Voter Rationality and Politician Incentives:
Exploiting Luck in Indian and Pakistani Elections[1]

Madiha Afzal, Yale University

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Abstract

Recent empirical work on US elections argues that any relationship between exogenous shocks and election outcomes is evidence of voter irrationality. In contrast, I develop a theoretical framework which highlights two different mechanisms underlying politician behavior, effort and corruption, which relate exogenous shocks to election outcomes under the assumption of complete voter rationality. Although corruption is generally considered the motivation underlying politician behavior, I show that the more benign effort story also leads to the same predictions on electoral outcomes. In addition, the model shows that the relationship between politician behavior and thus probabilities of re-election and rainfall can vary with the underlying political environment of incumbency advantage or disadvantage. I empirically examine the relationship between politician re-election and rainfall using data from both Indian and Pakistani parliamentary elections. The results show that rainfall is significantly positively related to re-election in times of incumbency advantage and negatively related to re-election in times of incumbency disadvantage in both countries, consistent with the theoretical framework. Furthermore, evidence using development fund spending and politician occupations shows that the results are consistent with the effort story.

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1 Introduction

Classical democratic theory states that voters collect information on party platforms, policy pronouncements, legislative voting, etc, on all candidates and cast their vote for the candidate who offers them the best package. However, collecting such information on each candidate is costly, and voters know that policy pronouncements are non-binding. The alternative approach proposed by the retrospective voting model places less of an information demand on voters and argues that their decision rule is based on readily available information[2]. This information is simply the performance of the incumbent while in power. If his performance is satisfactory, voters will re-elect the incumbent; if it is unsatisfactory, they will vote for the opponent.

This leads us to the classic political agency problem: voters want to re-elect competent leaders, but cannot directly observe effort and ability. In voting retrospectively, they should respond to economic indicators that reflect performance. However, they should also filter out exogenous factors, such as rainfall, which affect economic outcomes but lie beyond the politician's control. An inability to do so raises the probability of re-electing lucky but incompetent incumbents and results in a lack of political accountability. A number of recent working papers, notably Wolfers (2007), Achen and Bartels (2004), and Healy (2006), study data from US elections to show that politicians are re-elected in lucky times and voted out in unlucky times. Wolfers relates oil price shocks to US governors' probability of re-election, while Achen and Bartels show that there is an electoral response to droughts and floods in US presidential elections, and Healy uses individual voting data to show that weather affects voting behavior through income[3]. All three papers argue that any relationship between exogenous shocks and electoral outcomes is evidence of voter irrationality.

However, this literature relies on the critical assumption that there is no response by politicians to these exogenous shocks. As soon as there is any interaction of an exogenous shock with politician behavior, we can no longer conclude that a relationship between shocks and politician re-election is evidence of voter irrationality. I develop a theoretical framework which highlights two possible mechanisms, effort and corruption, which relate politician behavior to exogenous shocks, specifically rainfall shocks in the South Asian context, under the assumption of complete voter rationality. I also formalize the notion that voter behavior only changes because politician behavior changes; specifically, voters vote out the politician if he behaves badly enough that a randomly selected

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[2]See Key (1966) for seminal work on this topic; also see Fiorina (1981).

[3]In similar vein, Bertrand and Mullainathan (2001) show that CEO pay responds to exogenous factors that affect his company's industry. Social psychology experiments also show that subjects in experiments aiming to assess competence systematically fail to take sufficient account of background or environmental factors.

challenger is deemed better than him[4]. In the effort story, rainfall affects the politician-landowner's own farm, and therefore changes his incentives to put in farm labor versus political effort. In the corruption story, rain affects the constituents' aggregate income, and changes the politician's incentives to steal from them. The corruption and effort stories yield analogous results for the direction of the effect on politician incentives but the effort story is more benign in terms of its effect on constituents' welfare. In my empirical work, I test whether the effort story is consistent with politician behavior in the South Asian context, but cannot directly test for the corruption story.

The theoretical model shows that the effect of exogenous shocks on both effort and corruption can vary with the underlying political environment. Specifically, I show that politicians increase effort or lower corruption when there is higher rainfall (a good shock), if there is a high enough incumbency advantage; and they lower effort or raise corruption when there is higher rainfall in times of incumbency disadvantage. A good rainfall shock in times of incumbency advantage serves as an "income" shock and politicians are able to undertake better actions in the political arena. However, in times of incumbency disadvantage, a rainfall shock has a "substitution" effect into worse politician behavior. More generally, one can argue that politician incentives vary in good versus bad times, and any relationship between good times and re-election would reflect that rather than irrational voter behavior.

I empirically examine the relationship between re-election and rainfall using data from both Indian and Pakistani parliamentary elections. Specifically, I have election and rainfall data for each parliamentary constituency in both countries for eight election years in India, and four election years in Pakistan. I use a measure of rainfall, the ratio of annual rainfall to mean annual rainfall in the constituency, which is monotonically related to crop yield and agricultural productivity in South Asia. The results show that rainfall is significantly positively related to politician re-election in India pre-1991, when there was an incumbency advantage, and negatively related to re-election post-1991, when there was an incumbency disadvantage. Rainfall is negatively associated with re-election in Pakistan in its democratic period, which was also characterized by an incumbency disadvantage. These results are not consistent with an irrational voter response to luck, which would have implied the same response across different political environments.

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[4]The paradigm shift I propose between voter irrationality and rationality is similar to the one from traditional business cycle theories to budget cycle theories. The traditional political business cycle literature argues that voters are systematically fooled by politicians who manipulate monetary policy resulting in temporary output and employment increases before an election. However, Rogoff (1990) shows that politicians who generate political budget cycles through expansionary fiscal policy may use this to signal competence.

The rainfall effect comes through rural constituencies, consistent with both the effort and corruption stories in South Asia. I use two additional pieces of data to test the effort story: Pakistani legislators' development fund spending, which I will argue is interpretable as effort, and the occupation of Indian MPs, and specifically, information on whether the politician is an agriculturist. Development spending is negatively associated with rainfall in Pakistan, consistent with the effort mechanism in an environment of incumbency disadvantage. The rainfall effect also comes through politician-agriculturists in India, lending further support to the effort story.

The remainder of this paper is organized as follows. Section 2 presents a simple theoretical framework which highlights the various ways in which rainfall (or any other exogenous shock) can impact a politician's probability of re-election in a Bayesian framework. In Section 3, I discuss the empirical strategy and describe the data in Section 4. Section 5 lays out the political context and Section 6 presents and discusses the central empirical results of this paper. In Section 7, I test the effort story, and in Section 8, I test alternative explanations for my results. Section 9 concludes.

2   Theoretical Framework

This theoretical framework identifies the possible channels through which rainfall (or any exogenous source of variation in voter's payoff) can impact an incumbent's probability of re-election. Rational voters will only change their voting behavior if politician behavior changes. I set up the politician's maximization problem to show how his behavior changes with rainfall, using two alternative mechanisms for politician behavior: effort and corruption.

