The Phenomena of Voter Turnout and Wasted Vote in Parliamentary Elections of India

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Certificate

Certified that the dissertation entitled '**The Phenomena of Voter Turnout and Wasted Vote in Parliamentary Elections of India**' submitted by **Sanmitra Ghosh** is in partial fulfilment of the Master of Philosophy degree of this University. The work presented is original and has not been submitted in part or full for any other degree to this or any other University to the best of our knowledge.

We recommend that this dissertation be placed before the examiners for evaluation.

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To

The Memory of My Father

And

To My Mother

Preface

This dissertation consists of two papers. The first one is entitled 'The Phenomenon of Voter Turnout in the Parliamentary Elections of India' and the second one is labeled as 'The Phenomenon of Wasted Vote in the Parliamentary Elections of India'. Though the papers are complete by themselves, their subject matters are interdependent. There is a whole set of factors which affect both voter turnout and wasted votes in an election. As Bruce Cain observes, "...At the same time, we would expect the third-party votes to be inversely related to abstention since some potential third party supporters will prefer to abstain rather than support a losing cause."* It is, therefore, no mere coincidence that there is considerable overlap between the set of regressors which have been employed in these papers for seeking explanation to these dual phenomena.

I am indebted to my supervisors Dr. Sugato Dasgupta and Prof. S.K.Das. Special mention should be made of the former for his active help and suggestions at every step, without which this work would not have been possible.

I am grateful to the Planning and Policy Research Unit, Indian Statistical Institute, Delhi, for granting me access to the data on Indian elections. I would like to thank the Centre for Economic Studies and Planning, School of Social Sciences, Jawaharlal Nehru University, New Delhi, for the computer facility they provided.

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* Cain, B.E. 1978. "Strategic Voting in Britain", *American Journal of Political Science*, 22, p - 644.

Paper I: The Phenomenon of Voter Turnout in the Parliamentary Elections of India

1. Introduction

The phenomenon of voter turnout in an election is interesting for two reasons. First, it addresses the question of why a voter votes – what drives an individual to participate in the political decision-making process and register her voice. Second, insofar as the government can be thought of as a public good, voter turnout in an election would reflect people's perception about the importance of this public good. Both these and other motivations of the voters for turning up in the polling booths are well documented and have been tested in the context of the western polity, particularly that of the United States. Our objective here is to test some of these conventional explanations of turnout in the Indian context and also to offer a new theoretical rationale for the same.

There are two traditional explanations of voter turnout in the literature. The older one is known as the "calculus of voting" theory, which was initially developed by Downs (1957) and extended by Riker and Ordeshook (1968). According to this theory, a voter finds it worthwhile to vote whenever she thinks that there is a possibility of a tie between the first two candidates and her decision might affect the outcome of the election. The theory thus predicts that the propensity to turn up in an election goes up as the perceived closeness of the election increases.

Ledyard (1984) and Palfrey and Rosenthal (1983, 1985) have extended this decision theoretic model to endogenise the probability of a tie for the first place. The *pivot probabilities* are derived as the outcomes of the strategic interaction between the voters. In a complete information framework, these models predict a high amount of turnout.[1] However, as the size of the electorate grows, complete information models seem less plausible and strategic uncertainties have to be taken into consideration.

Palfrey and Rosenthal (1985) have identified two sources of strategic uncertainty – uncertainty about whether other voters would vote or abstain and that about the preferences and costs of other voters. The intuition for the Palfrey-Rosenthal solution is as follows. First, none of the voters abstaining cannot be an equilibrium as in that case an individual has negligible probability of being pivotal and hence it's worthwhile for her to

[1] The high turnout equilibrium is one of the multiple equilibria that result in the model and Palfrey and Rosenthal (1985) have coined this a "fragile" equilibrium, since it requires rather restrictive assumptions

opt out. On the other hand, all the voters abstaining cannot be equilibrium too, as each individual becomes pivotal in that case. So people must mix between the options of voting and abstaining. Suppose the probability that an individual turns up to vote is p. If the size of the electorate is n then the total number of votes will be np. As n approaches infinity, Palfrey and Rosenthal show that np reaches a finite limit; however, the proportion of the electorate casting votes, p, tends to zero. This clearly marks a crisis for the pivotal voter hypothesis as a possible explanation for voter turnout in large elections.

There is an alternative, though somewhat heuristic, explanation of voter turnout. This literature[2] claims that there is a positive relationship between the campaign effort by the political parties and the proportion of voters turning up, in close elections. The underlying individual level behavioral assumptions are, however, not clearly specified. One might presume that these political "advertisements" appeal to the voter's sense of duty as a citizen.[3] Even if the individual voter might not bother about the closeness of the election, it is worthwhile for the political parties to mobilize their supporters en masse' in districts where the race is close.

A similar explanation in terms of group behavior is the argument of "instrumental voting" or voting as an investment in future political clout.[4] If a demographic group votes en bloc on certain issues and is able to make or break a tie, political parties will adopt policies acceptable to the group. For the group to continue to represent a credible threat it must provide consistently high turnout, even if the election is not so close from an individual's point of view.

Feddersen and Pesendorfer (1996) have recently forwarded a new rationale for explaining abstention, particularly those related to "roll-off". They have argued that in the U.S. elections voters choose to cast their vote on certain issues while abstaining on some others. According to them, the voter should not have opted for the latter once she had already borne the cost of voting. They have attributed this behavior to the fact that the uninformed voters abstain in order to let the informed voters take the decision.

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like complete certainty about the number of players who play a pure strategy in equilibrium or a small electorate.

[2] See Cox and Munger (1989), for example.

[3] This is sometimes called "expressive voting", where the voter expresses her support for the political system through the act of voting.

[4] Foster (1984).

There is a vast amount of empirical research on the subject. Researchers have used individual level as well as aggregate data on U.S. presidential, senatorial and gubernatorial elections to examine the relationship between turnout and closeness of an election. Among the early studies Brazel and Silberberg (1973), Silberman and Durden (1975), Crain and Deaton (1977), Foster (1984) and in the recent years, Poole and Rosenthal (1997), Hanks and Groffman (1998), Groffman, Collet and Griffin (1998), Rothenberg and Sanders (2000) are a few notable examples. All of the above papers try to test the calculus of voting theory in one way or the other. Similarly the alternative approach, incorporating the party elites as the intermediary agents, has been tested widely using various data sources. Patterson and Caldeira (1983), Cox and Munger (1989), Mutsuska (1993), Ansolabehere et al. (1994), among others, have garnered varying levels of evidence for the same.

It has been noted that electoral closeness had not been very effective in explaining voter turnout.[5] Our study investigates the effectiveness of this traditional explanation for voter turnout in the context of the Indian electorate. The main emphasis of the exercise, however, is on exploring new factors, which might be causally linked to the phenomenon. We have tried alternative sets of variables – fiscal as well as demographic – and looked at their significance. The study presents an interesting stylized fact: in parliamentary elections during the period 1967 to 1998, constituencies that are heterogeneous in terms of demographic composition exhibit significantly higher turnout. This effect is robust across various alternative specifications and is significant even if we control for the closeness of the race.

We have also tried to provide a theoretical justification for the above-mentioned result. In India, various religious and linguistic groups have different policy preferences regarding a wide spectrum of issues. Consequently, more heterogeneous the composition of an electoral district, more acute is the perception of political competition in the minds of the voters and larger the turnout. But, more importantly, heterogeneity also has a direct impact on turnout. For a given level of closeness, as heterogeneity increases, the expected utility differential between the alternative outcomes of the election also goes up. A formal model with this property is described in Appendix 1.

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[5] See Aldrich (1993).

The rest of the paper is organized as follows: Section 2 describes the variations in the pattern of voter turnout across states and elections. Section 3 presents the econometric analysis. Finally Section 4 summarizes the principal findings of the paper and concludes the discussion.

2. The Variation in Voter Turnout

This section tries to measure the level of turnout and looks at the variations across states and elections. It is divided into two parts: Subsection 2.1 looks at the variation at the state level and finds that there is considerable difference in the level of turnout across states. Subsection 2.2 examines the overall variation in turnout at an all India level[6] over time. It is found that there is an upward trend at the all India level if we pool together all the states. However, at the state level, the trend is significantly upward sloping for some states, while there is a downward sloping or insignificant trend for some other states.

2.1 The State Level Scenario

Turnout has traditionally been defined as the proportion of the adult population who cast their votes. We have followed the same convention here. This stands in contrast with the way we measure the *other* constituency[7] level variable, namely the closeness of the election. We measure closeness by the difference in votes obtained by the top two parties in each district as a proportion of the total number of valid votes in the district. This allows us to avoid an econometric problem pointed out by Cox (1988), where he argues that the negative relationship between turnout, measured in the above manner, and closeness, defined as the ratio of the margin between the top two parties to the total

[6] We shall mean the sum total of all the fifteen major states whenever we refer to the "country" or "all India" figures.

[7] In India, electoral districts are called constituencies.

number of votes cast in the district, could indicate a mere statistical artifact rather than the predictions of the calculus of voting theory.

The average level of turnout across all the states and all the parliamentary elections from 1967 to 1998 is a moderate 59%. Some of the states are well above this level. Kerala and West Bengal have the highest level of turnout among the Indian states. The average level for these states is as high as 73%. The lowest turnout is recorded in Orissa, where it is 51%.

The states can be categorized into two groups: those with turnout level above the all India average, and those below it. There are almost equal numbers of states in these groups. In agreement with empirical studies that find little evidence of correlation between income level of the electorate and voter turnout[8], the above mentioned groups are also very heterogeneous in terms of the economic status of their members. For instance, the first group of high-turnout states includes Andhra Pradesh and Kerala whose average per capita state domestic products (over the entire period) are much lower than that of Punjab and Tamil Nadu. Similarly, in the second group of low-turnout states, Gujarat is much more affluent than Bihar or Uttar Pradesh. The turnout values in the "high turnout" group are clustered around 67%, whereas for the rest, the average value is centered on 54%. The figures are shown in Table 1 below[9]:

***Table 1*: Distribution of Mean and Standard Deviation of Turnout Across States**

States	*Mean*	*Standard Deviation*
AP	0.64	0.08
ASM	0.65	0.14
BH	0.57	0.10
GUJ	0.54	0.11
HAR	0.68	0.05
KAR	0.62	0.08
KER	0.73	0.07
MP	0.53	0.09
MH	0.58	0.08
ORI	0.51	0.11
PNJ	0.60	0.15
RAJ	0.54	0.07

[8] See Patterson and Calderia (1983), Cox and Munger (1989), Ansolabehere et al. (1994), for example.
[9] Let the set of *constituency-years* in state s be C(s). The entries in the table denote the mean and standard deviations of voter turnout calculated over all $c \in C(s)$.

TN	0.68	0.07
UP	0.52	0.08
WB	0.73	0.10

Note: The entries are means and standard deviations of voter turnout across all constituencies over all the elections from '67 to '98, calculated for each state. Unit: proper fraction.

2.2 The Time Variation: All India Scenario

The level of voter turnout has varied considerably over the years from the first general election of independent India till now. The political and economic situations, which affect the decisions of a voter, have not remained the same during this span of more than fifty years. There have been major changes in the demographic characteristics of the Indian electorate. Important political events have also taken place, both within the country and also in the outside world. These have influenced the conditions prevailing in certain elections. For example, the declaration of emergency in 1975 had a great impact on the outcome of the following parliamentary election of 1977. Almost every election is unique in this respect.

