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The Determinants of Public Goods Provision: An Empirical Evidence From the Major States of India

Enakshi Sinha Ray
Associate Professor Department of Economics, Rajdhani College, University of Delhi.
E-mail: sinharayenakshi@gmail.com

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Abstract: The objective of the paper is to identify the factors that affect the physical provision of public goods by the state governments and measure their impact. The empirical analysis is based on political and socio-economic panel data from the 14 major states of India during 1967-68 to 2000-01. The analysis indicates that variation in the provision of public goods can be explained by the proximity of a scheduled state legislative assembly election, the effective number of parties, and the caste heterogeneity of the population. It is observed that the proximity of a scheduled election lowers the provision of public goods that require large investments and more time to deliver physically and vice-versa. Effective numbers of parties raise zilla parishad road length and lower urban road length, wells, etc. Moreover, caste heterogeneity raises per capita net electricity generated but lowers net area irrigated.

Keywords: Public goods, Infrastructures, Government investment analysis, Government policy, and Irrigation.

JEL Classification: H41, H54, R42, R48, and Q15.

INTRODUCTION

In a society, the quality of life of citizens depends crucially on the role of the government and the quality of its governance. This is true in case of developing countries like India where 29.8 per cent (2009-10) of the population is living below the poverty line[1], the illiteracy rate is 25.9 per cent (2011), death rate is 73 per thousand populations (2009) and infant mortality rate is 50 per thousand live births (2009)[2]. Hence, government intervention is essential to maximise a citizen's welfare. The political economy literature argues that public policies are formulated by politicians. Therefore, the politicians want to maximise their own preferences subject

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to the institutional constraints under which they function. Public policies that are undertaken are therefore tempered by political factors.

The objective of my paper is to study the factors that affect the provision of public goods in the 14 major states of India for the period 1967-68 to 2000-01. The three crucial factors that I consider are as follows: the proximity of a scheduled state legislative assembly election (i.e. Vidhan Sabha), the effective number of parties in a legislature, and caste heterogeneity in the population. Most published papers dealing with developing countries, address issues related to public *spending* on infrastructure. In contrast, I consider physical provision of various types of infrastructure by the government because public spending is a poor determinant of actual service delivery. I include three categories of public goods: irrigation infrastructure (e.g. canals and tube wells) to cultivate land, the generation and transmission of electricity, and the construction of different road-types.

Table 1: Different sources of irrigation in India

Source	*Percentage of land irrigated*
Canals	26.4
Tube Wells and other Wells	61.7
Tanks	2.6
Other sources	9.3
Total	100.0

Notes:

(1) In the Table, 'Percentage of land irrigated' is the proportion of land irrigated by different sources in total arable land.

(2) The data are collected from the *Statistical Year Book*, India 2013, Ministry of Statistics and Programme Implementation, Government of India.

Agriculture in India is the means of livelihood of almost two thirds of the work force. Empirical evidence suggests that increase in agriculture production in India has mostly taken place under irrigated conditions; close to three fifths of India's grain harvest comes from irrigated land (Brown, 2003). Therefore, the importance of irrigation in India cannot be overemphasised. Land is irrigated by means of government canals, wells, tanks, and other sources. Table 1 shows the percentage of land irrigated by the aforesaid sources in India.

Power is an important infrastructure on which the economic growth and development of a country depend. India has the fifth largest generation capacity in the world with an installed capacity of 373 Giga Watts as on Oct. 2020[3]. The thermal, hydro, and nuclear energy are the major sources of generation of electricity in India. India is also the world's fourth largest energy consumer accounting for about 4.29 per cent (in 2010) of the world's total primary energy consumption[4]. The first three columns of Table 2 display installed capacity, gross generation, and consumption of power. Final column shows the number of consumers of power in India during the period 2003-04.

Road networks are vital for economic development, trade and social integration. The road network of India is the third largest road network (approximately 33 lakh kms in 2009) in the world[5]. Table 3 depicts the different categories of roads in India. The data compiled on road network can be broadly classified into three categories: highways, urban roads, and project roads. Highways consist of PWD roads and rural roads. Zilla parishad roads, panchayat samiti roads, and village panchayat roads are the components of rural roads. Urban roads comprise municipal roads, military engineering service roads, railway authority roads, and port roads.

Table 2: State wise installed capacity, gross generation, consumption, and number of consumers of power in India during the period 2003-04

States	*[1]Installed Capacity (Utilities) (M.W.)*	*[2]Gross Generated (Utilities) (G.W.H.)*	*[3] Consumption (Utilities) (G.W.H.)*	*[4] No. of Consumers (In '000)*
Andhra Pradesh	7786.61	32913.93	34165.97	95870
Bihar	598.4	447.38	3730.34	1928
Gujarat	7463.39	38269.84	37971.72	9958
Haryana	1990.29	10865.37	12915.72	3737
Karnataka	5367.12	22996.43	23143.17	12653
Kerala	2240.07	5629.02	9093.1	7393
Madhya Pradesh	3236.57	15802.08	15907.83	6598
Maharashtra	13188.56	66390.48	51823.9	16928
Orissa	2300.91	9119.33	7157.48	1857
Punjab	4532.17	24047.89	22125.3	5706
Rajasthan	3681.05	18614.08	14691.24	5748
Tamil Nadu	7750.64	30353.93	39240.21	17026
Uttar Pradesh	4620.6	22835.51	26659.62	8487
West Bengal	4782.47	23508.42	17815.87	6711
India	112683.5	565101.7	360937.2	133571

Notes:

(1) In Column [1], M.W. is a unit of measurement of power. M.W. is Mega Watt (10^6 Watts).