In the effort story, rainfall affects the politician-landowner's own farm, and therefore changes his incentives to put in farm labor versus political effort. In the corruption story, rain affects the constituents' aggregate income, and changes the politician's incentives to steal from them. It is standard in the literature to model politician behavior as corruption[5]. However, the effort story is an alternative way of looking at politician behavior, and is especially relevant in the South Asian context where many politicians are landowners and must also spend time and effort on development schemes, for example, for their constituents. The corruption and effort stories yield analogous results for politician incentives but have very different implications in terms of their welfare effects: the corruption story posits the politician as an extorter whereas the effort story

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[5]In recent work addressing similar issues of corruption and politician re-election, Campante, Chor, and Do (2006) show that greater instability leads the incumbent to embezzle more during his short window of opportunity. Ferraz and Finan (2007) also find that mayors in Brazil in their final term are significantly more corrupt than mayors who can still be re-elected.

implies that he is a more benign citizen-candidate. I can later test whether the effort story is consistent with politician behavior in the South Asian context; however, I cannot directly test for the corruption story because of lack of data on corruption.

2.1 Effort Mechanism

The main motivation for this mechanism is the fact that a majority of politicians in South Asia tend to own agricultural land in the constituencies from which they are elected; they are even referred to as landowner-politicians. Agriculture is the primary occupation of 34% of MNAs, legislators who were elected to the Lower House of Parliament in Pakistan, in 2002. It is the occupation of 50% of MPs elected to the Lok Sabha, the Lower House of Parliament in India, in 2004. These numbers are an underestimate for the time period under study in this paper, which is before 1999 for both countries, given that the agricultural population has gone down over time. The Pakistan number is an additional underestimate for two reasons: i) agriculture tends to be the secondary occupation for more politicians, and ii) a policy change prior to the 2002 elections barred all candidates who did not have a Bachelors degree from contesting elections; to the extent that landowner-politicians were more affected by this education requirement, 34% is an underestimate for the time period under study.

The landowner-politician can spend time on his farm or spend time in the political arena. Farm production is determined by rainfall and the politician's labor on the farm. The politician thus faces a tradeoff between farm labor and political effort, because the latter increases his probability of re-election but the former increases current income.

Formally, the politician faces the following utility maximization problem: he chooses e to maximize

$$U = p(e)U(R^\alpha L^{1-\alpha} + W) + (1 - p(e))U(R^\alpha L^{1-\alpha}) \text{ s.t. } e + L \leq T.$$

where L is farm labor and e is political effort. Production on the farm is given by $R^\alpha L^{1-\alpha}$, where R is rainfall. $p(e)$ is the probability of re-election given effort e; this probability is increasing in effort. W is the benefit from re-election. The politician's utility function exhibits diminishing marginal utility: that is, $U'() > 0, U''() < 0$. This is how we generally expect utility functions to behave; and this turns out to be crucial for the main result of the model. A high enough probability of re-election, p defines incumbency advantage, and low enough p defines incumbency disadvantage.

Result i: When there is a high enough incumbency advantage, politicians increase effort with higher rainfall; and when there is a high enough incumbency disadvantage, politicians lower effort

with better rainfall. Formally, for large enough p, $\frac{\partial e}{\partial R} > 0$, and for low enough p, $\frac{\partial e}{\partial R} < 0$; this is true if W is sufficiently large, $p(e)$ is concave, and $U''' = 0$.

Result ii: The response of effort to rainfall is increasing in incumbency advantage; that is, $\frac{\partial e}{\partial R}$ is increasing in p.

Proof: in Appendix.

2.2   Corruption Mechanism

The main motivation for this mechanism is that rainfall increases constituency income, from which the incumbent can steal. This extortion can take the form of bribes from his now richer constituents (because of rainfall). Voters will update their beliefs according to Bayes rule upon observing corruption and will not re-elect the incumbent conditional on him undertaking corrupt activities.

Here, the idea is that the politician can choose the how much to steal from constituency income, which depends on rainfall. Formally, the politician chooses α to maximize:

$U = p(\alpha)U(\alpha f(R) + W) + (1 - p(\alpha))U(\alpha f(R))$

where constituency income $f(R)$, depends on rainfall R; α is the proportion of constituency income the politician chooses to steal, and $p(\alpha)$ is the probability of re-election given corruption α; this probability is decreasing in α. Finally, as in the effort model, W is the benefit from re-election, and $U()$ exhibits diminishing marginal utility.

Result i: When there is a high enough incumbency advantage, politicians lower corruption with higher rainfall; and when there is a high enough incumbency disadvantage, politicians increase corruption with better rainfall. For large enough p, $\frac{\partial \alpha}{\partial R} < 0$, and for low enough p, $\frac{\partial \alpha}{\partial R} > 0$; this is true if W is sufficiently large, $p(\alpha)$ is convex, and $U''' = 0$.

Result ii: The response of corruption to rainfall is decreasing in incumbency advantage; that is, $\frac{\partial \alpha}{\partial R}$ is decreasing in p.

Proof: in Appendix.

Table 1 contains a summary of the results of both models, and Figure 1 depicts the p functions graphically.

2.3   Intuition

The intuition of the main results is as follows: in the corruption case, as p goes up (as we move into the case of incumbency advantage), the incumbent is more likely to get W; in this case, when rainfall R goes up, the politician reduces corruption (α) because of diminishing marginal utility.

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Similarly, in the effort story, as p increases, the incumbent is more likely to get W, and when R increases, he lowers effort on the farm (L) and so increases political effort (e). This can be termed the "income" effect of increasing rainfall, which is to make the politician substitute into better politician behavior (lower corruption and higher effort) and it exists in times of incumbency advantage precisely because the politician is more likely to get the benefit from re-election. The "substitution" effect, which is to make the politician substitute into worse political behavior (higher corruption and lower effort) exists in times of incumbency disadvantage because the politician is less likely to get the benefit from re-election and so will substitute into activities that make money now.

What does it mean for $p(e)$ to be concave and for $p(\alpha)$ to be convex, which are assumptions we need for the above results to hold? It means that an increase in effort at lower levels is rewarded at a higher rate than the increase at higher levels of effort, that is, there are diminishing marginal returns to effort (Figure 1). The fact that $p(\alpha)$ is convex means that the politician is increasingly more likely to be punished the higher the α (Figure 2). It is entirely reasonable to assume that voters reward lower levels of effort at a higher rate and penalize higher levels of corruption at a higher rate.

2.4 Irrational voter

In contrast to the above, the irrational voter will not base his vote on his belief about the politician's type, and he will not update this belief using Bayes rule; rather he will re-elect the incumbent when his payoff under the incumbent's government $y = a + R$ is (equal to or) higher than a certain threshold. One can think of this in terms of the incumbent's probability of re-election increasing as the voter's payoff increases. This latter framework guarantees that there are no perverse effects of having a fixed re-election threshold on the politician's action, i.e., it ensures that (bad) politicians do not put in the bad action when there is no rainfall or when there is a bad state of the world just because they know that they will not be able to reach the threshold even if they do put in the good action[6]. In this case, the politician's action a is not affected by rainfall R; however, the incumbent is still more likely to be re-elected when there is higher rainfall just because the voter's total payoff is higher.

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[6]One can also guarantee that there is no perverse effect from a fixed threshold if the politician is uncertain about the exact threshold value.

