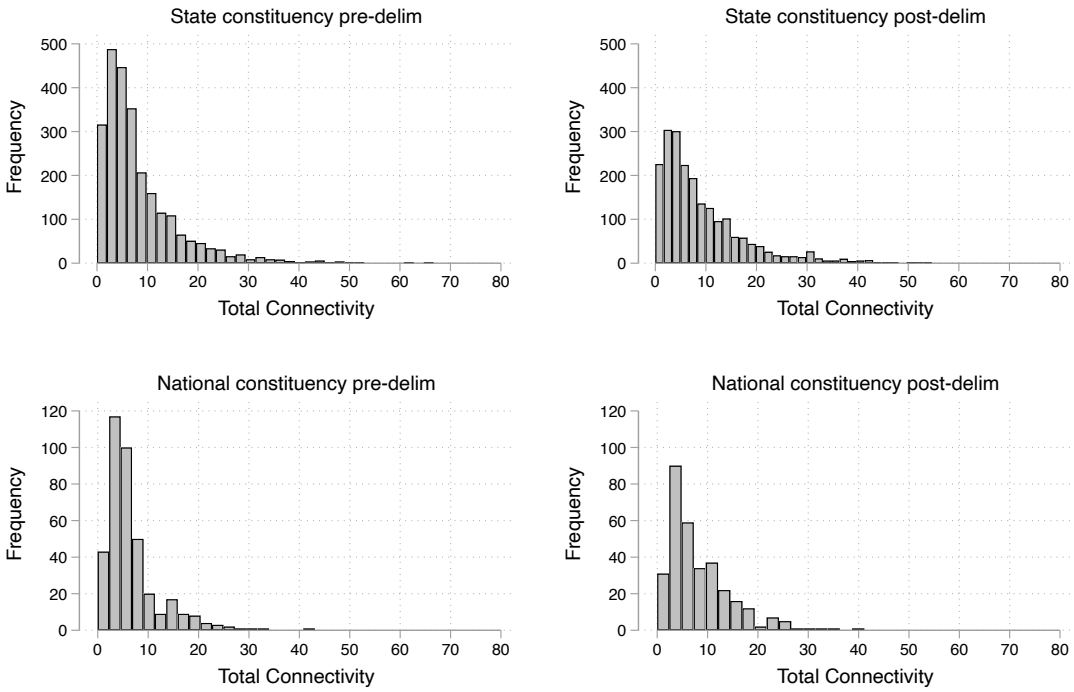
owing and conducting open-ended interviews with key program officials, attending quality assessment training, and visiting state-level public works departments in Jaipur and Uttar Pradesh to interview state politicians, bureaucrats, and citizens.

The second step was adding census identifiers for each of the connected villages. To improve match quality, I merged the roads dataset with the Census 2001 village dataset using an exact and fuzzy name matching process for village names and population.The names were matched using a standard approach based on calculating Levenshtein distance and string similarities between canonicalized village names. On average, I could exactly match names and populations for over 76 percent of observations, while 16 percent were fuzzy matches. I keep Indian states where the total matching is at least 80 percent, the exact matching is at least 60 percent, and at least 2000 villages are linked.This yields a sample of 15 large states, which contain close to 95 percent of India's population. See Appendix Table B1 for matching percentages for each state. Appendix B1 plots the number of PMGSY projects. Note that the outcomes are measured at the constituency level. Each state constituency is geographically nested within administrative districts that are nested within states. National constituencies are typically as large as districts, but their boundaries do not overlap with those of districts. For each village in the 2001 and 2011 censuses, it is possible to add an identifier for constituencies and districts and therefore aggregate the results to the constituency level.

The third step involved adding state and national constituency identifiers to the roads-village dataset and aggregating the data at the constituency level. A major border re-districting exercise was conducted in India in 2008, which makes electoral constituencies before and after this exercise incomparable. I refer to the period from 2000 until 2007 as "pre-delimitation" and from 2008 onwards as "post-delimitation." To add constituency identifiers for the pre-delimitation constituencies, I rely on data from Jensenius (2017). To add constituency identifiers for the post-delimitation constituencies, I rely on village and constituency maps from ML Infomaps. After adding the constituency identifiers, I estimated the

percentage of villages that were connected by PMGSY within each constituency. I refer to this key predictor variable as "total connectivity" or "change in connectivity." Figure 1 plots total connectivity within state and national constituencies for the pre- and post-delimitation periods. Roads are built to connect villages to one another and to the nearest economic centers. As such, as villages become more connected via roads, the constituency as a whole becomes more connected to other members as well (regardless of village population, to some extent). As a result, as a constituency becomes more connected, the likelihood that the incumbent is rewarded for facilitating this mobility increases.

Figure 1: Total connectivity across state and national constituencies



Notes: The plot shows the distribution of connectivity for each of the subsamples indicated in the title. On an average, PMGSY connected a substantive 8.3 percent of all villages ($\sigma = 7.8$) in each state constituency during the pre-delimitation period, and 9.2 percent of total villages ($\sigma = 9.8$) in the post-delimitation period. The comparative figures for the national constituency level are 6.9 percent ($\sigma = 5.6$) and 8.3 ($\sigma = 6.4$) percent of total villages connected in pre- and post-delimitation period respectively.

The fourth and final step was merging this road-constituency dataset with an electoral dataset to add the dependent variable: the change in the state or national ruling party's vote share. Because each constituency is observed exactly twice during pre- and post-delimitation, this variable is the difference in the vote share of the incumbent party or coalition in gov-

ernment between two consecutive state or national elections. There is no consolidated data on state-level incumbent governments. Therefore, I began by creating a list of consecutive state ruling parties for consecutive elections for both the pre- and post-delimitation periods. Appendix B2 visually shows this list of ruling parties' for each state. I used electoral data from Lokdhaba to estimate the change in each ruling party's vote share. Appendix B.3 provides details about the data and variable construction. Given that the program was funded and launched by the national government, I also investigate whether voters reward national incumbents for road provision.[12]

3.2 Empirical strategy

Politicians anticipate electoral returns to PMGSY roads, which means that road provision is likely to be correlated with not only geographic or economic but also political considerations. To address these concerns and investigate the electoral returns to PMGSY connectivity, I estimate the following OLS regression:

$$\Delta Y_i = \mu + \beta \Delta X_i + \delta_j + \epsilon \tag{1}$$

where ΔY_i is the change in incumbent vote share for constituency i, ΔX_i is the change in PMGSY roads built or upgraded in constituency i, δ_j is a district fixed effect (all state constituencies are geographically nested within districts), and ϵ is a random error term. The coefficient of interest throughout the paper is β, which captures the effect of road construction on the change in incumbent party's vote share. Note that this is a first difference estimation. However, because I consider only two time-periods in any given panel, first difference and fixed effects estimations yield identical results, as shown in Wooldridge (2013, p. 490). Following Wooldridge (2013), I prefer FD estimations for two reasons. First, it is easier to interpret the point estimate, which is the change in incumbent voteshare, and aligns intuitively with the theory. It is also *"easy to compute heteroskedasticity-robust statistics*

[12]Most voters do not attribute responsibility for PMGSY to individual legislators; rather, they attribute responsibility to state ruling party politicians, as discussed in the context section. However, as a robustness check, I constructed the dependent variable as the change in the vote share of individual candidates and found that the results did not change.

after FD estimation (because when $T = 2$, FD estimation is just a cross-sectional regression" (ibid.). Each constituency is observed exactly twice in each of the periods and all districts and constituencies within a district/ state undergo elections at the same point in time. In other words, there is no district-time or state-time variation.

This lean specification is similar to Harding (2015) and Aggarwal (2018, 2021) and robustly controls by design for (a) all time-invariant confounders at the constituency level such as geographic factors or pre-existing infrastructure (b) all time-variant and time-invariant confounders that vary across districts, for example, administrative capacity or district level-politics. However, because ruling party politicians could partly influence roads allocation at the constituency level, roads allocation is still likely to be endogenous to within-constituency expectations. Existing research on distributive politics raises the expectation of positive electoral returns to road provision (Golden and Min, 2013); studies documenting economic and social effects of PMGSY roads bolster this explanation (Aggarwal, 2018; Adukia, Asher and Novosad, 2019). The latter findings also allay concerns that the program was poorly implemented. Although less plausible, rent-seeking motives may override politicians' electoral motivations to the extent that politicians target roads in constituencies with the most rent-seeking potential but no scope for electoral gains, increasing the odds of a null finding.

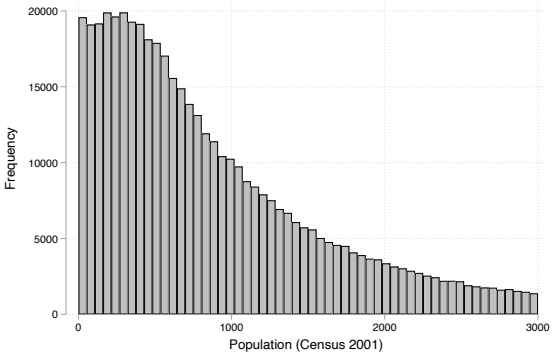
3.3 Endogenity concerns

To address concerns of political targeting, I use an instrumental variables approach which exploits the fact that PMGSY roads were provided partly along programmatic lines. An implementation rule targeted roads to villages with population exceeding two discrete thresholds, 500 and 1000, more generally, but 250 in hilly states, tribal districts, and districts affected by left-wing extremism. Appendix C1 lists the names of these specific states and districts. Village level Census 2001 provided population data and was used to determine which villages are eligible. Figure 2 Panel A is a histogram of village population and there is no visible sorting around the thresholds.

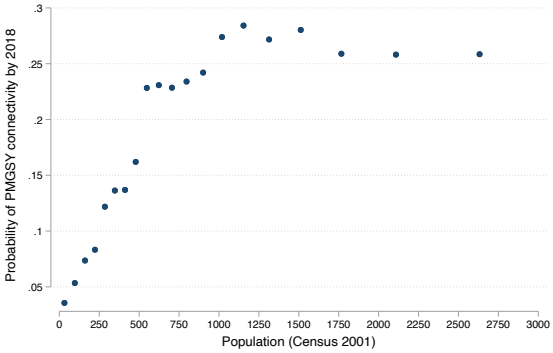
Each state could secure central funds to build roads in villages that qualified as per

Figure 2: Population thresholds partly determine road provision

A. Histogram of village population



B. Probability of PMGSY connectivity by 2018



Notes: The plots include all villages that have population between 1 and 3000 as per Census 2001 (N = 459181). The mean village population is 855 ($\sigma = 693$). The binscatter plot contains the default of 20 equally sized bins.

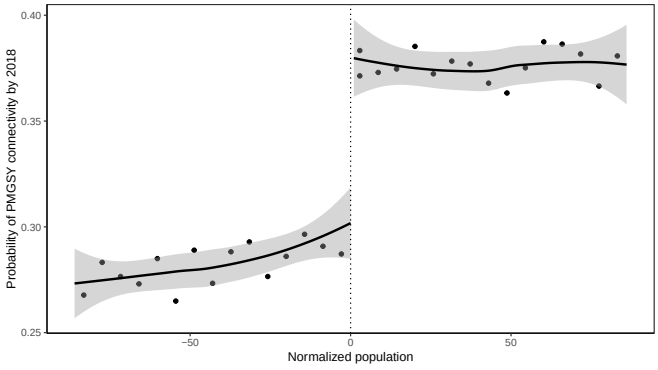
the implementation rule, which was one of the key factors in determining which villages to prioritize for connectivity. States also had discretion, and district-level administrations could propose villages that they determined required roads based on local knowledge and economic importance. state-level offices that compiled these district rural road plans (called DRRPs) and submitted the compiled proposal to the center to obtain the funding. States were responsible for allocating road contracts and implementing the program. Figure 2 Panel B shows that the implementation rules cause villages just above the population threshold of 500 and 1000 to be more likely to receive a road by 2018.

