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Media, Democracy, and Government Action: Prevention vs. Palliation in the Time of Cholera

Chongwoo Choe and Paul A. Raschky

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GCOE Secretariat
Graduate School of Economics
OSAKA UNIVERSITY
1-7 Machikaneyama, Toyonaka, Osaka, 560-0043, Japan

Media, Democracy, and Government Action: Prevention vs. Palliation in the Time of Cholera*

Chongwoo Choe † Paul A. Raschky ‡

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Abstract

This paper studies how media and democracy influence government action taken before and after a natural disaster. The key elements in this relationship are the media's role as the provider of information to voters about government action and the quality of democracy that pertains to how relevant election results are. We show that more media activity and more democratic institutions both contribute positively to the government's palliative effort after the disaster. However, the effects of media and democracy on the government's preventive effort before the disaster are negative. We provide empirical evidence based on major cholera epidemics around the world, which lends some support to these hypotheses.

JEL classification: D23, H40, L82
Keywords: Media, democracy, corruption, natural disaster

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†Department of Economics, Monash University; email: chongwoo.choe@monash.edu.

‡The corresponding author. Department of Economics, Monash University, PO Box 197, Caulfield East, VIC 3145, Australia; email: paul.raschky@monash.edu.

1 Introduction

Free press is considered to be one of the main pillars of a modern democratic society. The media feed information to citizens about otherwise opaque political processes, and informed voters are better able to hold elected officials accountable. A growing body of empirical evidence shows that media access increases citizens' political knowledge (Coyne & Leeson 2009, Snyder & Strömberg 2010), affects voter turn-out (Gentzkow 2006, Oberholzer-Gee & Waldfogel 2009), and can influence voting decisions (DellaVigna & Kaplan 2007, Enikolopov, Petrova & Zhuravskaya 2010, Chiang & Knight 2011). Moreover, related studies report the effect of media on actual policy outcomes. For example, Besley & Burgess (2002) develop a theoretical model and provide empirical evidence from India showing that more media activity increases government responsiveness to disaster relief. A cross-country study by Brunetti & Weder (2003) suggests that more press freedom leads to less corruption. Strömberg (2004) shows that U.S. counties with higher radio penetration received more public funding under the New Deal. Finally, Eisensee & Strömberg (2007) examine U.S. government emergency aid response to worldwide natural disasters and show that relief decisions are driven by news coverage of disasters.

For several reasons, however, the media are no panacea to inefficient or corrupt behavior of elected officials. First, the media in some societies can be subject to political influence or censorship, and captured media cannot function as a provider of transparent information (Besley & Prat 2006). Second, the physical and financial constraints facing the demand and supply side of the media market imply that only limited areas of government activities can be covered by media reports. On the demand side, consumers allocate only a fraction of their time to the consumption of news and, as argued by Mullainathan & Shleifer (2005) and Gentzkow & Shapiro (2006), they would prefer reading news that is more likely to confirm their prior beliefs. On the supply side, profit-maximizing media companies allocate limited budget, air time or newspaper pages to news that is more likely to attract a larger audience. As a result, only limited areas of government activities can be covered by news, and media presence is more likely to improve policy outcomes in those areas that receive more media coverage. Indeed Snyder & Strömberg (2010) show that local jurisdictions in the U.S. that receive less media coverage have less informed voters, which leads to political representatives that exert less effort on federal level and ultimately receive less federal funding.

The purpose of this paper is to extend the above literature by looking at the differential effects of media coverage and the quality of democracy on different types of government activities. Given that media coverage is selectively based on the media's profit-maximizing motives that may not be consistent with overall efficiency, more media attention in one area of government activity may shift more resources to that area even though it may not be socially efficient to do so.[1] To the extent that voters are informed of government action

[1] A somewhat related story can be found in Jayasuriya & McCawley (2010). During the 2004 Asian tsunami, the western media tended to focus on stories about the plight of western tourists caught up in the tsunami although less than one percent of those who died were tourists. It also meant that popular tourist locations in Thailand received extensive media coverage while far-flung places in Indonesia and Sri Lanka that were much more severely affected by the tsunami received less attention. Thus Thailand was inundated with offers of assistance from governments, multilateral donor agencies, corporate and community groups, and individuals.

through the media, more developed democracy can exacerbate this problem since election results matter more in a more democratic society. Thus a democratic society where voters form their political views mainly through the media is potentially susceptible to inefficient resource allocation. The inefficiency worsens as the media's objectives deviate further away from social welfare, as more voters are informed through the media, and as election results matter more in the ultimate change of government.

