# Political-economy of healthcare provision in India: Analysing the entire healthcare distribution

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**Abstract**

The public provision of healthcare is common in democracies. Conventional approaches to examine the link between political economy variables and healthcare provision focus on the average effect. However, the relationship at the extremes – when healthcare provision is extremely low or when it is remarkably high – may be quite different. This distinction is important from a policy perspective because it can affect many lives. We use cross-sectional data from the Indian District Level Household and Facility Survey for the year 2007-08 to examine the impact of three main political economy variables – political competition, voter turnout and effective number of parties – on different measures of healthcare provision and at different points along the conditional healthcare distribution using quantile regressions.

In most instances, we find that it is political stability rather than political competition that is associated with improved healthcare service delivery in India. The effect of turnout is mixed i.e. while its impact is positive for some healthcare measures, it is negative for others. For effective number of parties, we find a positive association in a majority of the cases which would suggest that a broader distribution of political power has had a favourable impact on healthcare service delivery. Importantly, these effects are heterogeneous along the conditional healthcare distribution. Our results are robust to heteroscedasticity and misspecification bias. We use several robustness checks to ensure the validity of our results.

**Keywords**: Political economics; Local government spending; healthcare; quantile regressions; India

**JEL codes**: D78; H40; H75; C31; I18

## 1 Introduction

The provision of healthcare – who funds it, and how – are issues occupying governments in both the developed and developing countries. While the mode of healthcare service delivery might vary across countries, some form of government intervention in healthcare is almost universal (Glied et al. 2012). Because of the widespread government intervention, there is a growing literature that examines the political economy of publicly provided healthcare. The standard approach to examine this relationship focuses on point estimates at the conditional

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mean obtained by estimators like the least squares. The picture that emerges from averaging out over the whole healthcare distribution is however incomplete since the relationship between local political economic variables and healthcare provision for regions lying at one end of the healthcare distribution, say the top quantile, may indeed be quite different from those lying at the bottom quantile. In this paper, we argue for adopting a more comprehensive approach to understand the link between political economics and public healthcare provision by examining the association at different points along the entire conditional healthcare distribution.

The support for government intervention in healthcare is often justified due to equity concerns – as the poor may not be able to afford high-cost healthcare; large positive externality benefits such as from immunizations which significantly limit the spread of infectious diseases; due to large information gaps that hinder the development of insurance markets; and from the consideration that healthcare infrastructure is a public good (Glied et al. 2012) These conditions that lead to market failures become even more acute in developing countries where inadequate health insurance coverage and high out-of-pocket expenses relating to healthcare means that an episode of sickness in many instances translate into a debilitating shock to human well-being, not only from lost productivity or physical impairment but also from the stress and strains caused by indebtedness (van Doorslaer et al. 2006) Because healthcare provision can affect so many lives, it is important to understand the link between political economics and publicly provided healthcare.

When groups within the electorate differ in their preferences for publicly provided healthcare, the relationship between political economic factors and publicly provided healthcare becomes hard to predict *ex-ante*. On the one hand, it is reasonable to argue that the top priority of voters in regions underserved by public healthcare would be to increase its provision. On the other hand, if healthcare supply creates its own demand, it is equally likely that further calls for improvements in healthcare would come from voters who already benefit from good healthcare. These conditions imply that the spread of the conditonal healthcare distribution is not likely to be the same across these groups and the association between political economics and healthcare provision is likely to vary along the conditional healthcare distribution.

From a policy perspective, in explaining regional disparities in healthcare provision, it is interesting to examine not only how the explanatory variables affect the dependent variable on average, but also how it affects the extremes of the conditional distribution of healthcare provision. In this paper, we concentrate on examining the association between different measures of healthcare provision and three main political economy variables – political participation of citizens, electoral competition and effective number of parties (ENP) – in the context of India. For example, does an increase in political participation have the same effect on healthcare provision for regions which are in the top quantile of healthcare provision as they do for regions that are in the bottom quantile? And what would be its magnitude and direction? Similarly, does the effect of electoral competition and ENP vary along the conditional distribution of healthcare provision? Given the hierarchical structure of the Indian public healthcare system, where different tiers specialize in offering different kinds of services, we investigate which aspects of healthcare provision are more sensitive to changes in political market characteristics.

The arguments that motivate an approach that looks beyond the mean become even more salient when the distribution of healthcare provision is skewed: for instance, while on average 41% of

villages within a district have access to a health subcentre in our sample, it is 21% at the $10^{th}$ percentile, and 68% at the $90^{th}$ percentile. Given such wide disparities in healthcare provision, do regions that lie at the lower end of the (conditional) healthcare distribution, say the bottom quantile, exhibit a different relationship with political economy variables than regions located at the top-most quantile? A quick visualization might aid in understanding the heterogenous relationship. In Figure 1 we divide the unconditional distributions of two variables – access to health subcentres and the presence of female doctors at primary health centres – into quartiles ranging from poor access (low presence of female doctors) to good access (high presence of female doctors). While those in the first quartile are the poorest fourth in terms of access to health subcentres (presence of female doctors), those in the fourth quartile are better-off than the lower three-fourths of the sample. Once we arrange them in this way, we plot the corresponding mean values for each of the three main political economic variables that we focus in this study – vote margin (or electoral competition, Panel (a)), turnout (Panel (b)) and ENP (Panel (c))– on the vertical axis. As we can observe from the figure, the unconditional relationship is heterogeneous: places with better access to health subcentres (high presence of female doctors) are associated, on average, with lower political competition (or a higher margin of victory) and lower ENP, but higher turnout in comparson to places with poorer access to health subcentres (low presence of female doctors).

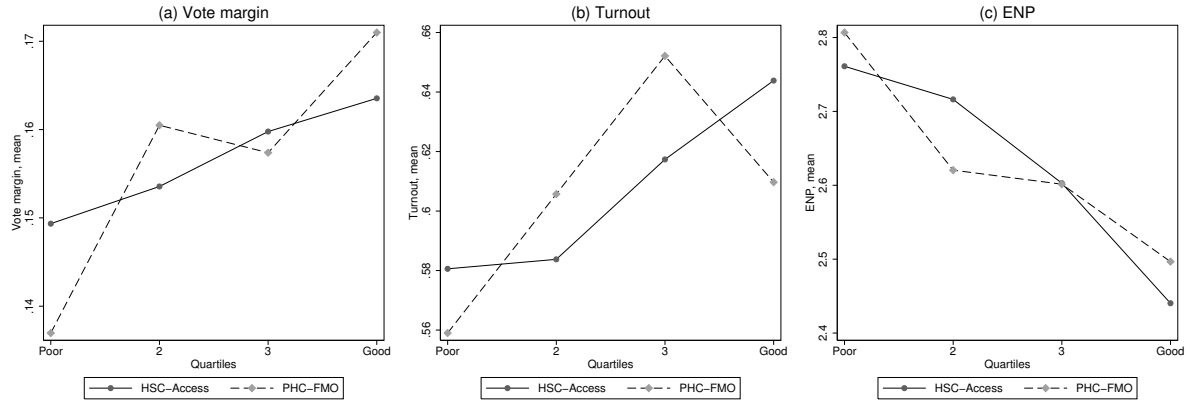


Figure 1: Relationship between political economic variables and healthcare provision at different quartiles of the unconditional distribution. HSC-Access = % of villages in a district that have access to HSC within the village, PHC-FMO = % of PHCs in a district where a female doctor is present.

When distributions are heterogenous, like the one we observe in Figure 1, regressions focusing on the mean might under or overestimate effects or even fail to identify effects (Cade and Noon 2003). One way to avoid this problem is to use quantile regressions (Koenker and Bassett 1978, Koenker and Hallock 2001, Koenker 2005) to study the effect of our covariates on different aspects of healthcare provision. The advantage of using a quantile regression is that it allows us to quantify the effect of our covariates at different points along the conditional healthcare distribution instead of focusing exclusively on the average. Using this method will therefore provide a more nuanced picture of the association between political economic factors and healthcare provision.

In this paper, we ask three specific questions: (a) is political stability more salient than political competition in improving healthcare provision?; (b) is voter turnout positively correlated with

healthcare provision?; and (c) does a broader distribution of political power (measured by ENP) improve healthcare provision?

To analyse these questions, we use district-level cross-esectional data from the third round of the Indian District Level Household and Facility Survey (DLHS-3) conducted in 2007-08.[1] For the purpose of this study, we focus on 15 major Indian states.[2] We combine this with electoral and socio-economic data from multiple sources which we discuss later on. India provides a rich set of variations to study these issues. It is a large and mature democracy that has had relatively fair elections at regular intervals for almost seventy years. It is geographically vast with the different administrative divisions bound together by a common legal and administrative framework. Once we control for confounding factors, these variations in our dataset helps us to identify the political economic correlates of publicly provided healthcare at different points along the conditional healthcare distributions.

We find that high political competition is largely associated with low healthcare provision which is not surprising once the institutional context is considered. The effect of turnout is mixed, whereas ENP is positively associated with healthcare provision in a majority of the cases. Importantly, the impact of political economy variables on healthcare provision is heterogeneous. This holds true across multiple measures of healthcare provision and across the different components of the hierarchical public healthcare system in India.

The rest of the paper is organized as follows: Section 2 provides institutional background and describes the organizational structure of public healthcare service delivery in India. Section 3 summarizes the related literature. Section 4 outlines the main hypotheses we intend to test. Section 5 describes the methodology. Section 6 introduces the data set, discusses the selection of variables and specifies the econometric model to test our hypotheses. Section 7 discusses regression results. We conduct several robustness checks which we present in Section 8. Section 9 concludes.

# 2 Background

## 2.1 Institutional background

The Indian Constitution, in its Directive Principles of State Policy mentions that one of the duties of the States is to improve public health, nutrition, and the standard of living of the people. Unlike fundamental rights, the directive principles are not enforceable. However, they are an integral part of the Constitution and serve as guiding principles for the States in policy making.

India is a federation of States. The Indian Constitution, in its Seventh Schedule outlines the legislative and financial responsibilities of the Centre and the States in the Union list, the State list and the Concurrent list. While the Union list contains matters of national interest; those within the domain of the States are in the State list; whereas, the Concurrent List contains items

[1] Districts are administrative units lower in hierarchy than the States and play an instrumental role in decision-making with regard to socio-economic development.

[2] The states covered in this study are: Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

that can be legislated upon by both the Centre and the States. With regard to healthcare, public health and sanitation, hospitals and dispensaries are the State's responsibility; whereas medical education, medical professionals, population and family control are under the joint responsibility of the Centre and the States.

The 73rd Amendment Act (1992) devolved powers and responsibilities to the grassroots by creating a third tier of local governance – the Panchayats (in rural areas) and municipalities (in urban areas). Under this system, district officials aggregate demand for healthcare provison from local governments (the blocks and panchayats) and present them to State governments. These are then discussed in the respective States' legislative assemblies and incorporated into state budgets. The implementation of policy decisions mainly rests with the District Planning Committees that co-ordinate information flow from the lower levels – the blocks and villages – to the States. Because districts play such an instrumental role in economic development in India, we analyze the political economic correlates of healthcare provision at this administrative level.