Figure 3 Panel A shows that villages just above the threshold of 500 are 8.9 percentage points more likely to receive a PMGSY project by 2018 than villages just below the threshold. This paper is by no means the first to exploit these population thresholds as a source of exogeneity in road provision. Existing research in economics investigates the economic returns to roads at the village and district level, relying on the same underlying implementation rules for the purpose of identification. Aggarwal (2018, 2021) conducts a district-level analysis using a first difference approach. Asher and Novosad (2020) conduct a village-level analysis by exploiting a fuzzy regression discontinuity (RD). These papers provide evidence that road provision is exogenous to village- and district-level characteristics. Crudely, the

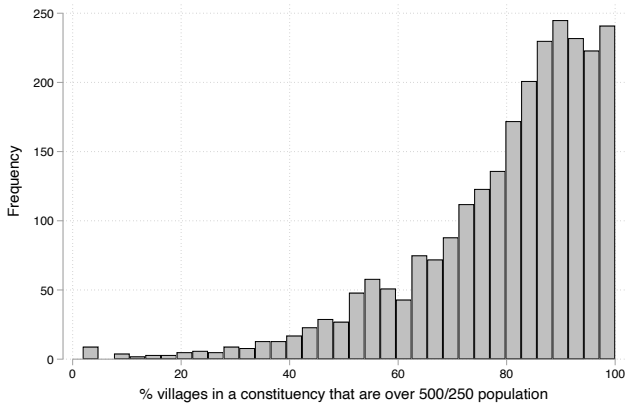
identification assumptions at the constituency level are stronger than those at the village level but less stringent than those at the district level, simply because constituencies are nested within districts.

Figure 3: Population thresholds and instrument

A. Road just above and below 500 population



B. Instrument



Notes: Plot A: The figure plots the probability of getting a PMGSY project by 2018 against village population centered at the cutoff of 500. The sample consists of villages with population within optimal band with of population thresholds (86). The optimal bandwith in the full sample of villages is calculated using rdRobust. The point estimate for the discontinuity is 0.089 with standard errors of .015. Plot B: Each unit is a state constituency in the pre-delimitation period with N = 2526. The mean of the eligibility instrument is 79.64 ($\sigma = 17.12$). See Appendix Table B2 for summary statistics for all levels and time periods.

Adherence to these implementation rules allows me to create an instrument that predicts road provision at the constituency level. This constituency-level instrument is the percentage of villages that are at or above 500 people in a given constituency.[13] Figure 3 Panel B shows the distribution of the instrument for pre-delimitation state constituencies. Note that Census 2001 villages have been part of the same constituencies from 1977 through 2008, and the Indian Census is conducted by an independent centralized body that limits political

[13]This instrumental approach is not a fuzzy RD variant because road provision is a function of a constituency's rule-based eligibility, but there is no discontinuity at the constituency level. Because reference groups cannot be designed around a threshold, the only possibility remains to construct an instrument that exceeds the threshold, which I do in this paper. Undoubtedly, a fuzzy RD design presents the most compelling identification strategy. However, electoral data at the polling station level is unavailable during these time periods in state elections in India, except in UP. Unfortunately, states vary in the extent to which they follow implementation rules. For example, Rajasthan observed the rules more strictly, while UP ignored them. Consequently, I do not observe a discontinuity and cannot use a fuzzy RD approach in UP. Future studies can collect pre-delimitation polling station-level electoral data in states like Rajasthan. Despite several rounds of fieldwork, I was unsuccessful in collecting such data, partly because such data is not digitized or maintained for extended time periods.

influence. In other words, constituencies vary in their eligibility to receive PMGSY funds for reasons that pre-date the program and are exogenous to political influence. By estimating constituency-level first-differences, I also control for time-invariant imbalances, which other studies have noted in PMGSY-eligible and non-eligible villages Aggarwal (2018, 2021); Asher and Novosad (2020). This first-difference instrumental variables approach is an improvement over Aggarwal (2018), but requires stronger identification assumptions than the fuzzy RD approach in Asher and Novosad (2020). I discuss these identification assumptions and threats to identification in the results section.

I estimate the following 2SLS regressions,

$$\Delta Y_i = \mu + \beta \Delta \hat{R}_i + \delta_j + \epsilon \tag{2}$$

$$\Delta R_i = \mu + \beta E_i + \delta_j + \epsilon \tag{3}$$

Where ΔY_i is the change in ruling party voteshare percentage in between two consecutive electoral periods, ΔR_i is the percentage of villages connected by PMGSY in a given constituency between two consecutive electoral periods, E_i is the eligibility instrument, which is percentage of villages over 500/250 population in a constituency as measured in Census 2001, and δ_j is a district fixed effect, and ϵ is a random error term.

4 OLS results

Table 1 reports the first difference estimates obtained by regressing the change in vote share on the change in PMGSY connectivity during pre- and post-delimitation periods at the state and national level. Increase in PMGSY connectivity has no effect on vote shares throughout the study period and in both election levels. The point estimate is both substantively and statistically insignificant. The results are robust to alternative clustering techniques such as clustering at the district level (Appendix Table B3). I also estimate these regressions in the subsample of constituencies where majority villages lack roads at baseline (Appendix Table B4). Even in this subsample, where demands for roads is arguably higher, roads fail to boost electoral support for the incumbent. Results remain unchanged when analyzing subsample of constituencies where challengers pose a viable threat in t_0 measured as vote margin

at or under 15% (Appendix Table B6) or which are held by the ruling party in t_0(Appendix Table B5). I also analyzed voter turnout and found that roads do not improve voter turnout in state elections, but there is a substantively positive effect in national elections (Appendix Table B8). It is plausible that roads facilitated migrants to make long journeys and to return to vote in national elections which generally see lower turnout than state elections.

Table 1: OLS results: road provision uncorrelated with change in ruling party(s) voteshare

	State elections		National elections	
	Pre-delimitation	Post-delimitation	Pre-delimitation	Post-delimitation
	(1)	(2)	(3)	(4)
Δ Connectivity	0.040	0.051	-0.097	-0.089
	(0.056)	(0.056)	(0.083)	(0.109)
Mean Δ incumbent voteshare	-2.667	-6.477	-4.570	-11.945
N	2526	2086	386	320
Fixed effects	District	District	State	State
Cluster SE	Constituency	Constituency	Constituency	Constituency

Notes: The dependent variable is the change in ruling party voteshare in state elections in (1) and (2), and in national elections in (3) and (4). *** p<0.001, ** p<0.01, * p<0.05.

It is important to emphasize here that these OLS estimates rely on all of the natural variations in road provision that exist across the entire sample; that is, the estimates include roads that politicians may systematically target to improve their electoral fortunes. Assuming that politicians are targeting roads to improve electoral support, the OLS investigation favors the accountability hypothesis. Additionally, road provision increases citizen's economic and social prosperity alongside multiple dimensions. Existing research on PMGSY shows that roads increase educational attainment for girls, health outcomes, marriage, employment, access to loans. Yet, the effect of road provision on ruling party vote share is substantively nil and statistically insignificant. These results run contrary to what existing models of voter accountability and economic voting would predict and are important in their own right. In the next section, I use IV regressions to show that the voters remain unresponsive to road provision that is not politically targeted but is instead determined by implementation rules. Together, these set of results strongly support that voters did not reward (or punish) incumbents for road provision.

5 IV results

Table 2 reports the IV estimates for the state and national elections in the pre-delimitation period.[14] Change in connectivity shows a marginally negative relationship with the change in the ruling party's vote share, but it is statistically insignificant in all estimations. Clustering the standard errors at a higher level of analysis (columns (2) and (4)) does not change the results.

Table 2: IV results: road provision does not increase ruling party(s) voteshare

	State elections		National elections	
	(1)	(2)	(3)	(4)
Δ Connectivity	-0.380	-0.380	-0.264	-0.264
	(0.198)	(0.235)	(0.256)	(0.408)
		First Stage		
Eligibility instrument	0.130***	0.130***	0.138***	0.138***
	(0.011)	(0.017)	(0.015)	(0.034)
F-stat	145.75	60.29	79.53	16.36
N	2526	2526	386	386
Fixed effects	District	District	State	State
Cluster SE	Constituency	District	Constituency	State

Notes: The dependent variable is the change in ruling party voteshare in state elections in (1) and (2), and in national elections in (3) and (4) in the pre-delimitation period. The eligibility instrument is defined as the percentage of villages in the constituency that are above the threshold of 500/250 population. *** p<0.001, ** p<0.01, * p<0.05.

5.1 Threats to identification

Ordinarily, threats to identification are discussed in the context of there being a treatment effect, making it easier to think about the direction of the bias. In the light of the null results versus the expectations of a positive finding, I weigh more heavily on identification threats that can bias the results downward. footnoteFor the same reason, I am unable to conduct tests that relax the exclusion restrictions as in Conley, Hansen and Rossi (2012), as this test requires that there is a treatment effect. For the IV approach to serve as a plausible identification strategy, the eligibility of a constituency must have an influence on the outcome only through the PMGSY program. While exclusion restrictions are an untestable assumption, several pieces of information suggest they are plausible. First, the centralized administration of the roads program determined these thresholds. A majority of the state and national politicians who were in office when the thresholds were established were no

[14] I am unable to use the instrument for the post-delimitation period because program rules provide for fewer roads in this period, arguably due to the greater number of new roads constructed in the prior period.

longer in office subsequently. Census data is also centrally collected by an independent and reputed government agency. Moreover, villages have largely remained within the same constituencies since 1977. Together, this means it is impossible for constituencies to select themselves into eligibility. Second, because the outcome is a *change* variable and not a *level* variable, time-invariant historical or pre-program imbalance, for example, geography or colonial administration, cannot explain the results. Third, the f-statistics for both instruments are always greater than 42 in the case of assembly constituencies and greater than 10 in the case of parliamentary constituencies. I also consider three other threats to identification that can bias the results downward.

5.1.1 Initial conditions and preexisting trends

Time-invariant, constituency-specific initial conditions cannot affect the outcome as they are controlled through the first difference. However, they can still be correlated with underlying trends that can continue to affect electoral returns in eligible constituencies through mechanisms other than road provision. I investigate this threat by regressing changes in incumbent vote share and turnout in previous election years on the eligibility instrument and road connectivity. If voters have a history of being unresponsive or less likely to turn out to vote in eligible constituencies, it is plausible that service provision is not rewarded in such constituencies. I also include the change in BJP vote share for the state elections because the BJP formally launched the program and may have incentives to design the program eligibility rules in ways that are more likely to benefit its strongholds. Appendix Table C2 assuages concerns that the instrument is correlated with underlying pre-trends in outcomes.

Appendix Figure C1 further shows that the instrument is uncorrelated with both previous and future employment and urbanization, that are likely to increase economic voting which favours the incumbent. Appendix Table C3 presents additional checks by adding change in employment and urbanization as controls in the 2SLS regression. The results are very similar suggesting that change in economic conditions is uncorrelated with the instrument as well as the outcomes. Appendix Table C4 presents results in additional sample cuts where pretrends

may bias results downwards, such as constituencies that are already highly connected prior to program start, constituencies with below average log employment growth overall and in government and non-government sectors. I find that the results are substantively unchanged.