2.5 Testing the model

This theoretical framework formalizes a number of ideas: the relationship between effort and corruption (and therefore probability of re-election) and rainfall can be positive or negative depending on the underlying political environment. Both the stories presented here give the same predictions about the direction of politician behavior under different political environments, but have different motivations for the politician, and different implications for the voter.

Can we distinguish between the effort and corruption stories empirically? In the effort story, rainfall affects the politician's personal income, and the story rests entirely on the fact that he is an agriculturist, whereas in the corruption story, rainfall affects constituency income. Two things can help provide support for the effort story: I have data on development fund spending in Pakistan, which I argue can be interpreted as effort (see description below in the data section) and can look at whether spending responds to rainfall in the manner predicted in this model. I also have data on occupations of MPs in India for four elections, and can therefore look at whether the rainfall effect comes through the politician being an agriculturist. Although I can directly test for the effort story, I cannot do so for corruption because of lack of data. Therefore, results consistent with the effort story do not rule out the corruption story also being at play.

3 Empirical Strategy

The empirical strategy of this paper is a difference-in-difference approach, with the following basic specification:

$$\Pr(reelect)_{ct} = \alpha_c + \beta_t + \gamma Rain_{ct} + \varepsilon_{ct}$$

where:

$\Pr(reelect)_{ct}$ for a constituency c at time t is defined in both of the following ways:

i) Pr(Candidate re-election): equals 0 if incumbent politician is not re-elected; 1 if incumbent legislator is re-elected in constituency c at time t[7].

ii) Pr(Party re-election): equals 0 if the incumbent political party is not re-elected; 1 if the incumbent party is re-elected in constituency c at time t.

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[7]This does not take into account whether the incumbent politician ran for re-election or not. The results are similar for candidate re-election conditional on running. However, candidate re-election unconditional on running should be the more salient measure, as incumbents who have any hope of re-election should run again from the same constituency.

$Rain_{ct}$ is rainfall for constituency c at time t. Two main measures for $Rain_{ct}$ are used: i) average annual rainfall in the duration between each election, and ii) rainfall in the year prior to the election (if voters remember more about the immediate past). The literature on the relationship between rainfall and agricultural production in South Asia states that the ratio of annual rainfall to mean annual rainfall is a strong predictor of crop yield[8]. In accordance with this work, I take the ratio of the rain measures identified above to mean annual rainfall (defined as average rainfall in the constituency over the 1950-99 time period) as my preferred measure of $Rain_{ct}$. Two other specifications are also tested to check for robustness: logs (equivalent to the log of the ratio measure, because of constituency fixed effects) and levels (mean deviations are taken care of by constituency fixed effects, so levels are exactly equivalent to rainfall deviations)[9].

α_c are constituency fixed effects, where c refers to 207 national-level electoral constituencies in Pakistan, and 543 national-level electoral constituencies in India. β_t are election-year effects, where t refers to election years 1990, 1993, and 1997 in Pakistan, and election years 1980, 1984, 1989, 1991, 1996, 1998, and 1999 in India.

3.1 Effort Tests

3.1.1 Development Fund Spending

$DevSpending_{ct} = \alpha_c + \beta_t + \gamma Rain_{ct} + \varepsilon_{ct}$

As I argue below, development spending is interpretable as effort. If there is a negative association between development fund spending and rainfall in Pakistan, given that there is an incumbency disadvantage in Pakistan, then this will provide support for the effort mechanism.

3.1.2 Politician-landlord

$\Pr(reelect)_{ct} = \alpha_c + \beta_t + \gamma_1 Rain_{ct} + \gamma_2 Agriculturist_{ct} + \gamma_3 Rain_{ct} * Agriculturist_{ct} + \varepsilon_{ct}$

where $Agriculturist_{ct}$ signifies whether the incumbent MP is a landowner/agriculturist.

If the rainfall effect mostly comes through γ_3 as opposed to γ_1, then this will provide support for the effort mechanism.

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[8] See Jayachandran (2006).

[9] Results available upon request.

4 Data

4.1 Rainfall Data

The rainfall data used in this paper is from the Center for Climatic Research at the University of Delaware, specifically from their Global Precipitation Monthly and Annual Data Series for 1950-99. Rainfall is measured at a 0.5 degree by 0.5 degree longitude-latitude grid. To compile this data series, researchers combined data from 20 nearby weather stations, using an interpolation algorithm based on the spherical version of Shepard's distance-weighting method.

In order to match this rainfall data to Indian and Pakistani electoral constituencies, I calculated the distance between the center of each constituency and the Delaware grid using the Haversine formula for measuring distance between two longitude-latitude points[10], and matched each constituency to the closest point on the grid. For Pakistan, I calculated constituency centroids using GIS maps of electoral constituencies that I constructed for an earlier project. For India, the centroids of each constituency are available on the Election Commission website. Using this process, I matched Pakistan's 207 electoral constituencies to 125 unique grid points. Therefore, in all my regressions, I cluster the standard errors at the longitude-latitude grid point from the Delaware database. The average distance between the grid and the constituency center is 20.8km (SD=8.5, min=1.6, max=49). Similarly, I matched India's 542 Lok Sabha constituencies to 327 grid points, with an average distance of 20.5 km (SD=8.4, min=1.5, max=51)[11].

In South Asia, more rain improves agricultural productivity; that is, crop yield increases monotonically with rainfall. This is in contrast to other environments in which rainfall above or below the average can hurt crop production[12]. Accordingly, all the rainfall measures I use define more rainfall as being good and less rainfall as bad for agricultural productivity. The summary statistics for both measures of rainfall defined in the last section are contained in Table 2 and 3, for India and Pakistan respectively.

4.2 Election Data

The Pakistani election data is for Members of National Assembly, MNAs, who are national-level legislators in the lower House of Parliament. The data is from the Election Commission of Pakistan

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[10]I am grateful to Seema Jayachandran for sharing her longitude-latitude matching program with me.

[11]India's Lok Sabha has 543 constituencies. Lakshadweep, a set of islands, was dropped from the analysis because longitude-latitude data did not exist for a point close to it. In particular, the closest point to which it could be matched was 337 km away.

[12]Jayachandran (2006), p.554-6.

from 1988 to 1997, during which time four elections took place[13]. For each election, the Election Commission releases detailed election results by constituency, including the names of candidates, their party affiliations, votes polled for each candidate, and voter turnout in each constituency. During the time period under study, there were 207 National Assembly constituencies. These constituencies are single-seat electoral districts, and the MNAs are elected under plurality rule. Each party can field one candidate per constituency, and a large number of independent candidates run for election as well[14]. Legislators do not face term limits in Pakistan.

The India election data is for members of the Lok Sabha, which is the lower House of Parliament. This data is from the Election Commission of India for the eight elections held between 1977 and 1999. For each election, I have detailed election results by constituency, including candidate names, votes polled, and party affiliations, as for Pakistan[15]. There were 543 Lok Sabha constituencies in this time period, but election results are reported consistently for only 504 of them. Similar to Pakistan, these are first-past-the-post elections.