We choose a natural disaster, epidemics in particular, as a basis for our model and empirical analysis. It is well-known that the effort to mitigate the damage from a natural disaster can be put in both before - called the preventive effort - and after - called the palliative effort - the disaster. In some natural disasters such as epidemics, efficiency may require more resources be allocated to the preventive effort;[2] in others such as earthquakes, speedy and organized palliative effort can be more crucial. Our model allows us to consider two different types of government effort around the time of natural disaster. In addition, a natural disaster is also likely to be a major media event, which enables us to examine how the interplay between media and democracy affects the government's resource allocation to the two types of effort.

Our theoretical model extends Besley & Burgess (2002) to the case where the incumbent politician with re-election concerns chooses both types of effort, and the quality of democracy is proxied by the extent to which election results are relevant. The incumbent's preventive effort can reduce the likelihood of epidemic outbreak while the palliative effort can reduce the number of fatalities from the epidemic. Voters are informed of the incumbent's effort only through the media, and profit-maximizing media choose to report news that is more newsworthy. Given that urgency matters in news report, we assume that the media are more likely to cover the incumbent's palliative effort than the preventive effort. It follows then that more media activity increases the incumbent's palliative effort since it raises the chance the incumbent wins the election. More democratic institutions imply election results are more relevant, which again raises the marginal value of palliative effort. On the other hand, the effect of media and democracy on the incumbent's choice of preventive effort runs in the opposite direction. This is because the preventive effort lowers the likelihood of epidemic outbreak and, since more media activity increases the marginal value of the incumbent's palliative effort which is relevant only in the event of epidemic outbreak, more media activity lowers the marginal value of the incumbent's preventive effort. Because media activity and the quality of democracy are complementary to the incumbent, more democratic institutions also lead to a lower level of preventive effort.[3]

We test the hypotheses derived from the model using the data on major cholera epidemics around the world during the period of 1976-2006. However the existing data on natural disasters do not contain enough information on the government's preventive and palliative effort across countries. Thus we adopt an outcome-based approach whereby the incidence of epidemic outbreak is used as a proxy for the preventive effort while the number of fatalities

[2]For example, the provision of safe drinking water can all but prevent the outbreak of cholera epidemic.

[3]Although our model is based on an epidemic where the two types of effort interact in a specific, temporal fashion, the main logic continues to hold in other types of natural disasters. For example, suppose the probability of disaster is exogenous and both types of effort can only reduce the size of damage. Then if more media activity increases the palliative effort, it will increase (decrease) the preventive effort if the two types of effort are complements (substitutes).

is used as a proxy for the palliative effort. We use three media variables to measure both media penetration and the quality of media. The proxy for the quality of democracy is from the Polity IV database. Our model is estimated using Heckman's two-stage procedure after controlling for various geographic, climatic and socio-economic variations across countries. The results partially confirm our hypotheses. As for the first-stage estimation, democracy is shown to have a positive effect on epidemic outbreak in some specifications although the effect of media on epidemic outbreak is not significant. The results from the second stage provide stronger support for our hypotheses: both democracy and media have a significant negative effect on cholera deaths in all specifications. We also conduct several further tests to check the robustness of our results and find that they stay qualitatively the same.