India is a bicameral parliamentary democracy. The two houses of the Parliament are the Lok Sabha (House of the People) and the Rajya Sabha (Council of States). While the members of the Lok Sabha are directly elected on the basis of adult suffrage, the members of the Rajya Sabha are indirectly elected. Their counterparts at the State-level are the Vidhan Sabha (or Legislative Assembly) and Vidhan Parishad (or Legislative Council), respectively. In this study, we focus on state legislative assembly elections where members are direcly elected by the people. Elections are typically held every five years and the winner is decided on a first-past-the-post basis.

One of the distinct features of the Indian legislative assembly elections is that of mandated reservations for the disadvantaged sections of society – the scheduled castes and scheduled tribes – since independence. The reservation of seats in assembly elections are proportional to the size of the population of the groups within every state. These groups have been historically discrimiated against, affecting not only their economic standing, but also their political influence. By politically organizing these marginal groups, the aim of the affirmative action policy was to reverse systematic disadvantages that these groups continue to face.

We next provide a brief description of the public healthcare system in India, the multiple tiers that constitute it and the kind of services they offer.

## 2.2 Organizational structure of the public healthcare system

From an operational point of view, the public healthcare system in India is composed of a network of health facilities at the primary, secondary and tertiary levels with each tier sprecialising in providing a set of healthcare services. These healthcare services are available free of charge or at a nominal price.

The health subcentres (HSC) are the first point of contact for individuals in rural areas. These centres provide only the most basic healthcare services – first aid, prenatal and postnatal care, malaria treatment etc., but not antibiotics. The second level of provision – primary health centres (PHCs) – forms the backbone of the Indian public health system. They provide basic preventive, promotive, curative and rehabilitative care. Cases from the HSCs are referred to the

PHCs with each PHC acting as a referral centre to six HSCs (the lowest tier). It is at the PHCs that residents in rural areas can access a qualified physician. The community healthcare centres (CHCs) are referral centres for an average of four PHCs and provide specialist care. The CHCs are 30-bed hospitals which, in turn, refer out to higher-level sub-divisional or district hospitals. In this study, we cover different aspects of healthcare provision at the HSCs, PHCs and CHCs which together serve most of the healthcare needs of the population, particularly of those who are poor or reside in rural areas.

Table 1 provides an overview of the different components of the Indian public healthcare system: the main functions they perform, the availability of hospital beds at each tier, the population covered and their shortfall, the interrelatedness among the tiers and the number of facilities within each tier. As we can observe from the table, the healthcare system takes the form of a pyramid with nearly 150 thousand HSCs making the base, a little over 24 thousand PHCs and about 5 thousand CHCs. The PHCs, as already mentioned, forms the main component, each serving about 35 thousand people. However, the number of healthcare facilities across the tiers are much lower than what the government norms provide. Our aim is to investigate the systematic differences in the provision of healthcare centres, their infrastructure and personnel from a political economics lens.

Table 1: Coverage of rural health system in India

| Level | Functions | Number of beds[a] | Avg. pop. covered (in '000)[b] | | Referred out by | Number of units[c] |
|---|---|---|---|---|---|---|
| | | | Norm | Present status | | |
| HSC | Most peripheral; first point of contact between primary healthcare system and the community in rural areas. | – | 3–5 | 5.6 | – | 148,366 |
| PHC | First point of contact with a qualified physician; provides basic preventative, promotive, curative and rehabilitative care and act as referral units. | 4 to 6 | 20–30 | 34.6 | 6 HSCs | 24,049 |
| CHC | Block level health administrative units and gatekeeper for referrals to higher level facilities. | 30 | 80–120 | 172.4 | 4 PHCs | 4,833 |

[a] Source: Rural Health Statistics Bulletin, 2012.
[b] Source: Rural population from Census 2011.
[c] As of March 2012.

Given the diversity of functions they perform, their respective specialisations, the population they cover, and the number of facilities within each tier, from a political economy perspective it is reasonable to argue that, at the margin, some services attract more votes than others even though they are parts of a single healthcare system. These differences in incentives and constraints that politicians face ultimately determines whether or not a service is actually provided.

In this paper, we investigate how our three main political economy variables – political participation, electoral compeition, and ENP – are related to different aspects of healthcare provision at each of the tiers just discussed. In order to get a complete picture we examine the relationship at different points along the conditional healthcare distribution.

Before we turn to our methodology, we summarise the main elements of the political economy literature that provides the conceptual background to our study.

# 3 Related literature

## 3.1 Political economy of healthcare provision

One of the distinguishing features of the healthcare market, as Arrow (1963) insightfully remarked, is the "existence of uncertainty in the incidence of disease and in the efficacy of treatment". The non-marketablity of risk therefore is a distinct feature of the healthcare market. Besides information gaps, there are other factors that support government intervention in healthcare: it is regarded as a merit good which ought to be provided on the basis of need and not on the basis of ability to pay alone; the large externality benefits of healthcare is another factor which a private market will not consider and hence underprovide healthcare; investments in healthcare infrastructure such as clinics and hospitals, healthcare research, etc. are public goods which the private market will under-supply (Glied et al. 2012)

While there is a strong case for government intervention in healthcare, what should be the optimal level of public provision? One way is to think of governments as benevolent social planners choosing the optimal level of healthcare that maximizes social welfare. However, this is not realistic because rational political actors, who decide on the size of provision, face incentives and constraints. This means that the electoral calculus plays a preeminent role in affecting not just the size of public provision but also what is publicly provided. The public choice literature, pioneered by Buchanan and Tullock (1962), provides a positive way forward. Our study is closely related to the literature on the determinants of local public service delivery. In what follows, we present some of the main insights from the growing political economy literature to help formulate our hypotheses.

The political economy literature sees healthcare provision either as a public good that is non-exclusive and non-rival (Arrow 1963, Mobarak et al. 2011) or as a publicly provided private good where the beneficiaries can be effectively excluded (see Blomquist and Christiansen 1999, Epple and Romano 1996*b*,*a*, Gouveia 1997, and others). The main predictions from the literature regarding optimal public provision differs based on whether one views healthcare as a public good or a publicly provided private good. In the former case, the preferences of the median voter is pivotal in deciding the size of public provision of healthcare (Downs 1957, Roberts 1977, Meltzer and Richard 1981). And, in the latter case, under a mixed-provision scheme (i.e. where both the private and public sectors operate) and where services are excludable, the size of public provision conforms to the preferences of a lower than median-income household (Epple and Romano 1996*a*).[3]

## 3.2 Voter engagement, political competition, party fragmentation

Along with theoretical developments, there have been rapid progress in empirical political economy studies. It is widely accepted that the participation of voters in elections is one of the "most common and important act citizens take in a democracy" (Aldrich 1993) to the extent that the legitimacy of democracy and the outcome of elections may be undermined when citizens do not participate (Lutz and Marsh 2007).

[3]This arises when the marginal willingness to pay for publicly provided healthcare rises with income.

The impact of higher voter participation on economic and developmental outcomes is largely positive. High levels of voter participation are associated with lower income inequality, a larger government size but also slower economic growth across a panel of countries (Mueller and Stratmann 2003). At a cross-country level, Fumagalli and Narciso (2012) find that voter turnout is the channel through which different forms of government affect economic policies. However, using night light intensity as an indicator of electricity distribution that politicians can control, Baskaran et al. (2015) find that voter turnout is not significant in explaining variations in the log of per capita light or its growth in India, but has a negative impact on the proportion of lit villages. Another set of literature studies the effect of voting reforms that increase the franchise on government size. For example, Aidt et al. (2006) find that the extension of franchise contributed to an increase in government spending in 19th century Western Europe. Husted and Kenny (1997) find that the abolition of poll taxes and literacy tests increased the scope of the welfare state in the US. However, enfranchisement of the middle class led to a U-shaped relationship between voter participation and health related public spending in 19th century England and Wales (Aidt et al. 2010).

In the Indian context, while a higher voter turnout in a district increases the allocation of nurses to rural areas of a district, it has no effect on the allocation of doctors and has a negative effect on the allocation of teachers (Betancourt and Gleason 2000). The argument provided in the literature is that nurses are less expensive to provide than doctors, but the explanation in relation to teachers is less clear. In another study examining the factors affecting the number of schools and teachers and related school infrastructure in villages in North India, the role of voter turnout is not found to be important (Crost and Kambhampati 2010). With respect to publicly provided health services in Brazil, clinics and consultation rooms per 1000 people – the visible public goods – are positively related to turnout but not doctors and nurses (Mobarak et al. 2011).

Another important political variable that might affect public provision is political competition. When there is greater contestability of power, policies tend to be more efficient (Aidt and Eterovic 2011). In closely contested constituencies aligned with the ruling party, elected leaders provide more electricity and this is positively related to output as measured by the log of per capita light, its growth and the proportion of lit villages (Baskaran et al. 2015). Higher political competition is associated with lower public spending in Latin American countries (Aidt and Eterovic 2011). However, Crost and Kambhampati (2010) find that the effect of a higher margin of victory, or the difference in vote-share between the winner and runner-up is less clear in the context of schools in India. It limits the number of middle schools in villages but has no effect on the number of primary schools and teachers nor on the different school infrastructure parameters that they study.

In addition, the degree of social fragmentation is known to reduce public provision (see Easterly and Levine (1997), Alesina et al. (1999), Alesina and La Ferrara (2000), Collier (2000), Miguel and Gugerty (2005), Habyarimana et al. (2007) etc.). When societies are deeply divided, partisan preferences become salient. One of the implications of partisan preferences is a greater number of political parties contesting elections to represent the electorate's disparate preferences (Neto and Cox 1997). But whether this translates to reduced public provision depends on the institutional context and is an open empirical question.

In the next section we discuss our main hypotheses relating to the association between each of the three main political economy covariates and healthcare provision.

# 4 Main hypotheses

In this section, we outline the set of hypotheses that we intend to test. They are as follows:

- **Hypothesis 1:** *Political stability, rather than political competition, improves healthcare provision*

  The political economy literature suggests that greater contestability of power yields more efficient policies. However, the empirical evidence on this is ambiguous (see section 3). Given the imperfections in the political market, particularly in developing economies like India, we argue that public provision is likely to be negatively (rather than positively) associated with political compeition. We measure political competition as the difference in the vote share between the winner and the runner-up. In other words, while the political economy literature would suggest that higher political competition increases public provision, we argue against this proposition in the case of India.

  A necessary precondition for the prediction from the political economy literature to hold, i.e. greater contestability of power increases public provision, is that the political market is relatively free from frictions. This is because high political market frictions – barriers to information on candidate's performances, voter heterogeneity, low credibility of voters and politicians (Keefer and Khemani 2005), etc. – distort the operation of the political market. In fact, if these frictions are too extreme, the relationship might run in the opposite direction and public provision will be high in places associated with political stability rather than higher political competition. Thus, once we consider these political market frictions, a safe seat (or a high margin of victory which is associated with low political competition) might actually provide a positive incentive for elected leaders to invest in public goods in the form of rewards to their political supporters. That politicians engage in 'white elephant' projects which drain the tax payers money but benefit only a narrow group is common in developing economies characterized by weak enforcement mechanisms (Robinson and Torvik 2005).

  Hence, the first hypothesis that we want to test is whether politicians reinvest in places with low contestability of power (or safe seats), that is, whether public provision is high in places with low political competition. In addition, we intend to analyse if the relationship between political competition and healthcare provision in places with low healthcare provision is different from those that are already better-off with respect to healthcare, and the extent to which this relationship is sensitive across a range of healthcare measures.