The summary statistics for candidate and party re-election are in Tables 4 and 5, for India and Pakistan respectively. Party and candidate re-election do not correspond exactly for two reasons: parties may not field the incumbent for re-election in the same constituency or at all, and candidates may switch parties. Whether the candidate or party is more salient for voters in terms of retrospective voting is an empirical issue.

4.3   Development Fund Data

A slush fund has been allocated to each legislator in Pakistan in every year since 1985 to spend on various development projects in his/her constituency. The name of the program has varied with successive governments, but the overall mandate remains the same: provision of development schemes to communities by their elected representatives. Development funds were allocated to MNAs under the Peoples Programme in 1988-90 and 1993-97, and under the Tameer-e-Watan

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[13]I am grateful to Asim Khwaja for sharing the soft copy of this data with me.

[14]Interestingly, candidates can stand for election from more than one constituency, and can therefore win from more than one constituency as well! In practice, there are a few strong candidates in every election who win from multiple constituencies. When that occurs, the candidate must resign from all winning seats but one, and bye-elections are held in the constituencies where he resigned. For these constituencies, I encode the incumbent politician as the one who is in power for the duration between the current election and the next election; specifically, if the winner resigns, the bye-election winner is denoted as the incumbent. This makes sense because it is the incumbent's performance that voters are evaluating. However, I denote the person who wins the election the first time around as the winner, since he is the first preference of voters.

[15]I am grateful to Leigh Linden for sharing the soft copy of this data and his measure of candidate re-election with me.

Programme in 1991-93 and 1998-2000. MNAs can spend these funds on projects in the broad areas of health, education, roads, water supply, drainage and sanitation, electrification, gas, construction, establishment of public call offices, and certain miscellaneous fields[16]. For example, the funds could be used to help with the establishment of a basic health unit (BHU, a primary level public health care facility) or an elementary school for boys, or both. In the time period under study, the highest amount of money spent by legislators was on road projects, followed by water-related projects.

How does MNA development fund spending work in the Pakistani context? Each MNA is allocated the same amount of money in each budget year. However, the key thing to note is that this money is not handed over to them at the start of the year to spend as they wish. MNAs must propose the exact projects that they wish to be implemented. In this proposal, they must also submit a detailed cost estimate, as well as suggest executing agencies who can implement the project. This proposal is then put through a process of bureaucratic approval. The projects are approved at the top by the heads of a federal ministry and an implementation agency is assigned[17]. Funds are then disbursed directly to the executing agency selected for project implementation, and the project is underway.

The entire amount allocated for development fund spending in every year is not spent by many MNAs, similar to the situation with Indian MPLADS, the analagous development program for Lok Sabha legislators in India[18]. In fact, many MNAs spend less than the allocated amount; some spend more; and some do not propose projects at all[19]. This variation in total spending provides a very useful measure for legislator effort. Since there is a considerable amount of effort required to decide on projects and propose them with a detailed cost analysis, total spending by MNAs can plausibly be interpreted as effort expended by them in pursuing their political duties towards their constituents. This interpretation of total funds spent as effort was confirmed by a senior Ministry officer[20]. This is especially useful given that other measures of legislator effort (or those correlated

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[16]The Pakistan Ministry of Local Government and Rural Development generously provided detailed development fund spending data for this paper, including data on the number of projects implemented and the amount of funds spent by each MNA under each broad area, in each year.

[17]Specifically, the Secretary and Minister of Local Government and Rural Development Ministry is responsible for final approval of the proposal. If the cost estimate exceeds the allocation, the projects are prioritized according to cost. These cost estimates are also verified by the AGPR (Accountant General, Pakistan Revenue) office in consultation with the designated executing agency. The majority of projects are implemented by the Pakistan Public Works Department, followed by the Local Government and Rural Development Department and the Water and Power Development Agency.

[18]See Keefer and Khemani (2007) for an analysis of MPLADS in India.

[19]The latter group of MNAs is missing in the data provided by the Ministry, and a Ministry officer confirmed that this was so because they had not spent their development fund money in that year.

[20]Keefer and Khemani (2007) also interpret MPLADS similarly.

with it) are not available, since voting in the legislature is not recorded in Pakistan. It is even more salient given that development schemes form a large part of what constituencies expect from their legislators in Pakistan.

4.4 Agriculturist Data

The data source is a collection of biographies of MPs published by the Lok Sabha. These biographies are available for all legislators for the 1991, 1996, 1998, and 1999 elections (4 out of 8 elections in my sample). MPs are asked to declare their occupations; they can declare a number of different occupations at the same time. What is relevant for this paper is whether the politician is an agriculturist or not, and whether it is one of his occupations or his only one.

5 Political Context

5.1 Pakistan

5.1.1 Background

The time duration under study in this paper was a purely democratic period in Pakistan between two military regimes. Elections were competitive, with a large number of candidates and parties running. There were four elections between 1988 and 1997. Elections were not held at fixed times because no government was allowed to complete its term; rather, each National Assembly was dissolved by the President prior to completing its term and early elections were announced to be held within three months, as dictated by the Constitution. There were a number of reasons the National Assembly was dissolved in each term, but government corruption was always cited as one of them. Infact, in calculating my prior year rainfall measure, I exclude the rainfall in the three months directly prior to the election because the incumbent was not in power then; I therefore use rainfall in the twelve months prior to the Assembly dissolution[21].

5.1.2 Incumbency Disadvantage

An incumbency advantage (disadvantage if negative) is defined as the causal advantage attributed to being an incumbent. It cannot simply be calculated by running a regression of probability of election in the next period on incumbency status because there may be other confounding factors correlated

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[21]Later, as a robustness check, I also confirm that rainfall during the three months while the National Assembly was dissolved is not related to re-election.

with incumbency; specifically, a candidate may both be an incumbent and more likely to be elected again simply because he is a great leader. We can tease out the causal incumbency advantage using the difference in the probability of winning in the next time period between someone who just won and someone who just lost this election, the idea being that they will be similar on all other dimensions; therefore we can employ regression discontinuity design for this purpose, following Lee. Specifically, the regression to run would be to regress election in the next time period on a quartic polynomial in the vote margin in this time period with an indicator for whether the politician is an incumbent; this way, controlling parametrically for the vote margin, the coefficient on incumbent captures the causal incumbency advantage. The vote margin is defined as follows: for the winner, it is his vote share minus the vote share of the runner-up; for the loser, it is his vote share minus the winner's vote share.

I run the following regression:

$\Pr(elect)_{ict+1} = \alpha_c + \beta_t + \gamma I(Incumbent_{ict}) + \theta_1 VoteM \arg in_{ict} + \theta_2 VoteM \arg in_{ict}^2 + \theta_3 VoteM \arg in_{ict}^3 + \theta_4 VoteM \arg in_{ict}^4 + \varepsilon_{ict}$

The results, which are in Table 6, show that there is a large incumbency disadvantage in Pakistan, to the order of about -13%, for the time period under study in this paper.

5.2 India

Linden (2004) shows that there was a fundamental shift in the Indian political arena in 1991: from a system dominated by one party, it became one that was fundamentally multi-party in that no single party could be counted on to control Parliament. Political competition increased as well, with a higher number of candidates and political parties contesting election in each constituency. Most importantly perhaps, it changed from an environment of incumbency advantage to one of an incumbency disadvantage post-1991. Elections were not held at fixed times between 1989 and 1999 in India, similar to Pakistan in the 1990s; this was primarily due to the fact that governments were not formed by a single party and the coalition governments tended towards instability. Table 7 documents incumbency effects by year, and shows the shift from incumbency advantage to disadvantage in 1991.