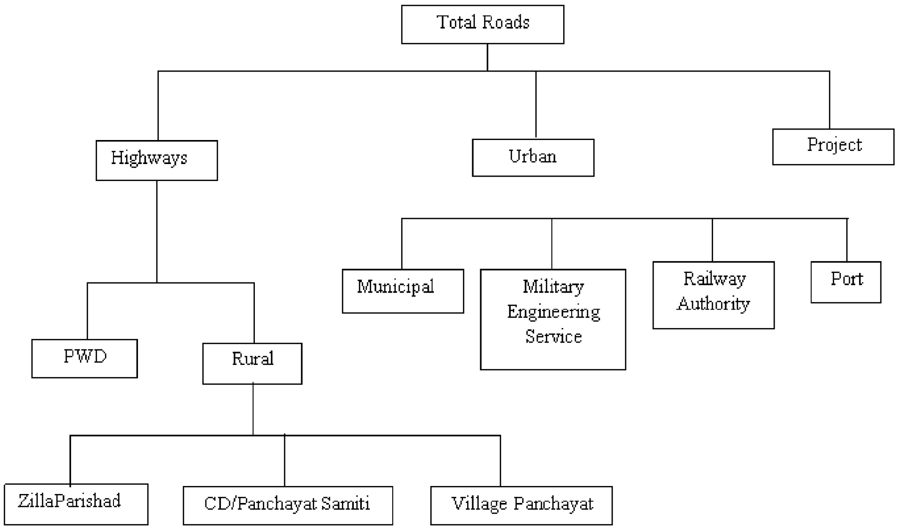
(2) In Columns [2] and [3], G.W.H. is a unit of measurement of power. G.W.H. is Giga Watt Hour (10^9Watts *Hour).

(3) 'Utility' is an electric power company that engages in the generation, transmission, and distribution of electricity, usually in a regulated market.

(4) Information on no. of consumers is taken on 31.03.2004.

(5) The data are compiled from the website http://www.indiastat.com.

Table 3: Different categories of roads in India



Source: Basic Roads Statistics of India, a Government of India publication.

Now, I will briefly outline the theoretical arguments that provide the rationale for my empirical investigation. In the Rogoff-Sibert (1988) model, the political business cycle is explained in terms of government policy on tax revenues. A government provides certain services to citizens. In order to provide these services, the government has to raise revenues through a combination of distortionary taxes (that citizens observe with a lag) and non-distortionary taxes (that citizens observe immediately). In the model, the government can be either competent or incompetent; however, the government's type is private information and, therefore, unknown to the electorate. In order to enhance its electoral prospects, the government wishes to signal to the electorate (through its election-year *actions*) that it is competent. A competent government requires less aggregate tax revenues than an incompetent government to provide the same level of services. During an election year, a competent incumbent government lowers the level of non-distortionary taxes to convince citizens about its competency. Why does an incompetent incumbent government not mimic the election-year tax decreases that a competent government engineers? In order to replicate the behaviour of a competent government, the incompetent government has to raise large revenues through distortionary taxes and is therefore unwilling to do since citizens' welfare which is severely reduced. Rogoff (1990) modifies Rogoff-Sibert (1988) by allowing for multidimensional signaling in his model. Specifically, the incumbent government now incurs two types of expenditures: consumption expenditure and investment expenditure. Voters can observe taxes and public consumption expenditure prior to elections, but public investment expenditure is observed with a one-period lag. Since the effects of investment expenditure are not visible immediately, public expenditure shifts towards the more visible consumption expenditure and away from investment expenditure during election years.

Drazen and Eslava (2005) present a different model of political budget cycles. In this model, the political budget cycle is measured as the difference in fiscal choices between the pre-election period and the post-election period. The authors assume that incumbents are unable to alter the overall level of spending, taxes or deficits. Voters value certain types of expenditures but dislike deficits. Prior to an election, incumbents attempt to influence voter behavior by changing the composition of government spending whilst keeping untouched the overall levels of spending or revenue. Rational voters that are the targets of government spending may support the incumbent even though it is recognised that such targeting is due to opportunistic manipulation. The authors classify total expenditures into two parts: expenditures that are targeted to voters (e.g. capital expenditure and infrastructure expenditure) and expenditures that are not targeted to voters (e.g. current expenditure). It is demonstrated that in equilibrium, there is a pre-electoral enhancement in targeted expenditures and a reduction of other types of expenditures.

Lizzeri and Persico (2005) develop a tractable model of N-party electoral competition to explain the link between public goods provision and the number of parties. Political parties have two options: to provide a public good that yields benefits to all citizens or to provide transfers to sub-groups of the population. It is argued that as the number of parties increases, each political party seeks to target benefits to a decreasing vote base. Of course, as the vote base decreases, public goods become an inefficient way of transferring benefits. Therefore, in equilibrium, the probability that public goods are provided decreases with N. In fact, as N converges to infinity, public goods are never provided, regardless of their efficiencies.

A separate theoretical strand (see e.g. Banerjee and Somanathan, 2004) emphasises the connection between the fragmentation of the population and the provision of public goods. Specifically, in heterogeneous communities, all groups do not share power equally. Some groups dominate others. Unequal power makes it difficult for disparate groups to cooperate in the provision of public goods. Therefore, as citizens are more fragmented either ethnically or economically, public goods provision decreases.

As mentioned already, this paper studies the provision of various types of public goods in India at the state level and focuses on three important determinants: the proximity of a scheduled state legislative assembly election, the effective number of parties, and the caste heterogeneity of the population. The main conclusions of the paper are as follows. First, the proximity of a scheduled election lowers the provision of certain public goods: net area irrigated by all sources (i.e. government canals, wells, tanks, and other sources) and net area irrigated by canals. This result is consistent with the theories developed by Rogoff and Sibert (1988) and Rogoff (1990). But, there are other public goods - net area irrigated by wells, zilla parishad road length, and per consumer electricity connection- which experience a boom in construction during scheduled election years. Second, the effective number of parties in a legislature is inversely related to the provision of certain public goods: net area irrigated by wells; per capita net electricity generated by all sources (i.e. nuclear, steam, gas, oil, and hydro); and total urban road length. This result validates the theory developed by Lizzeri and Persico (2005). There are however other public goods (e.g. zilla parishad road length) which increase with an increase in the effective number of parties. Third, caste heterogeneity of a population lowers the provision of public goods: net area irrigated by all sources (i.e. government canals, wells, tanks, and other sources). This result is consistent with my prior prediction. However, there are other public goods – per capita net electricity generated by all sources (i.e. nuclear, steam, gas, oil, and hydro) and length of transmission and distribution lines divided by population density – which experience a spurt in a heterogeneous society.