Our empirical analysis is most closely related to a study by Anbarci, Escaleras & Register (2006). They focus on annual cholera cases and deaths instead of only large scale epidemics. They provide separate panel estimates for the determinants of access to clean water and annual cholera cases and deaths. They suggest that economic development and income inequality[4] reduce the number of cholera deaths through the channel of clean water supply. Therefore our study is also related to empirical papers that analyze the determinants of clean water supply (e.g. Anbarci, Escaleras & Register 2009, Cole & Neumayr 2006).

The remainder of the paper is organized as follows. In the next section, we present a model and derive testable hypotheses. Section 3 describes the data and empirical strategy while Section 4 reports the empirical findings. Section 5 concludes the paper.

2 Model

Our model extends Besley & Burgess (2002) by introducing three additional ingredients that allow us to study the interplay among the quality of institutions, democracy, and disaster mitigation effort at both prevention and palliation stages. It comprises an incumbent politician, citizens and the media.[5] At the beginning of period 1, some citizens may experience a negative shock, which can be mitigated by the incumbent's effort exerted either before or after the shock arrives. Citizens do not directly observe the incumbent's effort, but only through the media. The incumbent is motivated to exert effort partly because the media's reports affect citizens' voting behavior at the end of period 1. Those citizens affected by the negative shock vote for the incumbent or the challenger based on their expectation of who is likely to exert more effort in period 2. The quality of institutions pertains to how effectively the incumbent's effort is translated into disaster mitigation, while the quality of democracy concerns how citizens' voting outcome is reflected in who holds power. In what follows, we detail our model and derive the main comparative statics results relating various institutional features to the incumbent's effort, which form the basis for our empirical exercise.

There are two types of citizens, vulnerable and nonvulnerable, the former comprising a fraction $\gamma < 1/2$ of the population.[6] Vulnerable citizens may experience a negative shock

[4] In our case, income inequality does not yield a statistically significant coefficient.

[5] We use the male gender pronoun for the incumbent politician.

[6] As will become clear below, $\gamma < 1/2$ guarantees that the probability the incumbent wins the election does not exceed 1.

which causes damage equal to k. To relate our model to the empirical part of this paper, we will call the negative shock an epidemic. The damage can be mitigated by two types of public action. First, the incumbent politician can exert effort $e_1 \in [0, E_1]$ to reduce the likelihood of epidemic outbreak, which we call the preventive effort.[7] We assume that the probability of epidemic outbreak is given by a twice-differentiable function $\alpha(e_1)$ with $0 < \alpha(E_1) < \alpha(0) < 1$, $\alpha'(e_1) < 0$ and $\alpha''(e_1) > 0$. Thus more preventive effort reduces the likelihood of epidemic outbreak but its marginal effect is decreasing. After the epidemic breaks out, the incumbent politician can further exert effort $e_2 \in [0, E_2]$ to reduce the size of damage, which we call the palliative effort. The effect of palliative effort is given by a twice-differentiable function $\beta(e_2)$ with $0 = \beta(0) < \beta(E_2) < \gamma k$, $\beta'(e_2) > 0$ and $\beta''(e_2) < 0$. Thus the palliative effort can reduce the size of damage but not entirely, and its marginal effect is decreasing. Given (e_1, e_2), the net expected damage from the epidemic is then $\alpha(e_1)[\gamma k - \beta(e_2)]$.

The incumbent politician is one of the three types. The altruistic incumbent always exerts the maximal effort level in both stages: $e_1 = E_1, e_2 = E_2$. The selfish (and myopic) incumbent never exerts any effort in either stage: $e_1 = e_2 = 0$. The opportunistic incumbent is a rational economic agent, optimally choosing the preventive and palliative effort to maximize his payoff, which depends on the utility from holding office, the costs of effort provision, and the disutility that he attaches to citizens' suffering from the epidemic. The exact form of the opportunistic incumbent's objective will be spelt out as we go on. Citizens' prior beliefs assign a strictly positive probability on each type of incumbent.