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6   Results

6.1   Basic Results

Tables 8, 9 and 12 present the main empirical reduced-form results of this paper for both India (split into pre- and post-1991 for the reasons outlined in the last section) and Pakistan, for party as well as candidate re-election, for annual rainfall in the duration between elections and for rainfall in the year prior to the election. Empirically, party re-election appears to be very strongly related to rainfall, while candidate re-election is weakly so (significantly related for prior year rainfall for India, and not at all for Pakistan across all specifications). Therefore, parties are the dimension along which voters appear to be voting retrospectively.

The main results are as follows: rainfall is significantly positively related to re-election prior to the 1991 elections in India, and negatively related to re-election post-1991 in India. It is significantly negatively related to re-election in Pakistan. The results hold up well for both the duration rainfall measure as well as the prior year rain measure, although they are somewhat stronger for the latter, consistent with the view that voters remember the most about the last year prior to the election rather than the entire duration. Consistent with the theoretical model, the negative relationship between rainfall and re-election exists in times of incumbency disadvantage, and the positive relationship exists when there is an incumbency advantage.

In terms of magnitude, the India results suggest that a 10% increase in annual rainfall relative to the mean over the duration that the incumbent was in power increases the probability of his party being re-elected by 4.9% pre-1991, whereas a 10% increase in the same measure post-1991 decreases the probability of the incumbent's party being re-elected by 1.7%. In Pakistan, a 10% increase in annual rainfall relative to the average over the duration that the incumbent was in power decreases the probability of his party being re-elected by 2%. A 10% increase in rainfall in the year prior to the election in India is associated with a 2.8% increase in the probability of the party being re-elected pre-1991 but a 2.3% reduction post-1991. A 10% increase in rainfall in the year prior to the election in India is also associated with a 1.4% increase in the probability of the candidate being re-elected pre-1991 and a 1.4% reduction post-1991. Finally, in Pakistan, a 10% increase in rainfall in the year prior to the election decreases the probability of the incumbent's party being re-elected by 2%[22].

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[22] Prior year rainfall for Pakistan is rainfall in the 12 months prior to the dissolution of government, that is, rainfall between 15 months prior to the election and 3 months prior to the election when the government was dissolved.

Tables 10 and 11, which break up the reduced form regressions for India up by year, show that the shift from a positive effect of rainfall on re-election to a negative effect occurred exactly in 1991. Infact, the pattern of coefficients more or less mirrors the shift in India's incumbency effect coefficients.

6.2   Urban-Rural

Since rainfall increases income in a constituency through crop productivity, we believe the effect on re-election should be more pronounced the more rural the constituency. For Pakistan, the proportion of the population living in rural areas is available at the district level through the Census[23]. Table 13 shows that the re-election-rainfall effect comes through rural areas in Pakistan, as we would expect. These results are consistent with both the effort and the corruption stories, because the effort story goes through landlord-politicians and rainfall increases constituency income in the corruption story through aggregate crop production.

6.3   Effects by Party

In India, the incumbency advantage pre-1991 was really a Congress advantage, exclusive to incumbents belonging to the Congress Party[24]. Given this, we should expect the relationship between rainfall and re-election to be positive during this time for Congress incumbents only. This is exactly what I find (Table 14). That is, the overall incumbency advantage is driven precisely through Congress incumbents and the positive relationship between rainfall and re-election is also driven exactly through Congress incumbents. More generally, the idea is that if the incumbency advantage or disadvantage varies by party, the rainfall effect should vary correspondingly by party as well. Post-1991, the incumbency disadvantage exists for both Congress as well as non-Congress incumbents, although it is stronger for non-Congress incumbents. Accordingly, we see the positive relationship between rainfall and re-election for Congress incumbents driven down to zero, and it is negative for non-Congress incumbents.

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[23]There are twice as many electoral constituencies as administrative districts in Pakistan during this time period. I matched constituencies to districts using a detailed breakdown of constituencies into administrative units using a file provided by the Election Commission.

[24]Linden (2004).

7 Effort Tests

7.1 Development Funds

Table 15 shows that rainfall is associated with reduced development fund spending in Pakistan. Since development spending can be interpreted as effort given the institutional structure in Pakistan, this result provides evidence that politician behavior seems consistent with the effort story (although we cannot rule out that the corruption story may also be at work); specifically, good rainfall is associated with reduced politician effort, which is rational given that there is an incumbency disadvantage in Pakistan.

7.2 Landowner-Politicians

The basic premise behind the effort story is that politicians are also agriculturists who divide their time between farming and the political arena. I have data on Indian MPs' occupations for those elected in the years 1991, 1996, and 1998. 50% of of MPs list "agriculturist" as one of their occupations in every year, and for approximately 10%, it is their only occupation. The latter measure is the relevant one to use in this paper, since the effort story is driven exactly by the tradeoff between time on the farm and in politics, without any other occupation to divide time. Table 16 shows that the overall negative rainfall-re-election effect during this time is infact driven by MPs whose only other occupation is farming. The interaction term of rainfall and agriculturist is negative and significant (with a one-tailed test) for my preferred specification using party re-election and prior year rainfall. The overall rainfall re-election relationship is weaker than before because I only have data on politician occupations for a subset of elections; since I have data on incumbents in the 1991, 1996, and 1998 elections, I am using the 1996, 1998 and 1999 elections to look at re-election. As seen in Table 6 and Table 10, the overall effect incumbency effect and the overall rainfall-re-election relationship is weaker for these years.

8 Testing Alternate Explanations

8.1 Why not an Irrational Voter?

These results are not consistent with an irrational voter response to luck. Specifically, an irrational voter story would imply that politicians are always more likely to be re-elected when there is better rainfall, and this would hold regardless of the political environment. My results show that

politicians are actually *less* likely to be re-elected in times of incumbency disadvantage, which shows that the irrational voter story is definitely not at play during those times. Politicians are more likely to be re-elected during times of incumbency advantage, but unless voters also shifted from being irrational pre-1991 to rational post-1991, which is hard to believe, my results cannot be explained by an irrational voter story.

The literature which establishes a positive relationship between good exogenous shocks and re-election in the US argues that it is evidence of voter rationality. It is important to note that my theoretical framework can explain even that relationship completely in a rational voter setting, given that there is evidence of a strong incumbency advantage in US elections (Lee).

8.1.1 Assembly Dissolution

As mentioned earlier, the national government was dissolved prematurely after each of the four elections under study in Pakistan, and the next election was held within three months of the dissolution of the Assembly. I can exploit this feature of the political environment as a robustness check, by looking at whether there is any relationship between rainfall in these three months and re-election. The idea behind this test is that politicians are not in power during this time and there is no such thing as politician behavior, so it cannot change during this time due to rainfall. Given that politician behavior cannot change, rational voters should not respond to rainfall during this time. The results in Table 17 show that there is no relationship between re-election and rainfall during the months of Assembly dissolution and are therefore consistent with rational voter behavior.