The remainder of the paper is structured as follows. Section 2 briefly outlines the empirical literature on the determinants of public goods provision in developed and developing countries. Section 3 provides a description of the data set used in the analysis. Section 4 presents the econometric procedures used and the empirical results obtained in the analysis. Section 5 concludes the discussion. Section 6 contains the data appendix.

EMPIRICAL LITERATURE

This section summarises the empirical literature on the determinants of public goods provision both in the context of developed and developing countries. This section is divided into three parts: Subsection 2.1 briefly outlines the empirical literature that links elections and public goods provision. Subsection 2.2 discusses the empirical literature that relates the number of parties to public goods provision. Subsection 2.3 describes the empirical literature that establishes a causal connection between fragmentation of the population (e.g. by religion) and public goods provision. A considerable volume of published work fits into Subsections

2.1 and 2.3. Surprisingly, only *one* paper deals with the issue highlighted in Subsection 2.2.

Elections and public goods provision

Many papers deal with elections and public expenditure. But, few papers deal with elections and the physical provision of public goods. Blais and Nadeau (1992) look at the effect of elections on government spending. They consider ten provincial governments in Canada between 1951 and 1984. They report that in an election year, total government expenditure increases. Indeed, approximately 40 per cent of the additional spending by the government goes to just two sectors: social services and roads. Their result is consistent with the theory developed by Drazen and Eslava (2005).

Alesina *et al.* (1993) utilise elections data from 14 OECD democracies with flexible timing of elections to analyse the effect of electoral business cycles on government policy. Recall that the theory, according to the authors, maintains that an opportunistic incumbent government manipulates policy instruments such as spending before elections to remain in power. Consistent with this theory, Alesina *et al.* (1993) observe that government spending relative to GDP tends to increase before elections. But, their result suggests that this manipulation may vary from country to country and/or election to election.

Schuknecht (2000) uses data from 24 developing countries for the period 1973-1992 to examine the effect of elections on government total expenditure and capital expenditure. The author reports that an election year engenders a 39 per cent spurt in total expenditure (measured as a share of GDP) and a 25 per cent jump in capital expenditure (again, measured as a share of GDP).

Block (2002) uses data from 44 Sub-Saharan African countries for the period 1980-1995 to measure the effect of elections on public spending. He reports that on an average, public expenditure increases by 3.6 percentage points of GDP during election years. This result is consistent with the theory developed by Rogoff (1990).

Another important paper by Block (2002) examines the relationship between elections and government spending by using data from 69 developing countries during 1975-1990. The author distinguishes between current account and capital account spendings. He notes that current account expenditure as a share of total expenditure increases before elections but capital account expenditure decreases before elections *only* in competitive system (i.e. multi-party). In a non-competitive system, there is no meaningful election-year change in capital spending.

Shi and Svensson (2002) use data from 29 developed and 94 developing countries to examine the relationship between elections and political budget cycles. The authors find that political budget cycles are much larger in developing countries than in developed countries. More specifically, developing countries increase spending on an average by 3.5 per cent in election years.

The empirical literature addressing the effect of elections on public goods provision in India is sparse. Khemani (2004) utilises data from the 14 major states of India over the period 1960-1994 to examine the effect of scheduled elections on both government spending and physical provision of public goods. She considers percent growth in new road (includes national highways and state roads) construction as dependent variable. She reports that national highways significantly increase in the scheduled election years but there is no significant effect of elections on state roads. She also observes that capital spending increases by 9 per cent of the average spending in the states in the scheduled election years. Khemani's result related to capital spending is supported by Eslava (2005), who uses data from Colombia during 1987-2000. Using data from Portuguese mainland municipalities for the period 1979-2001, Veiga and Veiga (2007) also confirm that capital account spending spurts precede elections.

Another important paper that links elections and public goods provision in India is Wilkinson (2006). He uses the same data as Khemani and retains as well her public goods variables. He also considers political competition and fractionalisation in terms of language and religion as other important determinants of public goods provision. He concludes that state elections significantly decrease capital expenditure on roads and state roads construction, which contradict the results of Khemani. But, Wilkinson's findings confirm the predictions of Rogoff (1990).

Vergne (2006) uses data from 42 developing countries for the period 1975-2001 to find the electoral impacts on the allocation of public expenditure. The author observes that public spending shifts towards more visible current account expenditure, specifically wages and subsidies, and away from capital account expenditure during election years. On an average, the share of current account expenditure is expanded by more than one percentage point in election years. On the other hand, the share of capital account expenditure is cut prior to elections. These findings strongly confirm the predictions of Rogoff's (1990) signaling model.

Number of parties and public goods provision

Surprisingly, there is just a *single* paper that studies whether party fragmentation adversely impacts the provision of public goods. Chhibber and Nooruddin (2004) use data from the 15 major states of India for the period 1967-1997. According to the authors, the Indian states do *not* share a common party system. While some states have a two-party system (e. g. Kerala), others are characterised by a multi-party system (e. g. Uttar Pradesh). It is argued that this variation in party system engenders variation in public policy as well. The government is more likely to provide public goods (e. g. electricity, development expenditure) in a two-party system and club goods (e. g. expenditure on salary) in a multi-party system. Their results show that the state government's development expenditure (a public good) increases when the effective number of parties is two (two-party system) and expenditure on salaries (a club good) increases when the number of effective parties is greater than two (multi-party system). Their findings confirm the above theoretical predictions and the theoretical arguments derived by Lizzeri and Persico (2005).

Fractionalisation and public goods provision

Alesina *et al.* (1999) use three related data sets: US cities, US metropolitan, and US urban counties for 1960 and 1990 to examine the effect of ethnic fragmentation on local public finances. They consider share of spending on health, police, fire protection, public welfare (metro and county only), and productive public goods - education, roads (highways), sewers, and trash pickup. Their fractionalisation index is based on race (e.g. White, Black). They conclude that the share of spending on the above mentioned variables is inversely related to ethnic fragmentation. In other words, public goods provision decreases in a more heterogeneous society.

