Constituencies of Change

Electoral Redistricting and Public Goods Provision in India

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September 15, 2025

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Abstract

This paper examines the causal impact of packing and cracking minorities on public good provision. While existing research largely focuses on the U.S. and emphasizes partisan gerrymandering, much less is known about how these configurations affect minorities in contexts without partisan manipulation. I exploit India's nationwide redistricting, implemented by an independent commission, which shifted villages across constituency boundaries exogenously to local politicians. Using village-constituency level data, I show that when Muslims are packed into constituencies, politicians respond by providing more schools - a public good both salient to Muslim voters and subject to local discretion, while no comparable effects are observed for roads or electrification. A probabilistic voting model highlights two mechanisms: as the minority population in a constituency increases, minority villages are more likely to receive schools either when their voting preferences are less dispersed, or when cross-village solidarity strengthens the demand for preferred public goods. The findings highlight how boundary design shapes minority welfare through the distribution of discretionary public goods.

JEL Codes: D72, H41, J15

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I am grateful to Andrew Foster, Sam Asher, Sisir Debnath, Brian Knight, Sourabh Paul, Jonathan Roth and Abhijit Banerji for their valuable feedback on this paper. I gratefully acknowledge the Commonwealth Split-site Scholarship and the Fulbright Nehru Doctoral Research Fellowship, which funded my research stays at Imperial College London and Brown University, respectively, where I developed this paper. I also thank participants at Brown University's Applied Micro Lunch for their comments. All remaining errors are my own.

1 Introduction

The 'packing' and 'cracking' of minorities has important implications for their access to local public goods, yet there is limited causal evidence on the conditions under which different configurations of minority populations facilitate provision. Most of the existing literature comes from the U.S., where gerrymandering is highly politicized and intentionally designed to serve partisan goals (Coate and Knight, 2007; Friedman and Holden, 2008; Stephanopoulos and Warshaw, 2020; Jeong and Shenoy, 2022). This makes it difficult to separate the effects of constituency composition from partisan intent.

In this paper, I use India's 2008 electoral redistricting exercise as an exogenous shock to a constituency's minority concentration. An independent redistricting commission re-assigned villages and wards across state and national constituency boundaries. This altered the share of minority voters in each constituency. However, this was not systematically driven by political interests or partisan intent, unlike the USA (Iyer and Reddy, 2013; Jensenius, 2013; Ahmed, 2022; Kjelsrud et al., 2024). Exploiting this change, I examine how local public goods in the villages responded to shifts in minority concentration for the state-level constituency they were assigned to. I find that villages with larger Muslim populations received more schools when they moved to constituencies where the overall Muslim share increased. This effect is specific to schools, in contrast to other public goods such as rural roads and electrification. I show that schools are of particular significance to Muslim voters, as compared to other infrastructure such as roads and electrification, for which I do not observe significant results. Local politicians also exercise greater discretion over school funding and allocation, whereas roads and electrification were determined by centrally sponsored schemes. The theoretical results further suggest that minority villages are more likely to receive schools when their voting preferences are less dispersed than the majority.

Studying the impact of packing and cracking is particularly challenging, yet interesting because its effects are not straightforward. On the one hand, concentrating minority voters in fewer constituencies can dilute their influence in shaping state-level outcomes, leaving them with fewer representatives overall. On the other hand, within constituencies where their numbers increase, they may gain enough electoral weight to pressure politicians into catering to their demands. Whether such local concentration translates into greater provision of public goods, however, is far from obvious: it could enhance their bargaining power or, alternatively, make them easier to ignore if parties view their support as guaranteed or their preferences as fragmented.

India provides an interesting setting to study the impact of packing and cracking mi-

norities because of its size, diversity, and institutional framework. First, the Indian case helps address common endogeneity concerns typically associated with redistricting, such as gerrymandering or politically motivated boundary drawing. The existing literature finds no evidence of systematic gerrymandering in the 2008 redistricting process of India (Iyer and Reddy, 2013; Jensenius, 2013; Kjelsrud et al., 2024; Ahmed, 2022). I contribute to this body of work by conducting further tests, which are presented in the Appendix. Second, biases in the provision of public services remain a major concern in India. A growing body of evidence documents how access to state resources is often shaped by identity-based considerations and political incentives, rather than objective need (Banerjee and Somanathan, 2007; Jensenius and Chhibber, 2023; Asher et al., 2024a). This makes it crucial to observe whether packing impacts existing biases in public service delivery. Third, data from rural India provides a great setting to empirically answer this question. From a policy perspective rural India is home to more than 65 percent (>900 million) of the country's population (Census 2011), and an even larger share of its development deprivation. The institutional setup in India enables a clear mapping between village-level outcomes and constituency-level politics. Fourth, being the world's largest democracy with a highly diverse electorate, it has a long history of institutionalized group-based political inclusion through reserved seats, which has improved the development outcomes of marginalised populations (Pande, 2003; Chattopadhyay and Duflo, 2004). However, Muslims in India make up over 14% of the population, but are not covered by political reservations at any level of government. Despite persistent socio-economic disadvantage (Asher et al., 2024b; Jaffrelot and Kalaiyarasan, 2023) and evidence of underrepresentation in elected office (Beg, 2024), they fall outside the constitutional framework of group-based affirmative action in politics. By focussing on Muslims, I am able to disentangle the impacts of packing from any other form of political affirmative action policies.

The first set of results test baseline disparities using the 2001 Census, focusing on three major public services: government schools, rural roads, and electrification. I find that villages with higher Muslim population shares are significantly less likely to have a public school. In contrast, there is no systematic relationship between village Muslim share and access to rural roads or electricity, suggesting a sector-specific bias in the distribution of public education infrastructure. To validate whether these patterns reflect community-level preferences, I turn to the Rural Economic & Demographic Survey (REDS), which asked respondents to rank the importance of different public services. Consistent with census patterns, villages with larger Muslim populations are significantly more likely to rank schools at higher importance, but not roads or electrification, possibly reflecting a desire for services they lack or feel excluded from.

The second set of results use a difference-in-differences (DiD) framework to estimate whether redistricting-induced changes in Muslim concentration, measured as shifts in the Muslim population share at the constituency level, affect subsequent public goods provision in villages with varying Muslim shares. I find that increases in Muslim concentration at the constituency level, leads to a significant rise in public school establishment in high-Muslim villages, with no corresponding effect on private schools, electrification, or roads. If a 100 percent Muslim village, shifts to a constituency where the Muslim population share increased by 1 percentage point due to delimitation, it raises the probability of getting a primary school by 0.24 percentage point, and an above-primary school by 0.191 percentage point

The third set of results draws on theories of electoral incentives and vote-bank politics (Downs, 1957; Lindbeck and Weibull, 1987; Foster and Rosenzweig, 2022). I build on the probabilistic voting framework to explain how shifts in constituency demographics influence the allocation of public goods. In the model, political parties compete for votes by deciding how much public goods to provide in minority and majority villages. The key mechanism is that as the minority share of the population in a constituency rises, the electoral weight of their preferences also increases. Whether this translates into more schools for minority villages depends on two conditions. First, if minority voters have relatively low dispersion in their voting preferences, they become easier to mobilize as a bloc, increasing their influence on parties' strategies. Second, if minority villages display strong cross-village solidarity, their collective bargaining power further strengthens, making the provision of their preferred public good—schools—more attractive to competing parties. Together, these mechanisms generate testable predictions about when and where minority communities benefit from shifts in electoral boundaries.

This paper is the first large scale study analyzing the impacts of 'packing' and 'cracking' minorities, through a non-partisan redistricting exercise. It contributes to several strands of literature. First, it adds to the work on the packing and cracking of minorities. Much of the existing research, both theoretical and empirical, emerges from the U.S. context. Theoretical models of redistricting typically adopt the perspective of the gerrymander, asking under what conditions it is optimal for politicians to pack or crack minorities (Friedman and Holden, 2008, 2020). Empirical studies have examined the long-run policy consequences of gerrymandered constituencies (Stephanopoulos and Warshaw, 2020; Jeong and Shenoy, 2022; Caughey et al., 2017; Shotts, 2003). Yet, we know little about how the packing of minorities, absent overt partisan bias, shapes the provision of public services. Evidence from developing democracies is particularly scarce, where the bulk of scholarship instead focuses on political reservations. Second, it brings the study of minority representation beyond for-

mal quotas, by focusing on a large and disadvantaged group that is politically visible but unprotected. While existing literature (Chattopadhyay and Duflo, 2004; Chin and Prakash, 2011; Pande, 2003; Ahmed, 2022) examines how explicit political reservations for marginalized groups affect public goods provision and development outcomes, I leverage a more subtle institutional shift - electoral redistricting, as a natural experiment. This approach allows me to study how changes in a group's concentration, in the absence of formal quotas, influence their access to public resources. Third, it contributes to the literature on segregation and access to public goods, offering new evidence on how demographic shifts within constituencies can shape distributive outcomes. Two of the most salient studies on segregation in India - Banerjee and Somanathan (2007) and Asher et al. (2024a), show that Muslim-dominated districts and neighborhoods tend to have the poorest access to public goods. Bhalotra et al. (2014) find that increasing the political representation of Muslims improves health and education outcomes in the district from which the legislator is elected. However, to the best of my knowledge, this is the first study to causally identify the link between shifts in a group's electoral importance and public goods provision for Muslims at the granular level of villages in India. While segregation is often associated with exclusion and neglect, this paper suggests that, under certain electoral conditions, concentrated minority populations may actually gain leverage in securing public goods, as politicians respond to their electoral weight and cohesion. Fourth, it adds to the literature on distributive politics by examining how constituency-level demographic changes shape allocation strategies. While prior work has analyzed how politicians use discretionary funds (Jensenius and Chhibber, 2023), this study shows that redistricting can also influence existing biases in public goods distribution. Finally, this paper engages with broader theoretical debates on democratization, elite capture, and accountability. In the spirit of Foster and Rosenzweig (2022), who show that the effect of democratic governance on public goods is mediated by local class structure. My results reveal how electoral incentives, shaped by spatially concentrated minorities, can shift state responsiveness. While their work focuses on class cleavages, I highlight the importance of identity-based demography in mediating distributive outcomes. Further, echoing findings from Besley and Case (1995) and Besley et al. (2010), the paper underscores how increased political competition, introduced through redistricting, can discipline state behavior. It also relates to Besley and Burgess (2002) in showing that state responsiveness is shaped by the extent to which citizens' demands are politically legible and electorally consequential.

The findings carry important policy implications for the design of electoral institutions and the delivery of public goods in diverse societies. Since the packing of minority voters systematically shapes the allocation of essential services such as schools, the redistricting exercises and constituency boundaries are not merely administrative decisions but also deter-

minants of equity in state provision. Even in a relatively neutral, non-partisan redistricting exercise, the central lesson is that boundary changes are not just about balancing population counts. They inevitably reshape the incentives of politicians, particularly in how they weigh the demands of minority versus majority groups. Policymakers should therefore approach redistricting with an awareness of its distributional consequences, ensuring that institutional processes do not unintentionally sideline vulnerable communities. In the Indian context, this becomes especially crucial in light of the recent controversial redistricting exercises in Assam and Jammu & Kashmir, as well as the nationwide redistricting scheduled to follow the 2026 Census. How these processes unfold will have a direct bearing on whether minority communities gain or lose access to vital public services. More broadly, similar dynamics are at play across the world: in the United States, for instance, the drawing of district boundaries has long been contested for its role in shaping minority representation and resource allocation. These parallels underscore that improving the responsiveness of political competition to marginalized groups - through institutional safeguards, transparency in resource allocation, or mechanisms to amplify minority voices is central to preventing systematic under-provision and fostering inclusive development.

The rest of the paper is organized as follows. Section 2 presents background of the study. Section 3 describes the the administrative and survey data sources, Section 4 develops a theoretical model to show that theoretically it is not obvious if 'packing' or 'cracking' improves or worsen public service provision. Section 5 describes the empirical strategy, Section 6 presents the results and Section 7 concludes.

2 Background

2.1 Indian Political System

India operates as a federal parliamentary democratic republic, characterized by a multi-tiered governance structure that distributes authority across different levels of administration. The country is governed under the framework of the Indian Constitution, which defines the separation of powers among the executive, legislature, and judiciary. The political structure consists of multiple levels, beginning at the national level and extending down to the grassroots at the village and neighborhood levels.

At the national level, India is divided into multiple states and union territories, each with its own government. The *Lok Sabha* (National Parliament/Legislature) is composed of Members of Parliament (MPs) elected from Parliamentary Constituencies (PCs), while the

Vidhan Sabha (State Parliament/Legislature) includes representatives elected from Assembly Constituencies (ACs). While both Parliamentary Constituencies (PCs) and Assembly Constituencies (ACs) were affected by the redistricting process, I focus on ACs primarily because they are substantially smaller in population size (approximately 350,000 versus 2.5 million for PCs). This smaller scale allows for greater variation in constituency composition and makes it easier to detect the effects of redistricting on political incentives and local development outcomes.

Each state is divided into districts, which function as important administrative and electoral units. Further, districts are subdivided into Assembly Constituencies (ACs), which elect representatives to the state legislative assemblies. These constituencies form the basis for local governance and policy implementation at the state level. Importantly, Assembly Constituencies must be contained within district boundaries to ensure consistency in administration and electoral representation. These ACs are further divided into urban neighborhoods (wards) and villages. A simplified depiction of this multi-tiered system is presented in Figure 1.

India follows a first-past-the-post (FPTP) electoral system, where the candidate securing the highest number of votes wins the election, regardless of whether they achieve a majority. This system operates uniformly at all political levels, including elections to the State Legislative Assemblies. While administratively straightforward, the FPTP system has profound implications for how politicians engage with voters and allocate public goods. Because representation is based on geographically defined Assembly Constituencies (ACs), and only a plurality is required to win, elected representatives face strong incentives to cater to areas or communities that offer concentrated and electorally valuable support.

Constituencies vary in composition, some encompass just a few large villages, others many small ones, and many also include semi-urban or urban areas. This variation in internal composition shapes how resources and political attention are distributed. Villages that are part of larger clusters or make up a greater share of the AC's population may have a stronger claim on the politician's attention and development funds, simply by virtue of being more electorally consequential. For marginalized groups such as Muslims, this means that being situated in a constituency with more villages of similar demographic or political character may improve the likelihood of receiving public investment. Conversely, being part of a small or isolated minority village within a fragmented constituency may limit political leverage and reduce access to state-delivered goods.

Villages hold immense significance in the Indian political system, because of their vast population share and also due to their role in electoral politics and governance. According

to the 2011 Census of India, over two-thirds of India's population resides in rural areas. As a result, villages form the backbone of electoral strategies, influencing both state and national election outcomes. Many political parties prioritize rural development policies, focusing on issues such as agricultural subsidies, infrastructure development, and welfare schemes to garner support from rural voters.

India's 73rd Constitutional Amendment established a three-tier system of local self-governance - the Panchayati Raj Institutions (PRIs) - empowering Gram Panchayats at the village level (Ministry of Home Affairs, 1992). These elected bodies are responsible for local development priorities such as water, sanitation, and road maintenance. However, services like secondary education remain under the purview of the state government (Mahal et al., 2000). Decisions regarding the construction of new primary schools and health centers, as well as their locations, are typically made at the District Planning Committee level or higher, leaving local village representatives with limited power. There is further evidence that minority MLAs result in better education and health outcomes for minority children Bhalotra et al. (2014). Panchayats primarily function as implementers, carrying out the construction of school buildings or health centers on behalf of state authorities. This creates a dual system of accountability: while villagers elect their own panchayat members, they are also dependent on the MLA for access to many essential public services. The MLA, in turn, is elected from an AC that contains multiple villages and urban wards. Importantly, villages do not have direct influence over state budgets - they must lobby their MLA or rely on being part of an electorally strategic cluster to receive state-delivered goods and services. In practice, this creates a political bottleneck, where even well-functioning village administrations may find themselves under-resourced if they are not prioritized by the MLA.