We analyze the period between 1967 and 1998. There have been nine parliamentary elections in India during this period, in the years 1967, 1971, 1977, 1980, 1984, 1989, 1991, 1996 and 1998, respectively. The entire period can be divided into three major parts: 1971 – 84, 1984 – 91 and 1991 – 1998. We have calculated the arithmetic mean of voter turnout across all the constituencies distributed over the fifteen major states for each of the elections and examined its variation over the entire period. Starting from a decent all-India average of 61% in 1967, turnout dropped to its record low level of 55% in 1971. In the next three elections, i.e. till 1984, there was an overall upward trend in turnout. It attained its maximum level of 64% in 1984. After 1984, however, turnout continued to decline till 1991, when it fell to the level of 56%. In the last phase of 1991 - 98, it again registered a steady rise up to 63% (See Table 2)[10].

[10] Let the set of constituencies distributed over all the fifteen major states in the election year t be C(t). The entries in Table 2 denote the mean and standard deviation of voter turnout calculated over all $c \in C(t)$.

Table 2: Distribution of Means and Standard Deviations of Turnout Across Elections		
Election	*Mean*	*Standard Deviation*
'67	0.61	0.11
'71	0.55	0.12
'77	0.60	0.10
'80	0.57	0.10
'84	0.64	0.10
'89	0.62	0.11
'91	0.56	0.13
'96	0.59	0.13
'98	0.63	0.09

Note: The entries are means and standard deviations calculated over the appropriate constituencies across all states, for each election year. Unit: proper fraction.

This study, in part, relates voter turnout to the closeness of the election. To this end, the all-India movement in turnout and the corresponding levels of closeness are shown in Figures 1 and 2, respectively[11]. The all-India average closeness of an election has been calculated in the way we have constructed the all-India average voter turnout.

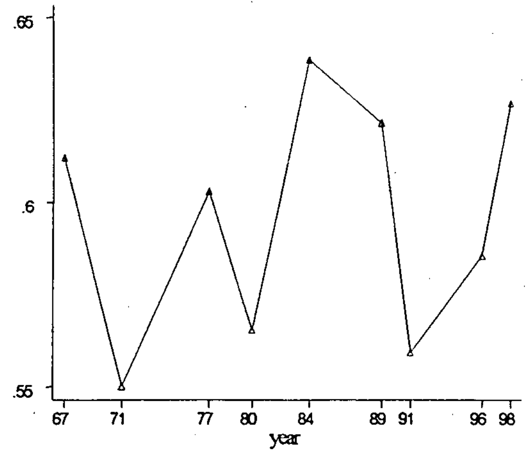

Figure 1: Turnout

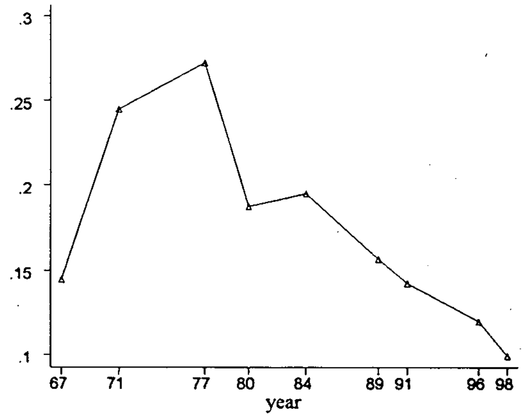

Figure 2: Closeness (top two parties)

There is an overall positive trend in the level of turnout, if all the states are pooled together; as can be seen in Figure 1. However, this is not true for each individual state.

[11] Figure 1 is constructed from the second column of Table 2. Let the set of constituencies distributed over all the fifteen major states in the election year t be C(t). Let the mean of vote share difference of the top two parties calculated over all $c \in C(t)$ be m(t). Figure 2 shows the plot (t , m(t)).

The trend is predominantly positive for most of the states. However, for a few states it is either negative or insignificant (Gujarat, Maharashtra, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh). It can be seen from the figures that for the most part, turnout has moved in a direction opposite to that of closeness. However, this trend is most prominent in the last three elections.

The standard deviations do not seem to have changed much over the entire period. The constituencies in particular, and the states at large, have maintained their relative positions vis-à-vis each other in the levels of turnout they have experienced over the years.

We shall wind up the description of the data with the transition probability matrix. Specifically, we ask the following question: Suppose that the level of turnout in constituency i is high (low) during election t. Then, what is the probability that the turnout level in constituency i remains high (low) during election $(t+1)$? Persistence in turnout reveals the importance of constituency level determinants. We proceed as follows. We divide up the range of turnout into three quantile groups: high, medium and low. Then label each constituency with the appropriate tag. Next we see how the constituency has changed its status over the years. The result is summarized in the following table.

Table 5: Transition Probabilities

	Next Period Status		
Initial Status	*Low*	*Medium*	*High*
Low	0.6557842	0.2888573	0 .053939
Medium	0.2835821	0.4524745	0.2631579
High	0.0543229	0.2662586	0.6786534

The values in each cell denote the probability of a transition from a certain status to the other. For example p_{LL} is the probability that if a constituency is a low turnout constituency it will remain so in the next election, p_{LM} the probability that a low turnout constituency will shift to a medium class and so on. It can be seen that the diagonal values are much larger than the off-diagonal ones. This indicates that our suspicion was correct – there is indeed a lot of persistence in the level of turnout at a constituency level.

This provides us with the motive for introducing constituency level dummies to capture the time-invariant constituency level characteristics, when we try to estimate the influences of various regressors on the level of turnout. This issue will be taken up in the next section.

3. Modeling Voter Turnout in the Indian Electorate

3.1 The Data and the Methodology

In this section we shall empirically examine the relative importance of various factors identified in the literature as affecting the level of voter turnout. We use panel data techniques to estimate the model. The variables that we employ involve two different levels of aggregation. The dependent variable, which is the rate of turnout, has been recorded at the constituency level. The regressors include the closeness of the election, various measures of heterogeneity within the electorate, estimates of government spending and several control variables for capturing the demographic characteristics of the electoral districts. Among these the closeness of the election is computed from constituency level data. The rest of the regressors are measured at the state level.

We have already discussed the essential elements of the calculus of voting theory. The theory predicts that there should be a negative relationship between election closeness, measured as the difference in the vote shares between the top two parties and the level of voter turnout: as the election becomes more close – i.e. as the difference between the parties decreases – the level of voter turnout should go up, since each voter thinks that she might become pivotal in making or breaking a tie. We found mixed evidence for the theory: whereas the sign of the coefficient on closeness was negative and significant in the basic model, with increasing level of complexity in the model specifications, the effect seems to weaken to a great extent. Indeed, it is significantly positive for some specifications.

We have used two types of heterogeneity measures.[12] The first one is a measure of religious heterogeneity: reflecting the fragmentation in the population according to the religions practised by its members. The second one is the linguistic heterogeneity, which measures the same in terms of the languages spoken by various people in the group.[13] The most significant finding of this paper is the effect of these heterogeneity measures on the level of voter turnout. It is observed that with increasing heterogeneity within the electorate the level of turnout increases as well. This effect is robust to the incorporation of various other controls and is significant across specifications.

We have tried several government spending variables, both from the current and capital accounts. The underlying hypothesis is that as the size of the government increases, the importance of the public good and hence the benefits from voting go up for everyone. This should induce some additional voters to turn up in the polling booths. Thus, we expect a positive sign on these variables. However, the spending measures do not provide satisfactory results. The only one among them, which shows some promise, is per capita total capital outlay. It is correctly signed and significant in most of the aggregative models. However, it fails to perform well when we break up the aggregative model into a set of year-wise regressions.

Our models for voter turnout also employ several additional variables principally as controls. These are literacy rate, newspaper circulation, proportion of the rural population and the per capita state domestic product.[14]

The dependent variable used in this analysis is turnout at the constituency level.[15] It is the proportion of the adult population who turned up to cast their votes. This is a proper fraction; say p, which can vary from 0 to 1. To avoid having any range restriction on the error term, we apply the following transformation on p. We take the log of the ratio $p/(1-p)$ and call this *tnt*. It has the range $-\infty$ to ∞.

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[12] Please refer to Appendix 2 for exact definitions of the heterogeneity measures.

[13] We have also tried caste-heterogeneity measures. However, this does not provide us with any consistently significant estimate.

[14] Education level have been employed by Ansolabehere et al. (1994), percentage of urban population by Cox and Munger (1989) and income level by Patterson and Caldeira (1983), among others.

[15] Please refer to Appendix 2 for a detailed description of each of the variables.

We have constituency level data for the variables related to turnout and closeness. The rest are computed from state level data. We run panel regressions (with robust standard errors) using both constituency and state level dummies. The former takes the following form:

$$y_{ct} = \alpha_c + \delta_t + x_{ct}\beta + z_{s(c)t}\gamma + \varepsilon_{ct} \quad (1),$$

whereas the latter looks like:

$$y_{ct} = \alpha_{s(c)t} + \delta_t + x_{ct}\beta + z_{s(c)t}\gamma + \varepsilon_{ct} \quad (2);$$

where y_{ct} is the turnout (*tnt*) in constituency *c* during the *t*'th election, α_c and δ_t denote constituency and election specific dummies, x_{ct} is the closeness of the *t*'th election in constituency *c*, *s(c)* identifies the state in which constituency c is located, and $z_{s(c)t}$ is the corresponding vector of state level regressors in the *t*'th election.

3.2 The Main Results

Table A1 in Appendix 2 presents the basic results. The four sets of regressors are introduced in succession. We start off by testing the effect of the closeness on the volume of turnout. The first two models, namely model 1 and model 2, involve state and constituency level dummies, respectively. The closeness variables have the expected negative sign and they are both significant. In the next two models (3 and 4) we introduce the heterogeneity measures, keeping the closeness variable in place. The heterogeneity measures are both positive and significant. This shows that heterogeneity has a positive and independent influence on turnout. This effect is not via the closeness route as described in the model of Appendix 1. Another fact is also worth noticing in these regressions. The *t*-values associated with the heterogeneity measures are much larger than those corresponding to closeness.

The government-spending variable – the per capita total capital outlay term – is introduced next. It is positive and significant in the basic model. However, this does not prove the hypothesis that larger the size of the public good, higher is the level of voter turnout. As mentioned before, among several measures of government spending only this specific variable turns out to be consistently positive and significant. However, it fails the robustness test as we shall see in Section 3.4 below.

In the last and final specification, we incorporate various state level regressors related to newspaper circulation, literacy rate, the proportion of the rural population and the per capita state domestic product. These variables are not the focus of our analysis. We introduce them to control for various demographic characteristics at the constituency level. The signs on these terms seem to be counter-intuitive. They show that as the electorate becomes richer, more informed and educated, the level of turnout tends to decline.[16] These variables are perhaps referring to a story of voter alienation: informed voters may be more "disillusioned" and, hence, more reluctant to turn up for voting.[17] We also discover that as the proportion of the rural population goes up, turnout tends to increase. This makes sense, as the urbanized districts tend to have higher costs of voting due to the higher "mobility" of the voters.[18] However, this variable is not significant.

3.3 The Measurement Error Problem

We have already estimated the effect of the closeness of the election on the level of voter turnout. This estimate is flawed in that election closeness suffers from measurement error. Theory maintains that an ex ante prediction of election closeness affects voter turnout; on the other hand, we have taken actual (or ex post) election closeness as the regressor. Ex post election closeness is, after all, only an erroneous approximation of ex ante closeness.[19] The measurement error biases the estimated coefficient downwards.