A few papers study the effect of fractionalisation on public goods provision in India. Wilkinson (2006) studies the impact of fractionalisation on public goods provision in India. Using data from the 14 major states of India, he concludes that fractionalisation in terms of language and religion leads to an increase in state roads spending and construction. Observe that this finding is not in conformity with our prior expectations.

Another important paper by Banerjee and Somanathan (2007) uses parliamentary constituency-level data from rural India over the sixties, seventies, and eighties to analyse the effect of fractionalisation in terms of caste and religion on physical provision of various public goods. Specifically, they consider education, health, water, communication facilities, and electricity as public goods. They find that fractionalisation is inversely related to public goods provision in rural India. This finding strongly confirms the general belief[6] that fractionalisation decreases public goods provision.

Finally, Banerjee *et al.* (2007) use data from 14 countries for the period 1998-2003 to analyse the effect of fragmentation in the population on public goods provision. They consider physical provision of public goods - clean water, health facility, sanitation, electricity, and access to schools. Consistent with general belief, they however observe that more heterogeneous communities get less public goods.

DATA

In the analysis, the data set is a panel of the 14 major states of India for the period 1967-68 to 2000-01. The provision of various types of public goods serves as dependent variables in this empirical analysis. Broadly, three types of public goods are considered. The public goods are: irrigation, power, and roads. The state-level political and non-political variables are taken as independent variables in the empirical analysis.

Land is irrigated by means of government canals, wells, tanks, and other sources. Therefore, I first construct three preliminary dependent variables linked to irrigation-related public goods. These preliminary variables are as follows: [i] *Irrigation*, [ii] *Canals*, and [iii] *Wells*. The variable *Irrigation* is the ratio of net area irrigated by all sources (government canals, wells, tanks, and other sources) to state arable land. The variable *Canals* is the ratio of net area irrigated by government canals to state arable land. The variable *Wells* is the ratio of net area irrigated by wells to state arable land. Notice however that the above variables are proper fractions which lie between 0 and 1. In order to avoid range restrictions, the following transformation is made to obtain the final dependent variables. The transformed variables are $Log\ \frac{Irrigation}{(1-Irrigation)}$, $Log\frac{Canals}{(1-Canals)}$, and $Log\ \frac{Wells}{(1-Wells)}$.

I have considered three dependent variables related to generation of power. The power-related public goods variables are as follows: [i] *Log* (*Power*), [ii] *Log* (*Electricity Connection*), and [iii] *Log* (*Transmission and Distribution*). The variable *Power* is the per capita net electricity generated by the following sources: nuclear, steam, gas, oil, and hydro. The variable *Electricity Connection* is the ratio of total number of electricity connections to total number of consumers. The variable *Transmission and Distribution* is the length of transmission and distribution lines divided by population density.

Finally, I have constructed four roads-related public goods variables. These variables are as follows: [i] *Log* (*Roads*), [ii] *Log* (*Urban*), [iii] *Log* (*Zilla Parishad*), and [iv] *Log* (*Panchayat Samiti*). The variable *Roads* is total roads length (highways, urban roads, and project roads). The variable *Urban* is total urban roads length (municipal roads, military engineering service roads, port roads, and railway authority roads). The variable *Zilla Parishad* is the length of zilla parishad roads. The variable *Panchayat Samiti* is the

Table 4: Election details of the 14 major states of India during the period 1967-68 to 2000-01

States	*[1]* *Number of elections*	*[2]* *Number of scheduled elections*
Andhra Pradesh	8	7
Bihar	9	6
Gujarat	8	6
Haryana	9	7
Karnataka	8	7
Kerala	8	5
Madhya Pradesh	8	6
Maharashtra	8	7
Orissa	9	6
Punjab	8	5
Rajasthan	8	6
Tamil Nadu	8	6
Uttar Pradesh	10	4
West Bengal	9	6

Note: The Table is based on state-level Vidhan Sabha electoral data over the period 1967-68 to 2000-01. The data are available from the webpage of the Election Commission of India (http://www.eci.nic.in).

length of panchayat samiti roads. The data on irrigation and power are collected from various issues of *The Statistical Abstract of India*, a Government of India publication. The data on roads are taken from various issues of *Basic Road Statistics of India*, a Government of India publication, and *Infrastructure in India*, published by the Centre for Monitoring Indian Economy.

In this paper, I have explained the variation in the provision of public goods at the state level by using explanatory variables that may be divided into two categories. The first category constitutes political variables- proximity of a scheduled state legislative assembly election and the effective number of parties in a legislature- that measure political attributes of states which are likely to influence public goods provision. In order to examine how the proximity of a scheduled state legislative assembly election affects the provision of public goods in a particular state, an election year dummy is constructed. Fix a state-year (s, t)[7]. The election year dummy is a zero-one variable that equals one if financial year[8] t is a scheduled election[9] year in state s, and is zero otherwise. Table 4 shows the election details of the 14 major states of India during the period 1967-68 to 2000-01.

The emphasis of my empirical work is on *effective* number of parties rather than total number of parties in determining the delivery of public

Table 5: Descriptive statistics of explanatory variables

States	*[1] Effective number of parties*		*[2] Per capita GSDP*		*[3] Share of agriculture in GSDP*	*[4] Caste heterogeneity measure*
	Mean	*SD*	*Mean*	*SD*	*Mean*	*Mean*
Andhra Pradesh	2.377	0.535	819.472	257.270	41.664	0.344
Bihar	3.585	1.198	453.720	53.983	44.241	0.357
Gujarat	2.541	0.595	1128.585	387.582	31.238	0.361
Haryana	3.137	0.937	1224.268	376.207	50.090	0.314
Karnataka	2.624	0.643	877.605	293.145	40.391	0.335
Kerala	2.249	0.254	713.392	177.940	35.676	0.170
Madhya Pradesh	2.740	0.818	562.515	103.551	45.664	0.509
Maharashtra	2.825	0.790	1192.339	413.388	23.163	0.324
Orissa	2.749	0.781	510.610	64.447	47.286	0.543
Punjab	2.596	0.621	1607.706	445.760	49.359	0.398
Rajasthan	2.667	0.863	701.774	192.999	47.661	0.457
Tamil Nadu	2.547	0.398	792.931	265.300	27.147	0.319
Uttar Pradesh	3.550	0.947	570.312	105.950	47.399	0.338
West Bengal	2.446	0.464	934.091	246.172	33.162	0.427