2.2 Delimitation & Gerrymandering

Delimitation in India refers to the redrawing of boundaries of electoral constituencies to reflect changes in population and ensure equal representation. The foundational rationale is to uphold the democratic principle of 'one person, one vote' by ensuring that each constituency represents roughly the same number of people. Without periodic adjustments, areas with faster population growth would become underrepresented in legislatures, while slower-growing regions would be overrepresented.

Delimitation exercises have been carried out under four major Delimitation Acts: in 1952, 1962, 1972, and 2002. However, after the 1971 exercise, the Indian Parliament froze delimitation until after the 2001 Census, largely due to concerns that states with higher

population growth (mostly in the north) would gain more seats, thereby penalizing states that had implemented successful family planning measures. This freeze was lifted in 2002, but only for the redrawing of constituency boundaries, not for changing the number of seats allotted to each state-a freeze that remains in place until 2026. As a result, delimitation since 2002 has focused on adjusting internal constituency boundaries within states without altering the inter-state seat distribution.

The Commission follows several key rules while redrawing boundaries:

1. Equal population across constituencies is the primary objective, with a permissible margin of variation to respect administrative boundaries and geographic contiguity.
2. Constituency boundaries must not cross district boundaries, wherever possible.
3. Seats are reserved for Scheduled Castes (SCs) and Scheduled Tribes (STs) in areas where their population is concentrated, based on the latest Census data.
4. Public consultations are held before finalizing maps, although the final decisions of the Commission are binding and not open to judicial review.

The process is carried out by the Delimitation Commission of India, an independent and quasi-judicial body appointed by the President of India and chaired by a retired Supreme Court judge. The Commission also includes the Chief Election Commissioner and the respective state election commissioners. This autonomous structure is designed to insulate the process from partisan political influence-unlike the redistricting system in countries like the United States, where gerrymandering can occur due to legislative control. Iyer and Reddy (2013) finds no evidence that the redistricting process in India was influenced by incumbent politicians. They also find no change in partisan bias or in the responsiveness of the seat–vote curve, indicating that the process did not systematically favor any political party. Jensenius (2013) refutes the Sachar Committee Report's (2006) claim that Muslim-dominated constituencies were more likely to be reserved for Scheduled Castes (SCs). Her analysis shows that, on average, reserved constituencies had lower Muslim population shares, largely due to the demographic concentration of SCs in those areas. Kjelsrud et al. (2024) similarly finds no evidence of gerrymandering, showing that even potentially influential politicians did not receive more favorable redistricting outcomes than others. They further demonstrate that, across a range of observable characteristics, areas reassigned to new constituencies were not systematically different from those that remained unchanged. Ahmed (2022) show that the primary objective of delimitation-equalizing the voter population across constituencies-was

largely achieved. They also find no evidence that incumbent politicians who served as associate members of the Delimitation Commission were able to manipulate the redistricting process to their advantage. I further contribute to this literature by examining the spatial shape of constituencies. Specifically, I analyze the compactness scores of constituencies (Figures A.9 and A.10) before and after the 2008 delimitation and find no significant change, suggesting that the redistricting process did not systematically alter constituency compactness.

While the primary goal of delimitation is to equalize population representation across constituencies, its effects are far-reaching, especially in a country as spatially and socially diverse as India. By redrawing boundaries, delimitation reshapes not only who votes together but also who is represented together. This redistricting can alter the demographic and political composition of a constituency, influencing electoral incentives, competition, and ultimately, public goods distribution. In this way, delimitation is not a merely technical exercise, it is deeply political in its consequences.

For rural areas, and particularly for villages, these changes can be transformative. Villages may find themselves reassigned to new constituencies, grouped with unfamiliar or socioeconomically distinct areas, or separated from clusters with whom they previously shared political leverage. Such realignments can affect their visibility, bargaining power, and access to state resources. In cases where Muslim-majority villages are absorbed into larger, more heterogeneous constituencies, their influence may be diluted-especially if they no longer form a critical electoral bloc. Conversely, being situated in a constituency where they represent a sizeable and cohesive segment can enhance their salience in the eyes of elected representatives.

Thus, the impact of delimitation extends beyond fairness in population counts. It reconfigures the landscape of political accountability and representation. For historically marginalized groups like Muslims, especially those residing in smaller or more isolated villages-the redrawing of boundaries can either exacerbate their exclusion or open new avenues for inclusion, depending on the demographic and spatial logic of constituency design. Understanding these shifts is essential to assessing the distributive outcomes of Indian democracy.

2.3 Muslims in India

Muslims are the largest religious minority in India, comprising approximately 14.2 percent of the population (around 172.2 million people) according to the 2011 Census. Despite their numerical strength, Muslims continue to face deep and persistent socio-economic and political

marginalization. The Sachar Committee Report (2006), a seminal study on the status of Muslims in India, documented stark disparities in education, employment, and political representation. Educational attainment among Muslims remains particularly concerning: only 50 percent of Muslim students who complete middle school go on to finish secondary education, compared to a national average of 62 percent. Intergenerational mobility in education has also been on the decline for Indian Muslims (Asher et al., 2024b). These poor outcomes are closely linked to the unequal provision of public goods in Muslim-majority areas (Asher et al., 2024a), and a consistent lack of political representation to advocate for improved access to state resources (Bhalotra et al., 2014).

Muslim political representation in legislative bodies has been disproportionately low. Although they form over 14 percent of the population, their representation in the *Lok Sabha* (Lower House of Parliament) has historically remained below 6-7%. Similar trends are observed at the state level, where Muslims are often underrepresented in Assemblies, particularly in states with significant Muslim populations such as Uttar Pradesh, Bihar, and West Bengal. For instance, although Uttar Pradesh has 20 percent Muslim population, only 6 percent of Muslim MLAs were elected in the 2017 state elections. Additionally, the lack of Muslim leadership within major political parties has contributed to their marginalization from mainstream politics.

This marginalization is not confined to urban areas. In rural India-home to 60 percent of the country's Muslim population-Muslims often inhabit socio-economically disadvantaged and spatially peripheral villages. Rural Muslim communities are also more likely to be excluded from networks of political patronage that facilitate access to development schemes and welfare entitlements. As studies have shown, spatial and religious marginality often intersect, compounding barriers to public goods and services and perpetuating cycles of deprivation.

Together, these dynamics underscore the importance of studying the political geography of development. The interaction between electoral boundaries, demographic composition, and patterns of exclusion raises critical questions about the equity of state provisioning. Therefore, I explore whether changes in constituency boundaries reshape access to public services for marginalized communities, and whether demographic clustering offers protection-or further isolates-those who are systematically left behind.

3 Data

3.1 School Data

The Unified District Information System for Education (UDISE+), maintained by the Ministry of Education, Government of India, serves as the primary data source for all schools in the country. This comprehensive database contains detailed information on various attributes of schools, including the year of establishment, type of management (government, private, government-aided, unaided), and level of schooling provided (primary, upper primary, secondary, and higher secondary). Additionally, it records the geographical location of each school, specifying the village/ward, district, and state in which it is situated.

According to the UDISE+ 2021-22 India has approximately 1.5 million schools, of which nearly 1.2 million (or about 82 percent) are located in rural areas. The distribution of schools across different management types reveals that government-run schools form the majority, accounting for over 70 percent of total schools. Private schools, although fewer in number, have a significant presence, especially in urban and semi-urban regions. The dataset also captures crucial variables such as student enrollment numbers, teacher availability, and infrastructure details, including access to basic amenities like electricity, drinking water, and sanitation facilities.

Using the year of establishment for each school, I construct a village-year panel. For the purpose of this study, I restrict the sample to the rural areas in UDISE+ dataset, which then is utilized to track the establishment of new schools in each village over time and to assess whether changes in electoral boundaries influence the provision of educational infrastructure. I divide the schools into 5 categories: government/private and primary(classes 1 to 5)/above primary(classes 6 and above) and *Madrasas* (Islamic Schools). The yearly trends of school establishment is plotted in figures A.11 to A.15.

3.2 Rural Roads

The data on rural roads is drawn from the Pradhan Mantri Gramin Sadak Yojana (PMGSY), a major centrally sponsored scheme launched by the Government of India in 2000 with the aim of improving rural connectivity through all-weather roads. The dataset used in this study, constructed by (Asher and Novosad, 2020; Asher et al., 2021a), links project-level road award data to individual villages across India. It is restructured into a panel format covering the period 2000 to 2015, with one observation per year for each village or town,

resulting in a village-year panel.

The key outcome variable is a binary indicator, Road Award, which captures whether a given village was sanctioned a road under the PMGSY scheme. The variable takes the value 0 for all years prior to the sanction and switches to 1 in the year of award, remaining 1 in all subsequent years. This coding structure captures the long-term effect of receiving a road while avoiding anticipatory effects.

To ensure that the analysis focuses on road provision driven by the scheme's official allocation criteria, rather than by political discretion or local influence, I restrict the sample to a set of states identified by Asher and Novosad (2020) as having strictly followed PMGSY guidelines. These include Chhattisgarh, Gujarat, Madhya Pradesh, Maharashtra, Odisha, and Rajasthan. These states were selected in consultation with the National Rural Roads Development Agency (NRRDA), the nodal agency responsible for overseeing PMGSY implementation. This restriction allows for a cleaner identification of the impact of institutional reforms on development outcomes by ensuring that the road allocation process itself was not endogenously influenced by political actors.

3.3 Electrification

The Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), launched in 2005, aimed to electrify all un-electrified villages and provide free electricity connections to below-poverty-line (BPL) households. All existing rural electrification programs were subsequently consolidated under the RGGVY. Drawing on the digitized dataset developed by Vanden Eynde and Wren-Lewis (2024), which links RGGVY implementation to villages, I construct a village-level panel spanning 2005 to 2015. Following a similar approach to that used for school establishment and road construction, I create a binary variable, electrification, which takes the value 1 from the year a village is electrified onward, and 0 in all preceding years. This does not indicate the village actually received electricity; it only reflects whether the government classified the village as electrified, i.e., if it had the necessary infrastructure to recieve electricity.

3.4 Assembly Constituencies and Villages Shapefiles

To examine the spatial relationship between electoral constituencies and villages, I utilize the shapefiles of pre- and post-delimitation Assembly Constituencies (ACs). These shapefiles, which delineate the boundaries of electoral constituencies before and after the delimita-

tion process, are procured from the library of the University of Pennsylvania. Additionally, village-level shapefiles and demographic data is obtained from the Socioeconomic High-resolution Rural-Urban Geographic Platform for India (SHRUG) (Asher et al., 2021b), which relies on the 2011 Indian Census data to provide fine-grained geographic and socioeconomic details of villages.

I perform a spatial merge between the village shapefiles and the Assembly Constituency boundaries to map villages to their respective constituencies. Ideally, each village should fall entirely within the boundary of a single constituency. However, due to inaccuracies in the available shapefiles and minor discrepancies in geographic projections, some villages are found to overlap multiple constituencies. To address this issue, the proportion of each village's total area falling within each constituency is calculated. In cases where a village is split across multiple constituencies, the constituency with the highest percentage of the village's land area is assigned as the primary constituency for that village. To enhance accuracy, only villages that have at least 75 percent of their area within a single constituency are retained in the final dataset, thereby minimizing potential misclassification errors. I use the rural Muslim population share at the AC level as a proxy for total Muslim population in the AC.

This is merged with the village-level religious demographic data, which has been compiled by Asher and Novosad (2020) using scraped data from the Socioeconomic and Caste Census (SECC). The SECC, conducted primarily in 2012, provides household-level demographic and economic data, which is instrumental in understanding the religious composition of villages. However, due to data loss and inconsistencies in scraping methods, some states exhibit incomplete coverage. Consequently, states with substantial missing data are excluded from the final analysis to maintain the robustness of the study.

3.5 Election Data

To analyze electoral dynamics and candidate characteristics, data on all contesting candidates in the Member of Legislative Assembly (MLA) elections is sourced from the Trivedi Centre for Political Data (TCPD). The TCPD dataset provides granular details on candidates, including their names, political party affiliations, constituencies contested, vote shares, and election outcomes. However, one key limitation of the dataset is the absence of information on the religion of contesting candidates, as the Election Commission of India does not officially record religious identities.

To infer the religious affiliations of candidates, I employ a probabilistic approach using

a name-based religion prediction algorithm. The methodology follows the framework developed by (Ash et al., 2025), which utilizes machine-learning techniques trained on large-scale datasets of government job exam forms to estimate the likelihood of a candidate being a Muslim based on their name. This approach has been widely used in political science research to infer religion when explicit self-reported data is unavailable. The accuracy of this particular model is over 97 percent, validated through comparisons with independent datasets where religious identity is known, ensuring a reasonable degree of reliability. The core reason why it works is because Hindu names come from the Sanskrit language and Muslim names come from either Arabic or Persian. Therefore these are significantly different sounding names.

My final consists of a village-year panel, from 2000 to 2021, with more than 200,000 villages each year.

4 Theoretical Model

I develop a simple probabilistic voting model to study how politicians allocate public goods, across minority and majority villages within a constituency. The model proceeds in three steps: a baseline without altruism, a setting where minorities also value other goods, and finally a case with altruism (or solidarity) among minorities.

4.1 Setup

Consider a constituency composed of two types of villages: fully minority and fully majority. Let the share of minority villages be denoted by $\rho \in (0, 1)$. Politicians allocate resources across two goods:

$$\text{Schools } (s) \quad \text{and} \quad \text{Other goods } (o).$$

The total school budget is S, so that if s_1 and s_2 denote the per-village allocation of schools to minority and majority villages, the feasibility constraint is

$$\rho s_1 + (1 - \rho)s_2 = S. \tag{BC}$$

4.2 Probabilistic Voting Framework

Voters in each group $g \in \{1, 2\}$ (minority, majority) have preferences that are not perfectly aligned with public goods. Instead, the probability that an individual in group g votes for

Party A depends on the difference in utilities offered by the two parties. Following the standard probabilistic voting model Lindbeck and Weibull (1987), this is written as:

$$\Pi_g = F\left(\frac{U_g^A - U_g^B}{\sigma_g}\right),$$

where F is a cumulative distribution function (CDF), U_g^j is group g's utility from party $j \in \{A, B\}$, and $\sigma_g > 0$ is a dispersion parameter. A smaller σ_g means that the group is more responsive (swingier), while a larger σ_g means the group is noisier and harder to target.

The politician's total expected vote share is:

$$\Pi = \rho\, F\left(\frac{U_m^A - U_m^B}{\sigma_1}\right) + (1-\rho)\, F\left(\frac{U_M^A - U_M^B}{\sigma_2}\right).$$

Since F is increasing, maximizing Π is equivalent to maximizing a weighted sum of utilities:

$$\max \;\; \rho\frac{1}{\sigma_1}U_m + (1-\rho)\frac{1}{\sigma_2}U_M,$$

where the weights reflect group size and responsiveness.

4.3 Part 1: Baseline Preferences

Suppose that only minorities value schools, while the majority cares about both schools and other goods. Formally:

$$U(s,o) = z(s), \qquad V(s,o) = z(o),$$

where $z' > 0, z'' < 0$ to capture concavity (diminishing returns).