One way to address this problem is to find instruments for election closeness. A natural choice for the instrument is the lagged value of the variable, that is $(closeness)_{-1}$, in our case.

There is one practical problem, however, in constructing the instrumental variables from the lagged values of the vote share differences. The elections are too far apart, making the correlation between constructed instrument, viz.- $(closeness)_{-1}$, and the

[16] See Patterson and Cadeira (1983), Table 3, where the effect of education is negative and insignificant.
[17] See Aldrich (1993), footnote 7.
[18] See Cox and Munger (1989).
[19] See Kirchgassner and Himmern (1997).

relevant variable, i.e. *closeness* extremely low. The correlation between closeness and its lagged value is only 0.14. Consequently the lagged values provide us with very poor instruments in the present case.

Table A2 in Appendix 2 presents the results. We re-estimate all the eight models of Table A1 using two-stage least squares technique. The performance of the closeness term has deteriorated considerably owing to poor instrumentation. The signs are correct in the models which use state level dummies, but it gets reversed in the models in which constituency dummies are used. However, the heterogeneity terms continue to be positive and significant, showing the robustness of the earlier results. The capital outlay also continues to perform well.

3.4 The Year-wise Estimates

The aggregate models described in equations (1) and (2) are too restrictive in the sense that they force the same β and γ across all the states and elections. As we have already noted in Section 2.3, there is considerable variation in the turnout across elections and each election has its unique features. In order to see if the estimates vary significantly over time or if they remain more or less unchanged around the values estimated by the aggregate model, we have run 'ordinary least square' regressions on voter turnout separately for each election year.

Since the demographic control variables in our dataset are values at the state level, multicollinearity rules out the incorporation of state and constituency dummies in the estimated regressions. Hence, we use lagged values of the dependent variable (voter turnout) to crudely control for unobserved constituency specific characteristics.

The results are demonstrated in Table A3 in Appendix 2. The entries denote the number of times the coefficient on a particular regressor was found positively or negatively significant or insignificant. The estimates deteriorate considerably, but it is partially due to the reduction in the number of observations, which is reduced to almost one tenth of that in the aggregate model. Closeness is significantly negative in five out of nine elections. Heterogeneity measures have worsened to some extent. The religious heterogeneity seems to have become ineffective. It is positive and negative in equal number of cases. However, the other measure – i.e. linguistic heterogeneity – is still pointing in the right direction. When significant, it almost always has the expected positive sign.

The government expenditure variable – per capita capital outlays – is clearly not working in the disaggregated model. It is found to be significant in the negative direction in four out of the eight cases.

4. Conclusion

The aim of the paper was to identify new explanatory factors for voter turnout in the Indian electorate. The conventional explanation in terms of the closeness of the election is proved to be insufficient in accounting for the observed movement in the level of turnout across constituencies and also over the years. However, other demographic characteristics of the electorate, such as the heterogeneity in the population, play a very important role in the political decision making of the individual. Increased heterogeneity within the electorate exerts pressure on the individual to register her voice in the political process.

This paper also identifies the role of certain other variables which affect the level of turnout. These variables are of great importance to the policymakers. The newspaper circulation or, for that matter, any other mode of information dissemination influences the level of turnout. The level of education, which endows a person with improved power of discretion, also plays an important role to the same effect.

The role of government size in affecting the level of turnout is not borne out by the data. We have obtained a noisy estimate of the influence of one specific fiscal variable (viz., per capita capital outlay). However, the effect is not robust.

APPENDIX 1

A Model of Voter Turnout

Alesina and Ferrara (2000) have modeled participation in social activities and shown that ethnic or racial fragmentation within the population leads to lower participation rates. The crucial assumption of the model is that an individual exhibits aversion towards people belonging to other races. Participation in political activities such as voting is different from this in a fundamental way. It involves political competition between groups of individuals who have dissimilar policy preferences. Below we model the effect of ethnic fragmentation within a constituency on the level of voter participation in that district.

Let there be two political parties catering to the two demographic groups, A and B, in a constituency. Let the proportions of groups A and B in the population be x_A and x_B, respectively; where $0 \leq x_B \leq 0.5$, $0.5 \leq x_A \leq 1$ and $x_A + x_B = 1$. A constituency is said to be homogeneous if the minority population is absent, viz. $x_B = 0$. On the other hand, it is most heterogeneous if both groups are of equal size, i.e. $x_A = x_B = 0.5$.

The policies that are available to the polity are *a* and *b*. Members of group A – and, hence, the party representing it – prefer policy *a* to *b*; members of group B – and, hence, the party representing it – prefer policy *b* to *a*. The parties can choose either of these policies and they can credibly announce their positions before the elections.

The probability of winning an election is a function of the size of the group the party is catering to. For instance, the probability of winning for the party representing the minority is given by $\pi(x_B)$, where $\pi(0) = 0$, $\pi(0.5) = 0.5$, $\pi'(x_B) > 0$. The minority party derives utilities $u(a)$ and $u(b)$ from policies *a* and *b*, with $u(b) > u(a)$.

In this model, the majority party should always stick to its preferred policy, viz. *a*. The minority party, however, might imitate the majority party in circumstances where the proportion of the minority population, x_B, is extremely small. It suffers a loss of utility from this action, which however is compensated by the fact that the winning probability of the party becomes 0.5. The party can also compensate its followers by targeted redistribution of the private benefits of being in office in case it wins the election. In general, the expected utility from choosing policy *b* for the minority party is

$$\pi(x_B)[\,u(b) + M] + [1 - \pi(x_B)]\,u(a),$$

while that from policy *a* is given by

$$u(a) + 0.5M,$$

where $M > 0$ is the benefit of being in office.

The utility difference between these two policy choices for the minority party is

$$D = \pi(x_B)[\,u(b) - u(a)] + [\pi(x_B) - 0.5]\,M.$$

Proposition: There exists unique $0 < x_B^* < 0.5$, such that $D = 0$

Proof: For $x_B = 0$, $\pi(x_B) = 0$, $D = -0.5M < 0$.

For $x_B = 0.5$ and $\pi(x_B) = 0.5$, $D = 0.5[u(b) - u(a)] > 0$.

Also, $\partial D/\partial x_B = \partial\pi/\partial x_B[u(b) - u(a)] + \partial\pi/\partial x_B.M > 0$.

Thus, as x_B increases from its lower extreme to its upper limit, D switches its sign from negative to positive. Since D is strictly monotonic in x_B, there must be a unique value of x_B, namely x_B^*, such that $D(x_B^*) = 0$.

Hence for $x_B > x_B^*$, the minority party announces policy *b*; for $x_B < x_B^*$, the minority party announces policy *a*. In sum, with increasing heterogeneity at the constituency level, policy diversification takes place (i.e., the political party representing group B commits to policy *b* while the political party representing group A commits to policy *a*). With differentiated policy platforms, the incentive to cast the vote goes up; hence turnout in the electorate increases.

APPENDIX 2

Data Sources and Definitions of the Variables

- Turnout

  tnt – Let the ratio of the total number of votes cast to the total number of voters in the electoral district be *p*. *tnt* = ln [*p* / (1-*p*)]. This is constructed from constituency level data.

  Unit: Real number

  Source: Election Commission of India

- Closeness of the race

  Let the vote shares of the first two parties as a proportion of the total number of valid votes in the district be v_1 and v_2. *closeness* = $v_1 - v_2$. Constituency level data.

  Unit: Proper fraction

  Source: Election Commission of India

- Heterogeneity Indices

  These variables have been constructed from the state level population data obtained from the Census of India. The figures for the four Census years, 1961, 1971, 1981 and 1991 have been interpolated to generate the numbers for the intermediate years. We have taken the three-year moving averages of these numbers to smoothen the series. The figures for the election years have been taken from this series.

  We have calculated the index as the probability that two randomly picked persons from the sample would belong to two different demographic groups. Let the proportion of people belonging to each group be p_1, p_2, etc. Then the index is given by $1 - \sum p_i^2$, i = 1, 2, …n.

  (i) *hetrlang* – We have calculated this index from the number of people belonging to the 14 major language groups, namely, Assamese, Bengali, Gujrati, Hindi, Kannada, Kashmiri, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Tamil, Telegu and Urdu.

(ii) *hetrrelg* – Constructed from the 8 major religious groups, classified as Hindu, Muslim, Christian, Sikh, Buddist, Jain, Others and Not Stated.

Source: Census of India, various volumes.

- Government spending (State level data)

  tco – Per capita total capital outlay

  Unit: Rupees (1960 prices)

  Source: Reserve Bank of India Bulletin, various issues, Reserve Bank of India.

- Newspaper circulation (State level data)

  The average number of copies of newspapers, magazines and periodicals sold or distributed freely per publishing day, in each of the 15 major states.

  Unit: Thousands of copies

  Source: Annual Reports of the Registrar For Newspapers in India, various years.

- Literacy rate (State level data)

  The number of literates in each state divided by the total population of the state.

  Unit: Proper fraction

  Source: Census of India, various volumes

- Proportion of the rural population (State level data)

  The proportion of rural population in each state

  Unit: Proper fraction

  Source: Census of India, various volumes.

- Per capita state domestic product (*sdp*) (State level data)

  Unit: Rupees (1960 prices)

  Source: Reserve Bank of India Bulletin, various issues, Reserve Bank of India.

Table A1: Regression Results – Aggregate Model								
Specifications	Ordinary least square regressions with robust standard errors							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent Variable	tnt	tnt	tnt	tnt	tnt	tnt	tnt	tnt
Independent Variables								
closeness	-0.178	-0.093	-0.167	-0.085	-0.152	-0.067	-0.149	-0.064
	(-3.504***)	(-2.066**)	(-3.384***)	(-1.968**)	(-3.080***)	(-1.571)	(-3.061***)	(-1.535)
hetrrelg			6.237	6.165	5.358	5.301	5.861	5.780
			(13.518***)	(16.020***)	(11.772***)	(14.254***)	(10.312***)	(11.943***)
hetrlang			1.453	1.467	1.365	1.383	1.366	1.373
			(4.957***)	(5.018***)	(4.679***)	(4.753***)	(4.460***)	(4.475***)
tco					0.001	0.001	0.003	0.003
					(2.052**)	(2.342**)	(4.019***)	(4.855***)
newspaper							-0.00002	-0.00002
							(-4.801***)	(-5.735***)
literacy							-2.273	-2.224
							(-8.657***)	(-9.893***)
rural							0.344	0.352
							(0.592)	(0.726)
sdp							-0.00028	-0.00029
							(-3.038***)	(-3.242***)
Election dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes		Yes		Yes		Yes	
Constituency dummies		Yes		Yes		Yes		Yes
No. of Obs	4496	4496	4473	4473	4388	4388	4388	4388
R Squared	0.4669	0.6773	0.49	0.7018	0.4973	0.7107	0.5118	0.7247

Note: Values in parentheses denote the *t - values*. Levels of significance – * = 90% ** = 95% *** = 99%.