Note: GSDP is gross state domestic product in 1970-71 rupees. Share of agriculture is in percentage. The sample period is financial year 1967-68 to 2000-01. Column [1] is based on state-level Vidhan Sabha electoral data. Columns [2] and [3] are calculated from state-level annual data. Column [4] is constructed from census data. Variables are defined in the text.

goods. The construction of the effective number of parties proceeds as follows. Fix a state-year (s, t). To determine the effective number of parties in a state-year (s, t), I have first identified the *last* Vidhan Sabha election[10] occurring in state s prior to year t. For constituency i in a state s, the effective number of parties (denoted n_i) is computed[11] as follows: $n_i = 1 \Big/ \sum_{j=1}^{N} v_{ij}^2$, where v_{ij} is the proportion of votes received by the j-th party in constituency i and N is the number of competing parties. The measure of effective number of parties for state-year (s, t) is the average of n_i measures across all the constituencies in the state. The data on political variables are taken from the website of the *Election Commission of India* (http://www.eci.gov.in). The schedules of all state legislative assembly elections are taken from the book *India Decides* (1996).

The second category of variables are non-political variables- e.g. per capita state domestic product in constant prices (1970–71 rupees), the share of agriculture in state domestic product, and a measure of heterogeneity in terms of caste- that measure ostensibly non-political attributes of the states that capture the need for public goods provision. The data on real per capita state domestic product and the share of agriculture in state domestic product are taken from the *National Accounts Statistics*, published by the Central Statistical Organisation.

I have used a caste heterogeneity measure as an independent variable. The caste heterogeneity measure reflects the fragmentation in the population according to caste practices. The population of state *s* in year *t* is now divided into three caste-based groups: Scheduled caste (SC), Scheduled tribe (ST), and others. Let P_{it} denote the population assigned to a caste-based group *i*. Then, the caste-based heterogeneity measure for state *s* in year *t*, denoted by C_{it}, is computed as follows: $C_{it} = 1\text{-}\Sigma\ P_{it}^{2}$. Notice that if two individuals are randomly picked up from the population of a state *s* in the year *t*, then C_{it} equals the probability that the chosen individuals belong to different caste groups. The required data in constructing the caste heterogeneity measure are taken from the *Census of India* (1961, 1971, 1981, 1991, and 2001). Data for the other years are obtained by linear average[12]. Table 5 shows the summary statistics of explanatory variables analysed in this study.

METHODOLOGY AND RESULTS

In this section, I have examined the effects of political and non-political variables on the provision of public goods in the states of India. This section is divided into two parts: Subsection 4.1 describes the empirical models used in the econometric analysis. Subsection 4.2 reports the empirical results obtained in the analysis.

Empirical model

Let P_{st} denote the provision of a particular public good in a state *s* during the financial year *t.* Two cases arise. For some public goods (e.g. per capita net electricity generated), P_{st} is required to be non-negative. For all such public goods, I have estimated equation (1).

$$\log(P_{st}) = \alpha_s + \delta_t + \beta\ x_{st} + \gamma\ z_{st} + \varepsilon_{st}\ ,\ s = 1,2,3,\ldots,S;\ t = 1,2,3,\ldots,T. \qquad (1)$$

There are other public goods (e.g. proportion of land irrigated) where P_{st} is restricted to lie between 0 and 1. In all such cases, the dependent variable in the model is taken to be the logit transformation of P_{st}. Therefore, for such public goods, I have estimated equation (2).

$$Log\frac{Pst}{(1-Pst)} = \alpha_s + \delta_t + \beta\ x_{st} + \gamma\ z_{st} + \varepsilon_{st}\ ,\ s = 1,2,3,\ldots,S;\ t = 1,2,3,\ldots,T. \qquad (2)$$

In equations (1) and (2), x_{st} is the vector of political variables (e. g. effective number of parties) measured at the state level and z_{st} is the vector of non-political variables (e. g. per capita gross state domestic product)

Table 6: Least squares results for irrigation in the 14 major states of India

	[1]	[2]	[3]
	Log	*Log*	*Log*
No. of Parties	-0.007	0.061	-0.313[c]
	(-0.11)	(0.68)	(-2.10)
Scheduled Election	-0.046[c]	-0.047[b]	0.082[a]
	(-1.97)	(-1.80)	(2.89)
Caste Heterogeneity	-5.311[a]	-0.668	-1.290
	(-3.22)	(-0.33)	(-0.84)
N	416	373	370
R-sq	0.96	0.92	0.82

Notes:

(1) The data set comprises of the 14 major states of India for 34 financial years, 1967/68 to 2000/01. The 14 major states are as follows: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal.

(2) In specification [1], log of the ratio $\frac{Irrigation}{(1-Irrigation)}$ is the dependent variable. The variable *Irrigation* is the proportion of net area irrigated by all sources (government canals, wells, tanks, and other sources) in state arable land in a state-year. In specification [2], log of the ratio $\frac{Canals}{(1-Canals)}$ is the dependent variable. The variable *Canals* is the proportion of net area irrigated by government canals in state arable land in a state-year. In specification [3], log of the ratio $\frac{Wells}{(1-Wells)}$ is the dependent variable. The variable *Wells* is the proportion of net area irrigated by wells in state arable land in a state-year.

(3) All specifications include two political variables, one caste heterogeneity measure, and two control variables. The political variables are the (effective) number of parties and the scheduled election. The control variables are the per capita gross state domestic product (at constant 1970-71 rupees) and the share of agriculture in gross state domestic product. All the regressions also include state and time dummies.