The politician's problem is:

$$\max_{s_1,s_2} \; \rho\frac{1}{\sigma_1}z(s_1) + (1-\rho)\frac{1}{\sigma_2}z(s_2),$$

subject to budget constraint.

First-order conditions. Form the Lagrangian:

$$\mathcal{L} = \rho\tfrac{1}{\sigma_1}z(s_1) + (1-\rho)\tfrac{1}{\sigma_2}z(s_2) + \lambda\big(S - \rho s_1 - (1-\rho)s_2\big).$$

Differentiating:

$$\frac{\partial \mathcal{L}}{\partial s_1}: \quad \tfrac{1}{\sigma_1} z'(s_1) = \lambda, \qquad \frac{\partial \mathcal{L}}{\partial s_2}: \quad \tfrac{1}{\sigma_2} z'(s_2) = \lambda.$$

Hence

$$\frac{1}{\sigma_1} z'(s_1) = \frac{1}{\sigma_2} z'(s_2). \tag{1}$$

Interpretation: If $\sigma_1 < \sigma_2$, then $\frac{1}{\sigma_1} > \frac{1}{\sigma_2}$, so we must have $z'(s_1) < z'(s_2)$. Since z' is decreasing, this implies $s_1 > s_2$. Thus, minorities receive more schools when their voting preferences are less dispersed than the majority.

Comparative statics. From (1), writing allocations as functions of λ:

$$s_1(\lambda) = (z')^{-1}\big(\lambda\sigma_1\big), \qquad s_2(\lambda) = (z')^{-1}\big(\lambda\sigma_2\big).$$

Substitute into the budget constraint:

$$\Phi(\lambda, \rho) \equiv \rho s_1(\lambda) + (1-\rho) s_2(\lambda) - S = 0. \tag{2}$$

Implicitly, this defines $\lambda = \lambda(\rho)$. Differentiate totally w.r.t. ρ:

$$\frac{\partial \Phi}{\partial \lambda}\frac{d\lambda}{d\rho} + \frac{\partial \Phi}{\partial \rho} = 0.$$

So

$$\frac{d\lambda}{d\rho} = \frac{s_2 - s_1}{\rho s_1'(\lambda) + (1-\rho) s_2'(\lambda)}.$$

Now,

$$\frac{ds_1}{d\rho} = s_1'(\lambda)\frac{d\lambda}{d\rho}.$$

Using

$$s_g'(\lambda) = \frac{d}{d\lambda}(z')^{-1}(\lambda\sigma_g) = \frac{\sigma_g}{z''(s_g)} < 0,$$

the denominator $\rho s_1'(\lambda) + (1-\rho) s_2'(\lambda)$ is negative. Therefore, the sign of $\frac{ds_1}{d\rho}$ equals the sign of $(s_1 - s_2)$.

$$\sigma_1 < \sigma_2 \quad \Rightarrow \quad s_1 > s_2 \quad \Rightarrow \quad \frac{ds_1}{d\rho} > 0.$$

Interpretation: If the minority's voting preferences are less dispersed (low σ_1), then as their population share grows, politicians allocate more schools to them.

4.4 Part 2: Minorities also value other goods

Now suppose minorities also derive utility from other goods:

$$U(x,y) = z(x) + z(y), \qquad V(x,y) = z(x) + z(y).$$

The politician maximizes

$$\max_{s_1,s_2,o_1,o_2} \ \rho\tfrac{1}{\sigma_1}\big(z(s_1) + z(o_1)\big) + (1-\rho)\tfrac{1}{\sigma_2}z(o_2).$$

The FOCs for schools are unchanged:

$$\tfrac{1}{\sigma_1}z'(s_1) = \lambda_s, \qquad \tfrac{1}{\sigma_2}z'(s_2) = \lambda_s.$$

Hence, the same targeting condition applies: $s_1 > s_2$ if $\sigma_1 < \sigma_2$. Adding o_1 simply means minorities also get some other goods, but the comparative static for schools is unaffected.

4.5 Part 3: Introducing Altruism (Solidarity)

Finally, suppose minorities exhibit altruism or solidarity across villages. I allow altruism or solidarity only among minority voters, and not among the majority. Minorities derive value from seeing their community visibly acknowledged by the state, even when the benefit accrues to another minority village. By contrast, majority villages already receive recognition by default, the baseline allocation of public goods is tailored to them, and they are not at risk of being symbolically excluded. In other words, altruism for the majority is redundant, because their identity and status are reflected in the 'default' policy environment. For the minority, however, solidarity is politically meaningful: When one minority village is targeted, others interpret it as a sign of inclusion, which generates constituency-wide goodwill.

Then their preferences are amplified by a factor $(1 + \alpha\rho)$:

$$U(x,y) = (1+\alpha\rho)z(x) + z(y), \qquad V(x,y) = z(y).$$

The politician's objective (schools only) becomes:

$$\max_{s_1,s_2} \ \rho\frac{1+\alpha\rho}{\sigma_1}\,z(s_1) + (1-\rho)\frac{1}{\sigma_2}\,z(s_2),$$

subject to (BC).

FOCs.

$$\frac{1+\alpha\rho}{\sigma_1}\, z'(s_1) = \lambda, \qquad \frac{1}{\sigma_2}\, z'(s_2) = \lambda.$$

Hence,

$$z'(s_1) = \frac{\lambda\sigma_1}{1+\alpha\rho}, \qquad z'(s_2) = \lambda\sigma_2.$$

Allocation rule. Comparing,

$$s_1 > s_2 \quad \Longleftrightarrow \quad \frac{1+\alpha\rho}{\sigma_1} > \frac{1}{\sigma_2}.$$

That is,

$$(1+\alpha\rho) > \frac{\sigma_1}{\sigma_2}. \tag{3}$$

Interpretation: The left-hand side is an altruism multiplier that increases minority political weight, while the right-hand side is the relative noisiness of minority vs. majority. Altruism can therefore offset a responsiveness disadvantage ($\sigma_1 > \sigma_2$).

Implications.

- Without altruism ($\alpha = 0$): minorities get more schools iff $\sigma_1 < \sigma_2$.
- With altruism: condition (3) applies, allowing minorities to gain even if they are noisier.
- Altruism is most effective when ρ is small, since

$$\frac{\partial}{\partial\rho}\ln(1+\alpha\rho) = \frac{\alpha}{1+\alpha\rho} \quad \downarrow \rho.$$

  Thus, small but cohesive minorities can gain disproportionately.

4.6 Summary

The model highlights two mechanisms by which minorities attract public goods: (i) electoral responsiveness (low σ_1), and (ii) cross-village solidarity (high α). Either mechanism increases the relative weight of minorities in politicians' objective, raising their share of school allocations.

5 Empirical Strategy

The main continuous Difference-in-Differences regression equation is:

$$\begin{aligned} \mathrm{Y}_{vcst} = \beta_0 &+ \beta_1\Big(\Delta\text{AC Muslim Share}_{vct} \times \text{Village Muslim Share}_{v} \times \text{Delimitation}_{st}\Big) \\ &+ \beta_2\Big(\Delta\text{AC Muslim Share}_{vct} \times \text{Village Muslim Share}_{v}\Big) \\ &+ \beta_3\Big(\Delta\text{AC Muslim Share}_{vct} \times \text{Delimitation}_{st}\Big) \\ &+ \beta_4\Big(\text{Village Muslim Share}_{v} \times \text{Delimitation}_{st}\Big) \\ &+ \gamma_{t,s} + \lambda_v + \epsilon_{vcst} \end{aligned} \tag{1}$$

where:

- Δ AC Muslim Share$_{vct}$ = (Muslim population share in AC c of village v post delimitation) - (Muslim population share in AC c' of village v pre delimitation)
- $Delimitation_t$ takes value one once delimitation is announced, zero otherwise.
- $\gamma_{t,s}$ represents year $\times$ state fixed effects,
- λ_s represents village fixed effects,
- ϵ_{vcst} is the error term, clustered at the village level.

The fixed effects ensure that certain types of variation are absorbed, preventing them from biasing the estimated effect of the interaction term. The village fixed effects (λ_v) absorb all time-invariant village characteristics, meaning that any pre-existing differences across villages that do not change over time, such as historical levels of school provision, geographic factors, or long-standing community characteristics, will not influence the estimation of β_1.

The year $\times$ state fixed effects ($\gamma_{t,s}$) capture all time-varying shocks that are common within a state in a given year, such as state-wide education policies, budget allocations, or macroeconomic trends.

As a result of these fixed effects, any variation in school provision that is purely driven by village-specific or by state-level trends over time, is absorbed. The remaining variation used to estimate β_1 comes from within-village changes due to delimitation and the shift in political accountability. This ensures that the identification strategy isolates the effect of the

triple interaction term -ΔAC Muslim Share$_{vct}$ $\times$ Village Muslim Share$_{vct}$ $\times$ Delimitation$_{vct}$, on school provision, rather than picking up spurious correlations driven by broader trends or unobserved heterogeneity.

$VillageMuslimShare_v$ does not vary because it was recorded only at one point in time (2013). I interact with this to acccount for variation in the population share at the village level. In my main specification, I use the announcement of delimitation in 2008 rather than its implementation. This is because the new constituency boundaries became public knowledge in 2008, giving politicians a strong incentive to begin redirecting resources in anticipation of upcoming elections. Nonetheless, the results remain robust even when I use delimitation implementation, a staggered treatment, as shown in Table 9.

On the left hand side I use a switch variable which takes value one once a public good (school, road or electrification) is established in village v, of AC c in year t, otherwise zero. This variable stays 1 for the consecutive periods. The use of a switch variable, rather than a flow variable, is particularly suited for studying this type of long-term institutional or policy changes that have a persistent effect over time. This captures whether a village received a school in a given year and retains that status thereafter, reflecting the structural nature of school openings as a largely irreversible event. This is in contrast to a flow variable, which would measure the annual rate of new school establishments but would not adequately capture the cumulative and lasting impact of school expansion. Most villages have only one school, and once they get a school, the probability of getting another school is very low. Since the presence of a school in a village is not a temporary or transient phenomenon but a permanent shift in the local education landscape, a switch variable ensures that the estimation accounts for the enduring availability of schooling opportunities rather than short-term fluctuations in school openings. Moreover, a switch specification aligns better with the panel structure of the data, where the focus is on whether and when a village transitions into having a school, rather than the year-to-year variation in the number of new schools being built. In the context of roads, it essentially captures when was the first road built in a village.

The triple interaction term captures the differential increase in probability of school establishment after 2008 in villages with higher Muslim share, in ACs that saw greater Muslim population increases. It is a projected treatment effect conditional on dose. This is typical when treatments are continuous or vary in intensity. Specifically, it identifies whether the impact of delimitation is stronger in villages with higher baseline Muslim population shares, located in Assembly Constituencies where the Muslim population share increased as a result of redistricting. A significant coefficient on this term indicates a heterogeneous

treatment effect, i.e., delimitation does not affect all areas equally, but its influence depends on both the local demographic composition and the political realignment caused by boundary changes. This term reflects a form of dose–response relationship, where the dose is the combined intensity of village-level Muslim population and the constituency-level shift in Muslim population.

6 Results

6.1 Correlational Evidence

The results in Table 1 for the year 2000, indicate that villages with higher Muslim population shares tend to have fewer government and private schools, but more Madarsas. The strongest negative effects are for government schools, suggesting a significant disparity in formal educational infrastructure in Muslim-concentrated villages. A 100 percent Muslim village is 16.8 percentage points less likely to have a government primary school, and 17.7 percentage points less likely to have a government above-primary school, compared to a 0 percent Muslim village, holding population and other controls constant. However, I do not find a bias in the provision of paved roads and electrification across Muslim villages from 2001 census.

The effect is weaker for private schools, where decisions are more market-driven rather than state-dependent. Moreover, the positive and significant coefficients on total population suggest that overall village size is a strong determinant of school openings, implying that larger villages, regardless of religious composition, are more likely to receive new schools. However, even after accounting for population size, Muslim-majority villages appear disadvantaged in the expansion of government schooling.

Chattopadhyay and Duflo (2004) highlight that when women take leadership roles, their policy preferences, reflect the genuine needs of their communities. Just as women in leadership roles reflect the needs of women in their communities, it is essential to examine whether Muslims in rural areas, truly see schools and roads as a key development priority. I do this by examining data from the Rural Economic and Demographic Survey (REDS), 2006. It surveyed 259 villages across India on a wide range of information on local governance, education, and social dynamics. The survey asks respondents to rank the importance of various public goods, including drinking water, sanitation, roads, and schools, on a scale from 1 to 4, with 1 indicating least important and 4 indicating extremely important. I look at the correlation between this rank and Muslim Population in the village, controlling for

block fixed effects and village population. In Table 2, a higher proportion of Muslims in the village is significantly associated with an increase in the ranking of the importance for schools, however, not for roads and electrification. This is likely because Muslim villages were not initially disadvantaged in terms of road and electricity provision, as shown in Table 1, but they faced discrimination in school provision.

6.2 DiD Results

The timing of delimitation implementation across various Indian states varies due to the scheduling of state elections. Although the delimitation was announced in 2008, it got implemented only in the next state election cycle. For example, in the state of Uttar Pradesh, since elections were held in 2007, delimitation was not implemented until 2012. However, post 2008, the new AC boundaries became public knowledge. Therefore, the incumbent MLAs could have swayed the provisioning of new government above primary schools in such a manner that they can be re-elected from the new AC. For my primary results, I only look at the delimitation announcement, however, results for delimitation implementation, which are similar, are discussed in the appendix.

The positive and significant effects of the triple interaction for both government primary and above-primary schools in Table 4 suggest that political redistricting and shifting demographic patterns, particularly increases in Muslim voter concentration, have played a role in expanding state-provided education. This expansion appears to be driven by two reinforcing mechanisms. First, data from the Rural Economic and Demographic Survey (REDS) indicate that Muslim communities place a high value on schooling, making education a politically prominent demand in Muslim-concentrated constituencies. Second, the increase in government school provision may reflect a corrective policy response to the historical underprovision of educational infrastructure in Muslim areas. In contrast, no significant effects are observed for private schools, either at the primary or above-primary level, suggesting that private provision is less sensitive to changes in political representation or constituency boundaries and more responsive to market forces. I do not find any significant results for rural roads and electrification in Table 5, likely because there was no historical bias in road provision that needed correction. To explore this further, I split the rural roads sample in three ways: (i) restricting it to villages that did not have a paved road in the 2001 Census, (ii) restricting it to states that complied with the government's population-based eligibility thresholds for road provisioning, and (iii) applying both restrictions simultaneously. Across all these subsamples, the results remain insignificant. This reinforces the conclusion that,

unlike school provision, rural road access and electrification was not shaped by patterns of exclusion or post-delimitation political incentives, there was simply no bias to begin with that required correction.

For a causal impact to exist, this should satisfy the parallel trends assumption. It states that in the absence of delimitation, the trends in school establishment across villages with different Muslim population shares (both at the village and AC levels) would have evolved similarly. This ensures that any observed post-delimitation divergence in school openings is attributable to the electoral boundary changes rather than pre-existing differences in trend trajectories. Parallel trends are plotted in Figures 2 to 9. The parallel trends assumption appears to hold for government above-primary schools. For government primary schools, however, there is evidence of a mild pre-trend. Following delimitation, there is a significant and sustained increase in the provision of above-primary government schools. If a 100 percent Muslim village, shifts to a constituency where the Muslim population share increased by 1 percentage point due to delimitation, it raises the probability of getting a primary school by 0.24 percentage point, and an above-primary school by 0.191 percentage point. Relative to the mean, this is equal to 1 percent and 1.4 percent increase, respectively.