- **Hypothesis 2:** *Voter participation is positively correlated with healthcare provision*

  The second hypothesis that we intend to test is whether high voter participation is associated with larger public healthcare provision. We use turnout i.e. the proportion of people who turned out to vote on the election day to the total voting population, as our measure of voter participation.

A high turnout reflects more engaged voters. When turnout is high, there is greater pressure on the politicians to perform. As a result, public provision is likely to be higher in places where voters are more engaged. The larger the turnout, more involved are the citizes in local politics and consequently greater is the weight politicians attach to voters' concerns. On the other hand, apathetic voters are less likely to see their demands converted into policies.

Voters across the quantiles are likely to demand different things. Thus, in the top quantile, voters might already have achieved basic healthcare and might prefer more expenditure on specialised healthcare or even a reduction in the public healthcare provided since they can easily substitute public with private healthcare providers. The reverse might be true in the lower quantiles, which are predominantly rural and poorer areas, and where even basic healthcare is inadequate.

- **Hypothesis 3:** *A broader distribution of political power increases healthcare provision*

  When previously marginal groups gain prominence in local politics it raises ENP. This might indicate increasing organizational ability of marginal groups, which in turn, is likely to improve public provision. India has witnessed a sharp rise in the growth of regional political parties (Varshney 2000). And this is not necessarily a bad thing. One has to keep in mind the unprecedented levels of heterogeneity in India compared to any other democracy. Under such circumstances, a rise in the number of parties might imply an improvement in the participation of marginal groups in local politics which might then result in a *positive*, rather than a negative association, between ENP and healthcare provision.

  On the other hand, if higher ENP is due to increasing social fragmentation, it would be associated with a reduction in public provision. This is because when opinions are diffuse and there are multiple social factions, it hinders collective action. Since political parties choose platforms to represent the preferences of the people, a fragmented electorate is unlikely to have valence issues which would result in a larger number of parties contesting on very disparate platforms.

  Following Laakso and Taagepera (1979), we construct a measure called the 'effective number of parties' (ENP), as $\frac{1}{\sum_{i=1}^{n} s_i^2}$ where $s_i$ is the vote share of the i$^{\text{th}}$ political party in a constituency and $n$ is the number of parties contesting elections. If all parties contesting elections get an equal number of votes, then ENP will equal $n$. At the other extreme, if only a single party gets all votes, ENP would be 1. And every other permuation of vote shares among contesting parties would lie between these two theoretical limits.

  Similar to electoral competition and voter participation, discussed above, we are interested in analysing how ENP affects healthcare provision at different locations along the conditional healthcare distribution and across a set of healthcare measures.

We discuss our methodology to test these hypotheses in the next section.

# 5 Methodology

The main empirical challenge in examining the relationship between political economy variables and healthcare is that the association between them at the lower quantiles may be different than at the higher quantiles (see Figure 1 above). The conventional least squares estimates focus on the average effect of the explanatory variables on healthcare provision. However, when the variables are heterogeneous, regressions focusing on the average effect might under or overestimate effects or even fail to identify effects (Cade and Noon 2003).

In this study, we consider 8 separate healthcare variables: 2 relating to access, and 6 relating to capacity – one for healthcare infrastructure and another for healthcare personnel and training over three levels – the HSCs, the PHCs, and the CHCs. The statistical tests clearly indicate that the conditional distributions of all the 8 variables are non-normal and heteroscedasticity is a problem in 6 out of the 8 variables.[4] The results are presented in Table 10 in Appendix B.1.

The heterogeneity and non-normality of the conditional distributions (OLS residuals) from statistical tests affirm the need to closely examine the association between political economy variables and healthcare provision at the extremes: at the lower end, where provision is exceedingly low, and at the higher end, where healthcare provision is much higher. One way to study this is to examine the coefficents of the political economy variables at different locations along the conditional healthcare distributions.

We use the quantile regression model, introduced by Koenker and Bassett (1978) to estimate the differential impact of the political economy variables on the conditional healthcare distribution. We model the association at the $\tau^{\text{th}}$ quantile as:

$$Q_\tau(\boldsymbol{y}|\boldsymbol{x},\boldsymbol{z}) = \boldsymbol{x}'\boldsymbol{\beta}(\tau) + \boldsymbol{z}'\boldsymbol{\gamma}(\tau) \tag{1}$$

where $\boldsymbol{y}$, the dependent variable, measures publicly provided healthcare. The quantile function, $Q(.)$, is linear in the political economy variables – the vector $\boldsymbol{x}$ and their corresponding quantile-specific coefficients, $\boldsymbol{\beta}$, which are our main interest – and a vector, $\boldsymbol{z}$, that controls for potential confounding factors like mandated representation in politics, socio-economic, demographic and geographic differences across the districts in our study. $\boldsymbol{\gamma}$ contains the corresponding coefficient estimates for the set of controls included in the model.

The quantile regression model minimizes the sum of errors, weighted by an *asymmetric* absolute loss function to estimate quantile-specific coefficients. Mathematically, quantile regression solves the following optimization problem:

$$\arg\min_{\boldsymbol{\beta},\boldsymbol{\gamma}} \frac{1}{n}\sum_{i=1}^{n} \rho_\tau(\boldsymbol{y} - \boldsymbol{x}_i'\boldsymbol{\beta} - \boldsymbol{z}_i'\boldsymbol{\gamma}) \tag{2}$$

which can be rewritten as:

$$\arg\min_{\boldsymbol{\beta},\boldsymbol{\gamma}} \frac{1}{n}\sum_{i=1}^{n} \rho_\tau(\boldsymbol{u_i}) \tag{3}$$

[4] We run the Shapiro-Wilk test for normality and White's heteroscedasticity test on OLS residuals with full model specification. The empirical specification is discussed in Section 6.2.

where $\tau \in (0,1)$, and $\rho_\tau(u) = u(\tau - I_{u\leq 0})$ is a piecewise linear and asymmetric absolute loss function (or "check " function) (Koenker and Hallock 2001). The penalty from straying away from a specific quantile increases with distance in either direction, positive or negative, which is controlled by $\rho_\tau(u)$.[5] As the objective function is not differentiable (at $u = 0$), linear programming based algorithms are used in its optimization.[6]

A different approach to this problem would be to create sub-samples depending on whether healthcare provision is low or high and running separate regressions. This however raises two important issues: first, focusing on smaller subsamples is not efficient in the use of available information. Secondly, sampling on the dependent variable raises concerns regarding sampling selection bias as the subsamples may be inherently different. The advantage of using quantile regression is that it uses the entire dataset by weighting the conditional distribution differently depending on how far they are from a specific quantile, and thereby avoids both these concerns.

Heteroscedasticity is also a problem in quantile regressions. A linear homoscedastic model would assume that the conditional distribution of healthcare provision is no more spread out for politically 'active' areas than for areas that are politically 'dormant'. In homoscedastic conditional quantile functions, the coefficients across the quantiles would only see a 'location' shift i.e. only the intercepts would change, whereas, heteroscedasticity would imply a 'location-scale' shift (Koenker 2005). Quantile regressions often assume that errors are i.i.d. and that the model is correctly specified. Misspecified models invalidate inferences based on conventional covariance matrix (Kim and White 2003) and i.i.d. errors are quite restrictive. Powell (1994), Kim and White (2003) and others have derived asymptotic properties when errors are independent but not identically distributed and quantile regressions are possibly misspecified (Machado and Silva 2013).[7]

We test for heteroscedasticity at the conditional quantiles using the Machado and Silva (2000) test. The results in Table 11 in Appendix B.2 shows that heteroscedasticity is present in a large majority of the cases we study. Since heteroscedasticity might bias our inferences of the estimates, we present standard errors in the regression tables that are robust to heteroscedasticity and misspecification bias.

Quantile regression is a semi-parametric approach wherein, similar to OLS, the linearity assumption is maintained but differs from it by considering the entire conditional distribution and not just the average effect (Powell 1994). Because of this, we are able to investigate the differential effect of a 1% point increase in the political economy variables at different points along the conditional healthcare distribution.

In the next section, we introduce our data and describe the specification of our econometric models.

[5] $\rho_\tau(u)$ asymmetrically weights positive and negative terms as: $I(u > 0).\tau u + I(u \leq 0).(1 - \tau)u$

[6] An alternative estimation approach is to smooth the 'cusp' of the 'check' function to allow computational techniques relying on differentiability (see Jung et al. 2015, and references therein)

[7] This is implemented in Stata using the 'qreg2' package developed by MSS 2011

# 6 Data and empirical specification

## 6.1 Data set and variable selection

In order to examine the political economy of publicly provided healthcare in India we created a dataset that combines information on healthcare provision, electoral results, socio-economy, demography and geography. Our sample consists of district-level observations for 15 major Indian states. Table 2 provides summary statistics.

One of the most time-intensive pre-analysis exercise was to reconstruct the district boundaries to match that of the 2001 census year. Because district boundaries change over time, it was essential that we maintained uniform district boundaries across the different data sources. Appendix A describes the procedure adopted to obtain district-level election variables by matching election results for every constituency to their respective districts. Once they were matched, we had 430 districts in our sample covering 15 major Indian states.

Table 2: Summary statistics

| Variable | Obs | Mean | Std. Dev. | Min | Max | p10 | p25 | p50 | p75 | p90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Fraction of villages in a district having: | | | | | | | | | | |
| HSC - access | 430 | .41 | .21 | 0 | 1 | .21 | .27 | .37 | .5 | .68 |
| PHC - access | 430 | .14 | .2 | 0 | 1 | .02 | .04 | .08 | .14 | .24 |
| Fraction of health centres in a district having: | | | | | | | | | | |
| *Infrastructure capacity:* | | | | | | | | | | |
| HSC - labour room | 430 | .35 | .25 | 0 | 1 | .02 | .13 | .33 | .52 | .7 |
| PHC - labour room | 428 | .69 | .28 | 0 | 1 | .25 | .5 | .78 | .89 | 1 |
| CHC - ambulance | 422 | .67 | .29 | 0 | 1 | .27 | .5 | .73 | 1 | 1 |
| *Human resource capacity:* | | | | | | | | | | |
| HSC - trained nurses | 430 | .31 | .2 | 0 | 1 | .08 | .17 | .28 | .43 | .56 |
| PHC - female doctors | 428 | .27 | .28 | 0 | 1 | 0 | .04 | .2 | .41 | .7 |
| CHC - general surgeon | 422 | .29 | .28 | 0 | 1 | 0 | 0 | .24 | .45 | .67 |
| Political variables: | | | | | | | | | | |
| Vote margin | 430 | .16 | .05 | .05 | .4 | .1 | .12 | .15 | .18 | .21 |
| Turnout | 430 | .61 | .09 | .37 | .81 | .49 | .54 | .6 | .68 | .73 |
| ENP | 430 | 2.63 | .44 | 1.73 | 4.06 | 2.13 | 2.3 | 2.56 | 2.89 | 3.26 |
| SC seat | 430 | .16 | .14 | 0 | 1 | 0 | 0 | .15 | .23 | .33 |
| ST seat | 430 | .08 | .22 | 0 | 1 | 0 | 0 | 0 | 0 | .33 |
| Socio-economy: | | | | | | | | | | |
| Literacy | 430 | .63 | .12 | .31 | .96 | .47 | .56 | .63 | .72 | .77 |
| Log pop. | 430 | 14.38 | .6 | 12.14 | 16.08 | 13.63 | 13.99 | 14.37 | 14.8 | 15.1 |
| Pop. growth | 430 | .21 | .08 | .04 | .55 | .1 | .15 | .22 | .26 | .3 |
| Urban pop. | 430 | .22 | .15 | 0 | .88 | .07 | .11 | .19 | .29 | .44 |
| Log income | 422 | 1.92 | 1.91 | 0 | 17.5 | .59 | .91 | 1.61 | 2.32 | 3.34 |
| Geography: | | | | | | | | | | |
| Log Area | 430 | 8.43 | .68 | 6.09 | 10.73 | 7.59 | 7.95 | 8.41 | 8.92 | 9.29 |
| Dist. from equator | 430 | .25 | .06 | .09 | .36 | .14 | .21 | .26 | .29 | .32 |

Data source: Own calculation using data from DLHS-3 (2007-8), Census of India (2001), ECI (1977-1999) G-Econ (2000) and GADM.