Table A2: Regression Results – Aggregate Model (2SLS)								
Specifications	Instrumental variable (2SLS) regressions with robust standard errors							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dependent Variable	tnt	tnt	tnt	tnt	tnt	tnt	tnt	tnt
Independent Variables								
(closeness) –1	-5.880	1.506	-4.574	0.806	-4.391	0.738	-5.781	0.703
	(-1.870*)	(2.751***)	(-1.642)	(1.834*)	(-1.616)	(1.718*)	(-1.321)	(1.821*)
hetrrelg			6.194	5.257	4.419	4.387	1.436	6.072
			(6.235***)	(11.577***)	(5.120***)	(10.112***)	(0.407)	(8.225***)
hetrlang			0.602	2.398	0.676	2.252	0.709	1.893
			(0.536)	(4.587***)	(0.655)	(4.426***)	(0.645)	(3.747***)
tco					0.008	0.000	0.009	0.003
					(1.889*)	(0.228)	(1.992**)	(3.440***)
newspaper							-0.00001	-0.00002
							(-1.398)	(-4.769***)
literacy							1.818	-2.769
							(0.540)	(-5.283***)
rural							5.853	-1.415
							(1.162)	(-1.809*)
sdp							-0.00002	-0.00031
							(-0.086)	(-3.091***)
Election dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes		Yes		Yes		Yes	
Constituency dummies		Yes		Yes		Yes		Yes
No. of Obs	3985	3985	3971	3971	3900	3900	3900	3900

Note: Values in parentheses denote the *t - values*. Levels of significance – * = 90% ** = 95% *** = 99%.

***Table A3*: Regression Results – Year wise**			
Total Regressions = 8	Dependent Variable : *tnt*		
Independent Variables	Positive and Significant*	Negative and Significant	Not Significant
lagged dependent variable	8		
closeness	2	5	1
hetrrelg	4	4	
hetrlang	4	1	3
tco	3	4	1
newspaper	1	4	3
literacy	4	2	2
sdp	4	3	1
rural	5	2	1

Note: We have run eight regressions, one for each election, starting from 1971. The entries denote the number of times the coefficient on a particular regressor was found positively or negatively significant or insignificant.

*The coefficients are significant at least at the 90% level.

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Paper II: The Phenomenon of Wasted Vote in the Parliamentary Elections of India

1. Introduction

As in a market with only a few firms, there is scope for strategic interaction between them, within a small electorate voters can come to know about each other's preferences and predict the likelihood of a certain candidate winning the election. Their voting decisions will then adequately take into account other people's expectations about the winner and their preferences. But as the size of the electorate increases the scope for strategic interaction decreases drastically. Under such circumstances it is expected that the voters would vote *sincerely*; that is, they would choose the candidate they like most. As a consequence, one should expect the votes to be divided up among the candidates who stood for the election.

One widely known law in political science, however, says that the top two parties in an electoral district should share all the votes and nothing should be left for a third party. This law, known as Duverger's Law[1], predicts that there should be no "wasted vote" even within a large electorate.

Duverger's Law is a statement about single-member district plurality systems. The argument is based on expected utility maximization. The first formalization of the model is due to Mckelvey and Ordeshook (1972). They demonstrate that in multiparty elections a voter might be willing to vote for her second or even lower ranked candidates if her most preferred party has a poor *viability* in the district and the second or third ranked party is a close contender for the seat. Consequently, the supporters of all the candidates other than those of the two most viable parties should switch their support to the more preferred of the top two candidates and the vote shares of all except these two should drop to zero.

The expected utility maximization hypothesis implicitly assumes that the voter calculates the probability of a tie between pairs of candidates for the first place, as she becomes *pivotal* only in the case of such a tie. The question, however, arises that in reality to what extent the voter's motivation to choose a certain candidate could be attributed to the argument of pivotal voter, as in a large electorate the probability of such an event should be extremely low. True enough, in the real world, very few voters actually think of breaking a tie while casting their vote. But, as Abramson (1992)

[1] Duverger (1954).

observes: "like all theories, the calculus of voting is a simplification of reality that seeks to capture the most salient features of the actual situations. Many voters may see some candidates as having real chances of winning and others as likely losers, and they may weigh these perceptions against the relative attractiveness of the candidates."[2]

Subsequently, a number of distinct theoretical models have analyzed the consequences of strategic voting in single-member district plurality systems. Cox (1987), for example, has modeled the strategic decision making of the voters using the framework of Bayesian games. He demonstrates that strategic voting works to improve the winning chances of the candidates who are expected to perform well. Using the same model, Palfrey (1989), has proved a much stronger result. He shows that as the size of the electorate grows the equilibrium vote share of the third party declines to zero and every voting equilibrium resembles Duvergerian equilibrium in the limit.

Myerson and Weber (1994) construct a counterexample of the Palfrey model using a somewhat different framework. The authors consider a model in which three political parties contest an election. They demonstrate that only under special conditions can positive votes be received by *all* three parties – indeed, the second and third parties must be *very* close in terms of the probabilities of winning the election. Under such circumstances the coordination on one of these candidates becomes very difficult and consequently the votes might get split between the two. Myerson and Weber have shown that non-Duvergerian three party equilibria are robust to small perturbations in the perceived ex ante winning chances of the candidates. However, Fey (1995) shows that the non-Duvergerian equilibria are dynamically unstable if learning on the part of the voters from past election data and opinion polls are incorporated into the model.

There have been several empirical studies to measure the extent of strategic voting in an electorate. The first of this kind are the studies by Cain (1978) and Black (1978). Subsequent authors like Curtice and Steed (1988), Galbraith and Rae (1989), Johnston and Pattie (1991) have compared the level of support obtained by a party in two consecutive elections to estimate the level of strategic voting. They use either the switch in support from the incumbent to the (major) opposition party or an increment in the vote share of the latter between pairs of elections as a measure of strategic voting in an

[2] Abramson et al. (1992).

electorate. Niemi et al (1992) and Evans and Heath (1993) have used 'self reporting intention' technique to identify the strategic voters from a sample of survey respondents. Others like Abramson et al (1992) and Alvarez and Nagler (2000) estimate strategic voting by measuring the objective difference between the stated vote and the preference ranking of the candidates on a feeling thermometer scale.

There has been relatively less empirical work on strategic voting in India. One reason could be the non-availability of good quality survey data. A recent study on India by Chhibber and Kollman (1998) makes a comparison of the party systems in India and the United States. They test the prediction of Duverger's Law at the national level and finds that fiscal centralization leads to a two party system in the same through coordination among parties on policy platforms.

In this paper we shall test the validity of the predictions of Duverger's Law at the constituency[3] level, namely that the volume of wasted vote should be zero at least in large elections. We use data from Indian parliamentary (*Loksabha*) elections between 1967 and 1998. There are nine of them, held in the years 1967, 1971, 1977, 1980, 1984, 1989, 1991, 1996 and 1998, respectively. We exploit constituency level data on the votes received by each party in each of the fifteen major states in India. Excluding a few outliers in the data, the total number of *constituency-years* sums up to 3393. Two of our principal variables are constructed from this data. These are the various measures of wasted votes and the difference in the vote shares of the top three parties in each constituency.

Even though the volume of the wasted vote appears to be quite large, we find that much of it is 'ineffective' in the sense that even when it is transferred to the second candidate en bloc it does not alter the outcome of the election. We find mixed evidence in favor of the theory that when the elections become close more people vote strategically and the volume of wasted vote decreases. The paper also identifies the importance of ethnic heterogeneity in explaining the volume of wasted votes.

A detailed road map for the rest of this paper is as follows. In Section 2, we spend considerable time describing the data, which have hitherto been unused. We also ask the following question: does a currently high (or low) wasted vote constituency remain so in

[3] In India, electoral districts are called constituencies.

the future? Finally in Section 3 we seek some informal explanations for wasted votes. We shall test whether the volume of wasted vote is influenced by the closeness of the election, the extent of fiscal centralization or ethnic heterogeneity. Section 4 will summarize the principal results and conclude the discussion.

2. Measuring The Wasted Vote

This section tries to measure the amount of wasted votes and looks at the variations across states and elections. It is divided into three parts. Subsection 2.1 studies the variation at the state level and finds that there is considerable difference in the level of wasted votes across states. Subsection 2.2 re-estimates the wasted votes to see to what extent these are "effective" in switching the identity of the winner from the candidate with the maximum votes to the one with the second largest number of votes. Finally, 2.3 examines the overall variation of wasted votes at an all India level[4] over time. It is found that with the exception of a few elections, there is no secular trend, upwards or downwards.

2.1 The Crude Estimate: State Level Scenario

The starting point of the analysis is the celebrated example of a three party equilibrium by Myerson and Weber (1994). They demonstrate that positive votes can be received by *all* three parties only if the second and third parties are *very* close in terms of the probabilities of winning the election, making the coordination on one of these candidates difficult for the voters. The same point had been emphasized in the empirical work by Johnston and Pattie (1991), though they did not give any theoretical justification in favor of the proposition. We begin here by looking at the degree of closeness between the second and the third parties in the electoral districts and the amount of third party-support in the same.

[4] We shall mean the sum total of all the fifteen major states whenever we refer to the "country" or "all India" figures.

The crude measure of wasted vote used in this section consists of the sum total of the vote shares[5] of all the parties who contested the election excepting the top two parties. We divide up the constituencies according to the extent of the difference in vote shares between the second and third largest parties. The entire range of difference between the second and third party vote shares in each of the fifteen major states as well as that for the entire country between '67 and '98 is divided up into twenty quantile groups. We look at the arithmetic means of the wasted vote as defined above in each of these groups. The means for the first and last two of these quantile groups are reported in Table 1 below.

***Table 1*: Distribution of Mean Wasted Votes According to the Difference Between the Second and Third Parties**

	Percentile of difference between 2 & 3			
	0 – 5	5 - 10	90 - 95	95 - 99
All India	0.23	0.22	0.03	0.02
AP	0.22	0.22	0.02	0.02
ASM	0.14	0.22	0.00	0.01
BH	0.21	0.23	0.06	0.04
GUJ	0.22	0.16	0.03	0.01
HAR	0.29	0.31	0.06	0.02
KAR	0.23	0.25	0.03	0.02
KER	0.19	0.10	0.02	0.01
MP	0.21	0.19	0.05	0.02
MH	0.25	0.25	0.03	0.01
ORI	0.25	0.22	0.05	0.02
PNJ	0.14	0.23	0.03	0.02
RAJ	0.25	0.18	0.04	0.03
TN	0.20	0.18	0.02	0.01
UP	0.24	0.25	0.10	0.08
WB	0.23	0.20	0.02	0.01
	Max 0.29			*Min* 0.01

Note: All the entries are proper fractions denoting the means of the wasted votes in respective categories.

Certain trends are noticeable in the data. First, consonant with the predictions of Myerson and Weber (1994), we observe that the wasted votes are declining with increasing difference between the second and the third parties. However, this declining tendency is more prominent in some of the states than in the others. In Kerala, Tamil Nadu, Maharashtra and West Bengal, for instance, the wasted votes are steadily decreasing both in the upper and lower ends of the range. In some other states like Andhra Pradesh and

[5] The vote share is the fraction of the total number of 'valid votes' obtained by a party or a candidate.

Rajasthan, the decline is somewhat arrested particularly at the lower end. Still others, like Assam, Madhya Pradesh and Punjab behave in a little bit erratic manner. While the cases of Assam and Punjab are clearly visible from the above table, both Madhya Pradesh and Punjab register a steep jump in the fourth quantile (not reported in the table).

The states can also be classified into "high" or "low" wasted vote states. Bihar, Haryana, Karnataka and Uttar Pradesh are clearly members of the first group. On the other hand, in states like Kerala and Tamil Nadu the wasted vote seems to be low across the range. However, what is astonishing about the above is that even in the last quantile group the value of the wasted vote is at least one percent of the total number of valid votes. It should be mentioned that the value of the difference between the second and third party vote shares in this group is as high as 46% on average.