5.1.2 Thresholds predict other service provision

It is plausible that villages that became eligible for roads were prioritized or de-prioritized using the same thresholds. I am not aware of any program that de-prioritized villages based on population thresholds. However, the Indian government launched an electricity and toilet provision program, where the eligibility criterion or incentives to implement these programs relied on population thresholds, in the later half of the 2000s. Consequently, villages in the pre-delimitation time period are no more likely to receive these other services. Unfortunately, the census is only conducted every 10 years, so I do not have outcome data that perfectly coincides with the pre-delimitation electoral period (before 2008) to explicitly test this. However, Appendix Figure C5 replicates the connectivity binscatter in Figure 2 Panel B, showing whether population thresholds in 2001 predict whether more households in a village are provided electricity or toilets in 2011. There is no clear visual jump in probability of receiving these services as in the case of PMGSY connectivity. Very large villages (that are few, 75th percentile of population is 1400) have a marginally higher probability of receiving electricity. Average number of households in rural India is 282 per village. A 5 percentage point increase reflects that approximately 14 more households are getting electricity or toilets in villages above 500 in population, and is not substantively meaningful to drive the results in a positive direction. Moreover, the direction is opposite to how we expect the bias to operate. Note that the point estimate in the regression discontinuity is also statistically insignificant.

5.1.3 Politicians under-provide other services in connected villages

Politicians know the program rules and which villages will qualify for the PMGSY program. It is possible that politicians may systemically underprovide other crucial services in villages where PMGSY roads are provided and divert those resources to villages that do not qualify. Consequently, we observe that the effects of road provision cancel out due to the under-

provision of other services at the constituency level, and this violates the exclusion restriction. Aggarwal (2021, p. 380) explores exactly this possibility and finds that PMGSY-beneficiary villages, over the 2001-2011 period, *were no more likely than other villages to have received a school, a health centre, a railway station, or a bank branch.* I replicate this analysis with my dataset and find that politicians do not under-provide other services in PMGSY villages, nor does PMGSY promote or undermine the delivery of other services.

6 Negative spillover effects

An advantage of an aggregated constituency-level analysis is that it accounts for positive spillover effects of the roads' visibility. After all, citizens' experience seeing new roads in their extended geographic area can lead those who do not get roads in their immediate community to punish the incumbent. In other words, *negative spillover effects* can occur. Aggregation may average out these micro-dynamics. To deal with this concern, I replicate the main OLS analysis at the level of the treatment: the village level. Investigating the change in polling station level vote share *within* a constituency also enables to hold politician characteristics constant.

I conduct this analysis in one of the most poorly connected and populous Indian states: Uttar Pradesh (UP). UP has a population of more than 200 million and is geographically as large as the United Kingdom. Susewind (2014) provides geo-coded dataset for two post-delimitation state elections in 2012 and 2017; the only state where such data is available. Using data on approximately 109,217 polling stations situated within 389 (out of 403) assembly constituencies, I construct a PMGSY roads-census 2001-village dataset. I identify whether roads have been built within the close proximity of a polling station. Lacking systematic information about which village votes in a given polling station, I overlay the geo-coded location of the polling stations on village boundary maps based on Census 2001. I follow the literature to create spatial buffers around point polling stations and, if a road is provided in a village within a 1-kilometer radius, I assign that polling station as treated

(Harding, 2015).[15] Appendix D7 shows that the results are insensitive to radius choice.

The analysis is highly localized: UP villages have a median population of 834. Between 2001 and 2017, approximately 95,000 kilometers of PMGSY projects were constructed, improving connectivity for 6 percent of all UP villages. Before delving in to the analysis, some specifics of the UP political context are relevant to the accountability relationship and worth noting here. Between 2012 and 2017, UP had a stable single-party majority-formed government—the Samajwadi Party (SP), a regional party—at the state level, making attribution easier for voters. Crucially, the SP won on a platform that spurned parochial identity-based divisions in favor of programmatic policies to improve development. It also faced a strong challenger, the BJP, which uprooted it from power in 2017.

Table 3: Roads uncorrelated with support for the ruling party at the polling station

	(1)	(2)	(3)	(4)
PMGSY road	0.062	-0.121	-0.057	-0.073
	(0.164)	(0.236)	(0.208)	(0.221)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	93017	41237	64755	47569
Mean Δ SP voteshare	-8.417	-9.167	-8.485	-9.135

Notes: The unit of analysis is a polling station and the dependent variable is the change in the SP voteshare at that level. The independent variable PMGSY road is 1 if any of the villages within a 1-kilometer radius of the polling station gets a PMGSY project and 0 otherwise. Standard errors are clustered at the polling station level. *** p<0.001, ** p<0.01, * p<0.05

Table 3 Column 1 confirms that road provision had no influence on the SP's vote share at the polling-station level and the null result is precisely estimated. Column 2, 3, and 4 show that roads fail to boost SP's vote share even in polling stations, which previously lacked roads in 2011, had no prior PMGSY provision, and lacked roads in 2001. Note that the point estimates are substantively marginal and the large sample size makes it more likely that the null hypothesis is rejected by chance. Yet, the appendix shows that the results are mostly robust to clustering the standard errors at the constituency level, although they turn up significant when the buffer size is 2km.

[15] A 1-kilometer radius buffer is reasonable given that Indian law requires that provide polling stations are within a walking distance of at most 2.5 kilometers.

7 Why accountability fails: Mechanisms

The main results confirm that voters do not reward incumbents for providing roads. There can be several reasons why this accountability failure may occur. It is plausible that the null result masks heterogeneity in the quality of the new roads or corruption experienced by villagers (de Kadt and Lieberman, 2017). In particular, some PMGSY roads have been marred by political influence in contracting, which may also lead to lower-quality road construction. Citizens may view high program costs as a signal of corrupt politicians who want to line their own pockets. PMGSY provides extremely rich road-level cost and quality data to test whether voters respond to the quality or cost of the new roads. I construct the following measures to tap into quality or corruption concerns: (a) log cost per kilometer of road length, (b) log maintenance cost per kilometer of road length, (c) log total cost per kilometer of road length, (d) average completion time in years, and (e) percentage of unsatisfactory road projects in relation to the total PMGSY projects undertaken in the unit. Appendix Table E1 reports the results. I find that there is no heterogeneity in voter response. Voters do not punish politicians for bad quality or costly roads at any political level, suggesting that corruption concerns are not the reason why voters punish incumbents (Klašnja, 2015).

Roads are highly attributable within policy types (Harding, 2015), and data from India and Ghana show that the quality of policy attribution across levels of government is high. However, it is plausible that the involvement of both state and national governments can complicate the attribution of roads in states with coalition governments or non-overlapping state or regional parties (Powell and Whitten, 1993). Building on the attribution literature, I identify subnational cases that have the potential to clarify politician's responsibility to citizens. Constituencies with ruling-party politicians and states with single-party majority (SPM) governments are expected to be more clearly responsible (Hobolt, Tilley and Banducci, 2013). SPM states aligned with central government also offer greater "vertical clarity" (Anderson, 2006). These cases are Gujarat in the pre-delimitation period and Andhra Pradesh and Rajasthan in the post-delimitation periods. Additionally, both BJP

and INC are strongly organized in these cases which further improves attribution (Jensenius and Suryanarayan, 2020). Also note that these SPM states are highly competitive, and often the incumbent party loses elections in the next round. Appendix Table E3 reports estimates for ruling-party constituencies in the full sample, and in SPM states aligned with the central government. In both electoral periods, I observe a either a weak or an inconsistent relationship between connectivity and incumbent voteshare.

It is also plausible that voters only focus on road construction occurring close to elections, and forget about roads that are provided early in the electoral cycle (Achen and Bartels, 2016). Appendix Table E4 reports results which show that voters remain unresponsive to roads construction that happens close to election cycle in states where the first program cycle completed close to the election year. Appendix Table E5 shows that the rural voters in UP also do not respond to the building of new roads ahead of the election year.

Evidence suggests that information media-rich and high-literacy environments in India can improve accountability (Besley and Burgess, 2002) and lower incumbency disadvantage (Uppal, 2009). To examine this possibility, I use village-level data on education, and newspapers and media access aggregated to electoral levels to create constituency- and village-level measures of the extent of media richness. See Appendix Table E6 and Table E7. The estimates suggest that the building of new roads in media-rich environments does little to increase an incumbent's vote share.

Finally, I investigate whether a high preference for challengers is the reason behind the weak accountability. To do so, I investigate whether a strong preference for challengers leads voters to reward the BJP, which can claim credit for PMGSY launch, only when it is the opposition party and presents a compelling alternative to the incumbent. See Appendix Table E10 and Table E11. The average change in BJP voteshare is positive, which suggests that the constructed sample does capture the BJP as a compelling challenger. I find that road provision is positively and substantively correlated with change in BJP

voteshare in majority of the specifications, particularly in the subsample of post-delimitation national constituencies, where it is more likely that BJP successfully engages in credit-claiming as challengers. Although the point estimate is statistically insignificant and results are preliminary, it is likely that road provision signals are more meaningful to voters when compelling challengers can claim credit for them. I also investigate whether constituencies where elections are highly competitive, and therefore campaigns more intense, are those where voters are more likely to learn about incumbent quality and respond to road provision. Appendix Table E8 and Table E9 show that electoral competition does not moderate voter responsiveness. Appendix Table E12 replicates these results in UP.

8 Conclusion

Voters are electorally unresponsive to a multi-billion dollar road construction program in India that connected close to half of India's villages, most of which lacked paved roads and desperately needed all-year market access. These results are consistent across the whole of India, in different time periods, at different electoral levels, and in different units of analysis. India is also a typical case in the Global South, where existing studies raise mixed expectations about accountability. It is a low-income multi-ethnic democracy with a prevalence of ethnic and clientelistic voting and a strong anti-incumbency bias. Further, infrastructure development programs have become increasingly common in such settings, and, therefore, the findings are of direct relevance to research on the relationship between development and accountability. I expect the results will generalize to other more complex goods and services—for example, education and healthcare—as roads are a highly attributable public good (Harding, 2015), and as such present a more likely case in which one may observe accountability. However, this remains an open empirical question.

This paper moves the agenda towards addressing another key question: why did voters not reward new road construction? The results in this paper are not incompatible with the existence of substantial causal pathways between the building of new roads and electoral effects. However, the paper rules out explanations that point to a breakdown in the infor-

mational chain as a key reason for the lack of performance-based voting. Findings suggest that attribution errors, concerns about corruption or quality, myopia, or the presence of a media-rich environment are unlikely to explain accountability failures.

The findings of this paper have implications for the political agency model. It is still plausible that providing roads is rewarded or punished under conditions that question the very premise of political agency models, but these conditions are more likely to hinder accountability than enable it. For instance, these findings leave open the possibility that caste, religious, or partisan identities may shape how citizens evaluate new road construction or are able to coordinate with other voters to enforce accountability. Investigating each of these is beyond the scope of this paper, but preliminary analysis suggests that it is likely that voters have a higher preference for challengers regardless of the incumbent's quality (Weaver, Forthcoming). If this is true, providing voters with more, better, and unbiased information cannot enhance accountability; these findings echo other recent research that challenges the foundational premise of political agency models (Boas, Hidalgo and Toral, Forthcoming; Martin and Raffler, 2021; Weaver, Forthcoming).

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A PMGSY program details

A.1 Politicians claiming credit for PMGSY roads

Figure A1: Foundation and Inaugural public ceremony of PMGSY roads

Notes: **(Top)** *"Jugal Kishore Sharma Member of Parliament Lok Sabha Jammu Poonch today visited Akhnoor and Chamb Assembly segments along with MLA Akhnoor Rajeev Sharma and MLA Chamb Krishan Lal Bhagat and laid foundation stone for the construction of various roads under Pradhan Mantri Gram Sadak Yojna (PMGSY)."* Source: *Daily Excelsior*. 23 Feb 2017.
(Bottom) *"Two Rural Connectivity Roads constructed under PMGSY were inaugurated by PD Rai, Lok Sabha MP on Friday and Saturday in the East District. In both the occasions, the area MLA, Bek Bahadur Rai was present along with the engineers of RM&DD headed by the Secretary, D R Nepal."* Source: *Northeast Today*. 21 May 2017.