### 6.1.1 Measures of healthcare provision

We obtained data on access to health facilities, its infrastructure and human resource capacities at health centres from district-level reports of the third round of the District Level Household and Facility Survey (DLHS-3), 2007-08. Our dependent variables – the different measures of publicly provided healthcare at the district level – come from this dataset. We examine a total of 8 healthcare variables: 2 relate to access and 6 relate to capacity – one for healthcare infrastructure and another for healthcare personnel and training over three levels – HSCs, PHCs, and CHCs.

The reason behind examining multiple healthcare variables needs to be explained. Access to healthcare is the most fundamental of all the healthcare measures. Given that the different tiers of the healthcare system perform very different functions, we examine access to HSCs and PHCs separately but not CHCs because the first two provide the bulk of the healthcare services that are most commonly accessed.

Besides access, healthcare infrastructure and human resource capacity affects healthcare service delivery. These present different incentives and contraints to the politicians which might systematically affect their provision. Firstly, healthcare services are not equally visible. For example, Mani and Mukand (2007) and Mobarak et al. (2011) show that more visible goods (e.g. buildings) take priority over less visible ones (e.g. doctors and nurses). A related point is that certain aspects of healthcare are associated with higher levels of treatment-uncertainty than others which affects their demand (Arrow 1963).

Secondly, not all healthcare services are flexible enough that a politician can change its provision within her tenure in office. For example, when doctors and nurses are not adequately trained, it takes concerted action across several departments to improve training and not just political will. In addition, certain aspects of healthcare provision are more likely to be influenced by government norms which reduces the politicians' scope to affect change. Thirdly, healthcare service delivery is prone to ratchet effects. So, while doctors and nurses are hired during good times, it is the supplies and training that are reduced during cut-backs (Kremer and Glennerster 2011). This is because restructuring of personnel faces stiff political opposition whereas supplies can be easily reduced.

In our sample, 41% of the villages in a district, on average, had access to a health subcentre within the village, whereas, only 14% of the villages in a district had access to a primary health centre within the village. The difference persists across the quantiles and at the 90th percentile 68% had access to HSCs but only 24% had access to PHCs (see Table 2).

Turning to infrastructure and human resource capacity variables, about 35% of the villages with HSCs had a separate labour room, which is slightly higher than the median at 33%, and 70% at the 90th percentile. Only 31% HSCs reported that nurses were trained in skilled birth assistance. With regard to PHCs, 69% of them had a separate labour room, 78% at the median and full coverage at the 90th percentile. However, only 27% of PHCs had a female doctor, 20% at the median, which rises to 70% at the 90th percentile. At the third tier, 67% of CHCs report an amulance on road and reaches full coverage at the 75th percentile, whereas only 29% of CHCs report having a general surgeon, 24% at the median and 67% at the 90th percentile.

### 6.1.2 Political variables

Three political variables are our main covariates of interest– the margin of victory, voter turnout and the effective number of parties. The hypotheses surrounding these variables and their construction have already been discussed in section 4 and will not be repeated here in the interest of brevity. The margin of victory, aggregated across all constituencies within a district and over all districts in our sample covering four election cycles averaged 16%. The average turnout was 61%. Once we weight parties by their respective vote shares as already described, the effective number of parties averaged 2.6, which at the 90th percentile was 3.26.

To add to these variables we include the institutional mandate of reservation of seats for the disadvantaged sections of society – the scheduled castes and scheduled tribes – in our models. We cover four election cycles spanning 1977-1999 to capture the longer-term impact of political forces on healthcare provision. Because elections are held once in 5 years, and states are on different election cycles, we effectively leave out two and in some cases one election cycle between the period upto which we consider to construct our political variables and the DLHS-3 survey.

We outline our model specification next.

### 6.2 Empirical Specification

We estimate the $\tau^{\text{th}}$ conditional quantile function for healthcare measure $k$ in district $i$, $Q(h_{ik})$, as:

$$Q(h_{ik}|x,z) = \alpha(\tau) + \beta_1(\tau)T_i + \beta_2(\tau)V_i + \beta_3(\tau)ENP_i + \gamma(\tau)Z_i \tag{4}$$

where,

- $T_i$ = Voter turnout;
- $V_i$ = Margin of victory;
- $ENP_i$ = Effective number of parties;
- $Z_i$ = vector of control variables.

$\beta_j(\tau)$, $j = \{1,2,3\}$ are the corresponding coefficient vectors; $\alpha(\tau)$ is a constant; $Z_i$ is a vector of district-specific controls and the proportion of seats reserved for SCs and STs in a district with coefficients in $\gamma$. Our main interest, as laid out in Section 4, are the coefficients $\beta_j(\tau)$s which capture the marginal impact of the $j^{\text{th}}$ political economy variable on healthcare provision, $k$, at the $\tau^{\text{th}}$ conditional quantile.

The healthcare variables that we observe today are the outcome of the cumulative impact of policy decisions over time. Here, we are primarily interested in the longer-term impact of political forces on healthcare provision and not on the political flavour in a single election year. Because changes in healthcare variables have been accumulating over a considerable period of time, it will be unreasonable to associate only the current political market forces with observed distributions of healthcare since it is not only the present but also past policies that have shaped current healthcare. Further, in an econometric analysis, using current political economy variables to explain healthcare will result in simultaneity bias as the political variables themselves will be affected by healthcare conditions. To minimize this problem, and to look at the longer-term impact of political forces, we aggregate district averages across roughly four election cycles spanning 1977-1999.

In addition to the the three main political economy variables – voter participation, electoral competition and ENP – we also include variables to control for the share of seats for SCs and STs, and other district level heterogeneity that might confound our results. Specifically, we control for a district's literacy rate, the natural logarithm of population, population growth, the

percentage of urban population and the natural logarithm of output. Since a district's income influences its ability to spend on public healthcare, we included data on output. To do this, we obtained gridded data on output for the year 2000 from the G-Econ database.[8]. Except output, socio-economic data was obtained from the 2001 census year.

Because geography determines a region's natural susceptibility to a disease which might affect healthcare provision, we include a district's latitude to control for possible differences in disease incidence. Using latitude to capture disease incidence is well-established in the economic growth literature (see Gallup et al. 1999, Hall and Jones 1999, Easterly and Levine 2003, Spolaore and Wacziarg 2013, and others). We also control for a district's area to net out any economies of scale that might arise in providing healthcare. Finally, we include dummies to control for regional effects that might arise due to shared culture, languages or other unobservable attributes.

To minimize simultaneity bias, we lagged political economy variables and controls. This ensures that the direction of influence runs from political variables to public provision of healthcare and not the other way round.[9]

In this paper, we are concerned with examining the association between political economy variables and provision of healthcare at different points along the conditional healthcare distribution, after controlling for potential confounding factors. Hence, our results are to be interpreted as associations and not as causal effects of the political economy variables. Our aim here is to extend our understanding of the association at the extremes of the conditional healthcare distrbution i.e. either when healthcare provision is excedingly low, or when it is remarkably high.

We discuss our empirical findings in the next section.

# 7 Results

Based on the empirical specification in eq.(4) we test the three main hypotheses outlined before in section 4. They are: (a) political stability, rather than political competition, is associated with improved healthcare provision; (b) voter participation is positively correlated with healthcare provision; and (c) a broader distribution of political power, measured by ENP, is associated with improved healthcare provision. Because the relationship between political economy variables and healthcare provision might be different when healthcare provision is severly deficient than when it is much higher, we use quantile regression to obtain values of marginal impact at different points along the conditional healthcare distribution.

We report our findings in Tables 3, 4 and 5. To obtain robust inferences, we report standard errors that are robust to heteroscedasticity and potential misspecifications.

Table 3 reports results relating to healthcare access, Table 4 on healthcare infrastructure, and Table 5 on healthcare personnel and training. These tables consist of separate panels each reporting estimates relating to a specific dependent variable and the Pseudo-$R^2$s corresponding

[8]Gridded data on the value of output at 1° by 1° resolution was obtained from the G-Econ project available at http://gecon.yale.edu/. The grid was then overlaid onto district boundaries and the value of output of the grid overlaying the district centroid was taken to represent the value of output for that district.

[9]However, to the extent that there is path dependence in health care provision, the issue of endogeneity will not be completely addressed.

to quantiles 10, 25, 50, 75 and 90, in separate columns. We also include OLS results in the first column. The rows, in every panel, are our main political variables of interest – margin of victory, turnout and ENP. For example, Panel C in Table 4 presents the quantile-specific impact of political economy variables on having labour rooms at PHC. At the $10^{th}$ quantile, a one standard deviation increase in the margin of victory (the standard deviation of margin of victory is obtained from Table 2) would be associated with a 8% point (=0.05*1.594, the coefficient 1.594 is from Panel B in Table 4) increase in having a labour room at PHC. Computed in the same way, a one standard deviation increase in turnout would be associated with over a 9% point (=0.09*1.044) increase, whereas a one standard deviation increase in ENP would be associated with almost a 7% point (=0.44*0.155) increase.

We discuss our results below. For the ease of exposition, we group the discussion of the results around the three main hypotheses which we have already outlined.