The above-mentioned classification can be elaborated further by looking at the distribution of the mean wasted votes across states as shown in Table 2.[6]

***Table 2*: Distribution of Mean and Standard Deviation of Wasted Votes Across States**

States	*Mean*	*Standard Deviation*
AP	0.11	0.08
ASM	0.13	0.10
BH	0.15	0.09
GUJ	0.07	0.06
HAR	0.15	0.11
KAR	0.12	0.09
KER	0.06	0.05
MP	0.11	0.07
MH	0.11	0.09
ORI	0.11	0.08
PNJ	0.12	0.08
RAJ	0.09	0.07
TN	0.07	0.06
UP	0.16	0.09
WB	0.10	0.08

Note: The entries are means and standard deviations of wasted votes across all constituencies over all the elections from '67 to '98, calculated for each state. Unit: proper fraction.

It can be seen that the average wasted vote is greater than 0.10 for ten out of the fifteen states. The values cluster around 0.13. For the rest, the average value is centered on 0.08.

[6] Let the set of *constituency-years* in state s be C(s). The entries in the table denote the mean and standard deviations of wasted vote calculated over all $c \in C(s)$.

Among these Uttar Pradesh has the highest magnitude of wasted votes while Kerala has the lowest score.

However, the picture is more revealing than just this. The high average wasted vote is accompanied by high standard deviations as well. This implies that in states with high wasted votes there is considerable variation in its level both across constituencies and also over time. Indeed, some elections are associated with higher wasted votes across the board than the others. But this is the subject matter of subsection 2.3 where we look at the aspect of time variation in more detail.[7]

2.2 The 'Effective' Wasted Vote: State Level Scenario

In this section we turn to a different, somewhat artificial, way of measuring the wasted vote. The rational expectation assumption of Bayesian Nash equilibrium makes two predictions about the election outcome in a single member district – the first one is regarding the identity of the winner and the second one is related to the distribution of the votes among the candidates. Duverger's Law makes a strong statement about the second prediction of the theory, namely that the top two parties should sweep all votes of the constituency and nothing should be left for a third party. In section 2.1 we have already seen that this prediction is not supported by data. This implies that a large section of the electorate casts their votes *sincerely*, while according to the theory they should act strategically and choose the more preferred of the top two candidates.

In the present section we ask the following question. Suppose the voters who have voted for the third party indeed vote strategically and shift their votes to one of the top two candidates. We then delve into the probability of the event as to what extent this rearrangement of votes is capable of switching the identity of the winner. If the identity remains unchanged the wasted votes are 'ineffective' in the sense that the outcome of the election is compatible with a strategic voting equilibrium in which candidate *one* continues to win.

In order to see the effectiveness of the wasted vote, we do the following exercise. Let the vote shares of the first two parties be v_1 and v_2. Then the crude measure of wasted

[7] See Table A1 in Appendix for a detailed election-wise break up of the state-averages of wasted vote.

vote will be equal to $v_3 = 1 - v_1 - v_2$. Let this wasted vote be distributed between candidates *one* and *two* in the proportions $(1 - x)$ and x, such that *two* is just able to make a tie with *one*. Hence, $xv_3 + v_2 = (1 - x)v_3 + v_1$, which yields $x = (v_1 + v_3 - v_2)/ 2v_3$. x is the minimum proportion of the wasted vote, which if transferred to *two* en bloc, enables *two* to turn the table. It is greater than or equal to 0.5 by construction.

Contrast the above with a situation where the wasted votes are distributed randomly to the top two candidates, so that each of them gets 0.5 proportion of it. This is similar to the hypothetical situation where the third party voters randomly allocate their votes between the first and the second candidates in a very close election. The difference between these two measures, namely $(x - 0.5)$, gives us the required index for the effectiveness of the wasted vote. It measures the extent to which the allocation would have to be systematically biased in favor of the second candidate to make the tie possible. Consider the case when $(x - 0.5)$ is small. If all voters coordinated their votes on the first two candidates, a small amount of excess popularity of the second candidate (over the first) within the class of third party voters would be enough to alter the outcome of the election. The wasted votes are precious under such circumstances. On the contrary, the further the value of x is from 0.5 wasted votes become less and less costly.

It must be noted that in constituencies where the difference in the vote share between the first and the second candidate (the closeness of the election) exceeds the crude measure of wasted votes, wasted votes can never make a switch in the outcome. These are uninteresting cases, since there is little incentive to vote tactically. We exclude these constituencies from the sample while calculating the effectiveness of the wasted votes. Moreover, this also implies that within the sample the value of $(x - 0.5)$ always lies between 0 and 0.5.

Table 3 below reports the means and standard deviations of this new index for each of the fifteen states.[8] The last column denotes the percentage of *constituency-years* in each state where the difference between the first and second candidates could be bridged by rearranging the wasted votes in the favor of the second candidate. As can be

[8] Let the set of *constituency-years* in state s be C(s). The first two columns denote the mean and standard deviations of $(x - 0.5)$ calculated over those $c \in C(s)$ for which difference between 1 and 2's vote shares is less than the sum total of the votes shares of all other parties.

observed, the index is generally small for the high wasted vote states like Uttar Pradesh, Haryana and Bihar and high for low wasted vote states like Gujarat, Kerala and Tamil Nadu. This shows that, as a whole, the more the volume of the wasted votes, more likely it is that it will be effective in switching the election outcome.

***Table 3*: Distribution of Mean and Standard Deviation of "Effective" Wasted Votes Across States**

States	Mean	Standard Deviation	Percentage of constituencies
AP	0.22	0.14	46.80
ASM	0.23	0.18	56.60
BH	0.20	0.13	47.94
GUJ	0.22	0.14	29.46
HAR	0.14	0.12	52.94
KAR	0.21	0.14	49.09
KER	0.25	0.15	55.62
MP	0.25	0.14	43.23
MH	0.23	0.14	42.59
ORI	0.22	0.15	45.00
PNJ	0.23	0.16	40.22
RAJ	0.21	0.14	39.49
TN	0.26	0.14	25.15
UP	0.18	0.14	51.95
WB	0.25	0.14	52.45

Note: The entries are means and standard deviations of the "effective" wasted votes, i.e.- (x – 0.5), across those constituencies for which difference between 1 and 2's vote shares is less than the sum total of the vote shares of all other parties, over all the elections from '67 to '98, calculated for each state. The last column gives the percentage of such constituency-years in each state.

There is one thing worth noticing in Table 3. If we look at the mean value of the "effectiveness" index across states, it seems that almost nowhere the wasted votes are effective enough to make much of a change in the election outcomes. For instance, the minimum value is as high as 0.14. This means that the redistribution of third party votes would have to be at least 64% vs. 36% in favor of the second candidate before election outcomes can be overturned. Within the class of third party voters, the preferences over the first two candidates are unlikely to be so skewed. We claim that much of the puzzle about the "volume" of wasted votes, as discussed in Section 2.1, is thus dispelled.

The standard deviations are not very telling in this case. They cluster around 0.14, indicating that the patterns of variation in the effectiveness index are more or less similar across states.[9] We shall now turn to the analysis of the time variation in the wasted votes – both in its crude form as well as for the effective estimate.

2.3 Time Variation: The All India Scenario

Wasted or third party votes have varied considerably over the years from the first general election of independent India until now.[10] The political and economic situations which affect the decisions of a voter have not, of course, remained the same during this span of more than fifty years. There have been significant changes in the demographic characteristics of the Indian electorate, particularly those relating to education, health and the caste composition. First of all, the electorate has grown in size, both in terms of the absolute number and also in terms of the proportion of the adult population who exercise their franchise. Political and economic empowerment has been extended to certain sections of the population. The Dalits and women have emerged as important demographic groups in terms of their political clout. With the advancement of technology, new modes of information dissemination have come into vogue and these have played an important role in the social, economic and political life of individuals.

There have also been important political events, both within the country and also in the outside world, which have influenced the outcomes of certain elections. For example, the declaration of emergency in 1975 had a great impact on the outcome of the following parliamentary election of 1977. Almost every election is unique in this respect. Still, one can say, that some of these have been preceded by more 'normal' years than the others. This fact is borne out very well from the data.

The over time variation in the wasted votes in India is quite exceptional in the sense that for the most part it has moved in the direction opposite to what is predicted by the theory of calculus of voting: its level has been high in those elections where the race was close.

[9] See Table A2 in Appendix for a detailed election-wise break up of the state-averages of effective wasted vote.

[10] Chhibber and Kollman (1998) have found it to vary from 22% in 1980 to 2% in 1977. See footnote 11 of the same.

We analyze the period between 1967 and 1998. In the earlier elections the wasted vote turns out to be high. In our dataset we find it to be as high as 12% in 1967 and 10% in 1971. The 1977 election proved to be an exception – the wasted vote fell to 5% - due to the extraordinary political developments that preceded it. In the next election, that is the one that took place in 1980 before the usual term of the government was over, the wasted vote level shot up to 14%. There was widespread confusion in the electorate regarding the relative chances of various parties. The Congress (I) was trying hard to fight back while the Janata Dal had the advantage of being in office for the last three years. The memory of the emergency was still fresh in the minds of the people. That the race was indeed very close is proved by the relatively low differences in the vote shares between the winner and the second and also that between the second and the third parties.

An interesting, but unexplored, stylized fact emerges from Table 4.[11] We have calculated the arithmetic mean of wasted votes – both of the crude measure as well as of the effectiveness index - across all the constituencies distributed over the fifteen major states for each of the elections and examined its variation over the entire period. The last three general elections, held in 1991, 1996 and 1998, witnessed very high levels of wasted votes. This happened despite the fact that the vote distances between the political parties were continuously declining.

***Table 4*: Distribution of Means and Standard Deviations of Crude and Effective Estimates of the Wasted Vote Across Elections**

Election	Crude Mean	Crude Standard Deviation	Effective Mean	Effective Standard Deviation	Proportion Of Constituencies
'67	0.12	0.09	0.23	0.14	65.57
'71	0.10	0.08	0.23	0.15	33.68
'77	0.05	0.05	0.28	0.15	29.32
'80	0.14	0.09	0.22	0.15	37.17
'84	0.09	0.07	0.24	0.15	27.61
'89	0.10	0.08	0.23	0.14	33.57

[11] Let the set of constituencies distributed over all the fifteen major states in the election year *t* be C(t). The first two columns of Table 4 denote the mean and standard deviation of crude wasted votes calculated over all $c \in C(t)$. The next two columns show the mean and standard deviation of the effectiveness index calculated over those $c \in C(t)$ in which the difference between 1 and 2's vote shares is less than the sum total of the vote shares of all other parties The last column shows proportion of C(t) in which difference between 1 and 2's vote shares is less than the sum total of the vote shares of all other parties.

'91	0.13	0.08	0.23	0.14	52.69
'96	0.16	0.08	0.20	0.13	64.30
'98	0.14	0.09	0.19	0.13	64.22

Note: The entries are means and standard deviations of wasted vote calculated over the appropriate constituencies across all states, for each election year.

An investigation into the "effectiveness" of the wasted votes reveals little variation in the level except in the year 1977, when the index was higher than its usual level implying that wasted vote was actually valueless. This is expected given that the election was not close at all. Again, after 1991, there is a continuous decline in the value of this index indicating that wasted votes have become more costly in recent years. This result, combined with the fact that the level of wasted votes had also been rising at the same time, is a bit counterintuitive. Figures 1 and 2 show the movements of the wasted vote and the effectiveness index.[12] It can be seen clearly that, as a whole, there is no trend in the data. However, in the last three elections, the two graphs are rising and falling, respectively.