(4) The absolute *t*-ratios given in parentheses are based on robust standard errors that correct for clustering at the state level; *c* denotes significance at 5% level, *b* denotes significance at 10% level, while *a* denotes significance at 1% level.

measured at the state level. To account for unobserved state-specific effects, I have included state dummies α_s; similarly, time dummies $\ddot{u}_t$ are included to account for unobserved time-specific effects. ϵ_{st} is the error term, presumed to be orthogonal to all of the regressors.

The set of political variables measured at the state level, in (1) and (2) consist of two variables: the proximity of a scheduled state legislative assembly election and the effective number of parties in a legislature. Thus,

$$\beta\, x_{st} = \beta_1\, Scheduled\ Election_{\ st} + \beta_2 No.\ of\ Parties_{\ st} \quad (3)$$

The set of non-political variables measured at the state level, in (1) and (2) consist of three variables: the per capita gross state domestic product (*PGSDP*), the share of agriculture in gross state domestic product (*SAGSDP*), and the caste heterogeneity measure. Therefore,

$$\gamma z_{st} = \gamma_1 \, PGSDP_{st} + \gamma_2 \, SAGSDP_{st} + \gamma_3 \, Caste\ Heterogeneity_{st} \quad (4)$$

Empirical results

My empirical results are divided into three subsections. In subsection 4.2.1, I have presented the empirical results for irrigation (refer to Equation 2 of section 4.1). In subsection 4.2.2, I have reported the empirical results for power (refer to Equation 1 of section 4.1). In subsection 4.2.3, I have discussed the empirical results for roads (refer to Equation 1 of section 4.1).

Empirical results for irrigation

In this section, the model specification used is equation (2) of section 4.1. I consider the following three dependent variables: $Log\frac{Irrigation}{(1-Irrigation)}$, $Log\frac{Canals}{(1-Canals)}$, and $Log\frac{Wells}{(1-Wells)}$.

The results corresponding to $Log\frac{Irrigation}{(1-Irrigation)}$ are given in Column [1] of Table 6. Three conclusions follow from Column [1]. First, notice that the coefficient on *Scheduled Election* is negative and statistically significant at the 5 per cent level. This means that the proportion of land irrigated by all sources is lower in scheduled election years relative to all other years. My finding is consistent with the theory developed by Rogoff (1990), which says that public expenditure shifts towards the more visible consumption expenditure and away from investment expenditure during election year. Second, observe that the coefficient on *Caste Heterogeneity* is negatively signed and statistically significant at the 1 per cent level. This indicates that the proportion of land irrigated by all sources is higher in a homogeneous society relative to a fragmented society. This highlights the role of social fragmentation in determining public goods provision. Third, the coefficient on *No. of Parties* is negatively signed but statistically insignificant. Hence, the number of parties in a legislature has no impact on the provision of irrigation.

Column [2] of Table 6 shows the regression results for $Log\frac{Canals}{(1-Canals)}$. The regression coefficient on *Scheduled Election* remains statistically significant at the 10 per cent level with the predicted negative sign. As before, this result provides support for Rogoff's (1990) signaling model. The coefficient on *No. of Parties* is statistically insignificant with the unpredicted positive sign. The coefficient on *Caste Heterogeneity* has the predicted negative sign; however, it is not statistically significant.

Column [3] gives the results for $Log \frac{Wells}{(1-Wells)}$. A surprising result is obtained in the case of *wells* compared to other categories of irrigation. The regression coefficient on *Scheduled Election* is statistically significant at the

Table 7: Least squares results for power in the 14 major states of India

	[1] Log (Power)	*[2] Log (Electricity Connection)*	*[3] Log (Transmission and Distribution)*
No. of Parties	-0.129[a] (-2.79)	0.032 (0.75)	-0.130 (-1.60)
Scheduled Election	-0.021 (-0.96)	0.038[a] (3.37)	-0.012 (-0.33)
Caste Heterogeneity	2.417[b] (1.70)	-2.043 (-1.43)	3.503[c] (1.97)
N	364	322	336
R-sq	0.96	0.30	0.96

Notes:

(1) The data set comprises of the 14 major states of India for 34 financial years, 1967/68 to 2000/01. The 14 major states are as follows: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal.

(2) In specification [1], log of *Power* is the dependent variable. The variable *Power* is the per capita net electricity generated by nuclear, steam, gas, oil, and hydro in a state-year. In specification [2], log of *Electricity Connection* is the dependent variable. The variable *Electricity Connection* is the proportion of total number of electricity connections in total number of consumers in a state-year. In specification [3], log of *Transmission and Distribution* is the dependent variable. The variable *Transmission and Distribution* is the proportion of length of transmission and distribution lines in population density in a state-year.

(3) All specifications include two political variables, one caste heterogeneity measure, and two control variables. The political variables are the (effective) number of parties and the scheduled election. The control variables are the per capita gross state domestic product (at constant 1970-71 rupees) and the share of agriculture in gross state domestic product. All the regressions also include state and time dummies.

(4) The absolute *t*-ratios given in parentheses are based on robust standard errors that correct for clustering at the state level; *c* denotes significance at 5% level, *b* denotes significance at 10% level, while *a* denotes significance at 1% level.

1 per cent level with a *positive* sign. This means that scheduled election years experience a spurt in the provision of wells. This may be due to the fact that wells are local public goods and easily visible to citizens. Note also that the coefficient on *No. of Parties* is statistically significant at the 5 per cent level and has a negative sign. This evidence is consistent with the theory developed by Lizzeri and Persico (2005), which says that public goods provision diminishes as party fragmentation rises. Finally, the coefficient on *Caste Heterogeneity* is negatively signed, suggesting that social heterogeneity is inimical to the provision of public goods. However, I acknowledge that the coefficient is not statistically significant.

Empirical results for power

Table 7 reports the regression results for three different power-related variables: *Log* (*Power*), *Log* (*Electricity Connection*), and *Log* (*Transmission and Distribution*). The model specification used is equation (1) of section 4.1.

Column [1] of Table 7 shows the results for *Log* (*Power*). Observe that the regression coefficients on *No. of Parties* and *Scheduled Election* have the predicted negative sign. Moreover, the coefficient on *No. of Parties* is statistically significant at the 1 per cent level. I should also alert the readers to a surprising result that is not consistent with my prior prediction. Specifically, the coefficient on *Caste Heterogeneity* turns out to be significant at the 10 per cent level and is positively signed. This means of course that an increase in social fragmentation results in greater power generation.