Table 3: Factors affecting healthcare access

| Variable name | OLS | Q(0.10) | Q(0.25) | Q(0.50) | Q(0.75) | Q(0.90) |
|---|---|---|---|---|---|---|
| | | | *Panel A: Access to HSC* | | | |
| Vote margin | -0.369 | 0.056 | 0.064 | -0.169 | -0.236 | -0.239 |
| | (0.235) | (0.250) | (0.193) | (0.264) | (0.341) | (0.209) |
| Turnout | -0.154 | -0.142 | -0.019 | 0.094 | -0.049 | -0.068 |
| | (0.138) | (0.130) | (0.118) | (0.199) | (0.175) | (0.294) |
| ENP | -0.111*** | -0.047* | -0.034 | -0.068** | -0.132*** | -0.179*** |
| | (0.024) | (0.027) | (0.022) | (0.030) | (0.037) | (0.042) |
| $R^2$ | .29 | .11 | .159 | .254 | .266 | .224 |
| | | | *Panel B: Access to PHC* | | | |
| Vote margin | -0.598** | 0.033 | 0.121 | -0.030 | -0.390 | -0.430* |
| | (0.258) | (0.096) | (0.089) | (0.098) | (0.461) | (0.234) |
| Turnout | -0.567*** | -0.114* | -0.107 | -0.172** | -0.228 | -0.150 |
| | (0.136) | (0.064) | (0.072) | (0.072) | (0.155) | (0.132) |
| ENP | -0.094*** | -0.001 | -0.016 | -0.036*** | -0.045 | -0.052*** |
| | (0.023) | (0.008) | (0.012) | (0.012) | (0.028) | (0.020) |
| $R^2$ | .35 | .146 | .173 | .22 | .323 | .233 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; N=422 in both Panels A and B. The table shows the marginal effects of our main covariates on the conditional distribution of different quantiles of healthcare access, where access is measured as the proportion of villages within a district with health sub-centres (Panel A) and primary healthcare centres (Panel B). All regressions include the proportion of seats in a district reserved for scheduled castes and scheduled tribes and district-specific controls: literacy rate, log. of population, population growth, percentage of urban population, log. of income, area, and latitude. We also include regional dummies in every regression. Standard errors in parenthesis are robust to heteroscedasticity for OLS models and robust to heteroscedasticity and misspecification bias for quantile regressions. Reported $R^2$s for quantile regressions are the square of the correlation between the fitted values and the dependent variables.

### 7.1 The effect of political competition

In the case of 5 out of 8 dependent variables we find that a low level of political competition (or equivalently a high margin of victory) is associated with an increase in healthcare provision. Thus, political competition has a largely negative (rather than a positive) impact on healthcare provision in India. This effect-size varies across quantiles and also over the different variables we study. Its effect is positive and most pronounced with respect to capacity variables – infrastructure (Table 4) and personnel and training of doctors and nurses (Table 5) – except having general surgeons at CHC, whereas, it is not statistically significantly associated with healthcare access (Table 3), except at the 90th quantile for PHC access, where it is, in fact, negative.

Table 4: Factors affecting healthcare infrastructure

| Variable name | OLS | Q(0.10) | Q(0.25) | Q(0.50) | Q(0.75) | Q(0.90) |
|---|---|---|---|---|---|---|
| | | | *Panel A: HSC - Separate labour room* | | | |
| Vote margin | 0.422 | 0.523** | 0.076 | 0.160 | 0.768* | 0.975** |
| | (0.279) | (0.211) | (0.280) | (0.415) | (0.408) | (0.473) |
| Turnout | -0.415** | 0.023 | 0.126 | -0.311 | -0.223 | -0.303 |
| | (0.173) | (0.197) | (0.220) | (0.211) | (0.202) | (0.318) |
| ENP | 0.130*** | 0.028 | 0.033 | 0.108* | 0.153*** | 0.155** |
| | (0.035) | (0.030) | (0.033) | (0.056) | (0.049) | (0.066) |
| $R^2$ | .277 | .141 | .157 | .25 | .209 | .154 |
| | | | *Panel B: PHC - Separate labour room* | | | |
| Vote margin | 0.954*** | 1.594*** | 1.055** | 0.532 | 0.557 | -0.016 |
| | (0.310) | (0.527) | (0.457) | (0.489) | (0.353) | (0.351) |
| Turnout | 0.554*** | 1.044*** | 0.916*** | 0.512** | 0.327 | 0.072 |
| | (0.181) | (0.330) | (0.303) | (0.214) | (0.211) | (0.213) |
| ENP | 0.101*** | 0.155*** | 0.089* | 0.048 | 0.031 | -0.017 |
| | (0.034) | (0.057) | (0.049) | (0.039) | (0.043) | (0.030) |
| $R^2$ | .369 | .332 | .321 | .325 | .293 | .233 |
| | | | *Panel C: CHC - Ambulance on road* | | | |
| Vote margin | 1.320*** | 0.762 | 1.052** | 1.448*** | 1.732*** | 0.459* |
| | (0.334) | (1.082) | (0.528) | (0.501) | (0.324) | (0.243) |
| Turnout | 0.749*** | 1.037* | 0.942*** | 0.637*** | 0.717*** | 0.166 |
| | (0.200) | (0.538) | (0.345) | (0.242) | (0.213) | (0.155) |
| ENP | 0.091** | 0.039 | 0.060 | 0.077 | 0.128*** | 0.033 |
| | (0.042) | (0.083) | (0.089) | (0.056) | (0.046) | (0.037) |
| $R^2$ | .199 | .122 | .179 | .189 | .14 | .103 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; N=422 in Panel A, N=420 in Panel B, and N=415 in Panel C. All regressions include the proportion of seats in a district reserved for scheduled castes and scheduled tribes and district-specific controls: literacy rate, log. of population, population growth, percentage of urban population, log. of income, area and latitude. We also include regional dummies in every regression. Standard errors in parenthesis are robust to heteroscedasticity for OLS models and robust to heteroscedasticity and misspecification bias for quantile regressions. Reported $R^2$s for quantile regressions are the square of the correlation between the fitted values and the dependent variables.

Table 5: Factors affecting healthcare personnel and training

| Variable name | OLS | Q(0.10) | Q(0.25) | Q(0.50) | Q(0.75) | Q(0.90) |
|---|---|---|---|---|---|---|
| *Panel A: HSC - ANM attended skilled birth training within last 5 years* | | | | | | |
| Vote margin | 0.297 | 0.669** | 0.638** | 0.096 | 0.561 | 0.690** |
| | (0.231) | (0.318) | (0.262) | (0.245) | (0.365) | (0.346) |
| Turnout | -0.525*** | 0.321* | -0.068 | -0.528*** | -0.869*** | -1.116*** |
| | (0.147) | (0.181) | (0.225) | (0.165) | (0.168) | (0.180) |
| ENP | 0.045 | 0.049* | 0.040 | 0.048 | 0.036 | 0.090*** |
| | (0.027) | (0.029) | (0.033) | (0.034) | (0.040) | (0.034) |
| $R^2$ | .231 | .0633 | .166 | .221 | .207 | .186 |
| *Panel B: PHC - Female medical officer* | | | | | | |
| Vote margin | 0.571 | 0.409 | 0.818*** | 1.011** | 1.420*** | 1.169*** |
| | (0.374) | (0.279) | (0.243) | (0.442) | (0.476) | (0.434) |
| Turnout | 0.129 | 0.220 | 0.414** | 0.586** | 0.038 | 0.577 |
| | (0.195) | (0.150) | (0.160) | (0.294) | (0.312) | (0.388) |
| ENP | -0.004 | 0.022 | 0.047* | 0.040 | -0.008 | 0.024 |
| | (0.033) | (0.024) | (0.026) | (0.030) | (0.054) | (0.053) |
| $R^2$ | .262 | .114 | .142 | .217 | .239 | .168 |
| *Panel C: CHC - has a general surgeon* | | | | | | |
| Vote margin | -0.901** | -0.215 | -0.752** | -1.715*** | -1.911*** | 0.141 |
| | (0.429) | (0.278) | (0.353) | (0.429) | (0.642) | (0.434) |
| Turnout | -0.876*** | -0.332* | -0.761*** | -1.038*** | -0.831* | -0.314 |
| | (0.241) | (0.196) | (0.231) | (0.276) | (0.459) | (0.503) |
| ENP | -0.131*** | -0.017 | -0.043 | -0.156*** | -0.232*** | -0.078 |
| | (0.039) | (0.042) | (0.037) | (0.060) | (0.055) | (0.083) |
| $R^2$ | .141 | .0645 | .054 | .0924 | .106 | .0649 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; N=422 in Panel A, N=420 in Panel B, and N=415 in Panel C. All regressions include the proportion of seats in a district reserved for scheduled castes and scheduled tribes and district-specific controls: literacy rate, log. of population, population growth, percentage of urban population, log. of income, area and latitude. We also include regional dummies in every regression. Standard errors in parenthesis are robust to heteroscedasticity for OLS models and robust to heteroscedasticity and misspecification bias for quantile regressions. Reported $R^2$s for quantile regressions are the square of the correlation between the fitted values and the dependent variables.

With respect to having labour rooms at HSC (see Panel A in Table 4), political competition is associated with a reduction in its provision. The (negative) association with political competition is small in size at lower quantiles, but increases as we move towards higher quantiles i.e. when its provision is also high. In Panel B of the same table, political competition is negatively associated with having labour room at PHC, like in the case of HSC, but differs in that the coefficients become smaller in magnitude as we move towards higher quantiles before losing statistical significance. For those quantiles where the effect of vote margin on having ambulance at CHC is statistically significant, it is positive (i.e. exhibits a negative association with political competition), but declines as we consider higher quantiles (see Panel C in the same table).

This is also true for nurses trained in birth assistance at HSC (Panel A in Table 5) and female doctors at PHC (Panel B in Table 5), although the association is stronger in the case of female doctors, where the effect size is inverted-U shaped (see Figure 2).

Neither access to HSC nor PHC (Panels A and B respectively, in Table 3) is statistically significant with respect to margin of victory. However, to the extent that there is any significant effect, its impact is negative indicating that higher vote margin is associated with an increase in provision but only at the top-most quantile which already enjoys better access than the remaining 90% of the sample. The effect of political competition is also positive with respect to having general surgeon at CHC (Panel C in Table 5) although its effect is much larger at lower quantiles, dips at the median, and rises again at higher quantiles before losing statistical significance (see Panel C in Table 5). This is not at all surprising. The norms surrounding access to healthcare are well-defined and its provision to a large extent depends on whether an area falls short of those pre-specified norms (see Table 1). Thus, relative to other healthcare variables we consider, politicians may not have a great degree of manoeuvreability in affecting change when it comes to access, which explains why they are not statistically significant. But when they are, as in the case of PHC access, the coefficient is negative and access is positively associated with increasing political competition.

As already mentioned, political market frictions such as information constraints on candidate performances, low enforcement of election promises, etc., impede greater political competition from increasing public provision. When political market frictions are high, there is a strong incentive for polticians to reinvest in 'safe' seats by increasing public provision (i.e. when margin of victory is high). This might be why we find the association to be positive in 5 out of the 8 dependent variables we study, that is, in these instances political stability rather than political competition is associated with improved healthcare provision.

In Figure 2, we plot the association between vote margin and our set of dependent variables at different quantiles. In all cases (except having general surgeons at CHC) the effect at the 10th quantile is positive. However, as already discussed above, the impact is heterogeneous across quantiles reinforcing the importance of examining the effect of our covariates along the entire distribution rather than just at the mean.