Overall, these findings indicate that shifts in the Muslim population share at the AC level resulting from delimitation, influenced the establishment of government above-primary schools, potentially reflecting a policy response to changing electoral dynamics. However, the lack of a comparable effect for other types of schools highlights that this relationship is specific to government provision, an area where politicians have greater influence compared to private education.

6.3 Mechanisms

Table 6 presents the impact of delimitation implementation on the electoral outcomes of Muslim candidates. The dependent variables are the share of contesting Muslim MLA candidates, the probability of a Muslim candidate winning, and the probability of a Muslim candidate being the runner-up. The provision of schools could increase through two mechanisms:

1. More muslim MLAs are elected in Muslim dominated ACs, and therefore it increases the provision of government schools in the villages.

2. Although more muslim MLAs are not elected, simply the increase in vote share of muslims at the AC level, increases their weight in the electorate.

The coefficient on $Delimitation \times \Delta Muslim_{ac}$ is positive and statistically significant across all three specifications. This indicates that following delimitation, ACs that experienced an increase in their Muslim population share also saw a greater share of contesting Muslim candidates, a higher likelihood of Muslim candidates winning, and an increased probability of a Muslim candidate securing the runner-up position. The effect is particularly strong for the probability of a Muslim candidate winning and the probability of a Muslim candidate being the runner-up, suggesting that an increase in the Muslim population share at the AC level post-delimitation is strongly associated with improved electoral prospects for Muslim candidates. A 1 percentage point increase in Muslim population share in an AC after delimitation is associated with an increase of 0.86 percentage points in the share of contesting candidates who are Muslim, 0.995 percentage point increase in the probability that a Muslim candidate wins and a 1.407 percentage point increase in the probability that a Muslim candidate finishes second.

This evidence is consistent with the citizen-candidate logic (Osborne and Slivinski, 1996): as minority population shares rise, more individuals from the community contest, and some succeed. At the same time, the patterns do not contradict the probabilistic voting model that anchors our analysis. Instead, they reinforce it. In the probabilistic voting model, the participating pool of candidates is basically taken as fixed, all the action is about policy choice once they're in. But when you see that more Muslim MLAs are being elected as Muslim population share rises, that suggests that the pool of viable candidates is itself shifting. What matters for a politician's allocation decision is the expected vote share as a function of different groups' utilities. A potential concern is that if the pool of contesting candidates shifts, for instance, if more Muslim candidates begin to contest as the Muslim population share rises, the framework may no longer apply. However, this is not the case. Instead, changes in the candidate pool translate into changes in the mapping from group utilities to vote shares. When more Muslim candidates contest, the dispersion of preferences within the Muslim electorate (σ_1) may shrink, because voters perceive a closer alignment between their preferences and at least one viable candidate. This makes the group more responsive in the sense of the probabilistic model. Moreover, the entry of Muslim candidates raises the baseline probability that Muslims' preferred policies will be credibly supplied, which effectively strengthens the weight politicians attach to Muslim votes in their maximization problem. From the perspective of the model, this is equivalent to an endogenous shift in its parameters: a higher ρ (population share) directly increases the political weight of Muslims, while candidate entry tightens their effective responsiveness. Thus, even though candidate entry resembles a 'citizen-candidate' mechanism, it is fully compatible with the probabilistic voting framework: the politician's problem remains unchanged, but the effective distribution

of voter responsiveness shifts in favor of Muslims. The result is the same prediction - as the Muslim population share increases, whether through changing incentives of existing candidates or through the entry of new Muslim candidates, resources are reallocated toward Muslim villages.

7 Conclusion

Conclusion

This paper shows that redistricting, even in a seemingly non-partisan context, can have meaningful consequences for the provision of public goods to minority communities. When minorities are packed or cracked across constituencies, it affects local politicians' allocation of resources. Using the 2008 redistricting in India as a natural experiment, I demonstrate that increases in Muslim concentration at the constituency level led to a higher likelihood of school provision in high-Muslim villages, while other public goods such as roads and electrification were largely unaffected. These findings carry important policy implications: in India, the upcoming nationwide delimitation post-2026 could reshape minority access to local public services. Internationally, similar dynamics can arise in multi-ethnic democracies, even in the absence of partisan bias such as the Canada, UK, Australia, etc. where redistricting can influence not only political representation but also distributive outcomes for minority groups.

Theoretically, I develop a probabilistic voting model that captures the mechanisms through which minority concentration affects public goods allocation. The model highlights that schools are allocated preferentially to minorities when their constituency level population increases, particularly if minority voters are cohesive (low dispersion of preferences) or if there is altruistic solidarity within the community. By explicitly incorporating population share, voter responsiveness, and political discretion, the framework rationalizes the empirical results. The model also demonstrates how changes in these parameters, such as through the entry of minority candidates or increased voter mobilization, can amplify resource allocation to minority-favored goods.

Importantly, this structural framework allows for counterfactual analysis: it can be used to predict how different redistricting scenarios, even in the absence of partisan intent, would alter the distribution of public services. In doing so, it provides a tool for policymakers to anticipate the distributive consequences of delimitation exercises and to design interventions

that mitigate historical disadvantages for marginalized communities. Overall, the paper underscores that minority welfare in democracies is shaped not only by formal institutional arrangements but also by subtle shifts in political geography, making careful consideration of electoral boundaries critical for equitable public service provision.

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Figures and Tables

Figure 1: Multi-tiered political and administrative structure in India

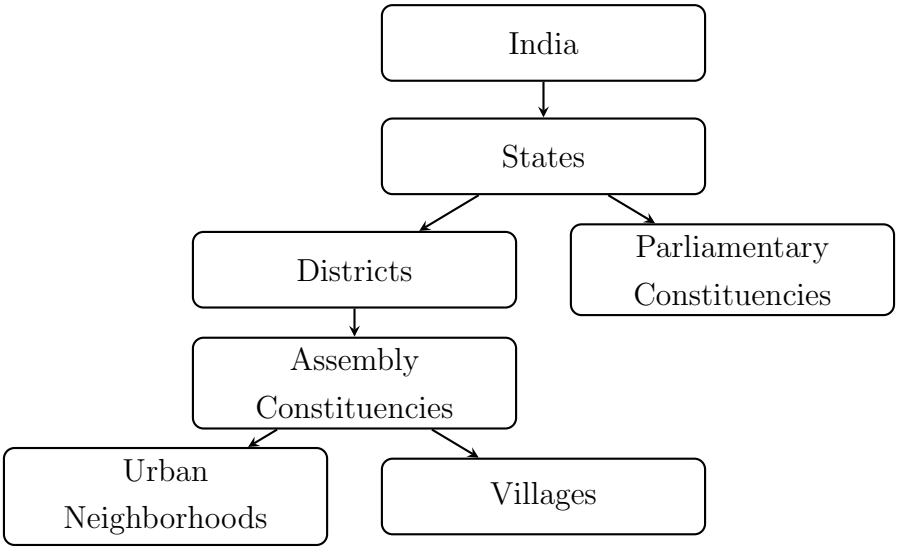


Table 1: Public Goods Provision in Villages in 2000

	(1) Govt. Primary	(2) Govt. Above Primary	(3) Pvt. Primary	(4) Pvt. Above Primary	(5) Madarsa	(6) Paved Road	(7) Electrification
$Muslim_v$	-0.168***	-0.177***	-0.00746*	-0.0570***	0.141***	0.00297	-0.0101
	(0.0135)	(0.0110)	(0.00380)	(0.00602)	(0.00532)	(0.00821)	(0.00733)
$Total\ Population_v$	0.000181***	0.000198***	0.0000231***	0.0000649***	0.00000871***	0.0000529***	0.0000131***
	(0.00000281)	(0.00000226)	(0.000000853)	(0.00000139)	(0.000000543)	(0.00000073)	(0.000000699)
Observations	208604	208604	208604	208604	208604	207243	165727
R-squared	0.300	0.414	0.0923	0.147	0.119	0.2711	0.616
Mean	0.822	0.555	0.0319	0.0788	0.0119	0.576	0.786

Standard errors in parentheses

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

Note: This table presents the baseline correlation between school and road provision in villages as of the year 2000. The results indicate that villages with higher Muslim population shares are less likely to have government and private schools. In contrast, there is no significant relationship between the Muslim population share in a village and the provision of paved roads or electrification. Standard errors are clustered at the district level.

Table 2: What do Muslims consider important?

	(1) Schools	(2) Roads	(3) Electrification
Muslim Share	0.0116*	-0.00263	0.00419
	(0.00622)	(0.0132)	(0.00738)
Observations	146	146	146
R-squared	0.650	0.563	0.686
Mean	2.384	2.610	2.048

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: This table, based on REDS data, demonstrates that villages with a higher Muslim population place greater importance on schools, whereas no significant relationship is observed for roads and electrification. This finding suggests that Muslim communities prioritize access to schools, reflecting a demand for resources they currently lack. Standard errors are clustered at the block level.

Table 3: Delimitation Announcement - School Outcomes

	(1) Govt. Primary	(2) Govt. Above Primary	(3) Pvt. Primary	(4) Pvt. Above Primary	(5) Madarsa
Delimitation Announcement $\times \Delta Muslim_{ac}$	-0.0344	-0.0593**	0.0312	0.0154	-0.0225
	(0.0346)	(0.0295)	(0.0262)	(0.0253)	(0.0139)
Delimitation Announcement $\times Muslim_v$	0.0889***	0.0445***	0.0358***	0.0329***	0.154***
	(0.00526)	(0.00423)	(0.00341)	(0.00332)	(0.00364)
Delimitation Announcement $\times Muslim_v \times \Delta Muslim_{ac}$	0.240*	0.191**	-0.0138	0.0150	0.134
	(0.123)	(0.0919)	(0.0848)	(0.0832)	(0.0914)
Observations	4589354	4589354	4589354	4589354	4589354
R-squared	0.800	0.779	0.732	0.729	0.686
Mean	0.238	0.137	0.105	0.0920	0.0122

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: This table estimates the impact of concentrating more high-Muslim villages within a constituency on outcomes in those villages. The triple interaction term indicates that, following delimitation announcement, high-Muslim villages assigned to constituencies with increased Muslim population shares experienced a rise in the provision of government primary and above-primary schools. Above-primary schools are defined as those offering education beyond grade 5. No significant effects are found for private schools or madarsas. The specification includes village fixed effects and state-by-year fixed effects. Standard errors are clustered at the village level.

Table 4: Delimitation Announcement - School Outcomes

	(1) Govt. Primary	(2) Govt. Above Primary	(3) Pvt. Primary	(4) Pvt. Above Primary	(5) Madarsa
Delimitation Announcement $\times\Delta Muslim_{ac}$	-0.0344	-0.0593**	0.0312	0.0154	-0.0225
	(0.0346)	(0.0295)	(0.0262)	(0.0253)	(0.0139)
Delimitation Announcement $\times Muslim_v$	0.0889***	0.0445***	0.0358***	0.0329***	0.154***
	(0.00526)	(0.00423)	(0.00341)	(0.00332)	(0.00364)
Delimitation Announcement $\times Muslim_v \times \Delta Muslim_{ac}$	0.240*	0.191**	-0.0138	0.0150	0.134
	(0.123)	(0.0919)	(0.0848)	(0.0832)	(0.0914)
Observations	4589354	4589354	4589354	4589354	4589354
R-squared	0.800	0.779	0.732	0.729	0.686
Mean	0.238	0.137	0.105	0.0920	0.0122

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: This table estimates the impact of concentrating more high-Muslim villages within a constituency on outcomes in those villages. The triple interaction term indicates that, following delimitation announcement, high-Muslim villages assigned to constituencies with increased Muslim population shares experienced a rise in the provision of government primary and above-primary schools. Above-primary schools are defined as those offering education beyond grade 5. No significant effects are found for private schools or madarsas. The specification includes village fixed effects and state-by-year fixed effects. Standard errors are clustered at the village level.

Table 5: Rural Road and Electrification

	(1) Road Award	(2) Road Award	(3) Road Award	(4) Road Award	(5) Electrification
Delimitation Announcement $\times\Delta Muslim_{ac}$	0.0433	-0.0338	0.0847	0.000594	-0.0177
	(0.0269)	(0.0503)	(0.0623)	(0.123)	(0.0255)
Delimitation Announcement $\times Muslim_v$	0.0166***	0.0334***	0.0448***	0.0859***	-0.0528***
	(0.00422)	(0.00717)	(0.00974)	(0.0178)	(0.00382)
Delimitation Announcement $\times Muslim_v \times \Delta Muslim_{ac}$	-0.134	0.0815	0.0513	0.186	-0.0607
	(0.101)	(0.176)	(0.265)	(0.475)	(0.0802)
Observations	3331536	1404384	1440112	590240	1733831
R-squared	0.641	0.635	0.651	0.649	0.773
Mean	0.0804	0.125	0.117	0.195	0.571
State Restriction	No	No	Yes	Yes	
Paved road in 2000	No	Yes	No	Yes	

Note: This table examines the impact of packing more high-Muslim villages into a constituency on the provision of rural roads and electrification. The triple interaction term shows no consistent evidence of increased provision of rural roads or electrification in high-Muslim villages following delimitation, even when assigned to constituencies with rising Muslim population shares. For rural roads, I further split the sample by whether a village had an existing paved road in 2000 and by states identified as compliers. Results remain null across these subsamples. The model includes village fixed effects and state-by-year fixed effects. Standard errors are clustered at the village level.