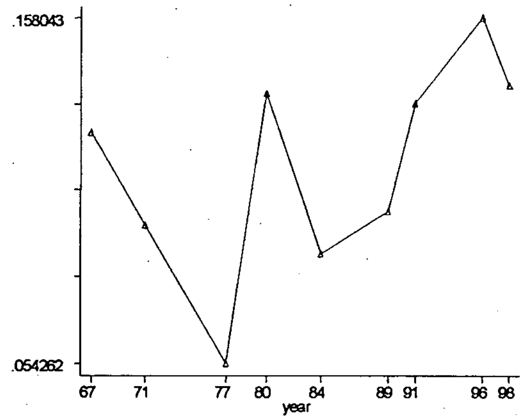

Figure 1: Wasted Votes

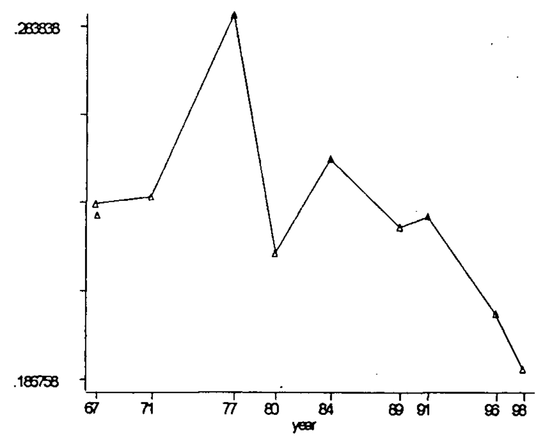

Figure 2: Effectiveness

We shall wind up the description of the data with the transition probability matrix. Specifically, we ask the following question: Suppose that the level of wasted votes in constituency i is high (low) during election t. Then, what is the probability that the level of wasted votes in constituency i remains high (low) during election $(t+1)$? Persistence in

[12] Figures 1 and 2 are constructed from columns 1 and 3 of Table 4, respectively.

the patterns of wasted votes reveals the importance of constituency level determinants. We proceed as follows. We divide up the range of wasted votes into three quantile groups: high, medium and low. Then label each constituency with the appropriate tag. Next we see how the constituency has changed its status over the years. The result is summarized in the following table. The values in each cell denote the probability of a transition from a certain status to the other. For example p_{LL} is the probability that if a constituency is a low wasted vote constituency it will remain so in the next election, p_{LM} is the probability that a low wasted vote constituency will shift to a medium class and so on. The values of these probabilities are as follows:

Table 5: Transition Probabilities

	Next Period Status		
Initial Status	*Low*	*Medium*	*High*
Low	0.492743	0.3418	0.164006
Medium	0.344487	0.38403	0.269962
High	0.182168	0.294389	0.523444

It can be seen that the diagonal values are larger than the off-diagonal ones. This indicates that there is indeed a lot of persistence in the level of wasted votes at a constituency level. This provides us with the motive for introducing constituency level dummies to capture the time-invariant constituency level characteristics when we try to estimate the influences of various regressors on the level of wasted votes. This issue will be taken up in the next section.

3. Modelling Wasted Vote in the Indian Electorate

3.1 The Data and the Methodology

In this section, we shall ascertain the relative importance of various factors identified in the literature as affecting the volume of the wasted vote. We use panel data techniques to estimate the model. This analysis has its shortcomings. It cannot be used, for instance, to infer individual level behavior such as strategic voting.

The dependent variable used in this analysis is wasted vote at the constituency level, measured in two different ways.[13] The first one is the total number of votes received by all the parties in the constituency excepting the top two parties, divided by the total number of valid votes in the same. This is a proper fraction, say p, which can vary from 0 to 1. Since we do not want to put any range restriction on the error term, we apply the following transformation on p. We take the log of the ratio $p/(1-p)$ and call this *wv*. It has the range $-\infty$ to ∞.

Note, first, that *diff12* is the difference in the vote shares of the top two parties in a constituency. When the election is close – i.e. *diff12* is small – the volume of wasted votes can be large. In particular, footnote 14 demonstrates that the upper bound for wasted votes is given by (1 – *diff12*)/3.[14] Rather than considering the actual volume of wasted votes, our second measure calculates the wasted vote, p, as a proportion of its theoretical upper bound, (1 – *diff12*)/3. Finally, we take the log transformation of [p ÷ (1 – *diff12*)/3] to ensure that the range remains $-\infty$ to ∞. We call this second measure *wv1*.

There are three sets of regressors used in the analysis. They pertain to three different theories for explaining wasted votes. We test each of these in turn, and look at their comparative explanatory power in explaining the volume of wasted votes in the Indian elections. The first one is the well-known calculus of voting theory, which attributes the volume of wasted votes to the closeness of the election. As elections get more and more close between the top two candidates wasted votes become more and more costly. Under such situations, voting sincerely might pave the way for a low ranked candidate to win the election. Hence voters do better by choosing the more preferred of the top two parties. The prediction, therefore, is that the less the distance between the top two parties, the less is the volume of wasted votes. An extension of this theory holds that the larger the difference between the second and the third parties, the more prominent is the identity of the loser and hence less the wasted vote volume. In the present paper, we

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[13] Please refer to Appendix for a detailed description of each of the variables.

[14] The upper bound is derived in the following manner. Let there be three parties in a constituency whose vote shares are denoted by v_1, v_2 and v_3; where $0 < v_3 < v_2 < v_1 < 1$ and $v_1 + v_2 + v_3 = 1$. Then, $v_2 > v_3 \Rightarrow 2v_2 + v_3 > 3v_3$. The LHS of the last inequality can be written as $v_1 + v_2 + v_3 - (v_1 - v_2) = 1 - (v_1 - v_2)$. This implies that $v_3 < [1 - (v_1 - v_2)]/3$. Note that, *diff12* = $(v_1 - v_2)$. Hence, the upper bound of v_3 is given by [1 – *diff12*]/3.

call the vote share differences between the top two parties and that between the second and the third parties, *diff12* and *diff23*, respectively.

The second class of theory relates the volume of wasted votes to the extent of ethnic heterogeneity within the electorate. Ordeshook and Shvetsova (1994) find that in single-member district plurality systems, heterogeneity at the constituency level does not affect the level of the wasted vote. In our dataset, however, we find it to be one of the influential factors. We measure heterogeneity as the probability that two randomly picked persons will belong to the same group.[15] We incorporate religious, linguistic and caste heterogeneity measures (*hetrrelg*, *hetrlang* and *hetrcast*, respectively) and find their effects on wasted votes to be of different types.

The third and the final theory to be discussed here is one which seeks to explain wasted votes in terms of the size and activism of the central or the federal government. Chhibber and Kollman (1998) have argued that as the federal government centralizes power, "voters develop national policy preferences and candidates associate themselves with certain national policy positions". As a result locally competitive but nationally uncompetitive parties are abandoned by the voters. One implication of this theory is that as the size of the public good increases, the identity of the winner becomes more important and wasted vote turns out to be a costly option to the voter. We introduce four different measures of government activism – the total capital disbursement, total capital outlay, total revenue expenditure and the revenue expenditure on development activities (*tcd*, *tco*, *tre* and *rxdev*[16], respectively). We do not find any systematic influence of any of these factors on the level of wasted votes.

We have constituency level data for the variables related to wasted votes and closeness. The rest are computed from state level data. We run regressions with robust standard errors on a panel using constituency and state level dummies. The former takes the following form:

$$y_{ct} = \alpha_c + \delta_t + x_{ct}\beta + z_{s(c)t}\gamma + \varepsilon_{ct} \quad (1),$$

while the latter looks like:

$$y_{ct} = \alpha_{s(c)t} + \delta_t + x_{ct}\beta + z_{s(c)t}\gamma + \varepsilon_{ct} \quad (2);$$

[15] Please refer to Appendix for exact definitions of the heterogeneity measures.
[16] All of these are measured per capita.

where y_{ct} is the wasted vote in constituency *c* during the *t*'th election, α_c and δ_t denote constituency and election specific dummies, x_{ct} is the vector of closeness measures of the *t*'th election in constituency *c*, *s(c)* identifies the state in which constituency c is located, and $z_{s(c)t}$ is the corresponding vector of state level regressors in the *t*'th election.

3.2 The Main Results

Table A3 in the appendix presents the basic results. The three sets of regressors are introduced in succession. We start off by testing the effect of the closeness measures on the volume of wasted votes. The first two models, namely model 1 and model 2, use the original measure of wasted votes (*wv*) and involve state and constituency level dummies, respectively. The same exercise is repeated, for the deflated measure, i.e. *wv1* and the results are reported in models 3 and 4. We also incorporate various state level regressors related to newspaper circulation, literacy rate, the proportion of the rural population and the state domestic product. These variables are not the focus of this analysis. We introduce them to control for various demographic characteristics at the constituency level.

The results are unexpected as far as the *diff12* variable is concerned. The estimated coefficient is found to be negative, statistically significant, and robust across specifications. This implies that as the election becomes close – i.e. as the difference in vote shares between the top two parties decreases – wasted votes register a rise. This violates the prediction of the theory that, in close elections, voters should vote strategically and opt for one of the top two candidates. However, the *diff23* variable all throughout has the expected negative sign, which shows that as the distance between the second and the third candidate increases the volume of wasted vote declines. This implies that voters abandon candidates who are identified as the likely losers.

Keeping the closeness variables in place, we now introduce the heterogeneity measures into the model. As stated earlier, we have measures for linguistic, religious and caste heterogeneities in the demographic composition of the electorate. Among these, the linguistic and religious heterogeneity measures are found to have a positive effect on the volume of the wasted votes, whereas an increment in the caste heterogeneity seems to reduce the same. There is hardly any theory which tells us whether these results are to be expected. However, one can forward informal explanations in favor of these results. The schedule caste and scheduled tribe population is extremely dynamic in India, both socially and politically. They have been the center of many political debates in the last few decades, reservation being one of them. The issue is extremely sensitive and has a symbolic value in the minds of certain sections of the population. There is little doubt that with increasing population of these castes in the electorate, people will perceive the political competition even more sharply. Thus, with the same level of closeness, a constituency with a more heterogeneous caste composition will have less wasted votes than one where degree of such heterogeneity is small.

The other two heterogeneity measures, however, indicate just the opposite. They show that wasted votes are likely to be higher in a district where the population is multi-linguistic and multi-religious. This difference in the behavior of the various heterogeneity measures is hard to explain. Perhaps the clue to this problem lies in the different manners in which these various identities – linguistic, religious and caste – enter the political life of an individual. While we have already mentioned the importance of caste in the political decision making process, we conjecture that the role of the other two is probably not one of promoting the sense of political competition. Rather, these may have certain emotional or ideological underpinning, which induces a person to vote sincerely.

In the end, we incorporate government spending variables in the model, representing government activism or the size of the government. These variables are not significant except in the last two models, where the revenue account spendings are found to be significant. Among these only the development expenditure seems to have a consistent negative sign, indicating that higher expenditure on development projects causes wasted votes to decline.

Although we did not put much emphasis on the demographic variables, some of them seem to have significant effect on the wasted vote. The coefficient on newspaper circulation has a negative sign, indicating wasted votes are likely to be low in a more informed constituency. However, an increase in the proportion of rural population seems to decrease the volume of wasted votes. One implication of this is that it had been relatively difficult for new parties to make a breakthrough in the rural areas, which are found to be favoring the status quo. Another interesting feature is the positive sign on the per capita state domestic product. It implies that richer constituencies tend to have more wasted votes. Given that we have already controlled for information and literacy, it probably indicates that the cost of a wasted vote is less to the more affluent people.