A.2 PMGSY roads and changes in Indian villages

Figure A2: PMGSY roads in previously unconnected regions (before - top and after - bottom)

(a) Bhangya village in Indore

(b) Dudhiya village in Indore

Source top figure: Presentation at the World Bank by H. K. Srivastava, Director Projects, NRRDA Ministry of Rural Development Government of India in 2007. *Source bottom figure*: Presentation at the World Bank by H. K. Srivastava, Director Projects, NRRDA Ministry of Rural Development Government of India in 2007.

A.3 Information boards for PMGSY roads

Figures below show the various information boards used by the PMGSY program. Top left figure A3 is a standardized logo sign board associated with every PMGSY road built across India. The text states the name of the scheme as PMGSY in Hindi. Top right figure A3 and bottom figure A3 are extensive information sign boards that list information such as length and cost of road and contact details of the contractor who built the road and were only introduced in 2014. Bottom figure A3 lists additional information on maintenance and road construction. They also mention the funding agency of the road as "Ministry of Rural Development" and identify the respective state-level government as the project executing agency. The source for the top and middle figure is the PMGSY website. The source for the bottom figure is the World Bank Development Blog.

Figure A3: Sign board in Haryana (top left), full board in Orissa (top right) and extensive board in Jharkhand (bottom)

B Data generating process

B.1 Matching results Roads-Census 2001 village dataset

I obtained the roads level dataset directly from the rural roads department. This dataset contains for every PMGSY project, project type (new road or bridge or upgrade), state-level executing agency administrative geographic markers that refer to the Census (state, district, block, village, habitations), the length, cost and maintenance amount of the road, sanction and completion year, execution status, population of habitation and villages served and so on. In addition, I obtained original data on data on the quality for all roads that underwent quality check under the PMGSY as opposed to a subset of (non-randomly) selected roads that is available online. These enable me to examine heterogeneous effects for a subset of cases. A check using random subset of 100 roads reveals that the data tallies 100% with the data that is publicly available, precisely to the last decimal point.

I start with using the roads level dataset and merge this with Census 2001 and 2011 village level data on the basis of an exact and fuzzy name matching process in R using a standard approach based on calculating Levenshtein distance and string similarities between canonicalised village names. Using this internal roads level dataset offers me several advantages over data that is scraped online. The internal dataset that I obtained directly provides the village identifier and population for every village treated by a PMGSY road for over 80% of PMGSY roads thereby reducing data loss, mismatches, and duplicates.

At the end of this process I successfully match 92% of the roads data to their census 2001 villages. I retain states where: (a) at least 2000 villages were connected; (b) where I have good levels of total matching (close to 80%) (c) where exact matching is close to 60%. This yields a dataset of 15 large states that reflect approximately over 95% of India's population. I obtain data on 15 states as see in Table B1. Note for pre-delimitation the number of states is 14. This data is then verified along with manual cleaning and quality checks. The plot below shows the number of projects in total that were undertaken across the entire dataset each year from 2000 to 2018. PMGSY projects include new roads, bridges and upgrades of existing roads.

B.2 Spatial aggregation to electoral dataset

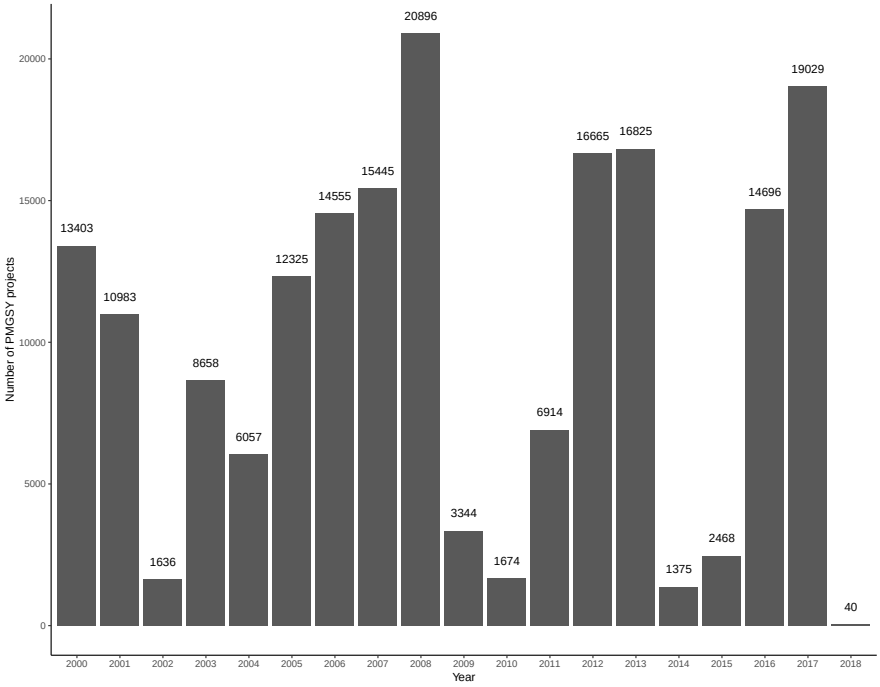
I divide the PMGSY dataset into two time periods: pre-delimitation (2000-2007) and post-delimitation (2008-2018). India's most recent border delimitation exercises was conducted

Table B1: Matching results Roads-Census 2001 village dataset 2001-2018

Sno.	State	N Villages Connected	Unmatched	Matched	Exact	Fuzzy	Sample
1	Andhra Pradesh	11184	6.55	93.45	71.86	21.58	Main Sample
2	Arunachal Pradesh	2024	19.17	80.83	68.92	11.91	Main Sample
3	Bihar	30509	8.42	91.58	81.4	10.18	Main Sample
4	Chhattisgarh	12812	6.99	93.01	72.56	20.45	Main Sample
5	Gujarat	4527	3.71	96.29	81.53	14.76	Main Sample
6	Jammu Kashmir	4700	5.62	94.38	81.96	12.43	Main Sample
7	Jharkhand	12796	10.18	89.82	62.91	26.91	Main Sample
8	Karnataka	6795	2.43	97.57	92.79	4.78	Main Sample
9	Madhya Pradesh	27302	5.49	94.51	79.46	15.04	Main Sample
10	Maharashtra	10008	4.14	95.86	78.39	17.48	Main Sample
11	Orissa	25352	11.91	88.09	59.36	28.72	Main Sample
12	Rajasthan	21817	4.25	95.75	93.96	1.79	Main Sample
13	Uttar Pradesh	25092	11.9	88.1	62.51	25.59	Main Sample
14	Uttarakhand	3242	7.74	92.26	81.65	10.61	Main Sample
15	West Bengal	15208	8.69	91.31	70.95	20.36	Main Sample
1	Andaman And Nicobar	41	12.2	87.8	82.93	4.88	Excluded
2	Assam	13621	31.05	68.95	32.91	36.03	Excluded
3	Dadar And Nagar Haveli	130	13.85	86.15	70.77	15.38	Excluded
4	Goa	116	16.38	83.62	68.97	14.66	Excluded
5	Haryana	1240	15.08	84.92	5.08	79.84	Excluded
6	Himachal Pradesh	5657	9.58	90.42	1.11	89.31	Excluded
7	Kerala	1951	15.94	84.06	62.22	21.83	Excluded
8	Manipur	2831	31.76	68.24	35.68	32.57	Excluded
9	Meghalaya	1079	10.84	89.16	68.03	21.13	Excluded
10	Mizoram	365	4.38	95.62	71.78	23.84	Excluded
11	Nagaland	312	35.9	64.1	44.55	19.55	Excluded
12	Punjab	2513	17.91	82.09	53.96	28.13	Excluded
13	Sikkim	754	16.71	83.29	58.75	24.54	Excluded
14	Tamil Nadu	10421	10.43	89.57	55.52	34.05	Excluded
15	Tripura	1965	41.73	58.27	26.82	31.45	Excluded

Notes: The table contains data on matching results for every state for period 2000-2018 from the roads-census village dataset. Total connectivity means number of villages connected through new roads, upgrades or bridges. A total of 186,988 projects were carried out, out of which 96% were roads, and only 4% were bridges. I was able to match villages for 172,204 or 92% of PMGSY projects, out of which 98% were roads and 2% were bridges. The main sample includes 143,725 projects, that is 76% of all PMGSY projects, out of which 98% were roads and 2% were bridges.

Figure B1: PMGSY projects 2000-2018



in 2008 and lead to major changes in the constituency boundaries, making it impossible to create a single panel of constituencies observed throughout this time period. However, while constituencies are not comparable pre- and post-delimitation, I observe each constituency at least twice before delimitation and twice after delimitation.

To map the roads-village dataset to assembly and parliamentary constituencies for the pre-delimitation time-period (that is until 2008), I use data from Jensenius (2015). Jensenius (2015) includes the pre-delimitation state- and national-level constituency identifier for each village. I follow the same process for the post-delimitation period, and locate census 2001 villages in constituencies by using proprietary ML Infomaps village and electoral maps. This exercise gives a dataset where for every census 2001 village there is a pre-and post-delimitation AC and PC identifier. It is important to emphasise here, that very few roads pass through more than one constituency. For instance only 6000 roads out of 180,000 roads pass through two assembly constituencies, and even fewer roads pass through two or more constituencies.

B.3 Electoral dataset with incumbent vote share

I then merge these pre and post delimitation roads datasets with the electoral dataset for state and National level elections. The electoral dataset for state and national elections is taken from the publicly available data on Lokdhaba website. Lokdhana is publicly available clean electoral data for assembly and national elections across India since Independence and is based on data from the Election Commission of India.

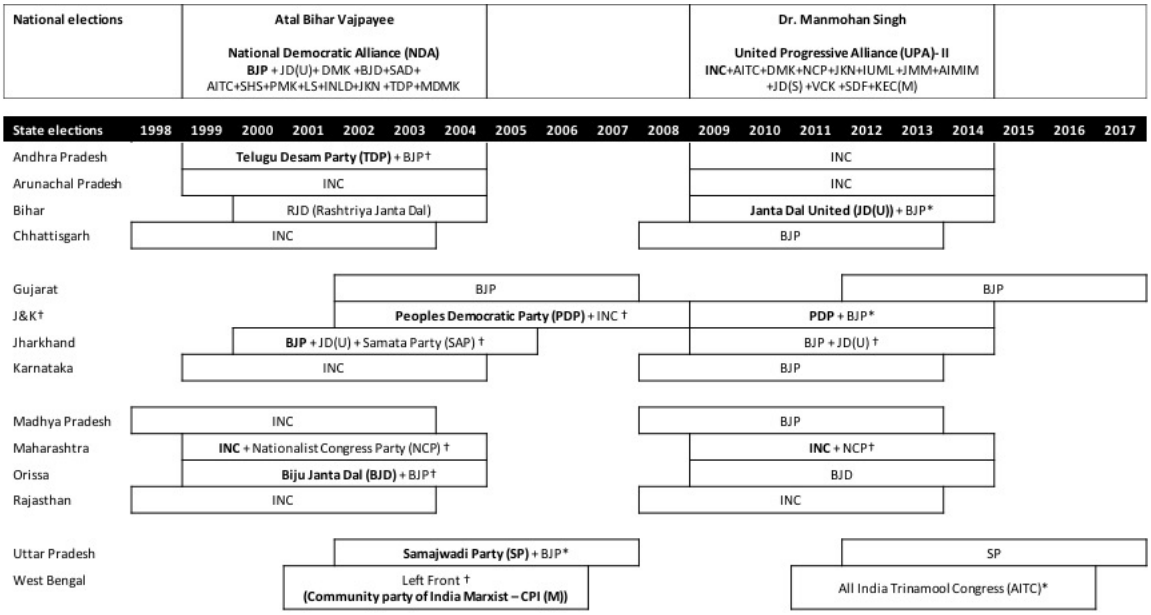
Elections are held every five years for both the central government in New Delhi and the 29 states and 2 Union Territories (Delhi and Pondicherry) that constitute the Indian Union (except Jammu & Kashmir where state-level elections are held every 6 years). India currently has 543 PCs and 4120 ACs. All these states except Arunachal Pradesh, Jharkhand and Jammu and Kashmir did not undergo delimitation. Jammu and Kashmir has a longer electoral tenure of 6 years as opposed to 5 years for the rest of India. For the main pre-delimitation analysis, I retain the first electoral period for all states which coincides with the moment of program launch. For the post delimitation dataset, I retain the first two consecutive elections that occur just after the 2008 delimitation exercise and make use of the newly delimited boundaries.