Citizens do not directly observe the incumbent's effort but only through the media. As in Besley & Burgess (2002), we assume that the media's report is imperfect in that it only informs citizens whether positive effort has been exerted. The media's report may cover both types of effort. But the palliative effort is more likely to be newsworthy than the preventive effort in that urgency matters in news report. Therefore we assume that the media's report covers only the palliative effort.[8] Given the extent of media activity m, let $q(e_2, m)$ denote the fraction of vulnerable citizens who are informed. We assume $q(0, m) = 0$, $q_m(e_2, m) > 0$, $q_{e_2}(e_2, m) > 0$, $q_{e_2 m}(e_2, m) > 0$ and $q_{e_2 e_2}(e_2, m) < 0$ where subscripts denote partial derivatives. Thus vulnerable citizens are more likely to learn the incumbent's positive palliative effort if media activity increases and the incumbent puts in more effort although the marginal effect of the latter decreases. Moreover the positive cross-partial derivative implies that media activity increases the marginal effect of the incumbent's

[7] In case of epidemics, examples of preventive effort include investment in sanitation and sewage system, and the provision of safe drinking water. In case of other natural disasters such as earthquakes or volcanic eruptions, the probability of disaster is more or less exogenous, hence the preventive effort also contributes to reducing the size of damage rather than the likelihood of disaster. This is the case considered by Cohen & Werker (2008) although they do not model the political economy aspect of natural disaster. Our model can be easily modified to account for this case, as shown in Appendix A.

[8] Although we do not explicitly model the media's objective, it is straightforward to formalize when reporting only the palliative effort can be optimal for the media. For example, suppose the media's revenue depends on the subscription rate and that citizens demand more news after the epidemic breaks out than before. Then, for some cost function, reporting only the palliative effort can be profit-maximizing for the media. Moreover, insofar as the probability citizens learn positive preventive effort through the media is less than the probability citizens learn positive palliative effort, our qualitative results hold. Thus we focus only on the media's report of palliative effort.

effort on the fraction that is informed.

After citizens learn the incumbent's palliative effort at the end of period 1, there is an election in which the incumbent faces a randomly selected challenger. Citizens have the same prior beliefs about the challenger and the incumbent. Since vulnerable citizens may again face a negative shock in period 2, they would want to vote for the politician who is likely to exert more effort in period 2. The probability the incumbent is altruistic conditional on the observation of positive palliative effort is larger than the prior belief of the randomly selected challenger being altruistic. Thus all the vulnerable citizens who learned $e_2 > 0$ through the media vote for the incumbent. The uninformed vulnerable citizens, a fraction $1 - q(e_2, m)$, have their prior beliefs about the incumbent's type unchanged. Thus they are indifferent between the incumbent and the challenger and, without loss of generality, we assume that a half of them vote for the incumbent. As in Besley & Burgess (2002), we assume that nonvulnerable citizens' votes are random: the fraction of nonvulnerable citizens who vote for the incumbent is given by v which is uniformly distributed on $[0, 1]$. Given $e_2 > 0$, the incumbent then wins the election if

$$\gamma\Big[q(e_2, m) + \frac{1 - q(e_2, m)}{2}\Big] + (1 - \gamma)v \geq 1/2.$$

Focusing on the interior solution, the probability the incumbent wins the election is then[9]

$$\pi(e_2; m, \gamma) := \frac{1}{2} + \frac{\gamma q(e_2, m)}{2(1 - \gamma)}.$$

As is clear from the above, $\pi(e_2; m, \gamma) \in [1/2, 1)$, $\pi(e_2; m, \gamma)$ increases in $q(e_2, m)$, and the maximum winning probability for the incumbent is $1/(2(1 - \gamma))$ which is less than 1 since $\gamma < 1/2$.

How the election result is translated into change of government depends on how democratic political institutions are. Similar to Bhattacharyya & Hodler (2010), we measure the quality of democracy by a parameter $\delta \in [0, 1]$, which is the probability the incumbent holds on to power even after losing the election. Thus $\delta = 0$ corresponds to full democracy, $\delta = 1$ corresponds to dictatorship, and political institutions are more democratic as δ decreases. We assume that the incumbent who wins the election remains in power for certain.[10] Then the incumbent who chooses $e_2 > 0$ can expect to remain in office with probability

$$P(e_2; m, \delta, \gamma) := \pi(e_2; m, \gamma) + \delta[1 - \pi(e_2; m, \gamma)]. \tag{1}$$

The following lemma is straightforward from (1) and the assumptions on q.