### 7.2 The effect of voter turnout

The percentage of people who actually turned out to vote is representative of how engaged voters are with politics. One would expect public provision to be positively associated with

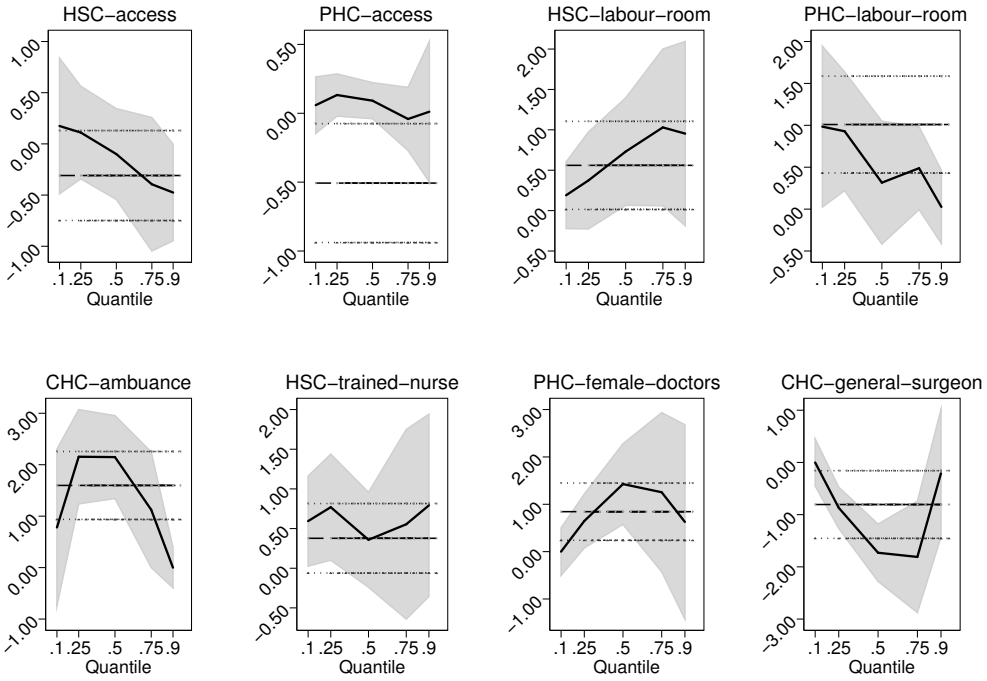


Figure 2: The figure shows the marginal effect of victory margin on healthcare provision across different quantiles based on bootstrapped regressions with 100 replications. Each panel corresponds to one of the 8 healthcare measures.

turnout because higher voter engagement means greater political pressure and stricter political accountability.

The impact of turnout is, however, heterogeneous across variables and also across quantiles. Like margin of victory, turnout is positively correlated with having labour room at PHC, having ambulance at CHC (Panels B and C in Table 4) and having female doctors at PHC (Panel B in Table 5) but is negatively associated with access to PHC (Panel A in Table 3), trained nurses at HSC and general surgeons at CHC (Panels A and C in Table 5).

The strength of the positive association between turnout and having labour room at PHC declines as we move to higher quantiles. For female doctors at PHC, the impact is positive and significant only at the 25th and 50th quantiles and is not significant elsewhere. With regard to ambulance at CHC, the effect declines gradually, and loses statistical significance thereafter (see Figure 3).

Turnout has no discernible impact on access to HSC (Panel A, Table 3) or labour rooms at HSC. This is expected. HSC have relatively high coverage: 41% of districts in our sample reported having access to HSC which increased to 68% at the 90th quantile. By contrast, only 14% of the districts reported having access to PHC and 24% at the 90th quantile.

In Figure 3, we plot the association between turnout and our set of dependent variables at different quantiles which again highlights the differential impact of turnout along the healthcare distributions. It is positively associated with 3 out of 8 dependent variables, an equal number for which the association is negative, and not significant for the remaining two variables. Therefore,

our hypothesis that turnout is positively associated with healthcare provision holds only for a subset of variables.

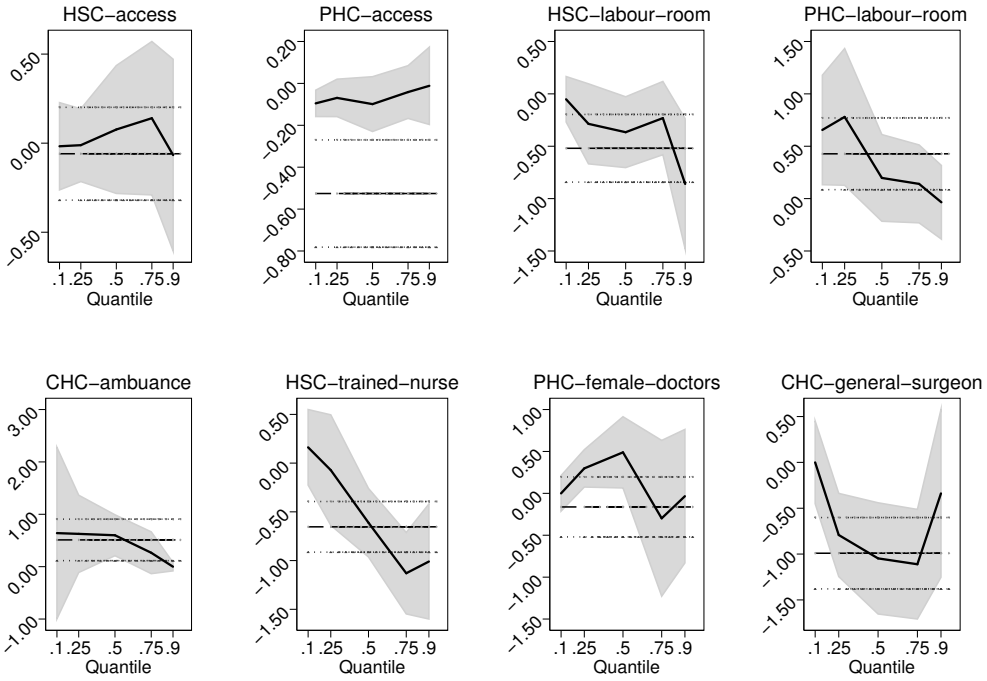


Figure 3: The figure shows the marginal effect of turnout on healthcare provision across different quantiles based on bootstrapped regressions with 100 replications. Each panel corresponds to one of the 8 healthcare measures.

### 7.3 The effect of ENP

We measure party fragmentation by the effective number of parties (ENP) which is the inverse of the sum of vote shares across all parties contesting elections. By weighting the parties by their vote shares, a high value for ENP indicates a broader distribution of political power. Its impact is hard to predict ex-ante. This is because ENP can be high when smaller groups are able to organize themselves politically. Anecdotal evidence on the growth of regional parties in India would suggest a broadening of the distribution of political power (see Varshney 2000) which would result in high ENP without a change in the underlying social divisions. If this is indeed the case, the association between ENP and healthcare provision is expected to be positive. On the other hand, a high ENP might indicate a heterogeneous society in which case the coefficient will have a negative sign.

We find that higher ENP is largely associated with an increase in healthcare provision with considerable heterogeneity across the variables and quantiles. Higher ENP or an increase in the effective number of parties is positively associated with a rise in having labour rooms at HSC and PHC (Panels A and B in Table 4). The association is also positive with respect to having trained nurses and female doctors at HSC and PHC respectively (Panels A and B in Table 5) and having ambulance at CHC (Panel C in Table 4). However, barring a few exceptions, its impact is statistically significant mostly at the higher quantiles. The positive association

between ENP and healthcare provision, in spite of controlling for the share of seats reserved for scheduled castes and for scheduled tribes in all our regressions is consistent with the (anecdotal) observation that smaller groups have increasingly organized themselves politically (without an increase in the underlying social heterogeneity) which might be why ENP is positively associated with healthcare provision.

With respect to access to HSCs and PHCs (Panels A and B in Table 3), and surgeons at CHCs (Panel C in Table 5) the association with ENP is negative. This is because whether or not a village has a local healthcare facility is largely influenced by government norms on coverage (see Table 1), whereas, CHCs, being more remote from most people are less electorally crucial.

In Figure 4, we plot the association between ENP and our set of dependent variables at different quantiles. Similar to margin of victory and turnout, the impact of ENP is heterogeneous across quantiles and over the different dependent variables we study.

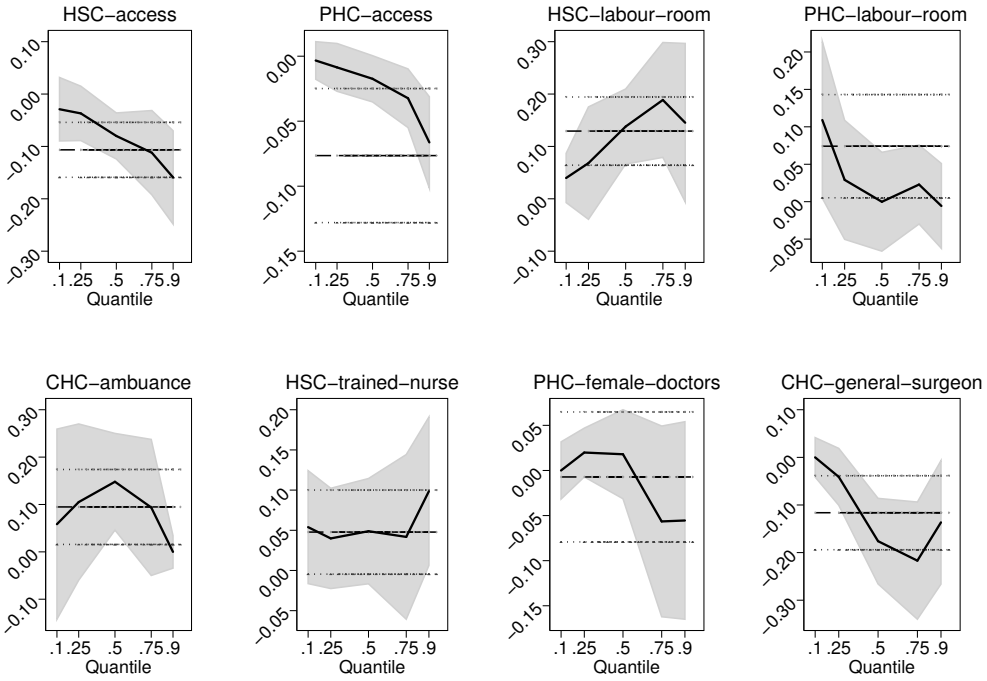


Figure 4: The figure shows the marginal effect of ENP on healthcare provision across different quantiles based on bootstrapped regressions with 100 replications. Each panel corresponds to one of the 8 healthcare measures.

To summarize, we find that the margin of victory is positively associated with 5 out of 8 healthcare variables which implies that it is political stability rather than political competition that is associated with improved healthcare provision. The effect of turnout is mixed: while its impact is positive for some, it is negative for others. In 5 out of 8 instances, healthcare provision is positively associated with ENP which would suggest that a larger distribution of political power has had a favourable impact on healthcare service delivery in India. These 5 variables that are positively associated with ENP are also the ones that see improvements from political stability (or low political competition). Importantly, these effects are heterogenous across the conditional distribution which reinforces our choice of methodology.

# 8 Robustness checks

## 8.1 Checks for validity

One of the concerns is whether our results are specific to the variables we select or, that they are valid over a wider range of simlar healthcare measures. In order to alleviate this concern we constructed several indices relating to access to healthcare, provision of healthcare infrastructure as well as for personnel and training of doctors and nurses. These indices were constructed using Principal Components Analysis (PCA). PCA allows us to use the correlatedness among a set of variables to reduce the dimension of the data. In this case, we used the first principal component to create our indices. The percentage of total variance explained by the first principal component in constructing each of the indices is presented in Table 12, Appendix C.