Figure 2: Government Primary Schools

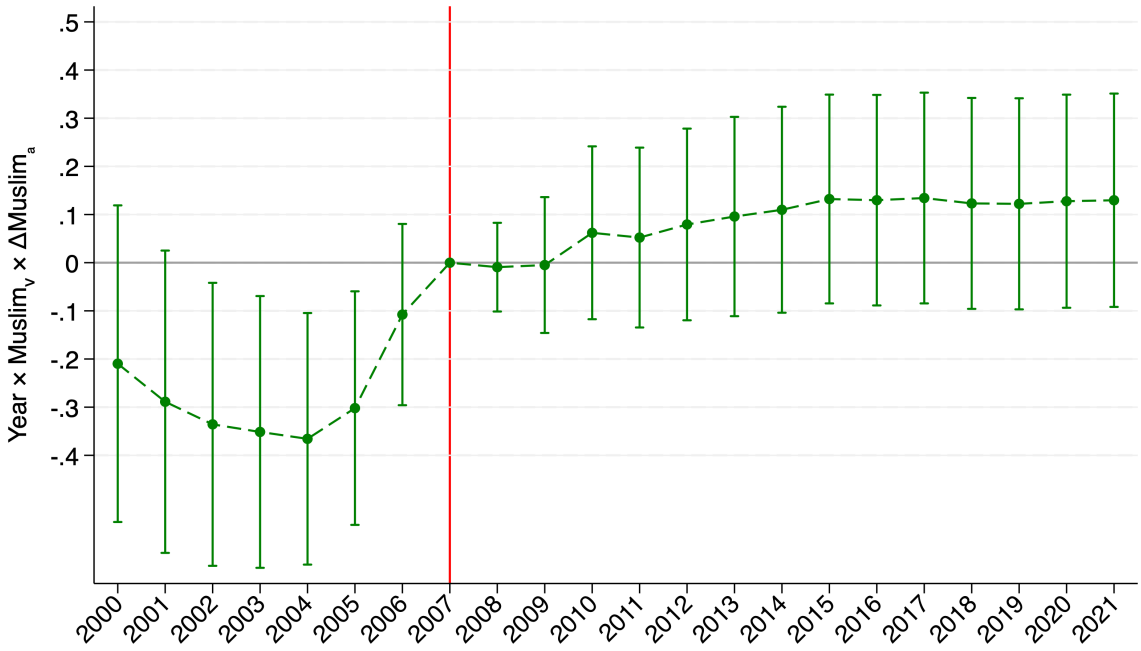


Figure 3: Government Above Primary Schools

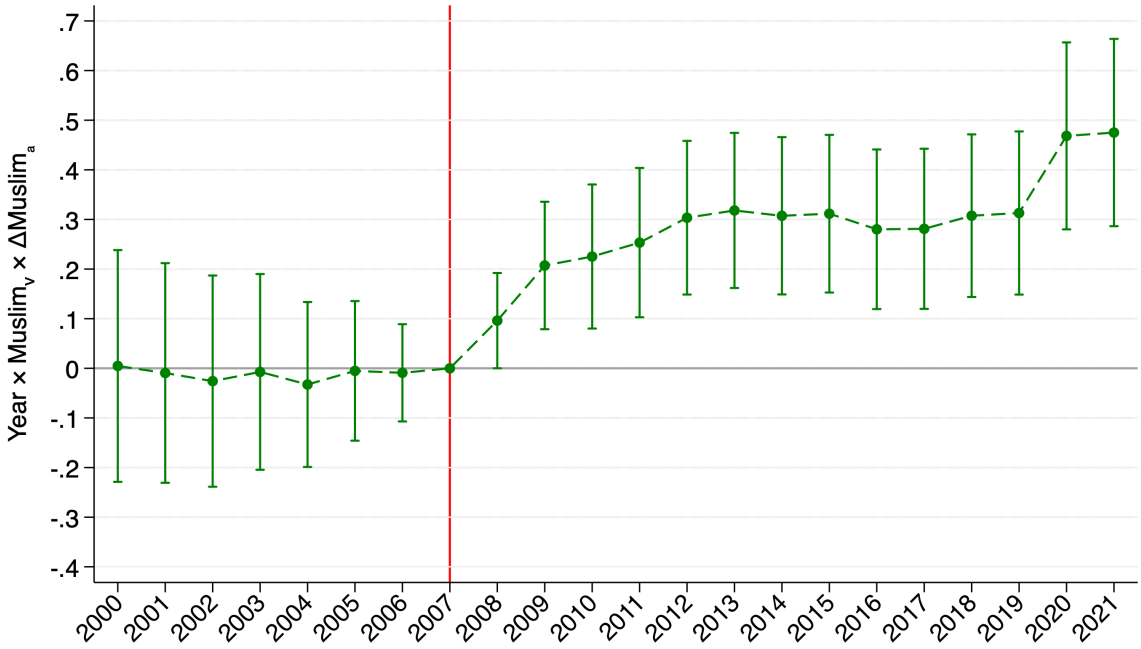


Figure 4: Private Primary Schools

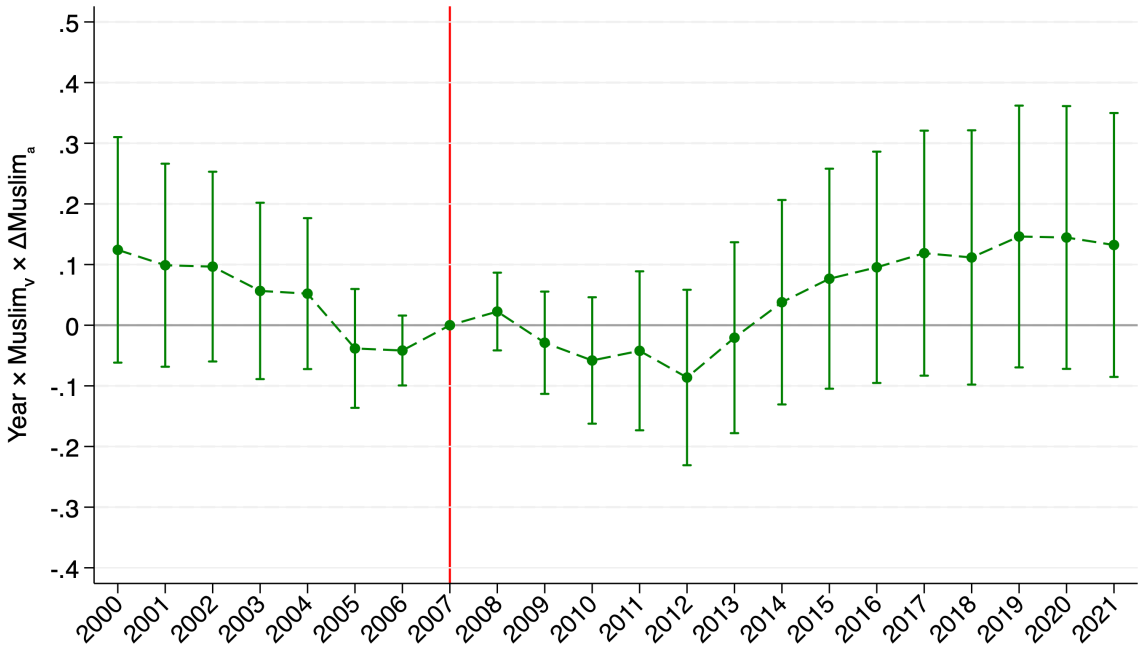


Figure 5: Private Above Primary Schools

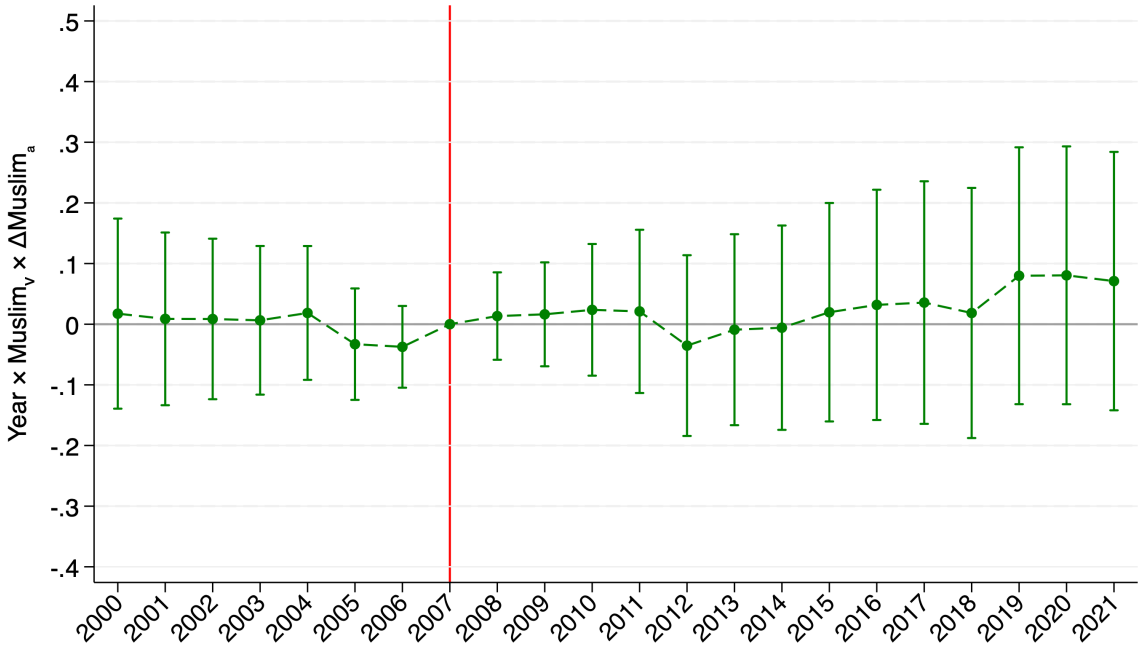


Figure 6: Rural Roads (Full Sample)

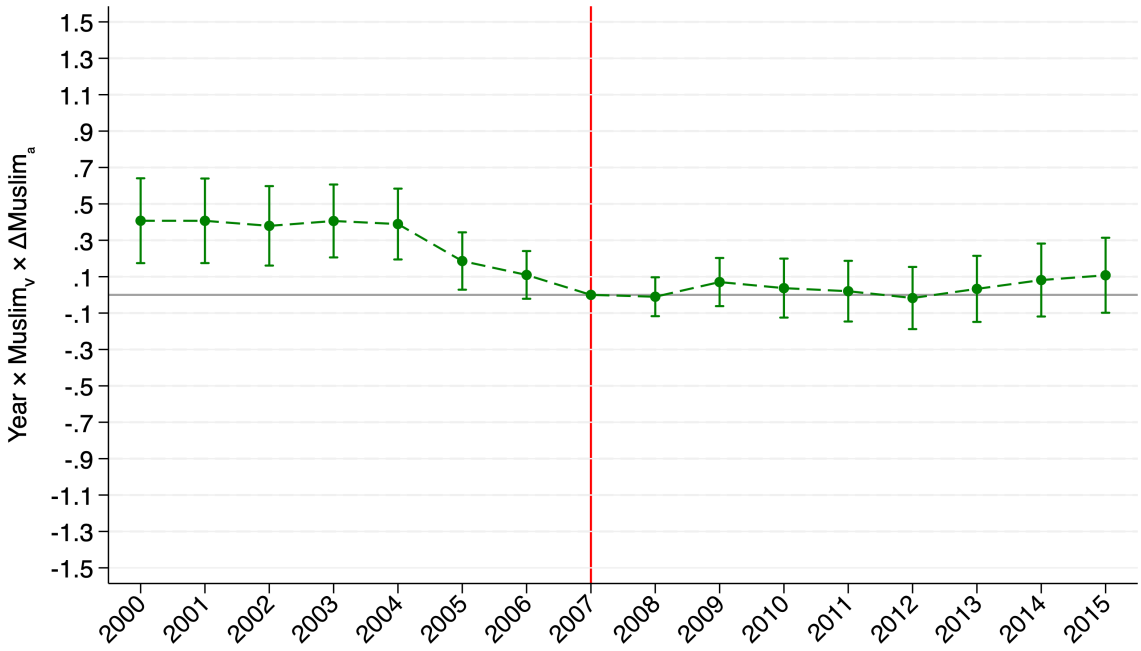


Figure 7: Rural Roads (No Paved Road in 2000)

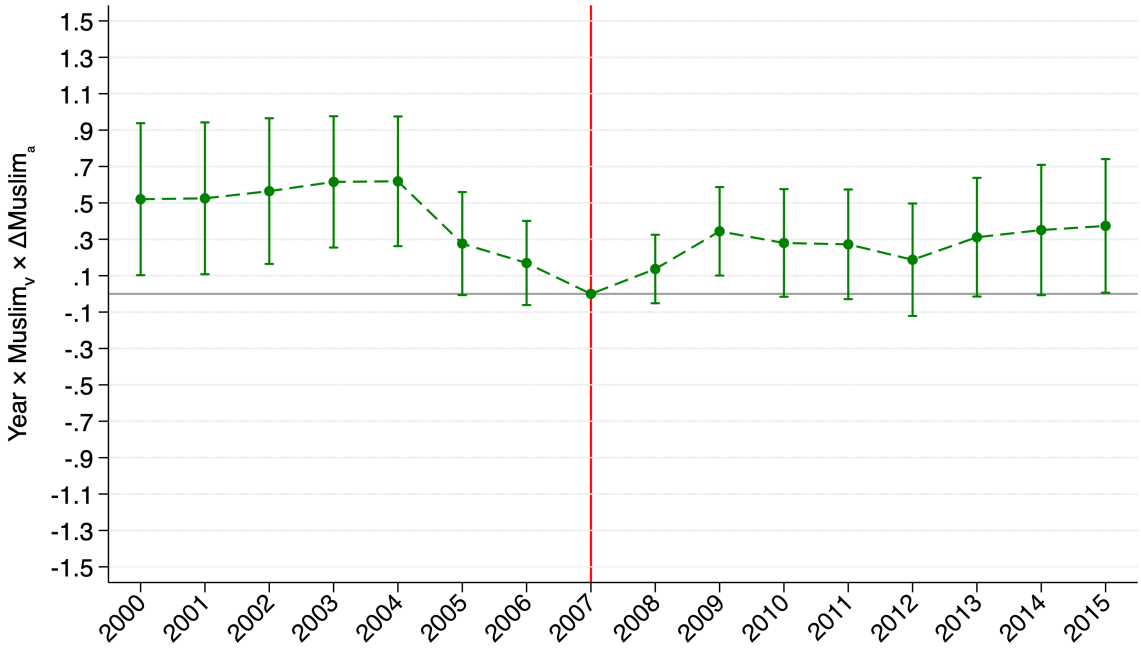


Figure 8: Rural Roads (Complier States)

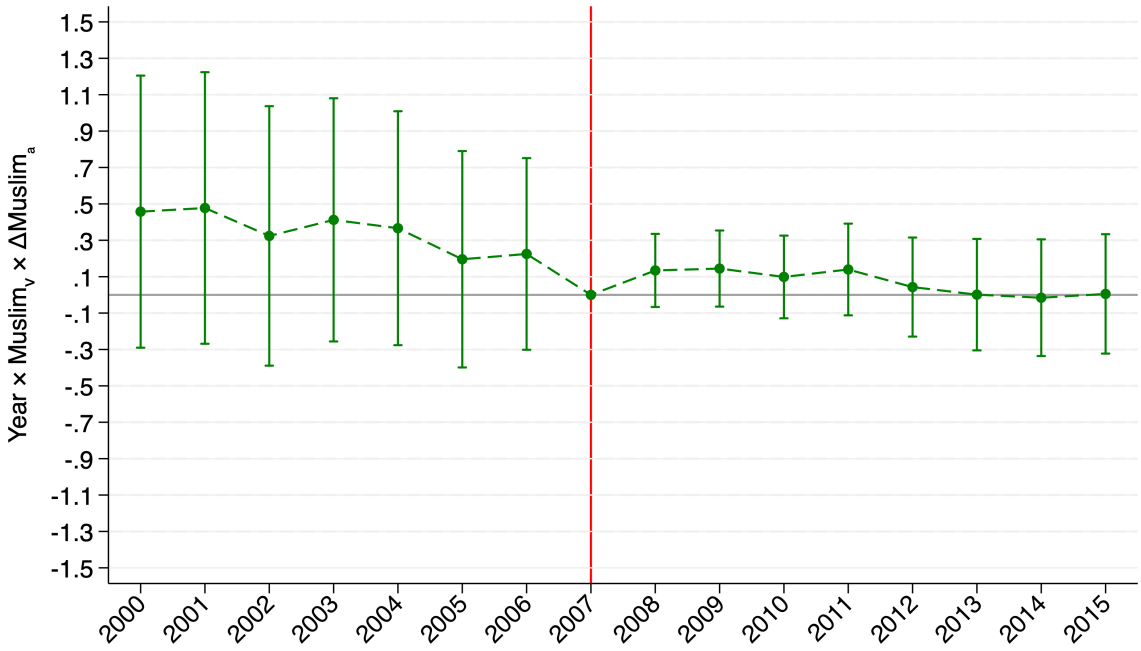


Figure 9: Rural Roads (No Paved Road in 2000 & Complier States)