LEMMA. If the incumbent exerts positive palliative effort, then the probability he remains

[9]We focus on the interior solution since our primary interest is in comparative statics of (e_1, e_2) with respect to various parameters.

[10]Bhattacharyya & Hodler (2010) model the quality of democracy as the difference between the probability the incumbent stays in power after winning the election and the probability the incumbent stays in power after losing the election. Our parameterization is a special case where the first probability is 1.

in office increases in the level of palliative effort ($P_{e_2} > 0$), the extent of media activity ($P_m > 0$), and decreases in the quality of democracy ($P_\delta > 0$). The marginal effect of the incumbent's palliative effort on the probability of holding office decreases in the level of palliative effort ($P_{e_2e_2} < 0$), and increases in the extent of media activity ($P_{e_2m} > 0$) and the quality of democracy ($P_{e_2\delta} < 0$).

We now turn to the opportunistic incumbent's objective function. He derives utility from holding office, denoted by Ω, and disutility from exerting effort. We proxy the quality of institutions by the extent to which the incumbent's effort is translated into effective disaster mitigation. Specifically we assume that, in order to exert one unit of effective preventive effort, the incumbent has to put in $1+\tau$ units of effort where $\tau \geq 0$.[11] Then larger τ implies a less effective channel through which the incumbent's effort is reflected in disaster mitigation. For example, this may be due to corruption down in the policy hierarchy, red tapes, slower administrative processes, etc. As for the incumbent's palliative effort, we assume that one unit of effective effort requires $1 + \epsilon(m)\tau$ units of effort where $\epsilon(0) = 1$, $\epsilon'(m) < 0$ and $\epsilon(m)$ approaches zero as m increases. That is, the quality of institutions becomes less of an issue in the post-epidemic stage as media activity increases. This is because, during a major disaster, a lot of attention is focused on government response, where the media play a major role. Thus media scrutiny will make it more difficult for corruption to persist or bureaucrats to delay the relief process.[12] Finally the incumbent also derives disutility from citizens' suffering from the epidemic and we denote the welfare weight by $\theta > 0$.

Given preventive effort e_1, the epidemic breaks out with probability $\alpha(e_1)$. In this event, the above discussions lead to the incumbent's expected utility from choosing e_2 equal to $P(e_2; m, \delta, \gamma)\Omega - \theta[\gamma k - \beta(e_2)] - [1 + \epsilon(m)\tau]e_2$. If the epidemic does not break out with probability $1 - \alpha(e_1)$, then the incumbent wins the election with probability $1/2$ and stays in power with probability $(1 + \delta)/2$. Thus his expected utility in this case is $((1 + \delta)\Omega)/2$. Putting all these together, the opportunistic incumbent chooses (e_1, e_2) to maximize his objective function[13]

$$V(e_1, e_2) := \alpha(e_1)\big\{P(e_2; m, \delta, \gamma)\Omega - \theta[\gamma k - \beta(e_2)] - [1 + \epsilon(m)\tau]e_2\big\}$$
$$+ [1 - \alpha(e_1)]\Big[\frac{(1 + \delta)\Omega}{2}\Big] - (1 + \tau)e_1. \tag{2}$$

We assume that the incumbent's problem has an interior solution. Then the first-order

[11] An alternative way to model this is that one unit of incumbent's effort is translated into $1/(1 + \tau)$ units of effective effort. These two approaches are equivalent after suitable normalization.

[12] In this sense, the quality of institutions refers to the more malleable part such as corruption rather than established bureaucracy. Public attention during the disaster relief may stop corruption temporarily although it may return afterwards. On the other hand, it is harder and takes longer to change established bureaucracy. In our empirical analysis, we proxy the quality of institutions by a measure of corruption control.