8.1.2 Rainfall on Election Day

Rainfall on the election day may directly affect re-election through a pure weather effect, without going through the channels of crop production and politician incentives. That is, election day rainfall could systematically change voter turnout, and this in turn could affect election outcomes. Specifically, this rainfall may deter voters from leaving home or work to go to the polling station simply because it is inconvenient to do so, thereby reducing voter turnout. On the other hand, rainfall may make it inconvenient to work outdoors, and more farmers may be able to leave work that day in order to vote. Either way, a relationship between rainfall on election day and voter turnout is suggestive of some sort of selection of voters in response to the weather, which may then affect election outcomes and thus re-election.

I test for this using rainfall in the election month as a proxy for election day rainfall. This

proxy, although imperfect, is quite relevant in South Asia because elections are staggered over a period of about a month across different constituencies, given the sheer scale of voting by such a large population. The results (Table 18) show that there is no effect of rainfall in the election month on voter turnout. This is consistent with rational voters, because it shows no evidence of a pure weather effect on voting.

8.2   Change in Voter Behavior

My theoretical framework relies on the idea that rainfall changes politician incentives. An alternate explanation for these results can be provided by a change in voter behavior in a rational setting, without any change in politician behavior. This explanation begins with the assumption that in times of incumbency advantage, incumbents are better than challengers, and therefore the correct way to vote is to vote for the incumbent; and in times of incumbency disadvantage, challengers are better than incumbents, and rational voters will vote out the incumbent. Some proportion of voters always vote randomly, and there is no cost to doing so; and some voters only vote if they can vote correctly, but there is a cost to voting correctly. The second step in this explanation is that an increase in rainfall increases voter income through crop production, and this enables voters to pay the cost of voting correctly. It follows that in times of incumbency advantage, when there is higher rainfall, more incumbents will be re-elected; and in times of incumbency disadvantage, when there is higher rainfall, more incumbents will be voted out. This is due to an increased turnout of those voters who vote correctly. Therefore a testable prediction of this alternate framework is that there is increased turnout in elections following times of higher rainfall. However, I find that turnout does not increase with higher rainfall (Table 19). This result is inconsistent with the alternate framework presented here, and therefore consistent with my theoretical framework.

9   Conclusion

Recent literature has argued that a relationship between election outcomes and luck is evidence of voter irrationality. By appealing to politician incentives, this paper shows that such a relationship is consistent with rational voter behavior. I develop a theoretical framework which highlights two alternative mechanisms, effort and corruption, that relate politician behavior and consequent voter behavior to exogenous shocks, under the assumption of complete voter rationality. In addition, the model shows that the relationship between politician behavior and thus re-election and rainfall

can vary with the underlying political environment of incumbency advantage or disadvantage. I empirically examine this relationship using data from both Indian and Pakistani parliamentary elections. The results show that rainfall is significantly positively related to re-election in times of incumbency advantage and negatively related to re-election in times of incumbency disadvantage in both countries, consistent with the theoretical framework. Furthermore, evidence using development fund spending and politician occupations shows that the results are consistent with the effort story, but this does not rule out the corruption story being at play as well.

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A Appendix

A.1 Effort:

Differentiating the politician's maximization problem with respect to e gives his optimal choice for e and L :

$FOC : p'(e^*)U(R^\alpha L^{1-\alpha} + W) - p(e^*)U'(R^\alpha L^{1-\alpha} + W)(1-\alpha)R^\alpha L^{-\alpha} - p'(e^*)U(R^\alpha L^{1-\alpha}) - (1 - p(e^*))U'(R^\alpha L^{1-\alpha})(1-\alpha)R^\alpha L^{-\alpha} = 0$

Differentiating the FOC with respect to R gives $\frac{\partial e}{\partial R}$: $\frac{\text{Numerator}}{\text{Denominator}}$

Numerator:$-\{p'(e)\alpha R^{\alpha-1}L^{1-\alpha}[U'(R^\alpha L^{1-\alpha}+W)-U'(R^\alpha L^{1-\alpha})]-p(e)\alpha(1-\alpha)R^{2\alpha-1}L^{1-2\alpha}[U''(R^\alpha L^{1-\alpha}+W)-U''(R^\alpha L^{1-\alpha})]-\alpha(1-\alpha)R^{2\alpha-1}L^{1-2\alpha}U''(R^\alpha L^{1-\alpha})-p(e)\alpha(1-\alpha)R^{\alpha-1}L^{-\alpha}[U'(R^\alpha L^{1-\alpha}+W)-U'(R^\alpha L^{1-\alpha})]-\alpha(1-\alpha)R^{\alpha-1}L^{-\alpha}U'(R^\alpha L^{1-\alpha})\}$

Denominator:$p''(e)U(R^\alpha L^{1-\alpha}+W)-2p'(e)U'(R^\alpha L^{1-\alpha}+W)(1-\alpha)R^\alpha L^{-\alpha}+p(e)U''(R^\alpha L^{1-\alpha}+W)(1-\alpha)^2 R^{2\alpha}L^{-2\alpha}-p''(e)U(R^\alpha L^{1-\alpha})+2p'(e)U'(R^\alpha L^{1-\alpha})(1-\alpha)R^\alpha L^{-\alpha}+(1-p(e))U''(R^\alpha L^{1-\alpha})(1-\alpha)^2 R^{2\alpha}L^{-2\alpha}-p(e)U'(R^\alpha L^{1-\alpha}+W)(1-\alpha)\alpha R^\alpha L^{-\alpha-1}-(1-p(e))U'(R^\alpha L^{1-\alpha})(1-\alpha)R^\alpha L^{-\alpha-1} = SOC < 0$

Assume $U''(R^\alpha L^{1-\alpha}+W) - U''(R^\alpha L^{1-\alpha}) \approx 0$ which is true if $U''' = 0$

Then we can see that:

i) $\frac{\partial e}{\partial R} < 0$ when $p = 0$ if $p'(e)\alpha R^{\alpha-1}L^{1-\alpha}[U'(R^\alpha L^{1-\alpha}+W)-U'(R^\alpha L^{1-\alpha})]-U''(R^\alpha L^{1-\alpha})(1-\alpha)\alpha R^{2\alpha-1}L^{1-2\alpha}-U'(R^\alpha L^{1-\alpha})(1-\alpha)\alpha R^{\alpha-1}L^{-\alpha} < 0$

ii) $\frac{\partial e}{\partial R} > 0$ when $p = 1$ if $p'(e)\alpha R^{\alpha-1}L^{1-\alpha}[U'(R^\alpha L^{1-\alpha}+W)-U'(R^\alpha L^{1-\alpha})]-U''(R^\alpha L^{1-\alpha})(1-\alpha)\alpha R^{2\alpha-1}L^{1-2\alpha}-U'(R^\alpha L^{1-\alpha})(1-\alpha)\alpha R^{\alpha-1}L^{-\alpha}+(1-\alpha)\alpha R^{\alpha-1}L^{-\alpha}[U'(R^\alpha L^{1-\alpha})-U'(R^\alpha L^{1-\alpha}+$

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$W)] < 0.$

These conditions hold for sufficiently large W and concave $p(e)$.