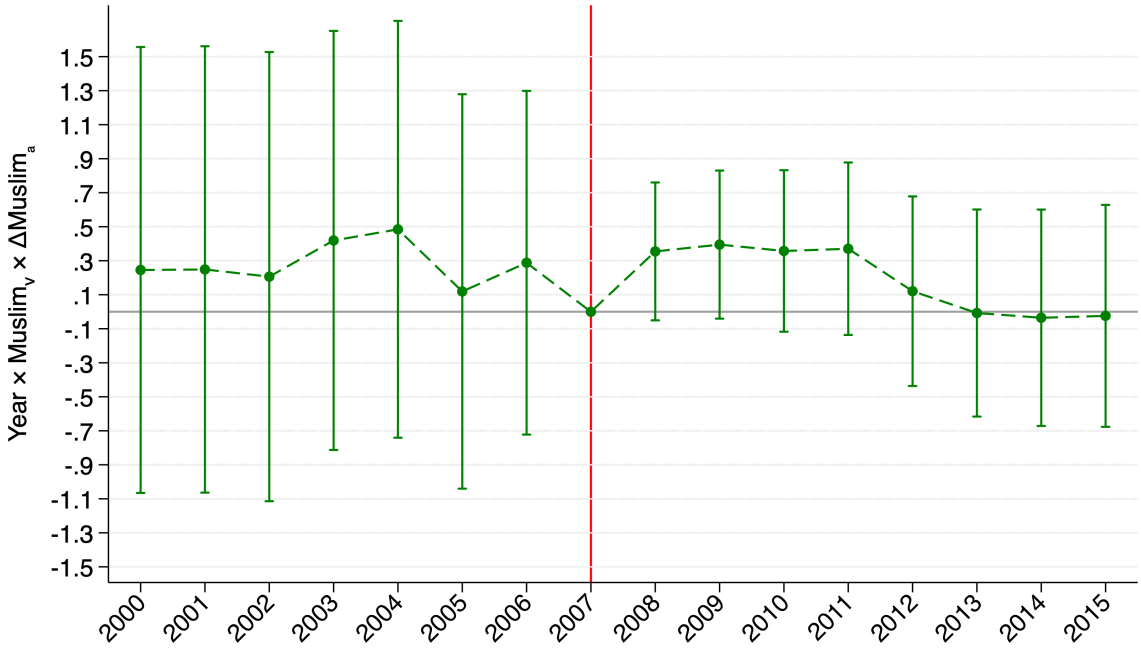


Figure 10: Electrification

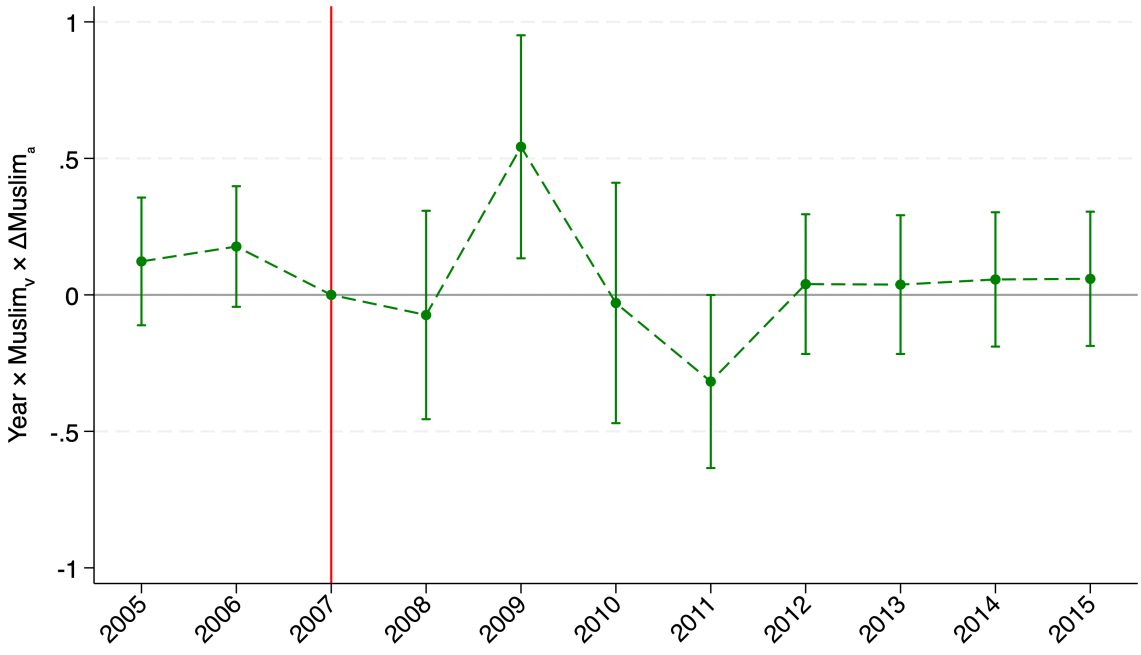


Figure 11: Effect of minority share on allocation to schools when variances are equal. The horizontal axes represent altruism (α) and minority share (ρ), and the vertical axis is the derivative $\frac{dx}{d\rho}$. Green indicates positive values, red indicates zero.

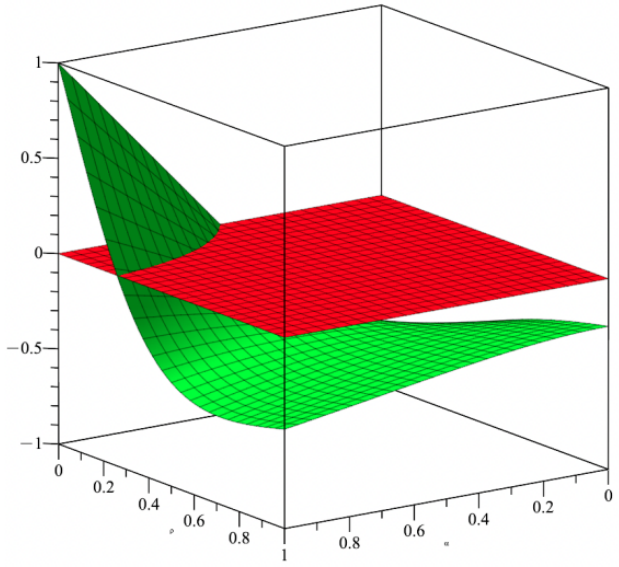


Figure 12: Effect of minority share on allocation to schools without altruism but allowing $\sigma_1 > \sigma_2$. The horizontal axes represent minority variance (σ_1) and minority share (ρ), and the vertical axis is the derivative $\frac{dx}{d\rho}$. Green indicates positive values, red indicates zero.

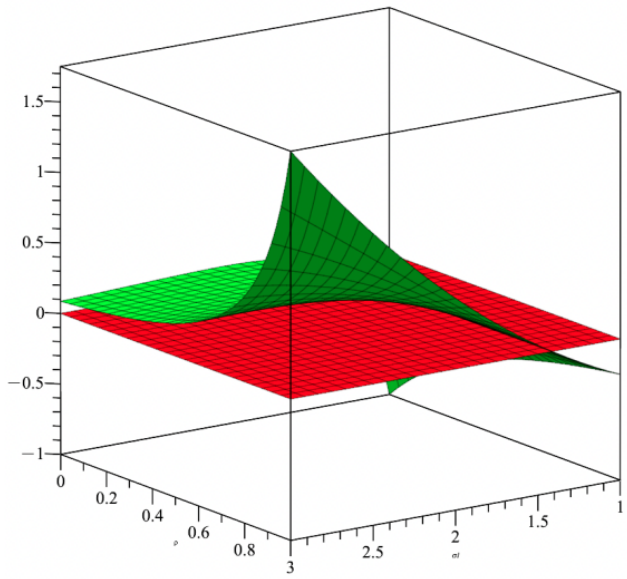


Table 6: MLA Representation

	(1)	(2)	(3)
	Share of Contesting Muslim MLA Candidates	Muslim Winner	Muslim Runner Up
Delimitation Implementation $\times \Delta Muslim_{ac}$	0.864***	0.995***	1.407***
	(64.44)	(27.54)	(38.69)
Observations	6812447	6812447	6812447
R-squared	0.671	0.475	0.424
Mean of Dep. Var	0.0683	0.0561	0.0676

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

*Note:*This table shows that the participation of Muslim politicians increased after delimitation in constituencies that experienced a rise in Muslim population share. I find strong and statistically significant effects for the share of contesting Muslim candidates, Muslim winners, and Muslim runner-ups. The specification includes village fixed effects and state-by-year fixed effects. Standard errors are clustered at the village level.

A Appendix

Table 7: Summary Statistics: Muslim Population Share in Pre-Redistricting Constituencies

Statistic	Muslim AC share (Pre-Redistricting)
Observations	345,669
Mean	0.1153
Std. dev.	0.0874
Variance	0.0076448
Minimum	0
1st percentile	0.0034529
5th percentile	0.0151243
10th percentile	0.0297953
25th percentile	0.0542585
Median (50th percentile)	0.0996155
75th percentile	0.1505254
90th percentile	0.2170137
95th percentile	0.2723416
99th percentile	0.460629
Maximum	0.6797324
Skewness	2.027292
Kurtosis	10.23448

Note: This table presents summary statistics for the Muslim population share in constituencies before redistricting happened. Percentiles and moments are reported. Most constituencies have low Muslim population shares, but a few have very high values, as indicated by the skewness and kurtosis.

Table 8: Summary Statistics: Muslim Population Share in Constituencies Post-Redistricting

Statistic	Muslim AC share (Post-Redistricting)
Observations	345,669
Mean	0.115338
Std. dev.	0.087079
Variance	0.0075828
Minimum	0
1st percentile	0.0038295
5th percentile	0.0134994
10th percentile	0.0298577
25th percentile	0.0549187
Median	0.1001285
75th percentile	0.1499853
90th percentile	0.2225311
95th percentile	0.2700117
99th percentile	0.4390527
Maximum	0.8408305
Skewness	2.001693
Kurtosis	10.12859

Note: This table presents summary statistics for the Muslim population share in constituencies post-redistricting. Percentiles and moments are reported. The distribution remains highly right-skewed, with most constituencies having low Muslim population shares and a few constituencies with very high shares, as indicated by skewness and kurtosis.

Figure A.1: Muslim AC Share pre-redistricting

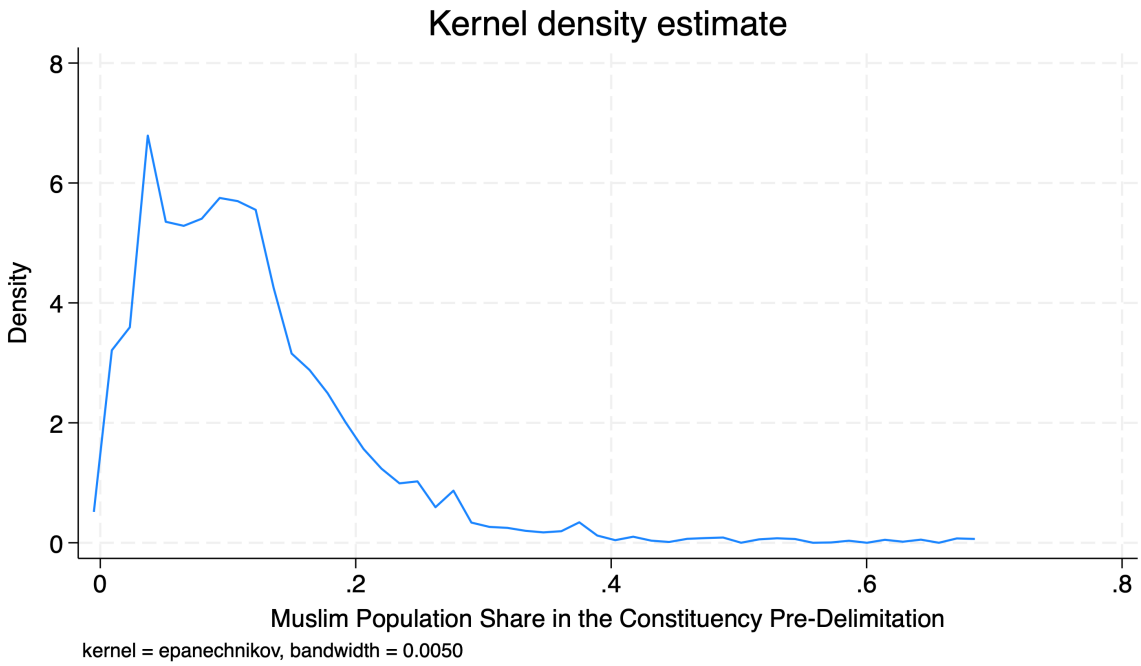


Figure A.2: Muslim AC Share post-redistricting

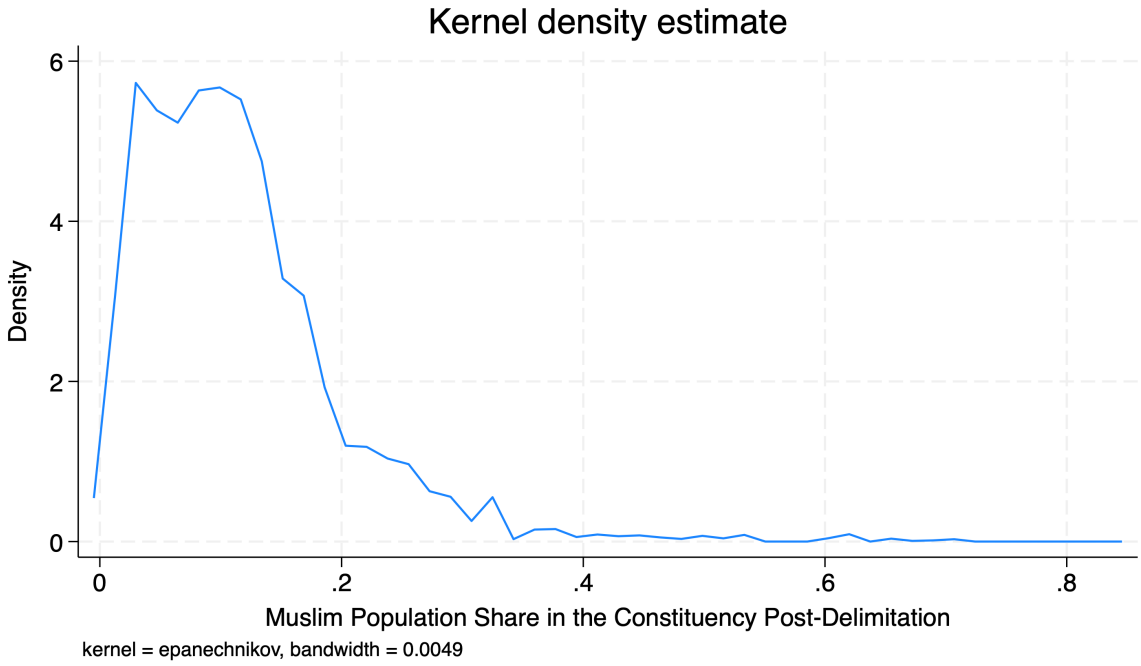


Table 9: Delimitation Implementation

	(1) Govt. Primary	(2) Govt. Above Primary	(3) Pvt. Primary	(4) Pvt. Above Primary	(5) Madarsa
Delimitation Implementation $\times \Delta Muslim_{ac}$	-0.0255	-0.0515**	0.0283	0.0191	-0.0250*
	(0.0302)	(0.0244)	(0.0261)	(0.0253)	(0.0138)
Delimitation Implementation $\times Muslim_v$	0.0761***	0.0406***	0.0383***	0.0328***	0.146***
	(0.00462)	(0.00347)	(0.00337)	(0.00328)	(0.00352)
Delimitation Implementation $\times Muslim_v \times \Delta Muslim_{ac}$	0.197*	0.192***	0.0397	0.00684	0.127
	(0.107)	(0.0733)	(0.0842)	(0.0825)	(0.0854)
Observations	4589354	4589354	4589354	4589354	4589354
R-squared	0.800	0.779	0.732	0.729	0.685
Mean	0.238	0.137	0.105	0.0920	0.0122