We constructed two indices for access: a broad measure which incorporates the complete range of public healthcare services that one can access, and another that looks at access to publicly provided services in HSCs, PHCs and CHCs only since these are the ones that are most commonly accessed (see Table 6). We also constructed healthcare infrastructure indices for the three levels – HSCs, PHCs and CHCs (see Table 7), and another set of indices for training and personnel of healthcare staff (see Table 8). Table 13 shows the input variables that go into constructing the indices along with their weights which we obtain from PCA.

The results from regressions do not fundamentally change when using healthcare indices as dependent variables instead of the specific measures which we present in section 7. Like before, margin of victory is largely positively associated with healthcare indices; the effect of turnout is mixed and its sign is positive or negative depending on the specific variable under consideration; and, a positive association with ENP, except access, which is influenced by government norms on coverage. Thus, we are assured that our results are not specific to the variables we choose and are consistent with a broader set of indicators. This adds to the external validity of our results.

## 8.2 Bootstrapped standard errors

We also checked for the robustness of our inference from Tables 3, 4 and 5 to the use of estimation method by bootstrapping. By drawing several samples with replacement and reestimating the statistic, we are able to compute standard errors that are robust to heteroscedasticity (Efron 1994, Gould 1992). The standard error is estimated as $\sqrt{(\frac{\sum(b_i-\bar{b})^2}{K-1})}$ where $K$ is the number of replications, which for our purpose is 100, $b_i$ is the estimate from the ith replication whereas $\bar{b}$ is the average of estimates over all replication samples. The inference based on bootstrapped standard errors is quite similar to the one we use which is not only robust to heteroscedasticity but also to misspecification bias.[10]

## 8.3 Inter-quantile comparison

Although we have conducted statistical tests to acertain the heterogeneity in the dataset, and used quantile regressions to show how the impact of political variables differ when we examine

[10]We do not present the results from bootstrapped regressions here to conserve space and are available from the authors on request.

Table 6: Factors affecting indices of healthcare access

| Variable name | OLS | Q(0.10) | Q(0.25) | Q(0.50) | Q(0.75) | Q(0.90) |
|---|---|---|---|---|---|---|
| | | | *Panel A: Healthcare access - I* | | | |
| Vote margin | -5.113** | 0.010 | -0.508 | -0.583 | -2.062 | -1.589 |
| | (2.416) | (1.240) | (1.043) | (1.252) | (3.009) | (2.705) |
| Turnout | -4.995*** | -0.703 | -0.748 | -0.541 | -2.445 | -0.172 |
| | (1.384) | (0.735) | (0.685) | (0.842) | (1.518) | (1.199) |
| ENP | -0.841*** | -0.254** | -0.269** | -0.418*** | -0.594** | -0.594** |
| | (0.227) | (0.121) | (0.115) | (0.134) | (0.299) | (0.239) |
| $R^2$ | .346 | .0965 | .184 | .249 | .306 | .225 |
| | | | *Panel B: Healthcare access - II* | | | |
| Vote margin | -3.715* | -0.068 | -0.004 | -0.501 | -4.100 | -4.139* |
| | (1.916) | (1.266) | (0.616) | (1.307) | (2.523) | (2.148) |
| Turnout | -3.798*** | -1.031 | -0.801 | -0.830 | -2.098* | -0.479 |
| | (1.031) | (0.630) | (0.604) | (0.666) | (1.244) | (1.164) |
| ENP | -0.676*** | -0.156 | -0.204*** | -0.302*** | -0.629*** | -0.668*** |
| | (0.173) | (0.102) | (0.076) | (0.109) | (0.237) | (0.252) |
| $R^2$ | .339 | .134 | .145 | .198 | .316 | .204 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; N=422 in both Panels A and B. P-values are in parenthesis. All regressions include the proportion of seats in a district reserved for scheduled castes and scheduled tribes and district-specific controls: literacy rate, log. of population, population growth, percentage of urban population, log. of income, area and latitude. We also include regional dummies in every regression. Standard errors in parenthesis are robust to heteroscedasticity for OLS models and robust to heteroscedasticity and misspecification bias for quantile regressions. Reported $R^2$s for quantile regressions are the square of the correlation between the fitted values and the dependent variables.

Table 7: Factors affecting indices of healthcare infrastructure

| Variable name | OLS | Q(0.10) | Q(0.25) | Q(0.50) | Q(0.75) | Q(0.90) |
|---|---|---|---|---|---|---|
| | | | *Panel A: HSC* | | | |
| Vote margin | 1.007 | -2.463 | -1.705 | 1.668 | -0.619 | 0.197 |
| | (1.632) | (1.993) | (1.556) | (1.874) | (2.463) | (3.615) |
| Turnout | -2.290** | -1.675 | -1.628 | -2.018* | -3.106*** | -3.650** |
| | (1.002) | (1.686) | (1.279) | (1.112) | (1.043) | (1.560) |
| ENP | 0.463** | 0.007 | 0.146 | 0.384* | 0.457* | 0.642** |
| | (0.190) | (0.294) | (0.223) | (0.227) | (0.245) | (0.269) |
| $R^2$ | .294 | .147 | .217 | .275 | .251 | .15 |
| | | | *Panel B: PHC* | | | |
| Vote margin | 6.976*** | 8.544*** | 8.712*** | 8.071*** | 3.116 | 6.681 |
| | (2.159) | (2.786) | (2.496) | (2.832) | (3.329) | (4.214) |
| Turnout | 7.167*** | 7.076*** | 7.780*** | 9.084*** | 5.886*** | 1.640 |
| | (1.223) | (1.782) | (1.900) | (1.683) | (1.823) | (1.987) |
| ENP | 0.603*** | 0.737*** | 0.635** | 0.470 | 0.357 | 0.324 |
| | (0.221) | (0.282) | (0.289) | (0.293) | (0.330) | (0.417) |
| $R^2$ | .376 | .331 | .341 | .362 | .342 | .249 |
| | | | *Panel C: CHC* | | | |
| Vote margin | 4.081** | 7.962*** | 2.200 | 1.979 | 1.228 | 1.188 |
| | (1.779) | (2.454) | (1.976) | (1.259) | (0.924) | (1.002) |
| Turnout | 2.609** | 0.635 | 0.132 | 0.572 | 0.748 | 1.115* |
| | (1.039) | (1.753) | (1.314) | (0.849) | (0.641) | (0.600) |
| ENP | 0.481** | 0.895*** | 0.397** | 0.318** | 0.093 | 0.274* |
| | (0.203) | (0.258) | (0.164) | (0.145) | (0.135) | (0.146) |
| $R^2$ | .281 | .226 | .243 | .155 | .139 | .0837 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; N=422 in Panel A; N=420 in Panel B, and N=415 in Panel C. All regressions include the proportion of seats in a district reserved for scheduled castes and scheduled tribes and district-specific controls: literacy rate, log. of population, population growth, percentage of urban population, log. of income, area and latitude. We also include regional dummies in every regression. Standard errors in parenthesis are robust to heteroscedasticity for OLS models and robust to heteroscedasticity and misspecification bias for quantile regressions. Reported $R^2$s for quantile regressions are the square of the correlation between the fitted values and the dependent variables.

Table 8: Factors affecting indices of healthcare personnel and training

| Variable name | OLS | Q(0.10) | Q(0.25) | Q(0.50) | Q(0.75) | Q(0.90) |
|---|---|---|---|---|---|---|
| | | | *Panel A: HSC* | | | |
| Vote margin | 4.754** | 8.110** | 2.320 | 2.864 | 6.155** | 10.550*** |
| | (2.349) | (3.315) | (2.637) | (2.654) | (2.905) | (2.895) |
| Turnout | -3.031** | 3.141 | -2.297 | -4.464*** | -7.432*** | -4.919** |
| | (1.307) | (2.372) | (1.798) | (1.226) | (1.224) | (2.170) |
| ENP | 0.432* | 0.639* | 0.542* | 0.173 | 0.571** | 0.859*** |
| | (0.248) | (0.343) | (0.280) | (0.251) | (0.262) | (0.271) |
| $R^2$ | .173 | .015 | .146 | .159 | .139 | .0886 |
| | | | *Panel B: PHC* | | | |
| Vote margin | 1.078 | 3.773* | 1.269 | 2.538 | 5.881 | 3.906 |
| | (1.934) | (2.018) | (1.977) | (1.846) | (3.890) | (2.891) |
| Turnout | -2.028* | 0.290 | -1.176 | -0.800 | -0.933 | 2.197 |
| | (1.037) | (0.856) | (0.963) | (1.404) | (1.973) | (1.940) |
| ENP | -0.057 | 0.060 | 0.028 | -0.040 | 0.106 | 0.166 |
| | (0.176) | (0.176) | (0.211) | (0.191) | (0.229) | (0.256) |
| $R^2$ | .374 | .179 | .28 | .327 | .328 | .256 |
| | | | *Panel C: CHC* | | | |
| Vote margin | -4.049** | -5.031*** | -1.984 | -1.575 | -5.067** | -0.831 |
| | (1.809) | (1.644) | (2.105) | (2.140) | (2.562) | (3.865) |
| Turnout | -3.892*** | -3.940*** | -2.342 | -2.300 | -2.382 | -2.866 |
| | (1.184) | (1.260) | (1.697) | (1.481) | (1.751) | (2.723) |
| ENP | -0.160 | -0.319* | -0.214 | -0.063 | 0.262 | -0.062 |
| | (0.205) | (0.188) | (0.214) | (0.321) | (0.232) | (0.401) |
| $R^2$ | .178 | .0361 | .0426 | .147 | .149 | .129 |

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; N=422 in Panel A, N=420 in Panel B, and N=415 in Panel C. All regressions include the proportion of seats in a district reserved for scheduled castes and scheduled tribes and district-specific controls: literacy rate, log. of population, population growth, percentage of urban population, log. of income, area and latitude. We also include regional dummies in every regression. Standard errors in parenthesis are robust to heteroscedasticity for OLS models and robust to heteroscedasticity and misspecification bias for quantile regressions. Reported $R^2$s for quantile regressions are the square of the correlation between the fitted values and the dependent variables.

the extremes of the distribution, it might be interesting to see whether the effect sizes themselves are statistically different across quantiles. Here we explicitly test for differences in the effect size by conducting pairwise t-tests between coefficient obtained at the 5th quantile with that at the median, 75th and 90th quantiles, successively, for the main political economy variables and over the 8 dependent variables in our study.

Table 9 presents results relating to the inter-quantile comparisons. As expected, in several cases we find the effect sizes to be statistically significant, reinforcing the choice of our methodology. For example, in the case of access to HSC, not only does ENP have a negative impact (see Table 3), the effect size at the 5th quantile is significantly different from its impact at the 75th and 95th quantiles, as the p-values in Table 9 indicates at the 10% level of significance. With regard to margin of victory, the difference in the effect-size is most discernible for having labour room and female doctors at PHC, and having general surgeons and ambulance at CHC. For turnout, it is access to PHC, having labour room and female doctors at PHC, and having trained nurses at HSC and general surgeons at CHC, that are statistically different. Finally, with respect to ENP, the difference in effect-size is statistically significant in the cases of access to HSC and PHC, having labour room at HSC and PHC, and having general surgeons at CHC.