I drop races where an incumbent majority party or its coalition partner do not contest election in a particular constituency - these are few. Assuming that politicians choose to run (or drop out) in locations that they anticipate electoral success due to (lack of) road provision, this decision favors the accountability hypothesis. For the constituency level analysis, I drop constituencies that are mainly urban (have below 20 villages) and are not eligible for PMGSY. This leads me to a sample of 5607 constituencies, and in total, I present evidence from an analysis of over 11,000 electoral races. Table B2 present the summary statistics for state and national level constituencies.

List of incumbent political parties The figure below shows the National and State level incumbent governments that won elections for the electoral term just before delimitation and for the first term just after delimitation. The delimitation causes a break in the dataset. The top panel shows national level alliances: BJP dominated NDA alliance with Atal Bihari Vajpayee as Prime Minister formed government from 1999-2004 (pre-delimitation), while the INC dominated UPA-II alliance, with Dr. Manmohan Singh formed the government for the second term from 2009-2014 (post-delimitation). I only retain partners that remained in the alliances for the whole electoral term.

The bottom panel shows state-level parties that were incumbent in the pre-delimitation election, and in the first election post-delimitation in 2008. Single Party Majority govern-

Figure B2: The Indian Political Landscape (2000-2017)



ments are those that only list one party, while coalition governments are listed as a sum of all the member parties, with the Chief Ministerial party marked in bold. In the table, † indicates stable coalitions, that is, coalitions that remained stable and governed for the entire electoral term. * indicates unstable coalitions in which one or more partners broke away or changed during the electoral term. In such cases, I have retained the main and largest coalition partner that has governed for the maximum time during the electoral term. Left front is composed of multiple parties. In 2001, these are: CPI(M), All India Forward Block (AIFB), RSP (Revolutionary Socialist Party), CPI (Communist Party of India), WBSP (West Bengal Socialist Party), PDS (Party of Democratic Socialism (India)), RCPI(R) (Revolutionary Communist Party of India), and FBL (Marxist Forward Bloc). In 2011, INC was a minority coalition partner with AITC, but I do not retain it in calculating incumbent vote share as INC joined the challenger coalition in 2016 in West Bengal.

B.4 Summary statistics

Table B2: Summary statistics

	Mean	SD	Min	Max	N
Pre-delimitation state constituency					
Δ incumbent voteshare	-2.667	14.219	-60.310	66.340	2526
Δ connectivity	8.307	7.832	0.000	66.667	2526
Δ BJP voteshare	0.759	13.588	-50.950	59.320	1414
Δ turnout	1.696	9.964	-39.680	50.697	2526
Post-delimitation state constituency					
Δ incumbent voteshare	-6.477	16.178	-73.870	52.440	2086
Δ connectivity	9.155	8.465	0.000	54.651	2086
Δ BJP voteshare	6.367	15.578	-64.500	53.280	1600
Δ turnout	3.258	4.632	-15.183	27.376	2086
Pre-delimitation national constituency					
Δ incumbent voteshare	-4.570	9.186	-30.950	27.680	386
Δ connectivity	6.866	5.576	0.000	43.066	386
Δ BJP voteshare	-2.089	10.607	-49.460	52.900	386
Δ turnout	-1.199	6.896	-38.450	25.630	386
Post-delimitation national constituency					
Δ incumbent voteshare	-11.945	16.325	-53.320	32.420	320
Δ connectivity	8.341	6.394	0.000	41.093	320
Δ BJP voteshare	11.437	13.627	-37.230	59.000	320
Δ turnout	8.824	5.785	-5.540	21.880	320
Uttar Pradesh Polling Station Data (1km buffer)					
Δ incumbent voteshare	-11.945	16.325	-53.320	32.420	320
Δ connectivity	8.341	6.394	0.000	41.093	320
Δ BJP voteshare	11.437	13.627	-37.230	59.000	320
Δ turnout	8.824	5.785	-5.540	21.880	320

C Robustness checks: OLS results

C.1 Alternative clustering

Table B3: Alternative clustering at higher level

Δ Connectivity	0.040	0.051	-0.097	-0.089
	(0.062)	(0.068)	(0.133)	(0.160)
N	2526	2086	386	320
Fixed effects	District	District	State	State
Cluster SE	District	District	State	State

C.2 Constituencies with high need for roads

Table B4: Constituencies where majority villages lack paved road at baseline

	State elections		National elections	
	Pre-delimitation	Post-delimitation	Pre-delimitation	Post-delimitation
	(1)	(2)	(3)	(4)
Δ Connectivity	-0.035	0.010	-0.282	-0.310
	(0.145)	(0.101)	(0.414)	(0.196)
N	930	716	139	109
Fixed effects	District	District	State	State
Cluster SE	Constituency	Constituency	Constituency	Constituency

C.3 Competitive challengers

Table B5: Constituencies where margin of victory between top two candidates is under 15%

	State elections		National elections	
	Pre-delimitation	Post-delimitation	Pre-delimitation	Post-delimitation
	(1)	(2)	(3)	(4)
Δ Connectivity	-0.027	0.063	-0.102	-0.107
	(0.070)	(0.062)	(0.108)	(0.118)
N	1752	1634	299	257
Fixed effects	District	District	State	State
Cluster SE	Constituency	Constituency	Constituency	Constituency

C.4 Ruling party constituencies

Table B6: Ruling party constituencies

	State elections		National elections	
	Pre-delimitation	Post-delimitation	Pre-delimitation	Post-delimitation
	(1)	(2)	(3)	(4)
Δ Connectivity	0.067	-0.058	-0.125	0.157
	(0.063)	(0.064)	(0.087)	(0.174)
N	1548	1313	230	149
Fixed effects	District	District	State	State
Cluster SE	Constituency	Constituency	Constituency	Constituency

C.5 Dependent variable as change in turnout

Table B7: Change in turnout

	State elections		National elections	
	Pre-delimitation	Post-delimitation	Pre-delimitation	Post-delimitation
	(1)	(2)	(3)	(4)
Δ Connectivity	-0.031	0.005	0.136*	0.086*
	(0.021)	(0.014)	(0.067)	(0.036)
Mean Δ turnout	1.696	3.258	-1.199	8.824
N	2526	2086	386	320
Fixed effects	District	District	State	State
Cluster SE	Constituency	Constituency	Constituency	Constituency

C.6 Dependent variable as change in BJP voteshare

Table B8: Change in BJP voteshare

	State elections		National elections	
	Pre-delimitation	Post-delimitation	Pre-delimitation	Post-delimitation
	(1)	(2)	(3)	(4)
Δ Connectivity	-0.139	-0.051	0.096	0.212
	(0.088)	(0.060)	(0.163)	(0.132)
Mean Δ BJP voteshare	0.759	6.367	-2.089	11.437
N	1414	1600	386	320
Fixed effects	District	District	State	State
Cluster SE	Constituency	Constituency	Constituency	Constituency

Notes: The dependent variable is the change in turnout. *** p<0.001, ** p<0.01, * p<0.05.

D Instrumental variable estimation

D.1 Constructing the eligibility instrument

For constructing the eligibility instrument, I calculate the percentage of villages in a constituency that are above the population threshold prescribed for that state and district. This threshold is 500 for general cases, and is 250 in the constituencies that are in hilly states, left-wing affected, or dessert or tribal districts as listed below.

Table C1: List of tribal districts

Sno	State	District classified as tribal (census population >=25%)	N district
1	Jammu kashmir	Leh (Ladakh), Kargil, Punch, Rajauri	4
2	Rajasthan	Dausa *, Sirohi, Udaipur, Dungarpur, Banswara	5
3	Arunachal pradesh	Tawang, West Kameng, East Kameng, Papum Pare *, Lower Subansiri, Upper Subansiri, West Siang, East Siang, Upper Siang *, Dibang Valley, Lohit, Changlang, Tirap	13
4	Jharkhand	Sahibganj, Pakaur *, Dumka, Ranchi, Lohardaga, Gumla, Pashchimi Singhbhum, Purbi Singhbhum	8
5	Orissa	Jharsuguda *, Sambalpur, Debagarh *, Sundargarh, Kendujhar, Mayurbhanj, Gajapati *, Kandhamal, Nuapada *, Kalahandi, Rayagada *, Nabarangapur *, Koraput, Malkangiri *	14
6	Chhattisgarh	Koriya *, Surguja, Jashpur *, Raigarh, Korba *, Rajnandgaon, Mahasamund *, Dhamtari *, Kanker *, Bastar, Dantewada*	11
7	Madhya pradesh	Umaria *, Shahdol, Sidhi, Ratlam, Jhabua, Dhar, West Nimar, Barwani *, East Nimar, Betul, Harda *, Dindori *, Mandla, Chhindwara, Seoni	15
8	Gujarat	Panch Mahals, Dohad *, Vadodara, Narmada *, Bharuch, Surat, The Dangs, Navsari *, Valsad	9
9	Maharashtra	Nandurbar *, Dhule, Gadchiroli	3
10	Andhra pradesh	Khammam	1

Definition of hilly, dessert, tribal and Left wing extremism (LWE/ IAP) areas

- **Hilly states:** The hilly states refer to the North eastern states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and to Uttarakhand, Jammu Kashmir and Himachal Pradesh.
- **Dessert districts:** Dessert districts are those in which the majority (at least 50%) of the sub-administrative units called *blocks* are classified as desserts in the internal block level PMGSY pre-program dataset. I use the dataset that is pre-program and based on dessert area figures from the Census 2001. The classification also remains unchanged throughout the program. These are: in Jammu and Kashmir - Leh (Ladakh), Kargil; in Rajasthan: Churu, Jhunjhunu, Sikar, Nagaur, Jodhpur, Jaisalmer, Barmer, Jalor, and Pali; and in Andhra Pradesh: Anantpur.

- **Tribal districts:** Tribal districts are those in which over 25% of population in the district is classified as tribal. These are 83 in nos. and listed in table C1.