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Night Time Lights

	(1) Mean night light in polygon, by year	(2) Mean night light (calibrated) in polygon, by year	(3) Max night light pixel value in polygon
Delimitation Announcement $\times \Delta Muslim_{ac}$	-0.469	0.199	-0.495
	(0.288)	(0.193)	(0.366)
Delimitation Announcement $\times Muslim_v$	0.233***	0.131***	0.286***
	(0.0375)	(0.0258)	(0.0495)
Delimitation Announcement $\times Muslim_v \times \Delta Muslim_{ac}$	-0.781	-0.496	-1.251
	(1.039)	(0.677)	(1.291)
Observations	2920470	2920470	2920470
R-squared	0.876	0.912	0.874
Mean	3.620	4.154	5.153

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure A.3: Government Primary Schools

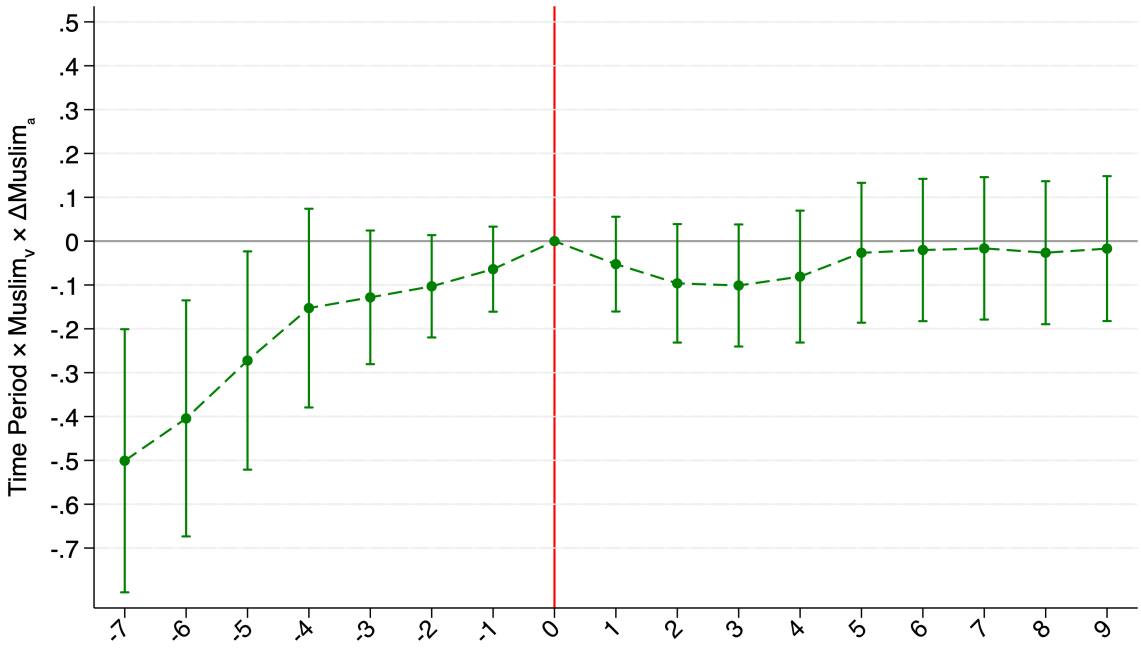


Figure A.4: Government Above Primary Schools

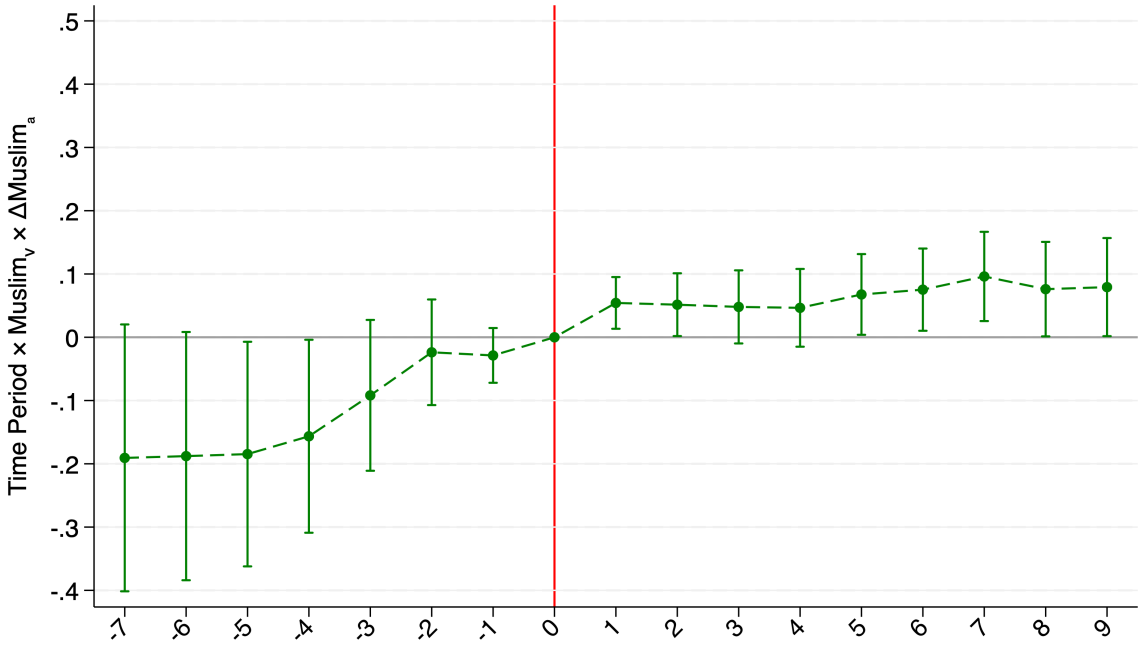


Figure A.5: Private Primary Schools

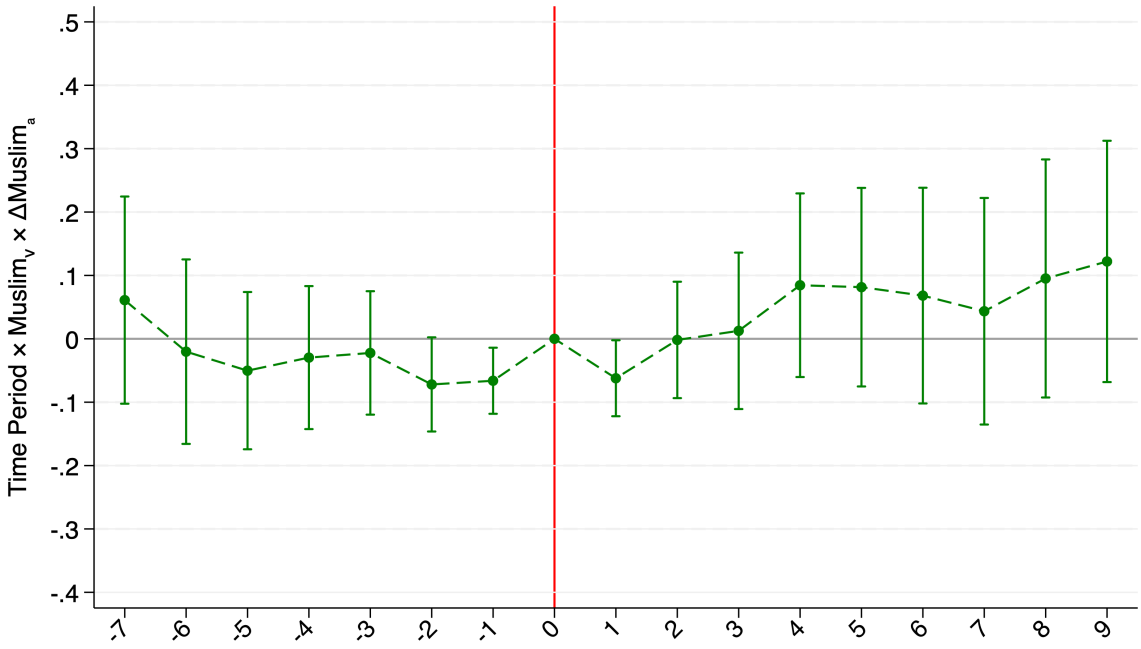


Figure A.6: Private Above Primary Schools

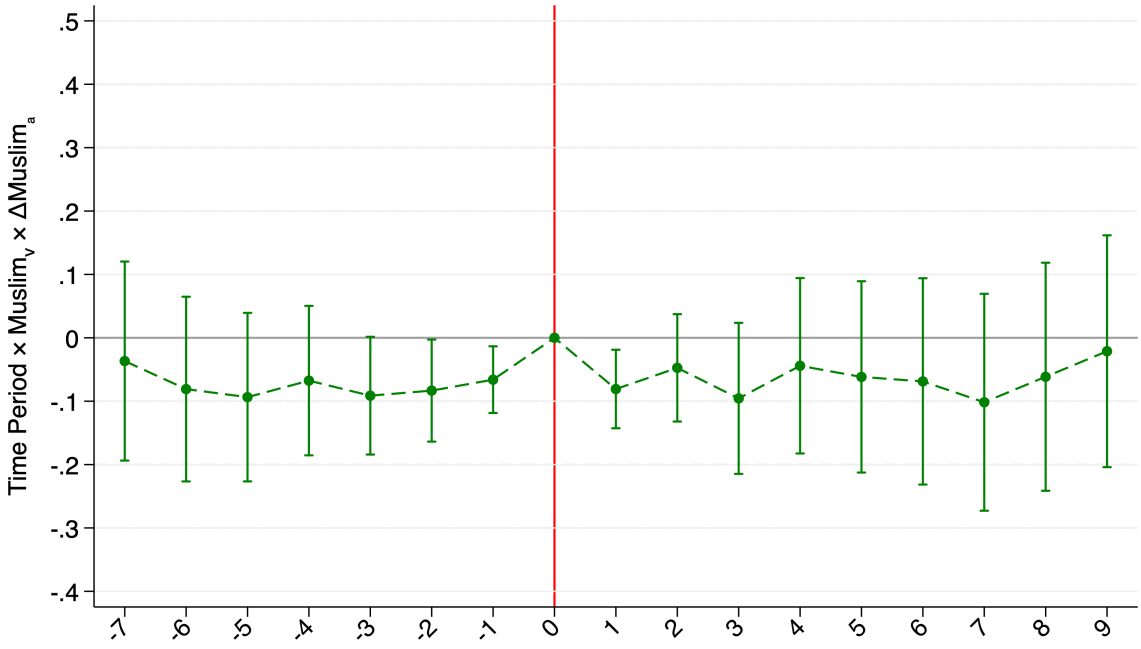


Figure A.7: Kernel Density Plot for $Muslim_v$

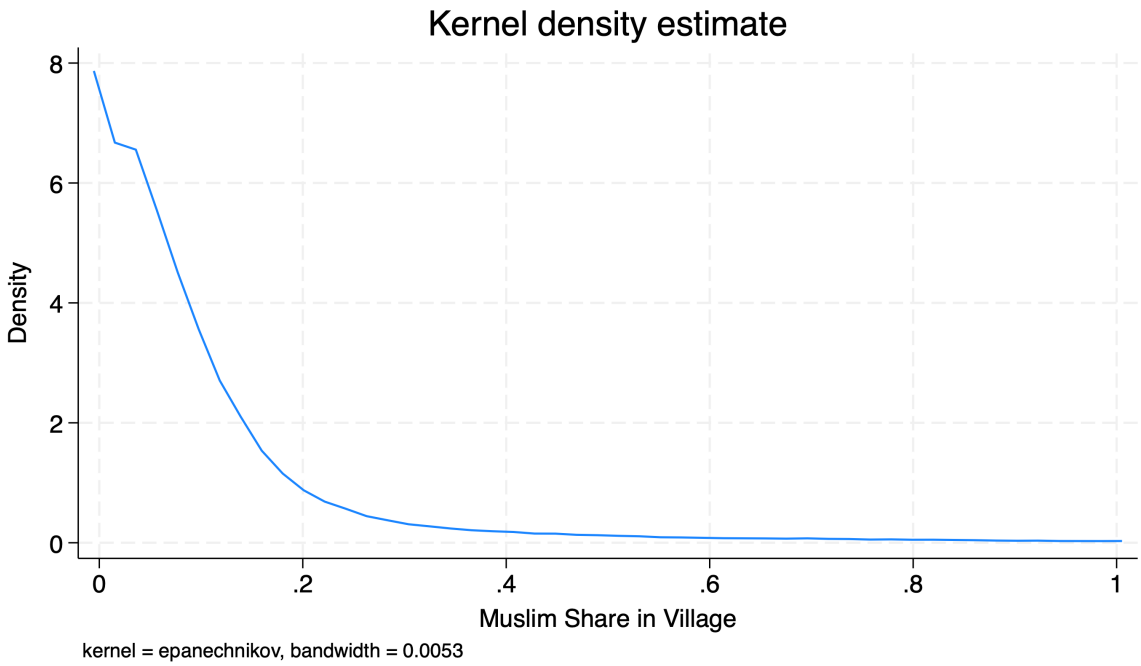
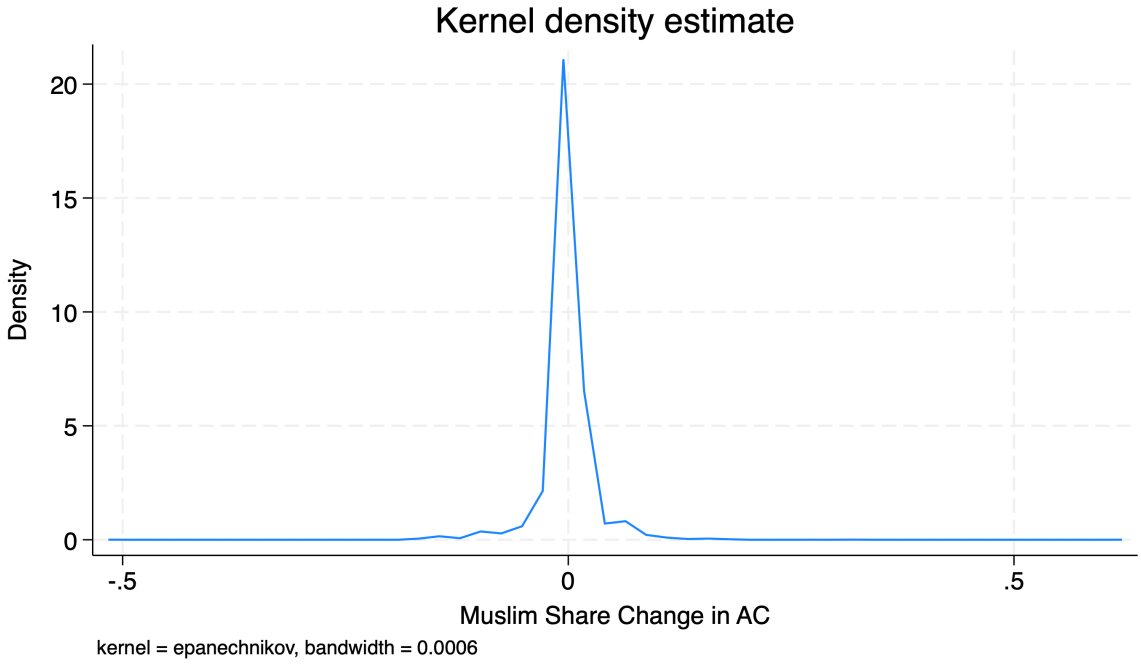


Figure A.8: Kernel Density Plot for $\Delta Muslim_{ac}$



A.1 Compactness Measures

I use two standard measures to quantify the geographic compactness of electoral constituencies:

- **Polsby-Popper Score:** This metric is defined as

$$\text{Polsby-Popper} = \frac{4\pi \times \text{Area}}{\text{Perimeter}^2},$$

  where the area and perimeter correspond to the constituency's geographic shape. Values closer to 1 indicate higher compactness, while values near 0 indicate irregular or elongated shapes. I use a cutoff of 0.2 to identify low-compactness constituencies.