We can also see that an exogenous increase in $p(e)$, which can be represented by $p(e) + c, c > 0$ causes an increase in $\frac{\partial e}{\partial R}$:

Specifically, $\frac{\partial}{\partial c}(\frac{\partial e}{\partial R}) = (1-\alpha)\alpha R^{\alpha-1}L^{-\alpha}[U'(R^\alpha L^{1-\alpha}) - U'(R^\alpha L^{1-\alpha} + W)] > 0.$

A.2 Corruption:

Differentiating the politician's maximization problem with respect to α gives his optimal choice for α :

$FOC : p'(\alpha^*)U(\alpha^*f(R)+W)+p(\alpha^*)U'(\alpha^*f(R)+W)f(R)-p'(\alpha^*)U(\alpha^*f(R))+(1-p(\alpha^*))U'(\alpha^*f(R))f(R) = 0$

Differentiating the FOC with respect to R gives $\frac{\partial\alpha}{\partial R}$: $\frac{\text{Numerator}}{\text{Denominator}}$

Numerator: $-\{p'(\alpha)\alpha f'(R)[U'(\alpha f(R)+W)-U'(\alpha f(R))]+p(\alpha)\alpha f'(R)f(R)[U''(\alpha f(R)+W)-U''(\alpha f(R))]+p(\alpha)f'(R)[U'(\alpha f(R)+W)-U'(\alpha f(R))]+U'(\alpha f(R))f'(R)+\alpha f'(R)f(R)U''(\alpha f(R))\}$

Denominator: $p''(\alpha)U(\alpha f(R) + W) + p'(\alpha)U'(\alpha f(R) + W)f(R) + p'(\alpha)U'(\alpha f(R) + W)f(R) + p(\alpha)U''(\alpha f(R) + W)f(R)^2 - p''(\alpha)U(\alpha f(R)) - p'(\alpha)U'(\alpha f(R))f(R) - p'(\alpha)U'(\alpha f(R))f(R) + (1-p(\alpha))U''(\alpha f(R))f(R)^2 = SOC < 0$

Assume $U''(\alpha f(R) + W) - U''(\alpha f(R)) \approx 0$ which is true if $U''' = 0$

Then we can see that:

i) $\frac{\partial\alpha}{\partial R} > 0$ when $p = 0$ if $p'(\alpha)\alpha f'(R)[U'(\alpha f(R) + W) - U'(\alpha f(R))] + U''(\alpha f(R))f(R)\alpha f'(R) + U'(\alpha f(R))f'(R) > 0$

ii) $\frac{\partial\alpha}{\partial R} < 0$ when $p = 1$ if $p'(\alpha)\alpha f'(R)[U'(\alpha f(R) + W) - U'(\alpha f(R))] + U''(\alpha f(R))f(R)\alpha f'(R) + f'(R)[U'(\alpha f(R) + W) - U'(\alpha f(R))] + U'(\alpha f(R))f'(R) < 0$

These conditions are true for sufficiently large W and convex $p(\alpha)$.

We can also see that an exogenous increase in $p(\alpha)$, which can be represented by $p(\alpha) + c, c > 0$ causes a decrease in $\frac{\partial\alpha}{\partial R}$:

Specifically, $\frac{\partial}{\partial c}(\frac{\partial\alpha}{\partial R}) = f'(R)[U'(\alpha f(R) + W) - U'(\alpha f(R))] < 0.$
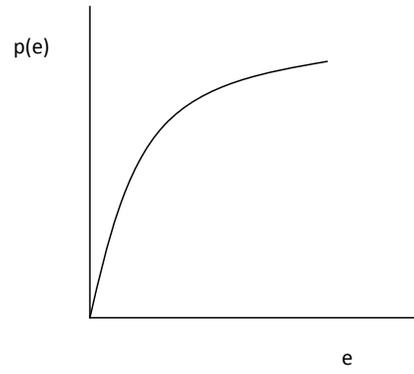
Figure 1: Probability of re-election given effort e
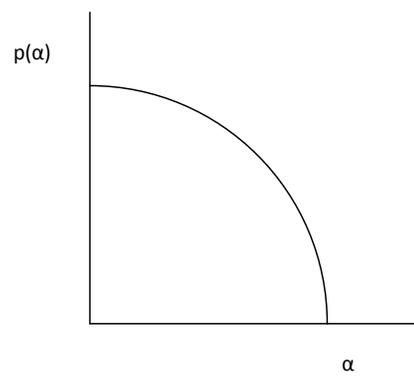
Figure 2: Probability of re-election given corruption α

B   Tables

Table 1: Change in Politician Behavior with Rainfall

	Incumbency Advantage	Incumbency Disadvantage
$\frac{\partial Corruption}{\partial Rain}$	< 0	> 0
$\frac{\partial Effort}{\partial Rain}$	> 0	< 0

Table 2: India Rainfall Summary Statistics

Election Year	India Rainfall Means (mm)	
	Duration	Prior Year
1980	1379.86	1120.05
	(612.43)	(573.42)
1984	1295.62	1294.82
	(590.78)	(726.55)
1989	1280.84	1150.72
	(599.04)	(610.17)
1991	1108.39	1309.98
	(468.72)	(600.25)
1996	1358.65	1130.97
	(559.28)	(588.68)
1998	1424.31	1226.41
	(614.52)	(540.88)
1999	1350.73	1223.48
	(653.20)	(602.70)
Obs	536	536

Table 3: Pakistan Rainfall Summary Statistics

| Election Year | Pakistan Rainfall Means (mm) | |
	Duration	Prior Year
1990	467.52	430.82
	(277.14)	(238.58)
1993	395.61	414.54
	(256.41)	(239.05)
1997	519.11	526.37
	(212.01)	(266.98)
Obs	207	207

Table 4: India Re-election Summary Statistics

| Election Year | India Re-election Means | |
	Party	Candidate
1980	0.29	0.19
	(0.46)	(0.39)
1984	0.64	0.29
	(0.48)	(0.46)
1989	0.37	0.22
	(0.48)	(0.42)
1991	0.59	0.42
	(0.49)	(0.49)
1996	0.49	0.27
	(0.50)	(0.45)
1998	0.50	0.39
	(0.50)	(0.49)
1999	0.50	0.43
	(0.50)	(0.50)
Obs	504	503

Table 5: Pakistan Re-election Summary Statistics

| Election Year | Pakistan Re-election Means | |
	Party	Candidate
1990	0.45	0.38
	(0.50)	(0.49)
1993	0.48	0.34
	(0.50)	(0.48)
1997	0.47	0.31
	(0.50)	(0.47)
Obs	207	207

Table 6: Pakistan's Incumbency Disadvantage

	Quartic Polynomial Regression
	Probability of Election
Incumbent	-0.133***
	(0.050)
Quartic in	vote margin
Fixed effects	constituency, year
R-sq	0.25
Obs	4048

Notes:

OLS regression with robust standard errors clustered by constituency in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 6: Incumbency Effects by Year

Year	Inc	Non-Inc	Diff
1957	16.48	14.25	2.23
	(10.36)	(9.21)	(18.08)
1962	27.65***	10.73*	16.92**
	(9.24)	(6.08)	(7.16)
1967	21.12***	10.08**	11.04
	(4.93)	(4.69)	(7.21)
1971	32.13***	9.79*	22.34**
	(5.97)	(5.88)	(10.23)
1980	27.65***	15.18*	12.47
	(8.97)	(8.70)	(12.75)
1984	12.13*	6.2	5.93
	(6.90)	(8.46)	(11.46)
1989	16.66***	6.91*	9.75
	(5.06)	(3.60)	(7.47)
1991	21.28**	40.92***	-19.64
	(8.79)	(7.24)	(12.09)
1996	15.32**	19.23***	-3.92
	(6.00)	(6.50)	(5.07)
1998	19.57**	27***	-7.43
	(7.97)	(6.00)	(11.27)
1999	21.75***	38.47***	-16.71
	(5.46)	(10.07)	(14.12)

Note: Standard deviations of point estimates, clustered by states, in parenthesis.
Estimates generated using spline estimator.