- **Left wing extremism affected areas:** Left wing extremism affected areas are now also referred to as the areas under the *Integrated Action Plan (IAP)*. LWE areas are those in which the majority (at least 50%) of the sub-administrative units called *blocks* are classified as LWE in a distinct block level dataset. These are: in Maharashtra: Gadchiroli, in Orissa: Nuapada, Koraput and Malkangiri; in Bihar: Jehanabad, Aurangabad, Gaya and Jamui; in Chhattisgarh: Rajnandgaon, Kanker, Bastar and Dantewada; and in Jharkhand: Garhwa, Palamu, Chatra *, Hazaribagh, Giridih, Ranchi, Lohardaga, Gumla, Pashchimi Singhbhum, Purbi Singhbhum. These are a total of 22 in number and except Nuapada, Koraput (Orrissa) and Ranchi (Jharkhand) all have historically been affected by LWE and form a subset of the districts identified as *Worst Affected Districts*. (Online source: South Asia Terrorism Portal, 2007)

E Robustness checks: IV exclusion restriction

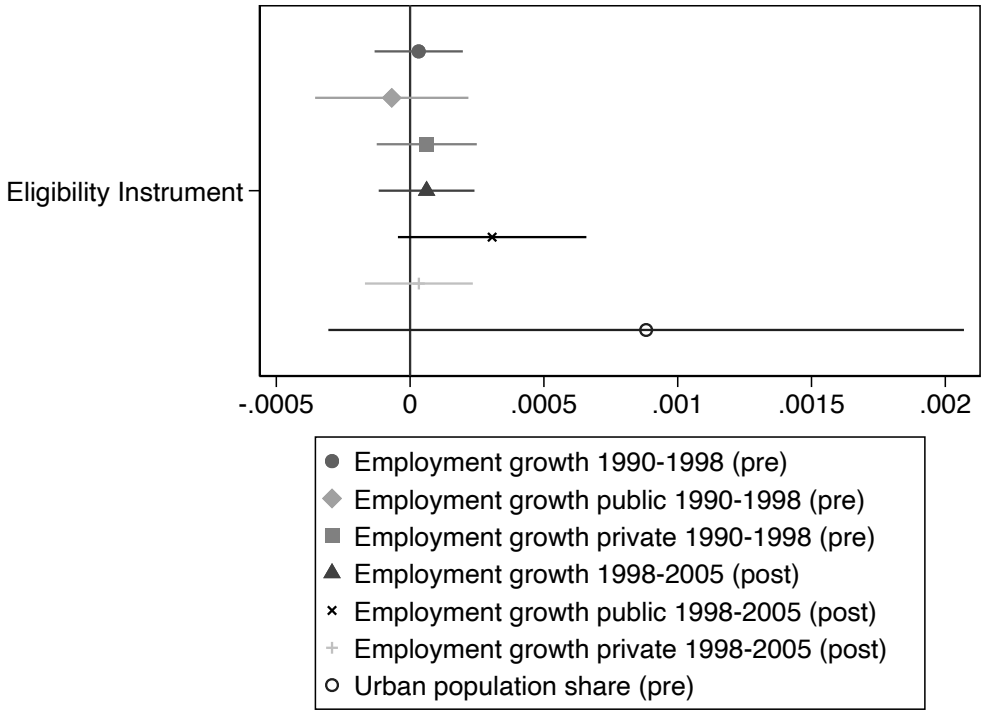
E.1 Pretrends and balance

Table C2: Instrument is uncorrelated with pre-trends in dependent variable

	Δ incumbent vote share	Δ BJP vote share	Δ turnout	Δ BJP+ vote share	Δ turnout
Eligibility instrument	-0.050	0.036	-0.014	0.025	-0.011
	(0.032)	(0.037)	(0.012)	(0.039)	(0.020)
Mean dependent variable	-2.624	1.234	-2.850	5.814	7.901
N	1783	1525	2405	280	280

Notes: *** p<0.001, ** p<0.01, * p<0.05

Figure C1: Instrument is uncorrelated with past and future employment and urbanization growth



Notes: The coefplot plots the point estimate obtained by regressing the growth in employment and urbanization on the instrument in pre- and post-periods. The employment/ urbanization data is taken from Asher and Novosad (2018). The regression controls for district fixed effects and standard errors are clustered at the constituency level.

E.2 Time-varying controls for employment and urbanization

Table C3: Results are robust to increase in employment and urbanization

	(1)	(2)	(3)
Δ connectivity	-0.355	-0.360	-0.353
	(0.264)	(0.264)	(0.264)
ΔAnnualized employment growth	5.030		4.901
	(9.585)		(9.565)
Baseline employment 1998	-0.198		-0.401
	(0.510)		(0.647)
Urbanization		0.026	0.787
		(1.070)	(1.413)
Eligibility instrument	0.126***	0.125***	0.126***
	(0.018)	(0.018)	(0.018)
F-stat	47.24	47.76	47.01
N	2099	2099	2099

Notes: $*p < 0.05, **p < 0.01, ***p < 0.001$

E.3 Subsamples where pretrends may bias results downwards

Table C4: Results are robust in subsamples

	State constituencies				National constituencies
	Highly connected	Below avg. log employment growth overall	Below avg. log employment growth government	Below avg. log employment growth non-government	Highly connected
	(1)	(2)	(3)	(4)	(5)
Δ connectivity	-0.103	0.127	0.168	-0.010	0.290
	(0.353)	(0.288)	(0.382)	(0.276)	(0.290)
Eligibility instrument	0.307***	0.129***	0.124***	0.133***	0.180***
	(0.045)	(0.018)	(0.020)	(0.018)	(0.025)
Fstat	47.14	50.29	38.39	56.97	53.43
N	601	1137	993	1144	199

Notes: $*p < 0.05, **p < 0.01, ***p < 0.001$

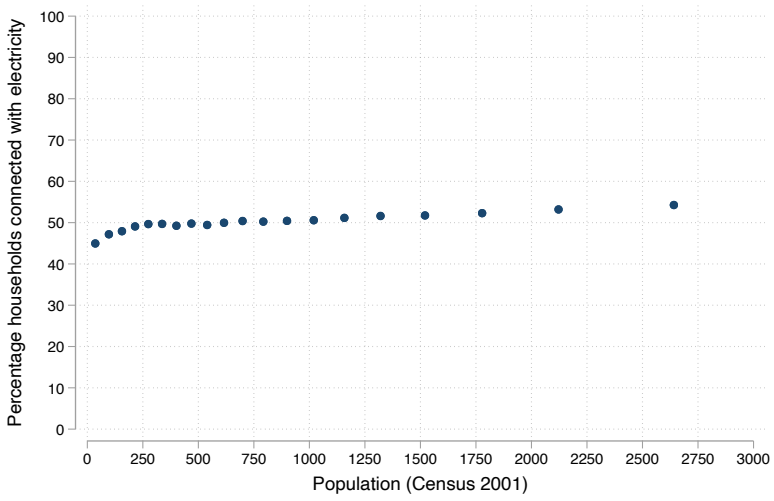
E.4 Is another public service or policy outcome implemented using population thresholds?

In the case that another public policy provided public services using similar thresholds or some function of population size which correlates with the threshold it would violate the exclusion restriction. In India, two programs the *Rajiv Gandhi Grameen Vidyutikaran Yojana* (RGGVY) and the *Total Sanitation Campaign* (TSC) did use some population based threshold and a monetary award which was a function of the population size to prioritise electrification and incentivise provision of *on-site pit latrines* (a type of toilet) respectively. However, both the RGGVY program and the TSC award came into effect post 2005, which

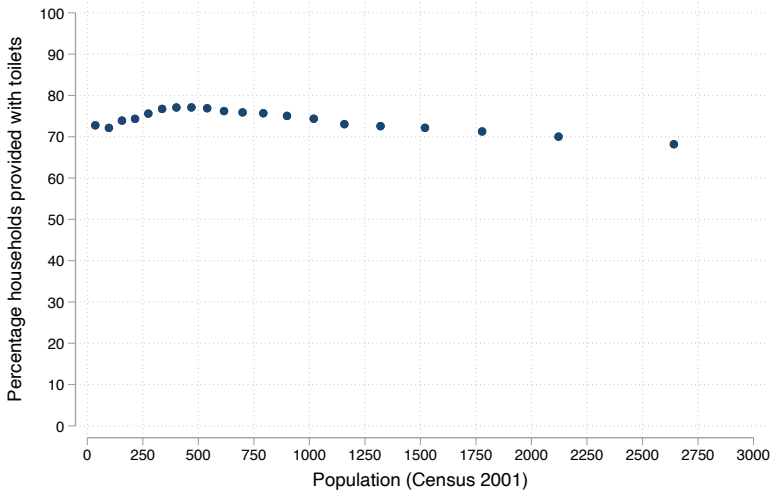
means that the first electoral period from the pre-delimitation is unaffected by these programs. Figure C2 replicates the binscatter in Figure 2 with toilets and electricity provision as function of village populations and shows that there is no discontinuity around population for both the services.

Figure C2: Population thresholds do not determine toilets or electricity

A. Households getting electricity as function of village population



B. Households getting toilets as function of village population



Notes: The plots include all villages that have population between 1 and 3000 as per Census 2001. The binscatter plot contains the default of 20 equally sized bins.

The RGGVY program was launched in April 2005, and actual implementation picked up in from 2006. Moreover, the funding of the program came from India's 10th Five-year plan (2002-2007) which included a slightly restricted set of 229 districts (out of 576) that

Table C5: Population thresholds and provision of electricity, toilets and PMGSY

	Electricity	Open-defecation	PMGSY
	(1)	(2)	(3)
100<pop<=250	2.379	-0.344	0.024*
(ref. pop<=100)	(1.245)	(0.612)	(0.008)
250<pop<500	3.487*	-0.541	0.076***
	(1.573)	(0.900)	(0.016)
500=<pop<1000	2.864	-1.268	0.176***
	(1.586)	(1.148)	(0.041)
pop>=1000	2.059	-1.698	0.225***
	(1.920)	(1.207)	(0.048)
N	124290	497225	505413

Notes: The unit of analysis is a census 2001 village in the sample of states used in main specifications. Measures of electricity and sanitation are measured as % households in the village with the particular facility, while PMGSY road is a dummy which is 1 for villages that have benefited from PMGSY (new road/ bridge/ upgrade) between 2001-2011. All regressions control for baseline Census 2001 variables: village population, percentage of sc/st, whether village has access to primary school, secondary school, senior secondary school, distance to town, water supply, primary health centre, commercial banking, telephone facility, communication facility. Each regression has a district fixed effect, state clustered standard errors, and constant that is not reported. $*p < 0.05, **p < 0.01, ***p < 0.001$

were allotted funding on a first-come first-serve basis. The funding was disbursed in between 2005-2010. The RGGVY did prioritise electrification of habitations that were above 300 in population size, and was later expanded to include habitations 100 in population size. If the program actually did follow these rules, it could be potential concern for the post-delimitation periods. However, unlike the PMGSY, program activity in RGGVY was largely concentrated in much smaller villages, and most of the program activity was concentrated in villages between 150 and 450. These RGGVY thresholds are both under the PMGSY program thresholds.

However, to examine whether villages that were above 500 and 1000, were more likely to experience a change in their power supply status, I combined data from census 2001 and 2011 to examine whether the thresholds that I use in my analysis also predict the provision of power supply, as measured by change in power status from 2001 to 2011 and % households in the village using electricity as prime source of lightning in 2011. I do not find a significant relationship between either of these two measures and the population thresholds that I use in my analysis (reported in Table C5).

The TSC campaign did not specifically use any population thresholds, but in December 2003, the Government of India launched a monetary incentive called the *Nirmal Gram Puraskar (NGP)* to incentivise the implementation of this program. The NGP offered cash incentives based on population criteria to Panchayati Raj Institutions (PRIs) and organisa-

tions to reward their contribution towards achieving total sanitation. The first awards were made in 2005, they were only give to 38 village panchayats and actual awareness and implementation only picked up in 2007-2008.[16] Therefore, all road sanctions that were planned during the pre-delimitation periods remain unaffected. I again use the Census 2001-2011 datasets to examine whether population thresholds used in this paper also predict whether villages are more likely to receive sanitation facilities (reported in Table C5). Using the same indicators as in Asher and Novosad (2020), who find no evidence that being above the population threshold (500/1000) is associated either with open defecation or any measure of access to toilets in a regression discontinuity, I find that the population thresholds are not related to the provision of sanitation facilities. Another policy scheme called *Saubhagaya yojna* that aimed to complete the electrification process by December 2018 was launched in September 2017 after the Uttar Pradesh Elections in February-March 2017 and also after the elections in other states in the post-delimitation sample.