- **Convex Hull Ratio:** This ratio is given by

$$\text{Convex Hull Ratio} = \frac{\text{Area of constituency}}{\text{Area of its convex hull}},$$

  which measures how closely the constituency approximates a convex shape. Ratios closer to 1 suggest more convex and compact boundaries, whereas lower values indicate irregular or concave shapes. I set a cutoff of 0.6 for this measure.

Figure A.9: Convex Hull Ratio

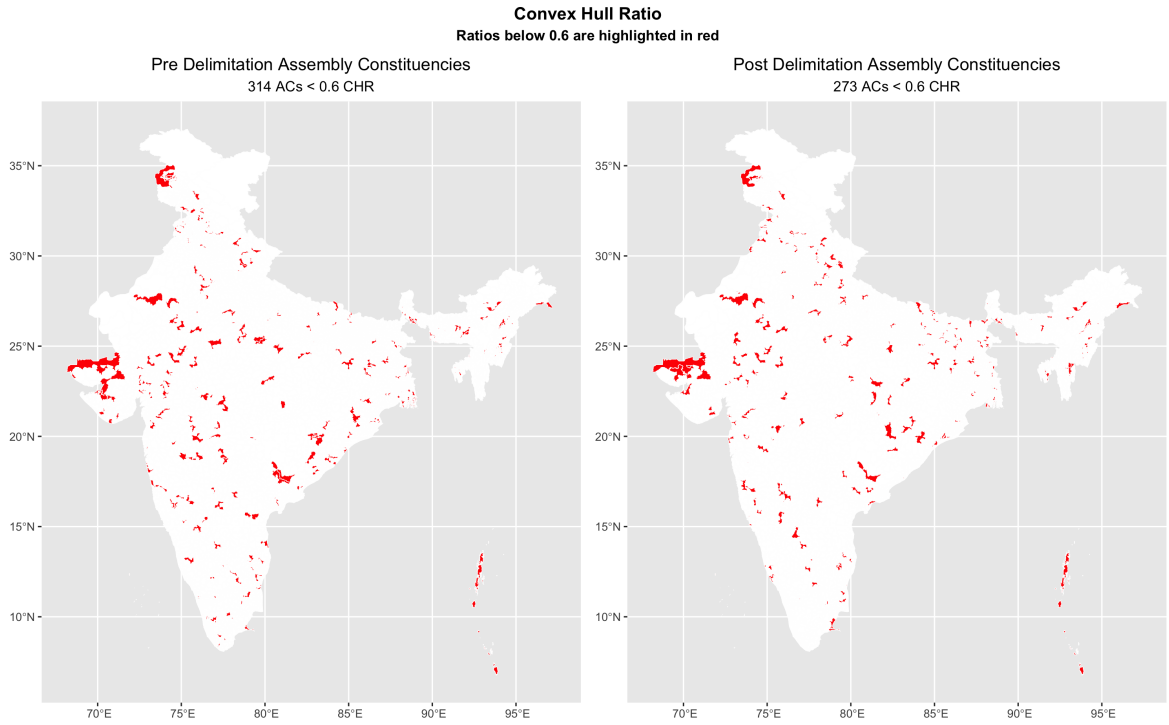


Figure A.10: Polsby Popper Score

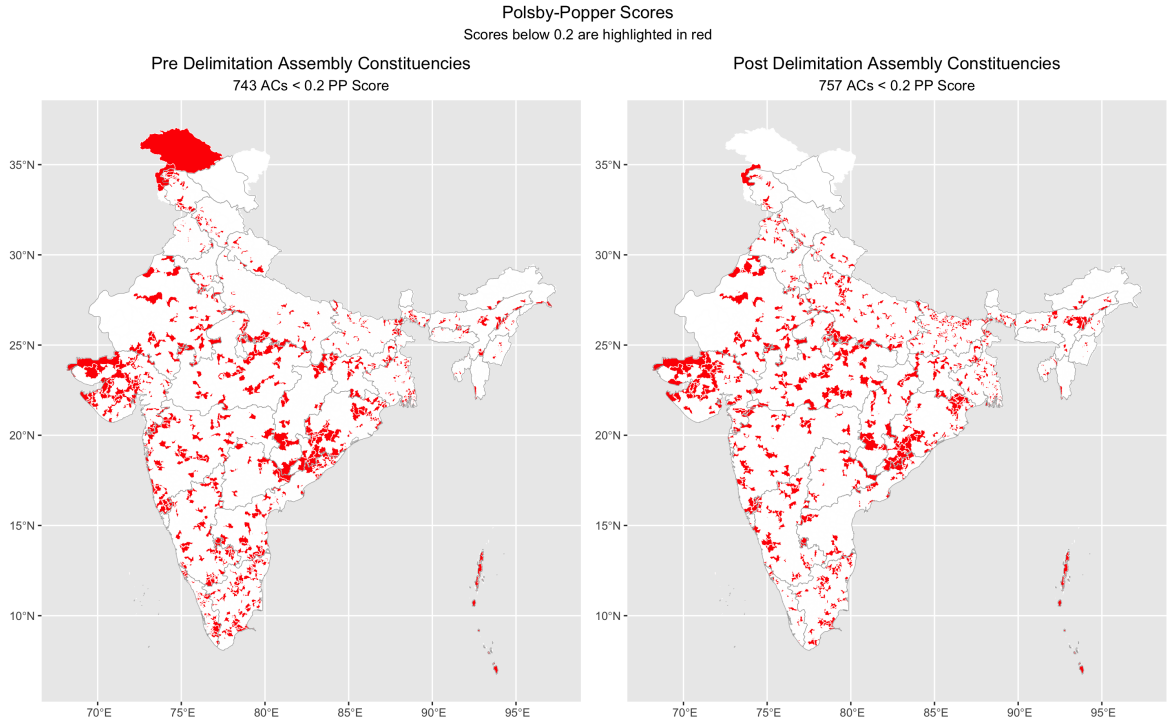


Figure A.11

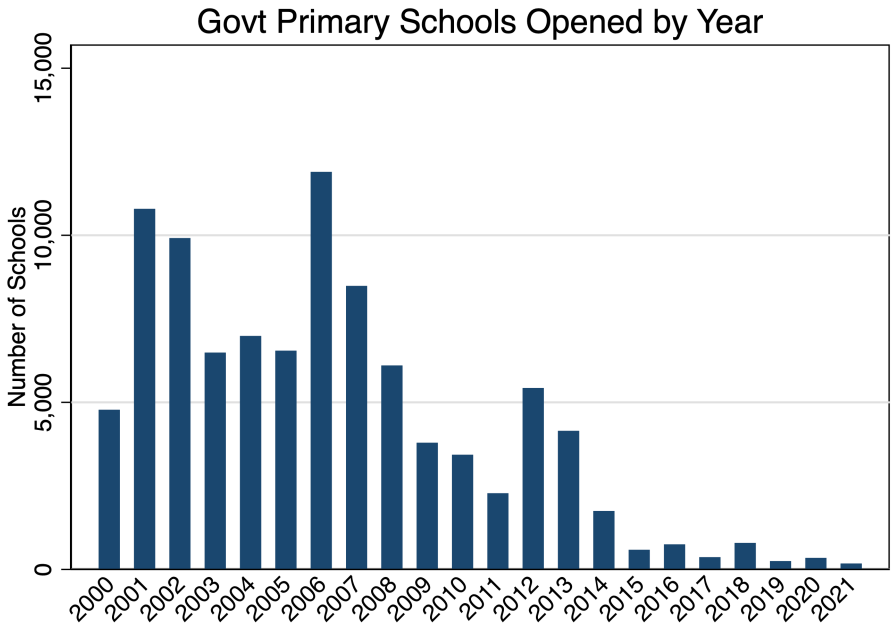


Figure A.12

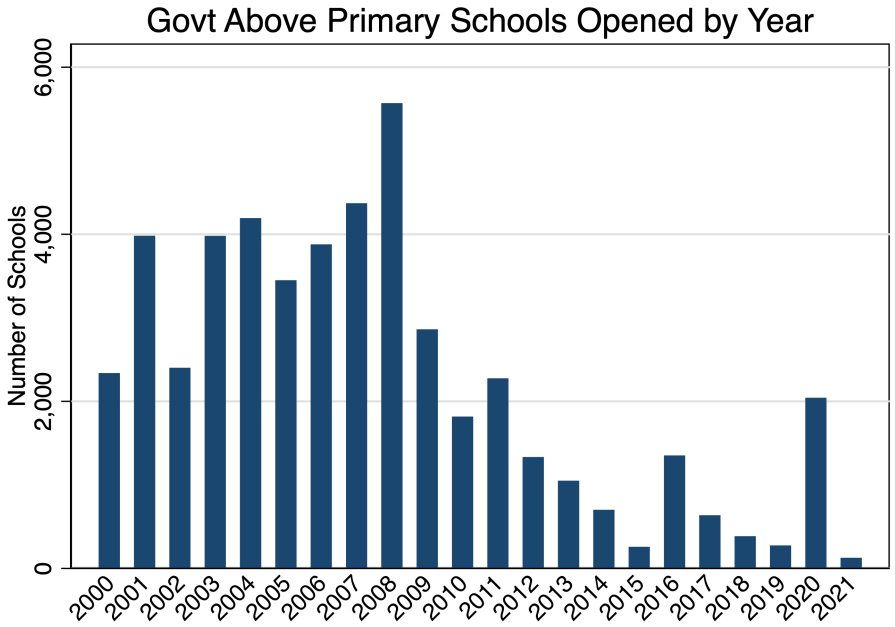


Figure A.13

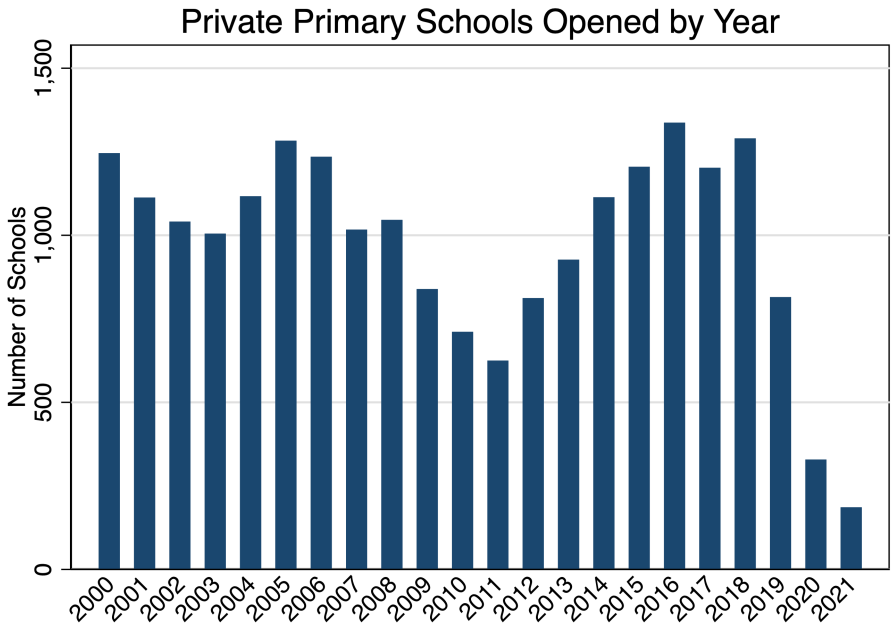


Figure A.14

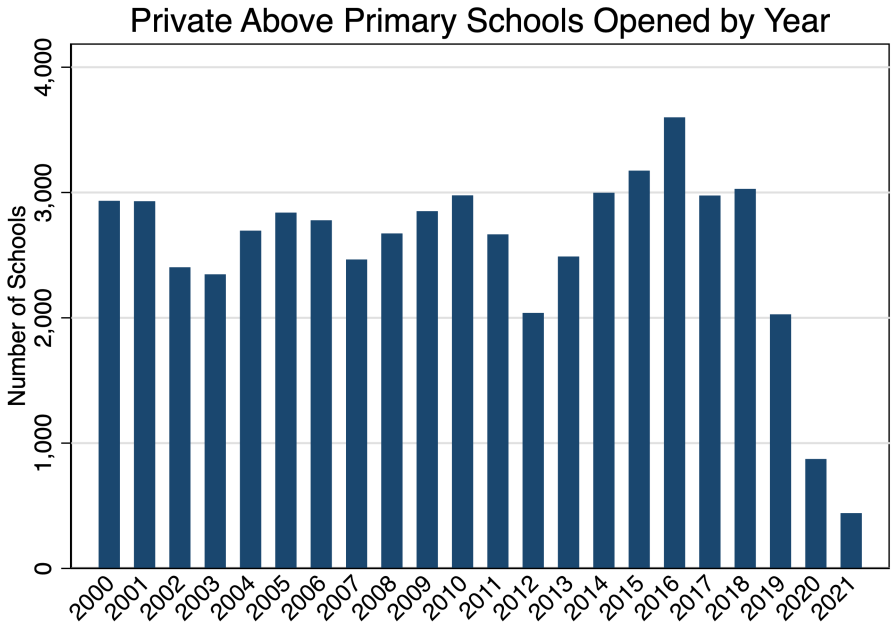
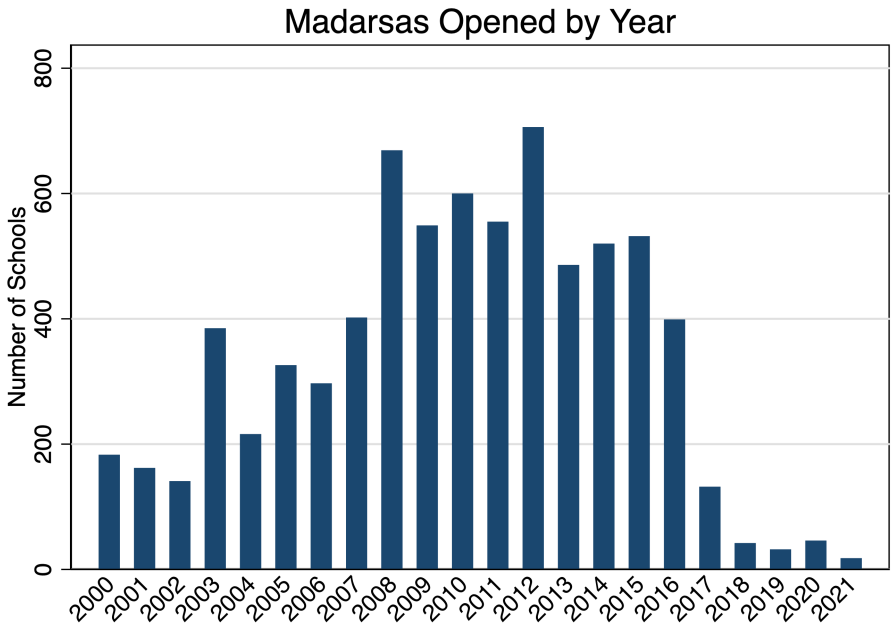


Figure A.15


Madarsas Opened by Year
Number of Schools
0
200
400
600
800
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021