In Column [2], the dependent variable is *Log* (*Electricity Connection*). An interesting result is found in case of electricity connection- the regression coefficient on *Scheduled Election* is *positively* signed and statistically significant at the 1 per cent level. This result is consistent with the following argument. Electricity connections are easily visible to citizens and require little money and time to provide. Thus, electricity connections experience a boom in scheduled election years.

Column [3] shows the regression results for *Log* (*Transmission and Distribution*). Observe that the coefficients on two key explanatory variables – *No. of Parties* and *Scheduled Election* – are statistically insignificant. The coefficient on *Caste Heterogeneity* has the unpredicted positive sign and this coefficient is statistically significant at the 10 per cent level.

Empirical results for roads

Table 8 illustrates the regression results for four roads-related variables: *Log* (*Roads*), *Log* (*Urban*), *Log* (*Zilla Parishad*), and *Log* (*Panchayat Samiti*). The model specification used is equation (1) of section 4.1.

Table 8: Least squares results for roads in the 14 major states of India

	[1] Log (Roads)	[2] Log (Urban)	[3] Log (Zilla Parishad)	[4] Log (Panchayat Samiti)
No. of Parties	-0.110	-0.281[c]	0.317[b]	0.513
	(-1.39)	(-2.16)	(1.86)	(1.61)
Scheduled Election	-0.011	-0.009	0.198[b]	-0.034
	(-0.75)	(-0.21)	(1.66)	(-0.13)
Caste Heterogeneity	1.233	-0.449	3.938	10.99
	(0.97)	(-0.15)	(1.16)	(1.21)
N	475	401	214	146
R-sq	0.94	0.84	0.92	0.46

Notes:

(1) The data set comprises of the 14 major states of India for 34 financial years, 1967/68 to 2000/01. The 14 major states are as follows: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal.

(2) In specification [1], log of *Roads* is the dependent variable. The variable *Roads* is the total road length (includes highways, urban roads, and project roads) in a state-year. In specification [2], log of *Urban* is the dependent variable. The variable *Urban* is the total urban roads length (includes municipality roads, military cantonment roads, port roads, and railway authority roads) in a state-year. In specification [3], log of *Zilla Parishad* is the dependent variable. The variable *Zilla Parishad* is the length of zilla parishad roads in a state-year. In specification [4], log of *Panchayat Samiti* is the dependent variable. The variable *Panchayat Samiti* is the length of panchayat samiti roads in a state-year.

(3) All specifications include two political variables, one caste heterogeneity measure, and two control variables. The political variables are the (effective) number of parties and the scheduled election. The control variables are the per capita gross state domestic product (at constant 1970-71 rupees) and the share of agriculture in gross state domestic product. All the regressions also include state and time dummies.

(4) The absolute *t*-ratios given in parentheses are based on robust standard errors that correct for clustering at the state level; *c* denotes significance at 5% level, *b* denotes significance at 10% level, while *a* denotes significance at 1% level.

Consider Column [1] of Table 8. In Column [1], the dependent variable is *Log* (*Roads*). The coefficients on *No. of Parties* and *Scheduled Election* have the predicted negative sign, but statistical significance is not achieved. Furthermore, social fragmentation as measured by the variable *Caste Heterogeneity* has no impact on the provision of roads.

Column [2] shows the regression results for *Log* (*Urban*). While the coefficient on *Scheduled Election* is statistically insignificant, the coefficient on *No. of Parties* is negatively signed and statistically significant at the 5 per cent level. This finding is consistent with the theory developed by Lizzeri and Persico (2005): as the number of political parties increases, public goods provision decreases. The coefficient on *Caste Heterogeneity* has the predicted negative sign, but is statistically insignificant.

The results for *Log* (*Zilla Parishad*) are given in Column [3]. A completely different result is obtained in case of zilla parishad road compared to other categories of roads. The coefficients on *No. of Parties* and *Scheduled Election* are positively signed and statistically significant at the 10 per cent level. This result is consistent with the following argument. Zilla parishad roads constitute a local public good and are easily visible to citizens. Thus, the provision of zilla parishad roads increases in a scheduled election year and when the effective number of parties increases. As in the previous two columns, the coefficient on *Caste Heterogeneity* is not statistically significant.

Column [4] reports the regression results for *Log* (*Panchayat Samiti*). Observe that the coefficients on all three explanatory variables – *No. of Parties*, *Scheduled Election*, and *Caste Heterogeneity* – fail to achieve statistical significance.

CONCLUSION

In this paper, I have examined the determinants of public goods provision in the 14 major states of India during the period 1967-68 to 2000-01. The determinants considered in this paper are as follows: the proximity of a scheduled state legislative assembly election, the effective number of parties in a legislature, and the fragmentation among the population in terms of caste practices. Theories providing the rationale for including the aforesaid determinants are given in Section 1.

My empirical findings show that the proximity of a scheduled state election lowers the provision of certain public goods– net area irrigated by all sources (i.e. government canals, wells, tanks, and other sources) and net area irrigated by canals- that require substantial money and time for construction and are not immediately visible to citizens before elections. This result is consistent with the theories developed by Rogoff and Sibert (1988) and Rogoff (1990). On the other hand, the proximity of a scheduled state election raises the provision of other public goods– net area irrigated by wells, per consumer electricity connection, and zilla parishad road length– that require relatively less financial resources and time for construction and are easily visible to citizens. Consistent with the theory developed by Lizzeri and Persico (2005), the effective number of parties in a legislature lowers the provision of the following public goods: net area irrigated by wells; per capita net electricity generated by all sources (i.e. nuclear, steam, gas, oil, and hydro); and total urban road length. There are however other public goods (e.g. zilla parishad road length) which increase with an increase in the effective number of parties. Finally, caste heterogeneity of a population lowers the provision of various public goods (e.g. net area irrigated by government canals, wells, tanks, and other sources). In sum, there is evidence that the aforementioned political and non-political variables play important roles in the provision of public goods in the states of India.