E.5 Politicians do not under-provide other services in connected villages

Table C6: Impact of receiving PMGSY benefits on other public goods and services in 2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Primary schools	Sec schools	Sr. Sec schools	Domestic electricity	Sanitation coverage	Primary health Cntr	Post office	Commercial bank	Bus service
PMGSY village	0.009	-0.014	-0.010	0.004	-0.005	-0.002	0.012	-0.010	0.027*
	(0.008)	(0.014)	(0.007)	(0.002)	(0.005)	(0.003)	(0.007)	(0.008)	(0.009)
District FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
N	410933	441691	441766	165907	441133	441138	441385	441384	30660
Adj. R^2	0.419	0.424	0.242	0.288	0.561	0.359	0.303	0.358	0.311
Mean	0.835	0.171	0.069	0.928	0.209	0.039	0.096	0.053	0.255

Notes: Table reports robust OLS estimates. The unit of analysis is a census 2001 village in the sample of states used in main specifications. PMGSY village is a dummy that is 1 if the village has received any PMGSY benefit and 0 otherwise. Each dependent variable is from the Census 2011. All regressions are estimated on a subsample of villages where the particular service is unavailable at baseline. Standard errors are clustered at the state-level. Each regression has a district fixed effect, state clustered standard errors, and constant that is not reported. $*p < 0.05, **p < 0.01, ***p < 0.001$

[16] http://pib.nic.in/newsite/PrintRelease.aspx?relid=101801

F Robustness checks: UP polling station analysis

F.1 Clustering at constituency level

Table D1: Clustering at constituency level

	(1)	(2)	(3)	(4)
PMGSY road	0.062	-0.121	-0.057	-0.073
	(0.242)	(0.349)	(0.304)	(0.320)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	93017	41237	64755	47569
Mean Δ SP voteshare	-8.417	-9.167	-8.485	-9.135

Notes: *** p<0.001, ** p<0.01, * p<0.05

F.2 Dependent variable as change in SP and INC voteshare

Table D2: Change in SP and INC voteshare

	(1)	(2)	(3)	(4)
PMGSY road	0.044	-0.155	-0.175	-0.022
	(0.175)	(0.250)	(0.222)	(0.233)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	87621	39116	61082	44774
Mean Δ SP+INC voteshare	-4.761	-5.830	-4.594	-6.291

Notes: *** p<0.001, ** p<0.01, * p<0.05

F.3 Competitive challengers

Table D3: Polling stations in constituencies where the margin of victory between top two candidates is under 15%

	(1)	(2)	(3)	(4)
PMGSY road	0.010	-0.164	-0.206	-0.187
	(0.180)	(0.257)	(0.227)	(0.244)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	80016	35435	55559	40839
Mean Δ SP voteshare	-7.685	-8.294	-7.816	-8.136

Notes: *** p<0.001, ** p<0.01, * p<0.05

F.4 Ruling party constituencies

Table D4: Ruling party constituencies

	(1)	(2)	(3)	(4)
PMGSY road	0.278	0.122	0.345	0.348
	(0.213)	(0.294)	(0.268)	(0.272)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	54204	25938	37735	30596
Mean Δ SP voteshare	-8.579	-9.309	-8.487	-9.334

Notes: *** p<0.001, ** p<0.01, * p<0.05

F.5 Dependent variable as change in turnout

Table D5: Change in turnout

	(1)	(2)	(3)	(4)
PMGSY road	-3.446	6.876	5.509	0.425
	(7.562)	(12.013)	(12.463)	(10.472)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	83916	37527	58465	42932
Mean Δ turnout	14.303	11.373	15.947	15.150

Notes: *** p<0.001, ** p<0.01, * p<0.05

F.6 Dependent variable as change in BJP voteshare

Table D6: Change in BJP voteshare

	(1)	(2)	(3)	(4)
PMGSY road	0.125	-0.269	-0.115	0.192
	(0.190)	(0.270)	(0.241)	(0.253)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	83525	36150	58623	41958
Mean Δ BJP voteshare	26.931	26.394	26.783	26.504

Notes: *** p<0.001, ** p<0.01, * p<0.05

F.7 Varying buffer radius

Table D7: Buffer size of 2 KM

	(1)	(2)	(3)	(4)
PMGSY road	-0.251*	-0.553***	-0.715***	-0.363**
	(0.124)	(0.143)	(0.214)	(0.135)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	97674	66331	43035	75989
Mean Δ SP voteshare	-8.242	-8.870	-7.944	-8.645

Notes: *** p<0.001, ** p<0.01, * p<0.05

Table D8: Buffer size of 2.5 KM

	(1)	(2)	(3)	(4)
PMGSY road	-0.112	-0.340*	-0.578*	-0.159
	(0.119)	(0.132)	(0.235)	(0.126)
Sample	All	No road in 2011	No PMGSY road prior	No roads in 2001
N	99120	74726	33751	83194
Mean Δ SP voteshare	-8.215	-8.681	-7.728	-8.494

Notes: *** p<0.001, ** p<0.01, * p<0.05

G Mechanisms

G.1 Quality and corruption concerns

Note that each PMGSY road is monitored and assigned a quality rating by State level quality monitors, while a random subset of roads is additionally verified by National level quality monitors. In the initial phases of the program, while quality checks were conducted, not all quality ratings were not entered into the system. As a result, there is lower data availability for quality ratings in pre-delimitation period (9% of all projects have quality ratings) relative to the post-delimitation period (85% of all projects have a quality rating). I use this data to calculate average quality rating at the constituency level: roads that do not have a satisfactory rating (either rated by State or National quality monitors) as a percentage of total projects rated in that unit. I only consider the subset of constituencies where a majority (51%) of roads are rated.

Table E1: Effect of quality of road provision on Δ incumbent vote share

		Quality measured as				
		Std. log Sanction cost/km	Std. log Maintenance cost/km	Std. log Total cost/km	Std. Poor quality	Std. Completion time (years)
		(1)	(2)	(3)	(4)	(5)
Pre-delimitation AC	Quality	-0.315	-1.877**	-0.386	-0.120	0.020
		(0.879)	(0.711)	(0.763)	(0.847)	(0.452)
	N	2407	1407	2407	623	2409
Post-delimitation AC	Quality	-0.332	-0.020	-0.319	0.386	0.055
		(0.290)	(0.333)	(0.290)	(0.322)	(0.310)
	N	1976	1966	1976	1906	1960
Pre-delimitation PC	Quality	-0.764	-0.445	-0.629	-0.124	-0.181
		(0.860)	(0.575)	(0.696)	(0.621)	(0.775)
	N	383	257	383	146	384
Post-delimitation PC	Quality	1.289	0.935	1.329	0.576	-0.473
		(0.758)	(1.171)	(0.769)	(0.738)	(0.953)
	N	319	319	319	318	319
UP Booths (1 km)	Quality	0.208	0.368	0.221	0.017	0.124
		(0.231)	(0.202)	(0.228)	(0.944)	(0.310)
	N	9802	9734	9802	4737	5415

Notes: The dependent variable is change in incumbent vote share measured in %. The predictor for each model refers to quality measured as indicated in column headings. The OLS specification is the same as in main OLS results. Standard errors are clustered at the constituency level, except at the polling station level for UP Booths. *** p<0.001, ** p<0.01, * p<0.05

G.2 Attribution and accountability

Table E2: Attribution and Δ incumbent vote share in state elections

	All states		Single party majority states		Centre-aligned states	
	(1)	(2)	(3)	(4)	(5)	(6)
Sample: Pre-delimitation AC						
Std. Δ connectivity	0.440	0.511	0.994	0.919	-0.098	-1.812
	(0.406)	(0.558)	(0.669)	(1.118)	(1.733)	(2.398)
Ruling party	-10.539***	-10.540***	-14.604***	-14.589***	-11.980***	-10.076***
	(0.549)	(0.549)	(0.869)	(0.910)	(1.707)	(2.509)
Ruling party × Std. Δ connectivity		-0.109		0.098		2.914
		(0.537)		(1.095)		(2.874)
N	2526	2526	912	912	158	158
Sample: Post-delimitation AC						
Std. Δ connectivity	0.172	0.529	0.010	0.844	1.265	1.940*
	(0.430)	(0.583)	(0.577)	(0.676)	(0.731)	(0.833)
Ruling party	-9.238***	-9.291***	-8.242***	-8.499***	-7.237***	-7.481***
	(0.600)	(0.596)	(0.650)	(0.652)	(1.060)	(1.086)
Ruling party × Std. Δ connectivity		-0.580		-1.686*		-1.727
		(0.601)		(0.781)		(1.094)
N	2086	2086	1458	1458	420	420

Notes: The dependent variable is change in incumbent vote share measured in %. The OLS specification is the same as in main OLS results. Standard errors are clustered at the constituency level. *** p<0.001, ** p<0.01, * p<0.05

Table E3: Attribution and Δ incumbent vote share in national elections

	All states		Single party majority states		Centre-aligned states	
	(1)	(2)	(3)	(4)	(5)	(6)
Sample: Pre-delimitation PC						
Std. Δ connectivity	-0.253	1.207	0.841	1.683	-0.969	-0.204
	(0.464)	(1.052)	(1.039)	(1.622)	(1.744)	(4.425)
Ruling party	-4.725***	-4.890***	-5.883***	-5.655***	-7.392**	-7.695**
	(0.965)	(0.959)	(1.439)	(1.402)	(2.092)	(2.256)
Ruling party × Std. Δ connectivity		-1.951		-1.423		-1.007
		(1.043)		(1.814)		(4.817)
N	386	386	118	118	25	25
Sample: Post-delimitation PC						
Std. Δ connectivity	-0.359	-2.090	-1.334	-2.785*	-0.251	-0.740
	(0.950)	(1.282)	(1.012)	(1.413)	(2.354)	(3.975)
Ruling party	-6.988***	-6.357***	-6.877***	-6.248***	-6.356	-6.166
	(1.329)	(1.327)	(1.580)	(1.533)	(4.817)	(4.914)
Ruling party × Std. Δ connectivity		3.238*		2.491		0.869
		(1.567)		(1.769)		(4.920)
N	320	320	233	233	64	64

Notes: The dependent variable is change in incumbent vote share measured in %. The OLS specification is the same as in main OLS results. Standard errors are clustered at the constituency level. *** p<0.001, ** p<0.01, * p<0.05

G.3 Voter Myopia

I exploit the timing of program announcement and the variation in Indian state-level election cycles (not all Indian states hold state elections in the same year) to arrive at a subsample which enables me to test for a myopic response mechanism. The roads program was announced in 2000, and four large Indian states (Rajasthan, Madhya Pradesh, Gujarat, Chhattisgarh) that follow the 1998-2003 cycle, therefore, comprise a sub-case where the bulk of road provision is concentrated close to the election cycle. I restrict the main sample to these four states and re-estimate the main specification. It is also possible that voters are most likely to remember program announcement in this sub-case and reward the BJP for introducing the program. To take this possibility into account, I re-estimate the main specification with a change in BJP vote share as the dependent variable; the results confirm that there is no myopic response.