Table 7: India Incumbency Effects

Notes:

Source: Linden (2004).

Table 8: India Reduced Form: Party Re-election

	India Reduced Form: Party Re-elect			
	Pre 1991		Post 1991	
Ratio (Duration	0.4870***		-0.1710*	
Rain)	(0.1004)		(0.1030)	
Ratio (Prior		0.2384***		-0.2106***
Year Rain)		(0.0877)		(0.0794)
R-sq	0.51	0.51	0.33	0.33
Obs	1503	1503	2004	2004

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 9: India Reduced Form: Candidate Re-election

	India Reduced Form: Candidate Re-elect			
	Pre 1991		Post 1991	
Ratio (Duration Rain)	0.0014		-0.1277	
	(0.1050)		(0.0954)	
Ratio (Prior Year Rain)		0.1832**		-0.1598**
		(0.0862)		(0.0759)
R-sq	0.39	0.39	0.36	0.36
Obs	1500	1500	2000	2000

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 10: India Party Re-election: Rainfall Effects by Year

	India Reduced Form: Party Re-elect	
Year	Ratio Prior Year Rain	Ratio Duration Rain
1980	0.3398***	0.1432
	(0.1173)	(0.1415)
1984	0.2447**	0.9256***
	(0.1058)	(0.1777)
1989	0.1604	-0.1469
	(0.1305)	(0.1595)
1991	-0.5083***	-0.5863***
	(0.1143)	(0.1519)
1996	-0.1075	-0.4090**
	(0.1177)	(0.1732)
1998	-0.0519	-0.0355
	(0.1091)	(0.1014)
1999	-0.2234*	-0.2399*
	(0.1345)	(0.1446)
R-sq	0.25	0.26
Obs	3507	3507

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 11: India Candidate Re-election: Rainfall Effects by Year

	India Reduced Form: Candidate Re-elect	
Year	Ratio Prior Year Rain	Ratio Duration Rain
1980	0.0245	-0.0727
	(0.0854)	(0.1563)
1984	0.1412	0.2362
	(0.1109)	(0.1897)
1989	0.2806**	0.0230
	(0.1135)	(0.1274)
1991	-0.3472***	-0.3605**
	(0.1060)	(0.1527)
1996	-0.0600	-0.3158**
	(0.0946)	(0.1328)
1998	0.0360	-0.0723
	(0.1029)	(0.0984)
1999	-0.1725***	-0.0836
	(0.1433)	(0.1556)
R-sq	0.24	0.24
Obs	3500	3500

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 12: Pakistan Reduced Form

	Pakistan Reduced Form			
	Party Re-elect		Candidate Re-elect	
Ratio (Duration Rain)	-0.2038**		-0.0079	
	(0.9061)		(0.0847)	
Ratio (Prior Year Rain)		-0.2041**		-0.0044
		(0.0847)		(0.1085)
R-sq	0.55	0.54	0.44	0.44
Obs	621	621	617	617

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 13: Pakistan Urban/Rural Regression

	Pakistan Urban/Rural: Party Re-elect	
	Ratio (Duration Rain)	Ratio (Prior Year Rain)
Rain	-0.3082**	-0.4091**
	(0.1349)	(0.2023)
Rain*Urban	0.0033	0.0053
	(0.0025)	(0.0035)
R-sq	0.53	0.53
Obs	585	585

Notes:

Urban denotes the proportion of the population living in urban areas in the district.

OLS regressions with robust standard errors clustered by district in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 14: Results by Party

| | India: Results by Party | | | |
| | Party re-elect | | | |
	Pre-1990	Post-1990	Pre-1990	Post-1990
Ratio (Duration			-0.004	-0.202*
Rain)			(0.144)	(-0.119)
Ratio (Prior	-0.095	-0.342**		
Year Rain)	(0.107)	(0.088)		
Congress Incumbent	-0.200	-0.508**	-0.074	-0.096
	(0.133)	(0.139)	(0.237)	(0.171)
Rain x Congress	0.673	0.454**	0.472*	0.061
Incumbent	(0.129)**	(0.131)	(0.213)	(0.154)
R-sq	0.62	0.34	0.60	0.33
Obs	1503	2004	1503	2004

Table 15: Pakistan Development Fund Spending

	Development Fund Spending
Ratio (Prior year rain)	-6.0559***
	(1.1635)
Fixed Effects	constituency
	election year
R-sq	0.61
Obs	621

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 16: Agriculturist Results

	India: Agriculturist Results			
	Party re-elect		Candidate re-elect	
Ratio (Duration		0.287*		0.078
Rain)		(0.151)		(0.146)
Ratio (Prior	0.135		0.044	
Year Rain)	(0.114)		(0.103)	
Only agriculturist	0.493*	0.260	0.203	0.154
	(0.282)	(0.272)	(0.243)	(0.225)
Rain x Only	-0.443	-0.181	-0.213	-0.145
agriculturist	(0.274)	(0.235)	(0.238)	(0.198)
R-sq	0.45	0.45	0.46	0.46
Obs	1503	1503	1500	1500

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 17: Dismissal Rain

	Pakistan: Dismissal Rain			
	Party re-elect		Candidate re-elect	
Rainfall	-0.000		-0.000	
	(0.000)		(0.000)	
Log(Rainfall)		-0.019		-0.002
		(0.020)		(0.023)
R-sq	0.55	0.54	0.41	0.41
Obs	621	617	617	613

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 18: Election Day Rain

	Election Day Rain	
	India	Pakistan
Election Month Rainfall	7.099	-736.647
	(21.046)	(452.271)
R-sq	0.78	0.84
Obs	3507	621

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.

Table 19: Voter Behavior

	Voter Behavior Explanation			
	Log (Voter Turnout)			
	India		Pakistan	
Ratio (Prior Year Rain)	-0.015		-0.345**	
	(0.022)		(0.086)	
Ratio (Duration Rain)		-0.135**		0.014
		(0.030)		(0.084)
R-sq	0.78	0.83	0.74	0.74
Obs	4007	3507	616	616

Notes:

OLS regressions with robust standard errors clustered by longitude-latitude grid point in parentheses.

* denotes significance at 10%, ** at 5%, and *** at 1%.