[13] This objective function can be suitably modified to justify the assumed behavior by other types of incumbent. For example, the altruistic type does not derive any utility from holding office, nor disutility from exerting effort, and assigns the welfare weight $\theta = 1$. The selfish (and myopic) type does not care about staying in power, nor citizens' suffering, hence $\theta = 0$.

conditions are

$$V_{e_1} = \alpha'(e_1)\Delta - (1+\tau) = 0, \tag{3}$$

$$V_{e_2} = \alpha(e_1)[P_{e_2}\Omega + \theta\beta'(e_2) - (1+\epsilon(m)\tau)] = 0 \tag{4}$$

where $\Delta := [P-(1+\delta)/2]\Omega - \theta[\gamma k - \beta(e_2)] - [1+\epsilon(m)\tau]e_2$. Observe first that (3) implies $\Delta < 0$, or the incumbent's utility in the epidemic event is smaller than that in the non-epidemic event so that he would optimally choose e_1 to reduce the probability of epidemic. Otherwise, $V_{e_1} < 0$, hence $e_1 = 0$. Next we note from (4) that $P_{e_2}\Omega + \theta\beta'(e_2) = 1 + \epsilon(m)\tau$, which implies that the incumbent's optimal palliative effort equates its marginal cost $1 + \epsilon(m)\tau$ to the marginal benefit, the latter being the sum of utility from holding office through the increase in the probability of staying in power and the reduction in citizens' suffering. Given these first-order conditions, it is easy to check that $V(e_1, e_2)$ is strictly concave in (e_1, e_2): $V_{e_1e_1} = \alpha''(e_1)\Delta < 0$, $V_{e_1e_2} = V_{e_2e_1} = 0$, $V_{e_2e_2} = \alpha(e_1)[P_{e_2e_2}\Omega + \theta\beta''(e_2)] < 0$, and $|H| := V_{e_1e_1}V_{e_2e_2} - V_{e_1e_2}^2 > 0$. These observations and Lemma lead to our main comparative statics results.

PROPOSITION. As voters have greater media access, the opportunistic incumbent exerts less preventive effort ($\partial e_1/\partial m < 0$) and more palliative effort ($\partial e_2/\partial m > 0$). As the quality of democracy improves, the opportunistic incumbent exerts less preventive effort ($\partial e_1/\partial \delta > 0$) and more palliative effort ($\partial e_2/\partial \delta < 0$). As the quality of institutions improves, the opportunistic incumbent exerts more preventive effort ($\partial e_1/\partial \tau < 0$) if and only if $1 + \alpha'(e_1)\epsilon(m)e_2 > 0$, and more palliative effort ($\partial e_2/\partial \tau < 0$) although the latter effect approaches zero as media activity increases ($lim_{m\to\infty}\partial e_2/\partial\tau = 0$).

Proof. For the comparative statics with respect to m, total differential of (3) and (4) leads to

$$\frac{\partial e_1}{\partial m} = \frac{-1}{|H|}[V_{e_2e_2}\alpha'(e_1)(P_m\Omega - \epsilon'(m)\tau e_2)] < 0, \ \frac{\partial e_2}{\partial m} = \frac{-1}{|H|}[V_{e_1e_1}\alpha(e_1)(P_{e_2m}\Omega - \epsilon'(m)\tau)] > 0$$

where the inequalities follow from $\alpha'(e_1) < 0$, $\epsilon'(m) < 0$ by assumption, $|H| > 0$, $V_{e_2e_2} < 0$, $V_{e_1e_1} < 0$ as shown previously, and $P_m > 0$, $P_{e_2m} > 0$ by Lemma. Similarly we have

$$\frac{\partial e_1}{\partial \delta} = \frac{-1}{|H|}[V_{e_2e_2}\alpha'(e_1)(P_\delta - 1/2)\Omega] > 0, \ \frac{\partial e_2}{\partial \delta} = \frac{-1}{|H|}[V_{e_1e_1}\alpha(e_1)P_{e_2\delta}\Omega] < 0$$

since $P_\delta - 1/2 = 1/2 - \pi < 0$ and $P_{e_2\delta} < 0$ by Lemma. For τ, similar steps lead to

$$\frac{\partial e_1}{\partial \tau} = \frac{1}{|H|}[V_{e_2e_2}(1 + \alpha'(e_1)\epsilon(m)e_2)] < 0 \text{ iff } 1 + \alpha'(e_1)\epsilon(m)e_2 > 0,$$

$$\frac{\partial e_2}{\partial \tau} = \frac{1}{|H|}[V_{e_1e_1}\alpha(e_1)\epsilon(m)] < 0.$$