3.3. The Measurement Error Problem

We have already estimated the effect of the closeness of the election on the level of wasted votes. This estimate is flawed in that election closeness suffers from measurement error. Theory maintains that an ex ante prediction of election closeness affects wasted votes; on the other hand, we have taken actual (or ex post) election closeness as the regressor. Ex post election closeness is, after all, only an erroneous approximation of ex ante closeness. The measurement error biases the estimated coefficient downwards.

One way to address this problem is to find instruments for election closeness. A natural choice for the instrument is the lagged value of the variable, that is $(diff12)_{-1}$ and $(diff23)_{-1}$, respectively, in our case.

There is one practical problem, however, in constructing the instrumental variables from the lagged values of the vote share differences. The elections are too far apart, making the correlation between the instrument and the relevant variable extremely low. The correlation between *diff12* and its lagged value is only 0.13 while that between *diff23* and $(diff23)_{-1}$ is about 0.23. Consequently the lagged values provide us with very poor instruments in the present case.

We re-estimated all the twelve models of Table A3 using two-stage least squares technique. The variables turned out to be mostly insignificant. However, *diff23* continued to be robust. The only other variable which we found significant was newspaper circulation. It was negative and significant, substantiating the role of information dissemination in the reduction of wasted votes.

3.4 The Year Wise Estimates

The aggregate models described in equations (1) and (2) are too restrictive in the sense that they force the same β and γ across all the states and elections. As we have already noted in Section 2.3, there is considerable variation in the wasted votes across elections and each election has its unique features. In order to see if the estimates vary significantly over time or if they remain more or less unchanged around the values estimated by the aggregate model, we have run 'ordinary least square' regressions on wasted vote separately for each election year.

Since the demographic control variables in our dataset are values at the state level, multicollinearity rules out the incorporation of state and constituency dummies in the estimated regressions. Hence, we use lagged values of the dependent variable (*wv* and *wv1*) to crudely control for unobserved constituency specific characteristics.

The estimates have deteriorated considerably, but this is partly due to a massive reduction in the number of observations. The summary of the signs on the coefficients and their significance levels is given in Table A4 in the appendix. The entries denote the number of times the coefficient on a particular regressor was found positively or negatively significant or insignificant.

The closeness measures are again very strongly significant with negative sign. The caste heterogeneity is mostly correctly signed. However, there has been reversal in the sign of the linguistic heterogeneity. Newspaper has also worsened considerably, but its place has been taken by literacy rate, which is a substitute to the former.

The government expenditure variables are still far from satisfactory. They are mostly insignificant. When significant, they are signed incorrectly, pointing to a direction opposite to the prediction of the theory, namely increased government activity reduces wasted votes (see *tco* and *tre*). The development expenditure variable is signed both ways. Only the capital disbursement variable seems to be moving in the correct direction, but only in a few cases. One should not read much into this, since capital account variables are very noisy.

4. Conclusion

The paper attempts an aggregative analysis of wasted or third party votes in India. It does not, however, try to measure the extent of strategic voting, which is a closely related aspect.

We measure the volume of wasted vote at the constituency level and find that it is quite large. The average level of wasted votes across all the states and all the parliamentary elections from 1967 to 1998 is as high as 11%. However, we have also shown that a reallocation of the wasted votes to the top two candidates is unlikely to affect the identity of the winner of the constituency in most of the cases.

The paper also looks at the determinants of wasted votes at the constituency level. It demonstrates that as the distance between the second and third ranked candidates in a constituency decreases the volume of wasted vote tends to go up. The paper thus finds evidence in favor of the Myerson-Weber argument that as coordination on one of these candidates becomes difficult wasted votes tend to increase.

The paper, however, identifies an aberration to one of the predictions of the calculus of voting theory in the context of the Indian electorate. It shows that when the elections are close between the top two candidates the volume of wasted votes tend to be larger. We pose it as a puzzle.

At the policy level, it identifies the role of information dissemination and the spread of literacy for bringing down the volume of wasted votes. However, it does not find any evidence in favor of government activism to achieve the same target. This paper also suggests that wasted vote is affected by the heterogeneity in the composition of the electorate, even though there is no theory which relates the latter to the phenomenon of strategic voting. There is, therefore, scope for further research in this area.

APPENDIX

Data Sources and Definitions of the Variables

- Wasted votes
  - (i) *wv* – Let the total number of votes received by all the parties in the constituency excepting the top two parties, divided by the total number of valid votes in the same be p. $wv = \ln [p / (1-p)]$. This is constructed from constituency level data.
    Unit: real number
    Source: Election Commission of India
  - (ii) *wv1* – Let the vote shares of the first and the second parties be v_1 and v_2, respectively. Let $q = p / [(1-v_1+v_2)/3]$. $wv1 = \ln[q / (1-q)]$. Constituency level data.
    Unit and source: Same as above.
- Closeness of the race
  - (i) *diff12* – Let the vote shares of the first two parties as a proportion of the total number of valid votes in the district be v_1 and v_2. $diff12 = v_1 - v_2$.
  - (ii) *diff23* – Let the vote shares of the second and the third parties as a proportion of the total number of valid votes in the district be v_2 and v_3. $diff23 = v_2 - v_3$.
    Constituency level data.
    Unit: Proper fraction
    Source: Election Commission of India
- Heterogeneity Indices

  These variables have been constructed from the state level population data obtained from the Census of India. The figures for the four Census years, 1961, 1971, 1981 and 1991 have been interpolated to generate the numbers for the intermediate years. We have taken the three-year moving averages of these numbers to smoothen the series. The figures for the election years have been taken from this series.

We have calculated the index as the probability that two randomly picked persons from the sample would belong to two different demographic groups. Let the proportion of people belonging to each group be p_1, p_2, etc. Then the index is given by $1 - \sum p_i^2$, $i = 1, 2, \ldots n$.

(i) *hetrlang* – We have calculated this index from the number of people belonging to the 14 major language groups, namely, Assamese, Bengali, Gujrati, Hindi, Kannada, Kashmiri, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Tamil, Telegu and Urdu.

(ii) *hetrrelg* – Constructed from the 8 major religious groups, classified as Hindu, Muslim, Christian, Sikh, Buddist, Jain, Others and Not Stated.

(iii) *hetrcast* – Constructed from SC, ST and other population in each constituency.

Source: Census of India, various volumes.

- Government spending (State level data)

(i) *tcd* – Per capita total capital disbursement
Unit: Rupees (1960 prices)

(ii) *tco* – Per capita total capital outlay
Unit: Rupees (1960 prices)

(iii) *tre* – Per capita total revenue expenditue
Unit: Rupees (1960 prices)

(iv) *rxdev* – Per capita revenue expenditure on development activities
Unit: Rupees (1960 prices)

Source: Reserve Bank of India Bulletin, various issues, Reserve Bank of India.

- Newspaper circulation (State level data)

  The average number of copies of newspapers, magazines and periodicals sold or distributed freely per publishing day, in each of the 15 major states.

  Unit: Thousands of copies

  Source: Annual Reports of the Registrar For Newspapers in India, various years.

- Literacy rate (State level data)

  The number of literates in each state divided by the total population of the state.

  Unit: Proper fraction

  Source: Census of India, various volumes

- Proportion of the rural population (State level data)

  The proportion of rural population in each state

  Unit: Proper fraction

  Source: Census of India, various volumes.

- Per capita state domestic product (*sdp*) (State level data)

  Unit: Rupees (1960 prices)

  Source: Reserve Bank of India Bulletin, various issues, Reserve Bank of India

Table A1 : Distribution of mean and standard deviation of wasted votes across state and elections										
	election									
state	' 67	' 71	' 77	' 80	' 84	' 89	' 91	' 96	' 98	state (all elections)
AP	0.15, 0.08	0.09, 0.08	0.05, 0.06	0.14, 0.06	0.05, 0.06	0.05, 0.05	0.12, 0.07	0.17, 0.07	0.18, 0.09	0.11, 0.08
ASM	0.11, 0.12	0.14, 0.08	0.05, 0.05	0.01, NA	0.18, 0.1	NA	0.26, 0.02	0.21, 0.06	0.2, 0.06	0.13, 0.1
BH	0.19, 0.08	0.16, 0.09	0.09, 0.07	0.22, 0.05	0.13, 0.08	0.12, 0.1	0.16, 0.08	0.14, 0.08	0.18, 0.09	0.15, 0.09
GUJ	0.07, 0.07	0.06, 0.06	0.04, 0.04	0.09, 0.06	0.07, 0.06	0.05, 0.03	0.06, 0.04	0.08, 0.06	0.13, 0.08	0.07, 0.06
HAR	0.15, 0.12	0.11, 0.05	0.05, 0.05	0.27, 0.05	0.11, 0.07	0.06, 0.03	0.25, 0.05	0.28, 0.07	0.22, 0.09	0.15, 0.11
KAR	0.12, 0.1	0.03, 0.03	0.03, 0.03	0.17, 0.05	0.06, 0.04	0.16, 0.07	0.19, 0.06	0.22, 0.07	0.19, 0.07	0.12, 0.09
KER	0.1, 0.09	0.06, 0.04	0.02, 0.03	0.03, 0.02	0.07, 0.05	0.06, 0.03	0.06, 0.03	0.09, 0.03	0.09, 0.03	0.06, 0.05
MP	0.13, 0.08	0.08, 0.06	0.05, 0.06	0.16, 0.06	0.1, 0.06	0.11, 0.06	0.09, 0.07	0.16, 0.06	0.12, 0.09	0.11, 0.07
MH	0.11, 0.08	0.08, 0.06	0.04, 0.06	0.12, 0.08	0.1, 0.06	0.14, 0.09	0.16, 0.08	0.19, 0.08	0.06, 0.06	0.11, 0.09
ORI	0.11, 0.1	0.22, 0.06	0.06, 0.06	0.15, 0.03	0.07, 0.05	0.06, 0.04	0.13, 0.06	0.16, 0.08	0.1, 0.07	0.11, 0.08
PNJ	0.21, 0.08	0.13, 0.07	0.05, 0.04	0.09, 0.07	0.12, 0.08	0.14, 0.08	0.16, 0.08	0.17, 0.05	0.03, 0.02	0.12, 0.08
RAJ	0.1, 0.08	0.07, 0.05	0.04, 0.03	0.18, 0.06	0.12, 0.06	0.06, 0.04	0.11, 0.08	0.11, 0.06	0.09, 0.07	0.09, 0.07
TN	0.05, 0.06	0.04, 0.05	0.04, 0.04	0.04, 0.04	0.03, 0.03	0.08, 0.07	0.09, 0.06	0.15, 0.05	0.09, 0.06	0.07, 0.06
UP	0.2, 0.08	0.12, 0.07	0.07, 0.05	0.25, 0.06	0.16, 0.06	0.18, 0.07	0.2, 0.07	0.24, 0.05	0.23, 0.06	0.16, 0.09
WB	0.13, 0.1	0.17, 0.08	0.07, 0.07	0.09, 0.06	0.04, 0.04	0.06, 0.05	0.15, 0.05	0.11, 0.05	0.16, 0.05	0.1, 0.08
All India	0.12, 0.09	0.1, 0.08	0.05, 0.05	0.14, 0.09	0.09, 0.07	0.1, 0.08	0.13, 0.08	0.16, 0.08	0.14, 0.09	
Note: The first and second entries in each cell denote the mean and the standard deviation of wasted votes for the particular state-year, respectively.										