Table E4: Voters remain unresponsive to road provision closer to state elections

Dependent variable is	Δ incumbent vote share %		Δ BJP vote share %	
	(1)	(2)	(3)	(4)
Δ connectivity	0.174	0.197	0.014	0.074
	(0.120)	(0.190)	(0.134)	(0.150)
Ruling party constituency	-12.553***	-12.350***	-10.188***	-9.017***
	(0.967)	(1.350)	(0.932)	(1.345)
Ruling party constituency × Δ connectivity		-0.033		-0.206
		(0.189)		(0.190)
N	663	663	656	656

Notes: Ruling party constituency refers to constituencies controlled by the state ruling party politician in the (1) and (2) and to the BJP politician in (3) and (4). The OLS specification is the same as in main OLS results. Standard errors are clustered at the constituency level. *** p<0.001, ** p<0.01, * p<0.05

Table E5: Voters remain unresponsive to local road provision closer to elections in UP

Dependent variable is	Δ SP vote share				Δ BJP vote share	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated prior 2016	-0.151	0.301	-0.068	0.746	2.034*	1.766
	(0.312)	(0.417)	(0.370)	(0.488)	(0.970)	(1.316)
Treated in 2016 or 2017	0.251	-0.215	0.260	-0.478	-0.605	-0.809
	(0.225)	(0.316)	(0.270)	(0.367)	(0.664)	(1.021)
N	69836	33194	48333	24432	7710	2815
Sample	All constituencies		SP constituencies		BJP constituencies	
	Full	No all weather 2011	Full	No all weather 2011	Full	No all weather 2011

Notes: The independent variable PMGSY beneficiary is 1 if any of the villages that intersect with a 1km booth radius receives a PMGSY project before 2016, and 2 if in 2016 or 2017, and 0 otherwise. That is, the reference group includes booths that were treated before 2016 as well as not treated before 2012. Each model has a constituency fixed effect and a constant that is not reported. Standard errors are clustered at the polling station level. *** p<0.001, ** p<0.01, * p<0.05

G.4 Information rich environments

Another prospect of heterogeneity is raised by varying levels of literacy and media availability within India. Table E6 interacts access to educational facilities, communication (phones) or media (newspapers/ magazine) with the connectivity variable. Results show that higher education, communication or media facilities do not increase the likelihood of a voter response. The results replicate in the post-delimitation time-period and in national elections.

Table E6: Voter response remains absent in media rich environments: State elections

	Pre-delimitation ACs				Post-delimitation ACs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δconnectivity (std.)	-0.598	0.235	0.554	0.524	0.389	0.534	0.419	0.439
	(0.847)	(0.516)	(0.481)	(0.527)	(0.909)	(0.508)	(0.477)	(0.474)
Edu facilities (std.)		-0.230				-0.167		
		(0.577)				(0.611)		
Δconnectivity × % edu facilities		0.327				-0.353		
		(0.526)				(0.559)		
Media availability (std.)			-0.549				0.053	
			(0.624)				(0.601)	
Δconnectivity × Media availability			-0.598				0.111	
			(0.379)				(0.381)	
Comm. facilities (std.)				0.079				0.121
				(0.549)				(0.970)
Δconnectivity × Comm. facilities				-0.388				0.022
				(0.334)				(0.514)
N	1038	2526	2526	2526	971	2086	2086	2086
Sample	States > avg. literacy	Full	Full	Full	States > avg. literacy	Full	Full	Full

Notes: The dependent variable is change in the state-level incumbent party/ coalition vote share in consecutive state-level elections, measured in %. The OLS specification is the same as in main OLS results. Standard errors are clustered at the constituency level. *** p<0.001, ** p<0.01, * p<0.05

Table E7: Voter response remains absent in media rich environments: National elections

	Pre-delimitation PCs				Post-delimitation PCs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δconnectivity (std.)	1.149	-0.740	-0.372	-0.698	0.348	-0.304	-1.306	-0.808
	(1.166)	(0.676)	(0.735)	(0.651)	(1.189)	(0.942)	(0.867)	(0.897)
Edu facilities (std.)		0.364				-2.218*		
		(0.644)				(0.971)		
Δconnectivity × % edu facilities		0.107				-0.791		
		(0.623)				(0.964)		
Media availability (std.)			-0.268				-4.169***	
			(0.652)				(1.010)	
Δconnectivity × Media availability			-0.130				0.477	
			(0.491)				(0.916)	
Comm. facilities (std.)				1.286				-5.010*
				(1.175)				(2.316)
Δconnectivity × Comm. facilities				-0.177				0.012
				(0.475)				(0.961)
N	165	386	386	386	152	320	320	320
Sample	States > avg. literacy	Full	Full	Full	Full	Full	Full	Full

Notes: The dependent variable is change in the national level incumbent party/ coalition vote share in consecutive national level elections, measured in %. Each model contains a district fixed effect, controls and a constant that is not reported. Standard errors are clustered to the constituency level.*** p<0.001, ** p<0.01, * p<0.05

G.5 The nature of challengers

To examine whether voters respond to road provision in competitive races that had highly competitive elections in round 1, I interact the close election dummy (constituencies where the margin of victory is at or below 5%) with standardized values of Δ in connectivity. Table E8 shows that voters are unresponsive in both competitive and non-competitive constituencies, and also in competitive constituencies held by the ruling party.

Table E8: The effect of road provision in competitive races on incumbent support in state elections

	Pre-delimitation ACs				Post-delimitation ACs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ connectivity	0.317	0.437	0.440	0.921	0.520	0.216	0.221	0.579
	(0.439)	(0.449)	(0.406)	(0.543)	(0.479)	(0.509)	(0.431)	(0.817)
Close elections	1.564**	1.584**	0.626	-3.482***	2.165***	2.270***	1.190*	-3.202***
	(0.560)	(0.560)	(0.532)	(0.880)	(0.582)	(0.579)	(0.552)	(0.936)
Close elections × Δconnectivity		-0.505		-1.209		1.104		-0.080
		(0.537)		(0.820)		(0.579)		(1.021)
Ruling party			-10.484***	-12.903***			-9.096***	-12.429***
			(0.548)	(0.674)			(0.609)	(0.842)
Ruling party × Δconnectivity				-0.399				-0.474
				(0.550)				(0.870)
Close × Ruling party				7.255***				7.548***
				(1.087)				(1.137)
Close × Ruling party				0.842				0.240
× Δconnectivity				(1.018)				(1.206)
N	2526	2526	2526	2526	2086	2086	2086	2086

Notes: The dependent variable is change in the state-level incumbent party/ coalition vote share in consecutive state-level elections, measured in %. Each model contains a district fixed effect and a constant that is not reported. Standard errors are clustered to the constituency level. *** p<0.001, ** p<0.01, * p<0.05

Table E9: The effect of road provision in competitive races on incumbent support in national elections

	Pre-delimitation PCs				Post-delimitation PCs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δconnectivity	-0.558	-0.771	-0.264	0.691	-0.707	0.486	-0.342	-1.316
	(0.469)	(0.517)	(0.465)	(1.344)	(0.912)	(1.085)	(0.957)	(1.452)
Close elections	-0.220	-0.217	-0.189	-1.225	0.618	-0.570	0.317	-3.636*
	(0.851)	(0.850)	(0.831)	(1.515)	(1.299)	(1.229)	(1.279)	(1.650)
Close elections × Δconnectivity		0.786		1.367		-4.722**		-3.099
		(0.695)		(1.949)		(1.492)		(1.856)
Ruling party			-4.724***	-5.578***			-6.974***	-8.886***
			(0.965)	(1.140)			(1.322)	(1.739)
Ruling party × Δconnectivity				-1.520				4.069*
				(1.353)				(1.894)
Close × Ruling party				1.914				6.550*
				(1.818)				(2.585)
Close × Ruling party				-1.042				-2.204
× Δconnectivity				(2.067)				(3.171)
N	386	386	386	386	320	320	320	320

Notes: The dependent variable is change in the national level incumbent party/ coalition vote share in consecutive national level elections, measured in %. Each of the predictors seen in the table is standardized. Each model contains a state fixed effect and a constant that is not reported. Standard errors are clustered to the constituency-level. *** p<0.001, ** p<0.01, * p<0.05

If contexts where incumbency disadvantage is rampant and voters find challengers attractive, regardless of incumbent's quality, it is likely that voters' reward challenger parties where there is a likelihood that challengers can claim credit for road provision. In the case of PMGSY road provision and state elections, this translates to cases when BJP candidates are compelling challengers, that is in 2nd electoral position, but the BJP is the major party in the state opposition. In such constituencies, voters may be more willing to reward BJP challengers, who can claim credit for PMGSY program launch. In the case of national elections, BJP is the ruling party in the pre-delimitation period, and therefore subject to incumbency disadvantage, but it is the opposition party in the post-delimitation period. Voters may be more willing to reward the BJP for road provision in the post-delimitation period than the pre-delimitation period.

Table E10: The effect of roads on Δ BJP's voteshare when BJP candidates are main challengers in the baseline election: State constituencies

	Δ BJP voteshare			
	Pre-delimitation		Post-delimitation	
	(1)	(2)	(3)	(4)
Δ connectivity	1.237	-1.127	2.006	1.948
	(1.324)	(1.450)	(1.874)	(2.057)
Mean Δ BJP voteshare	5.641	4.460	10.315	10.032
N	251	377	123	107

Notes: For (1) & (3), the sample refers to those constituencies where a BJP candidate occupies second position in previous election, the BJP is not the ruling party at the state level, and the electoral competition is between BJP and INC at the state level. For (2) & (4), the sample refers to those constituencies where a BJP candidate occupies second position in previous election, the BJP is not the ruling party at the state level, and the electoral competition is between BJP and INC at the constituency level, that is, the incumbent is from the INC. The mean Δ BJP voteshare also refers to the respective sample. Each model contains a district fixed effect and a constant that is not reported. Standard errors are clustered to the constituency-level. *** p<0.001, ** p<0.01, * p<0.05

Table E11: The effect of roads on Δ BJP's voteshare when BJP candidates are main challengers in the baseline election: National constituencies

	Δ BJP voteshare	
	Pre-delimitation	Post-delimitation
	(1)	(2)
Δ connectivity	0.902	0.949
	(1.025)	(1.447)
BJP challenger	-0.712	-0.604
	(1.297)	(1.395)
BJP challenger × Δ connectivity	-2.242	2.497
	(1.633)	(1.568)
Mean Δ BJP voteshare	-2.375	12.361
N	386	320

Notes: Each model contains a state fixed effect and a constant that is not reported. Standard errors are clustered to the constituency-level. *** p<0.001, ** p<0.01, * p<0.05

G.6 UP: Information rich environment and competitive races

Table E12: UP: Information rich environment and competitiveness

Dep. variable change in	SP voteshare (1)	BJP voteshare (2)	SP voteshare (3)	SP voteshare (4)	SP voteshare (5)	SP voteshare (6)	SP voteshare (7)
PMGSY road	0.152	0.105	0.110	0.133	0.053	-0.129	-0.167
	(0.325)	(0.842)	(0.265)	(0.263)	(0.270)	(0.382)	(0.519)
Media availability (std.)			0.331*				
			(0.148)				
PMGSY road × Media availability (std.)			-0.081				
			(0.321)				
Comm. facility (std.)				0.056			
				(0.161)			
PMGSY road × Comm. facility (std.)				-0.194			
				(0.315)			
Edu. facility (std.)					-0.265*		
					(0.131)		
PMGSY road × Edu. facility (std.)					0.631		
					(0.331)		
N	48333	7710	69836	68725	69836	28804	15820
Sample	SP Constituencies	BJP Constituencies	Full	Full	Full	Close-elections	Close-elections & SP Constituencies

Notes: Standard errors are clustered to the state-level. *** p<0.001, ** p<0.01, * p<0.05