Table 9: Inter-quartile comparisons with 5th quantile as base

| | HSC - access | | | PHC - access | | | HSC - labour room | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | q50 | q75 | q95 | q50 | q75 | q95 | q50 | q75 | q95 |
| Vote Margin | 0.545 | 0.534 | 0.627 | 0.749 | 0.296 | 0.543 | 0.609 | 0.499 | 0.821 |
| Turnout | 0.532 | 0.935 | 0.936 | **0.099** | 0.240 | 0.678 | 0.119 | 0.237 | 0.503 |
| ENP | 0.471 | **0.059** | **0.081** | **0.017** | 0.186 | 0.113 | 0.153 | **0.022** | 0.104 |
| | PHC - labour room | | | CHC - ambulance | | | HSC - trained nurses | | |
| Variable | q50 | q75 | q95 | q50 | q75 | q95 | q50 | q75 | q95 |
| Vote Margin | 0.378 | 0.338 | **0.030** | **0.065** | **0.031** | 0.883 | 0.286 | 0.785 | 0.324 |
| Turnout | 0.580 | 0.301 | **0.065** | 0.579 | 0.488 | 0.650 | **0.000** | **0.000** | **0.000** |
| ENP | 0.143 | **0.089** | **0.026** | 0.420 | 0.213 | 0.891 | 0.270 | 0.490 | 0.102 |
| | PHC - female doctors | | | CHC - general surgeons | | | | | |
| Variable | q50 | q75 | q95 | q50 | q75 | q95 | | | |
| Vote Margin | **0.055** | **0.031** | **0.035** | **0.000** | **0.004** | 0.635 | | | |
| Turnout | **0.092** | 0.917 | 0.804 | **0.002** | 0.133 | 0.738 | | | |
| ENP | 0.636 | 0.535 | 0.424 | **0.005** | **0.002** | 0.691 | | | |

Notes: Coefficients are estimated using full model specification at different quantiles and bootstrapped standard errors generated using 100 replications. Coefficient obtained at the 5th quantile are tested for equality with coefficients obtained at the median, 75th and 95th quantiles respectively and p-values presented in cells. P-values $\leq$0.10 are in bold.

# 9 Conclusion

In this paper, we started with three specific objectives relating to the political economy of healthcare provision in India: (a) to ascertain if political stability, rather than political competition, is associated with improved healthcare provision; (b) whether the impact of turnout is positive; and, (c) to assess whether a broader distribution of political power (measured by ENP) is associated with improved healthcare provision. Standard approaches to examine these questions focus on the impact of the political economy variables on the conditional mean. However, the association between political economy variables and healthcare provision may be different at the extremes i.e. when healthcare is exceedingly low, or when it is remarkably high.

To get a more complete picture of the relationship, we used quantile regressions to examine the relationship between political economy variables and healthcare provision at different points along the conditional healthcare distribution. For this purpose, we used cross-sectional data at the district level for 15 major Indian states.

We find that the margin of victory is positively associated with 5 out of 8 healthcare variables which implies that it is political stability rather than political competition that is associated with improved healthcare provision. The effect of turnout is mixed i.e. while its impact is positive for some healthcare measures, it is negative for others. For the same 5 out of 8 variables that were positively associated with political stability, the association with ENP is also positive suggesting that a larger distribution of political power has had a favourable impact on healthcare service delivery in India. Importantly, these effects are heterogenous across the conditional distribution which reinforces our choice of methodology. This holds true across multiple measures of healthcare provision and across the different tiers of the public healthcare system. We conduct several robustness tests to validate our results.

There are however some limitations to our study. We were primarily interested in the longer-term impact of political economy variables on healthcare provision. To this end we used the average of four election cycles because the observed levels of healthcare have been shaped by several years of policy decisions. We used lagged values of covariates and controls to minimize simultaneity bias. Therefore, one of the limitations of our study is that it is not very informative on how current political processes affect public healthcare provision. In addition, factors like absenteeism of doctors and nurses, which is a pervasive problem in developing economies (Banerjee et al. 2008), might impact healthcare service delivery.

# Appendices

## A Matching constituencies to districts

Matching constituencies to their respective districts is a time-consuming task. This is further complicated by redistrictings i.e. the process of redrawing district boundaries which often involve carving out new districts from a single district or a combination of districts. For instance, there were 466 districts in the 1991 census which increased to 593 during the 2001 census.

We first converted the data which we obtained from the ELection Commission of India into machine readable format. We then matched individual constituencies to their respective districts using the following algorithm: First, we obtained election results from the year 2004-05 which includes matched district-constituency information. This was possible because the Delimitation Order, 2003 did not come into effect until 2008. This was then modified to reflect the 2001 district boundaries, i.e. if a new district had been carved out after 2001 census, it was merged back with its parent and all constituencies transferred. However, districts carved out of multiple parents were dropped from the analysis. Those constituencies that remained unmatched at the end of the first step were attempted to be matched using the matching scheme available with www.empoweringindia.org, a non-profit organization that provides reliable information on Indian elections on their website. And finally, constituencies without a matched district at the end of the second step were matched using electoral orders from the Election Commission of India. Once constituencies were matched to their respective districts, we aggregated constituency-level data to the district-level which is used in our analysis.

## B Normality and heteroscedasticity tests

### B.1 Tests on OLS residuals

Table 10: Normality and heteroscedasticity tests [a] [b]

| | W | pW | H | pH |
|---|---|---|---|---|
| WV-HSC | 0.986 | 0.000 | 217.5 | 0.000 |
| WV-PHC | 0.884 | 0.000 | 328.1 | 0.000 |
| HSC-SLR | 0.987 | 0.001 | 145.3 | 0.385 |
| PHC-SLR | 0.986 | 0.000 | 248.2 | 0.000 |
| CHC-Ambulance | 0.971 | 0.000 | 161.5 | 0.114 |
| HSC-ANM-SBA | 0.980 | 0.000 | 227.4 | 0.000 |
| PHC-FMO | 0.966 | 0.000 | 247.2 | 0.000 |
| CHC-GS | 0.948 | 0.000 | 195.2 | 0.002 |

[a] Shapiro-Wilk's test for normality of OLS residuals.
[b] White's test for heteroscedasticity of OLS residuals.

### B.2 Machado and Santos Silva (2000) heteroscedasticity test

Table 11: MSS Quantile heteroscedasticity test[a]

| Variable | q10 | | q25 | | q50 | | q75 | | q90 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | P-val | $\chi^2$ | P-val | $\chi^2$ | P-val | $\chi^2$ | P-val | $\chi^2$ | P-val |
| WV-HSC | 8.29 | 0.02 | 32.98 | 0.00 | 58.00 | 0.00 | 47.79 | 0.00 | 44.84 | 0.00 |
| WV-PHC | 50.32 | 0.00 | 51.31 | 0.00 | 70.46 | 0.00 | 145.64 | 0.00 | 216.61 | 0.00 |
| HSC-SLR | 19.12 | 0.00 | 10.78 | 0.01 | 10.29 | 0.01 | 24.12 | 0.00 | 27.78 | 0.00 |
| PHC-SLR | 41.71 | 0.00 | 62.09 | 0.00 | 66.95 | 0.00 | 34.84 | 0.00 | 49.62 | 0.00 |
| CHC-Ambulance | 8.11 | 0.02 | 4.00 | 0.14 | 4.53 | 0.10 | 5.10 | 0.08 | 29.37 | 0.00 |
| HSC-ANM-SBA | 2.48 | 0.29 | 15.83 | 0.00 | 70.57 | 0.00 | 41.72 | 0.00 | 17.57 | 0.00 |
| PHC-FMO | 19.17 | 0.00 | 17.75 | 0.00 | 32.97 | 0.00 | 33.02 | 0.00 | 78.54 | 0.00 |
| CHC-GS | 17.17 | 0.00 | 4.87 | 0.09 | 4.07 | 0.13 | 4.51 | 0.11 | 27.09 | 0.00 |

[a] $\chi^2$ test results and corresponding p-values from Machado and Santos Silva (2000) quantile heteroscedasticity test.

# C Construction of healthcare indices

Table 12: Percentage of total variance explained by PC1.

| Indices | $\left(\lambda_i / \sum_i^m \lambda_i\right) * 100$ |
|---|---|
| Public Health access: | |
| Overall Access | 65.08 |
| Health Centre Access | 80.00 |
| Infrastructure: | |
| HSC | 53.06 |
| PHC | 36.47 |
| CHC | 27.27 |
| Human resource: | |
| HSC | 53.48 |
| PHC | 45.78 |
| CHC | 37.83 |

Notes and sources:

[a] Column 2 shows percentage of variance explained by PC1 i.e. the ratio of the eigenvalue corresponding to PC1 to the sum of eigenvalues of all the components.
Data source: DLHS-3, 2007-08.

Table 13: Input variables used in creating health indicators

| Indices | Input variables |
|---|---|
| Public health access: | |
| Broad access index | ICDS(0.19), HSC(0.40), PHC(0.48), Block PHC(0.45), gov. dispensaries(0.42), AYUSH(0.45). |
| Only HSC/PHC/CHC | HSC(0.55), PHC(0.62), CHC(0.56) |
| Infrastructure: | |
| HSC | Located in government building(0.49), communication facility(0.37), separate labour room(0.50), ANM staying in HSC village(-0.19), staff quarter for ANM(0.57), regular water supply(0.11). |
| PHC | Residential quarter MO(0.21), separate labour room(0.42), personal computer(0.25), normal delivery kit(0.41), large deep freezer(0.39), regular water supply(0.18), neonatal warmer(0.28), OT with Boyle's apparatus(0.35), OT with anaesthetic medicine(0.35), plan for current year(0.21). |
| CHC | Personal computer (0.14), operation theatre(0.53), labour room(0.58), blood storage facility(0.16), large deep freezer(0.32), plan for current year(0.12), 24-hr water supply(0.46), ambulance on road(-0.05) |
| Human resource: | |
| HSC | Male health worker in position(0.23), ANM had: ISD training in last 5 years(0.42), ever been trained in ISD(0.39), IMNCI in last 5 years(0.48), ever been trained in IMNCI(0.46), ANM attended SBA training(0.40). |
| PHC | Lady MO(0.56), lab technician (0.52), org. training prog. last year(-0.14), at least one MO attended: ISD training (12d in last 5 years) (0.25), IMNCI (in last 5 years)(0.58). |
| CHC | General surgeon (0.41), Obst./Gyn(0.45), MO training in last 5 years: NSV(0.43), HIV/AIDS(0.15), Basic emergency/Obst. care(0.51), Neo-natal care(0.39) |

Notes and sources:

The extracted weights from the first principal component are in parenthesis.
The abbreviations used in the table are as follows: ICDS - Integrated Childhood Development Services; HSC - Health Sub-Centre; PHC - Primary Healthcare Centre; AYUSH - Ayurveda, Yoga, Unani, Siddha and Homeopathy; MO - Medical Officer; HIV/AIDS - Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome; Obst.- Obstetrician; Gyn.- Gynecologist; NSV - Non-Scalpel Vasectomy; IMNCI - Integrated Management of Neo-natal and Childhood Illnesses; ICTC - Integrated Counselling and Testing Centre for HIV; OT - Operation Theatre; ISD - Integrated Skill Development Training; ANM - Auxiliary Nurse/ Midwife; SBA - Skilled Birth Attendant.
Data source: DLHS-3, 2007-08.

## References


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