DATA APPENDIX

The data used in the paper come from different sources. The research involved data from the 14 major states of India, over a period of 34 financial years, from 1967-68 to 2000-2001.

Public goods variables

[1] Land is irrigated by means of government canals, wells, tanks, and other sources. Therefore, I first constructed three preliminary dependent variables linked to irrigation-related public goods. These preliminary variables are as follows: [i] *Irrigation*, [ii] *Canals*, and [iii] *Wells*. The variable *Irrigation* is the ratio of net area irrigated by all sources (government canals, wells, tanks, and other sources) to state arable land. The variable *Canals* is the ratio of net area irrigated by government canals to state arable land. The variable *Wells* is the ratio of net area irrigated by wells to state arable land. Notice however that the above variables are proper fractions which lie between 0 and 1. In order to avoid range restrictions, the following transformation is made to obtain the final dependent variables. The transformed variables are $Log \dfrac{Irrigation}{(1 - Irrigation)}$, $Log \dfrac{Canals}{(1 - Canals)}$, and $Log \dfrac{Wells}{(1 - Wells)}$.

[2] I have considered three dependent variables related to generation of power. The power-related public goods variables are as follows: [i] *Log* (*Power*), [ii] *Log* (*Electricity Connection*), and [iii] *Log* (*Transmission and Distribution*). The variable *Power* is the per capita net electricity generated by the following sources: nuclear, steam, gas, oil, and hydro. The variable *Electricity Connection* is the ratio of total number of electricity connections to total number of consumers. The variable *Transmission and Distribution* is the length of transmission and distribution lines divided by population density.

[3] Finally, I constructed four roads-related public goods variables. These variables are as follows: [i] *Log* (*Roads*), [ii] *Log* (*Urban*), [iii] *Log* (*Zilla Parishad*), and [iv] *Log* (*Panchayat Samiti*). The variable *Roads* is the total roads length (highways, urban roads, and project roads). The variable *Urban* is the total urban roads length (municipal roads, military engineering service

roads, port roads, and railway authority roads). The variable *Zilla Parishad* is the length of zilla parishad roads. The variable *Panchayat Samiti* is the length of panchayat samiti roads. The data on irrigation and power have been collected from various issues of *The Statistical Abstract of India*, a Government of India publication. The data on roads is taken from various issues of *Basic Road Statistics of India*, a Government of India publication, and *Infrastructure in India*, published by the Centre for Monitoring Indian Economy.

Political variables

Two state-level political variables have been considered. The political variables are: [i] effective number of parties and [ii] scheduled elections. The effective number of parties is constructed from the vote shares of political parties in Vidhan Sabha elections. The vote share data has been downloaded from the website of the *Election Commission of India* (http://www.eci.gov.in). The dates for scheduled elections are taken from the book *India Decides* (1996).

Heterogeneity measure

The paper has one measure of heterogeneity: caste heterogeneity. The data for constructing the caste heterogeneity measure has been taken from the *Census of India* (1961, 1971, 1981, 1991, and 2001). The figures for the five census years, 1961, 1971, 1981, 1991, and 2001 have been interpolated to generate the numbers for the intermediate years. Between any two successive censuses, total state population and scheduled caste/scheduled tribe population are assumed to grow at a constant rate. I have used three-year moving averages to smoothen the series.

Control variables

The paper uses two control variables. These variables are as follows: [i] the per capita gross state domestic product in constant 1970-71 rupees and [ii] the share of agriculture in state domestic product. The data on these variables are state-specific annual observations. The data are taken from the *National Accounts Statistics*, published by the Central Statistical Organisation.

Notes

1. Planning Commission database, Government of India, http://planningcommission.nic.in/data/datatable/2504/databook_70.pdf , last accessed on 16th May, 2013.
2. Statistical Year Book India 2013, Ministry of Statistics and Programme Implementation, Government of India.

3. http://www.cea.nic.in/reports/monthly/installedcapacity/2020/installed_capacity-10.pdf
4. Energy Information Administration Database, http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=44&pid=44&aid=1, last accessed on 16th May, 2013.
5. The World Factbook, CIA, https://www.cia.gov/library/publications/the-world-factbook/rankorder/2085rank.html , last accessed on 16th May, 2013.
6. Theoretically, as citizens are more fragmented either ethnically or economically, public goods provision decreases. In heterogeneous communities, all groups do not share similar power. Some groups dominate others. As a result, they are less able to work together to take out public goods.
7. Note that I have used "state-year (*s*, *t*)" as shorthand for "state-financial year (*s*, *t*)."
8. Following Alesina *et al.* (1993) and Reid (1998), financial year *t* is called an election year in state *s* if a state legislative assembly election is held in the second half of financial year *t* or in the first half of the next financial year.
9. The constitution of India mandates that a state legislative assembly has a normal term of five years from the date appointed for its first sitting. Accordingly, I have classified a state legislative assembly election as *scheduled* if it is held when the current assembly is at least four years of age. In the data set, the fourteen states have experienced an aggregate of 119 assembly elections; 71 of these elections are classified as *scheduled*.
10. I begin by assuming that the decisions regarding the provision of public goods in state *s* for financial year *t* are made at the very beginning of that financial year (that is, March 31 of financial year (*t*-1)) using state electoral outcome information from the *last* Vidhan Sabha election.
11. Even if there exist various indices (e.g. Wildgen, 1971) to measure the number of "effective" parties, I have used Laakso-Taagepara Index (1979) due to its ease of calculation, its attractive theoretical properties (e.g. its link to the Herfindahl-Hirschman Index, and the fact that when all the parties are of the same size, the effective number of parties equals the actual number of parties (i.e. $n = N$), and if all components except one are zero, $n = 1$).
12. The figures for the five census years, 1961, 1971, 1981, 1991, and 2001 are interpolated to generate the numbers for the intermediate years. Between any two successive censuses, total state population and scheduled caste/ scheduled tribe population are assumed to grow at a constant rate. Three-year moving averages of these numbers to smoothen the series are used.

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