Table A2 : Distribution of mean and standard deviation of "x - 0.5" and percentage of constituencies with "effective" wasted votes across states and elections

state	election									
	' 67	' 71	' 77	' 80	' 84	' 89	' 91	' 96	' 98	state (all elections)
AP	0.24, 0.14, 53.33%	0.19, 0.14, 25%	0.32, 0.15, 24.39%	0.36, 0.12, 28.57%	0.24, 0.17, 30.95%	0.25, 0.13, 26.19%	0.24, 0.15, 60.98%	0.18, 0.12, 86.49%	0.16, 0.11, 87.5%	0.22, 0.14, 46.80%
ASM	0.24, 0.33, 66.67%	0.48, NA, 14.29%	0.23, 0.31, 50%	NA	0.24, 0.14, 71.43%	NA	0.19, 0.18, 100%	0.21, 0.14, 80%	0.18, 0.21, 57.14%	0.23, 0.18, 56.60%
BH	0.14, 0.11, 70.59%	0.2, 0.14, 50%	0.38, 0.14, 12.24%	0.2, 0.15, 83.33%	0.23, 0.13, 26.32%	0.17, 0.11, 28.21%	0.25, 0.12, 42.86%	0.2, 0.1, 50%	0.16, 0.1, 86.67%	0.2, 0.13, 47.94%
GUJ	0.25, 0.12, 65.22%	0.27, 0.14, 33.33%	0.31, 0.16, 34.62%	0.21, 0.15, 15.38%	0.15, 0.1, 23.08%	0, NA, 3.85%	0.28, 0.15, 20%	0.16, 0.18, 25%	0.19, 0.14, 50%	0.22, 0.14, 29.46%
HAR	0.05, 0.02, 60%	0.17, 0.16, 44.44%	0.18, NA, 20%	0.08, 0.08, 71.43%	0.36, 0.21, 30%	0.12, 0.05, 30%	0.15, 0.07, 100%	0.07, 0.06, 80%	0.11, 0.09, 100%	0.14, 0.12, 52.94%
KAR	0.24, 0.15, 64%	NA, NA, 19.23%	0.13, 0.04, 39.29%	0.28, 0.22, 16.67%	0.22, 0.15, 25%	0.3, 0.09, 39.13%	0.21, 0.14, 86.36%	0.14, 0.12, 95.24%	0.21, 0.12, 73.91%	0.21, 0.14, 49.09%
KER	0.3, 0.1, 57.89%	0.29, 0.06, 21.05%	0.32, 0.18, 60%	0.23, 0.15, 35%	0.21, 0.19, 35%	0.25, 0.19, 65%	0.27, 0.14, 70%	0.29, 0.13, 80%	0.15, 0.13, 75%	0.25, 0.15, 55.62%
MP	0.21, 0.17, 70%	0.34, 0.1, 28.57%	0.28, 0.16, 42.5%	0.27, 0.15, 47.06%	0.29, 0.1, 14.29%	0.29, 0.14, 31.43%	0.25, 0.14, 50%	0.2, 0.12, 56.25%	0.22, 0.13, 61.11%	0.25, 0.14, 43.23%
MH	0.24, 0.12, 48.65%	0.26, 0.18, 17.95%	0.25, 0.11, 43.75%	0.19, 0.14, 14.29%	0.31, 0.12, 29.73%	0.2, 0.14, 56.52%	0.24, 0.13, 53.66%	0.24, 0.14, 80%	0.2, 0.15, 37.5%	0.23, 0.14, 42.59%
ORI	0.29, 0.19, 68.75%	0.18, 0.12, 63.64%	0.15, 0.1, 61.9%	0.05, NA, 7.14%	0.16, 0.2, 14.29%	0.31, 0.04, 23.81%	0.21, 0.16, 77.78%	0.23, 0.14, 58.82%	0.26, 0.16, 38.1%	0.22, 0.15, 45%
PNJ	0.23, 0.17, 75%	0.15, 0.2, 27.27%	0.49, NA, 7.69%	0.18, 0.13, 33.33%	0.26, 0.19, 50%	0.41, 0.04, 50%	0.1, 0.09, 40%	0.22, 0.12, 100%	0.4, NA, 8.33%	0.23, 0.16, 40.22%
RAJ	0.36, 0.08, 72.22%	0.22, 0.19, 33.33%	NA, NA, 20%	0.16, 0.1, 63.16%	0.25, 0.1, 15.79%	0.12, 0.16, 8%	0.2, 0.15, 45.45%	0.15, 0.11, 60.87%	0.24, 0.16, 47.83%	0.21, 0.14, 39.49%
TN	0.22, 0.15, 51.28%	0.22, 0.2, 48.72%	0.16, NA, 12.82%	0.34, 0.23, 12.82%	0.34, NA, 15.38%	0.34, 0.08, 15.79%	0.44, 0.01, 5.13%	0.38, 0.08, 12.5%	0.2, 0.13, 50%	0.26, 0.14, 25.15%
UP	0.2, 0.14, 81.25%	0.25, 0.15, 24.53%	0.43, NA, 12.05%	0.2, 0.13, 93.55%	0.28, 0.15, 31.58%	0.17, 0.14, 57.14%	0.18, 0.13, 83.33%	0.16, 0.11, 85.29%	0.12, 0.1, 90%	0.18, 0.14, 51.95%
WB	0.22, 0.12, 88.89%	0.23, 0.16, 72.73%	0.34, 0.13, 41.46%	0.22, 0.13, 21.43%	0.2, 0.15, 40.48%	0.23, 0.14, 26.19%	0.24, 0.13, 61.9%	0.25, 0.13, 63.41%	0.29, 0.16, 71.79%	0.25, 0.14, 52.45%
All India	0.23, 0.14, 65.57%	0.23, 0.15, 33.68%	0.28, 0.15, 29.32%	0.22, 0.15, 37.17%	0.24, 0.15, 27.61%	0.23, 0.14, 33.57%	0.23, 0.14, 52.68%	0.2, 0.13, 64.3%	0.19, 0.13, 64.22%	

Note: The first, second and third entries in each cell denote the mean and standard deviation of (x – 0.5) and the percentage of constituencies in which the difference between the top two candidates can be bridged by wasted votes, for the particular state-year, respectively.

Table A3: Regression Results – Aggregate Model

Specifications	Closeness				Heterogeneity				Government Acitivism			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
	Regressions with robust standard errors											
Dependent Variable	wv	wv	wv1	wv1	wv	wv	wv1	wv1	wv	wv	wv1	wv1
Independent Variables												
diff12	-3.677	-3.605	-4.397	-4.241	-3.702	-3.634	-4.431	-4.278	-3.699	-3.630	-4.420	-4.263
	(-50.52***)	(-47.75***)	(-39.15***)	(-35.64***)	(-50.28***)	(-47.49***)	(-39.42***)	(-35.74***)	(-49.84***)	(-46.99***)	(-39.04***)	(-35.20***)
diff23	-7.827	-7.77	-14.555	-14.371	-7.843	-7.791	-14.576	-14.398	-7.839	-7.786	-14.590	-14.415
	(-83.25***)	(-79.08***)	(-99.68***)	(-94.8***)	(-83.18***)	(-79.31***)	(-100.07***)	(-95.23***)	(-83.06***)	(-79.07***)	(-100.08***)	(-95.22***)
hetrlang					1.056	1.084	1.535	1.641	0.850	0.866	2.170	2.291
					(3.220***)	(3.232***)	(2.782***)	(2.868***)	(2.359***)	(2.334**)	(2.945***)	(3.004***)
hetrrelg					2.041	2.008	2.383	2.462	2.256	2.224	3.393	3.479
					(2.577***)	(2.635***)	(2.056**)	(2.152**)	(2.756***)	(2.766***)	(2.744***)	(2.811***)
hetrcast					-1.618	-1.676	-2.293	-2.268	-1.651	-1.711	-2.253	-2.232
					(-3.213***)	(-3.278***)	(-3.066***)	(-2.985***)	(-3.278***)	(-3.346***)	(-3.022***)	(-2.942***)
tcd									0.001	0.001	-0.003	-0.003
									(0.519)	(0.473)	(-1.345)	(-1.290)
tco									-0.0002	-0.0003	0.000	-0.000
									(-0.148)	(-0.182)	(0.046)	(-0.079)
tre									-0.001	-0.001	0.004	0.004
									(-0.609)	(-0.646)	(1.781*)	(1.786*)
rxdev									-0.001	-0.001	-0.007	-0.006
									(-0.579)	(-0.512)	(-2.147**)	(-2.067**)
newspaper	-0.00003	-0.00003	-0.00003	-0.00003	-0.00004	-0.00004	-0.00005	-0.00005	-0.00004	-0.00004	-0.00006	-0.00006
	(-4.943***)	(-4.855***)	(-3.436***)	(-3.244***)	(-6.866***)	(-6.869***)	(-4.547***)	(-4.358***)	(-6.897***)	(-6.885***)	(-4.903***)	(-4.667***)
literacy	-0.439	-0.333	0.167	0.379	-0.353	-0.239	0.378	0.538	-0.262	-0.151	-0.119	0.021
	(-1.358)	(-0.973)	(0.298)	(0.674)	(-0.988)	(-0.637)	(0.621)	(0.882)	(-0.719)	(-0.392)	(-0.194)	(0.034)
rural	-2.413	-2.558	-3.606	-3.793	-4.075	-4.223	-5.645	-5.875	-4.161	-4.306	-6.356	-6.553
	(-4.238***)	(-4.426***)	(-4.260***)	(-4.546***)	(-5.366***)	(-5.674***)	(-5.219***)	(-5.475***)	(-5.247***)	(-5.481***)	(-5.537***)	(-5.707***)
sdp	0.0002	0.0002	0.0001	0.0001	0.0002	0.0002	0.00004	0.00004	0.0003	0.0003	0.0002	0.0002
	(2.485***)	(2.474***)	(0.735)	(0.654)	(2.153**)	(2.118**)	(0.335)	(0.304)	(2.684***)	(2.627***)	(1.168)	(1.149)
Election dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Constituency dummies		Yes		Yes		Yes		Yes		Yes		Yes
No. of Obs	3393	3393	3393	3393	3393	3393	3393	3393	3393	3393	3393	3393.
R Squared	0.8204	0.8546	0.8732	0.8956	0.8217	0.8559	0.8739	0.8964	0.8219	0.8561	0.8742	0.8966

Note: Values in parentheses denote the *t - values*. Levels of significance – * = 90% ** = 95% *** = 99%.

Table A4: **Regression Results – Year-wise**						
Total Regressions = 8	Dependent Variable : *wv*			Dependent Variable : *wv1*		
Independent Variables	Positive and Significant*	Negative and significant	Not significant	Positive and Significant	Negative and significant	Not significant
lagged dependent variable	7		1	3		5
diff12		8			8	
diff23		8			8	
hetrlang	1	3	4	1	4	3
hetrrelg	2	1	5	2	2	4
hetrcast	2	4	2	1	3	4
tcd		2	6	1	3	4
tco	4		4	3	1	4
tre	4	2	2	4	1	3
rxdev	2	3	3	1	2	5
newspaper	2		6	1	1	6
literacy		4	4		3	5
rural	1	3	4		1	7
sdp	1	1	6	1	2	5

Note: We have run eight regressions, one for each election, starting from 1971.The entries denote the number of times the coefficient on a particular regressor was found positively or negatively significant or insignificant.
* Coefficients are significant at least at the 90% level.

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