Since $\epsilon(m)$ approaches zero as m increases, $\partial e_2/\partial\tau$ approaches zero as m increases. ∎

The above proposition shows how the incumbent's effort responds to various institutional features. As for the palliative effort, the intuition is quite clear. Given that only the palliative effort attracts media attention, more media activity increases the marginal value of palliative effort as it increases the chance the incumbent wins the election and stays in power. More democratic institutions imply that election results are more relevant, which again raises the marginal value of palliative effort. Better quality of institutions implies lower marginal cost of palliative effort, hence has a positive effect on the palliative effort. However more media activity in the post-epidemic stage makes corruption more difficult to thrive, which makes the marginal cost of palliative effort independent of the quality of institutions.

The channel through which these institutional features affect the preventive effort is via the incumbent's cost-benefit comparison of the epidemic versus non-epidemic event. If the incumbent puts in more preventive effort, then the likelihood of epidemic event decreases, and so is the likelihood the incumbent is subject to public scrutiny through the media. On the other hand, the media are irrelevant in the non-epidemic event. Therefore, as media activity increases, the incumbent benefits more in the epidemic event than in the non-epidemic event provided that he subsequently chooses the optimal palliative effort. This implies that higher media activity leads to less preventive effort as it makes the epidemic event more likely. A similar reasoning can be applied to the relation between the incumbent's choice of preventive effort and the quality of democracy. As the quality of democracy deteriorates, the incumbent benefits more in the non-epidemic event than in the epidemic event. It is because the change in the probability the incumbent stays in power is $P_\delta = 1 - \pi$ in the epidemic event, which is less than $1/2$, the change in the probability the incumbent stays in power in the non-epidemic event. The flip side is that the incumbent benefits more in the epidemic event when the quality of democracy improves, in which case the incumbent will put in less preventive effort. As for the effect of institutional quality, we note that $V_{e_1\tau} = -1 - \alpha'(e_1)e_2$. Thus the condition $1 + \alpha'(e_1)\epsilon(m)e_2 > 0$ implies that the incumbent's marginal cost of e_1 increases as τ increases, or the quality of institutions deteriorates.

3 Empirical Analysis

Our main theoretical findings of the previous section concern the differential effects of media and democracy on government action before and after a natural disaster. That is, more media activity and more developed democracy both have positive effects on government response to a natural disaster, but negative effects on the preventive measures government can take before the disaster. On the other hand, better institutional quality has a positive effect on government action both before and after the disaster, although its effect on post-disaster response decreases in media activity. We empirically examine these implications below.

An empirical test of our model is not straightforward for two reasons. First, the existing data on natural disasters do not contain enough comparable information on the preventive and palliative effort across countries. Therefore, the existing empirical literature on the cross-country analysis of the fatalities from natural disasters (e.g. Anbarci, Escaleras & Register 2005, Kahn 2005, Anbarci et al. 2006) uses an outcome-based approach. For example, instead of collecting data on prevention and relief expenses, Anbarci et al. (2006) use the probability of an event or the magnitude of a disaster (e.g. death toll) to infer a country's preventive

effort. This approach builds the basis for our empirical analysis. The second one is the two-stage feature of our model. The studies using natural disaster data have their main focus on the determinants of preventive measures. Testing our theoretical predictions using typical natural disaster data is not possible because the data do not allow us to distinguish between the preventive and palliative effort. The occurrence and magnitude of a natural disaster are mainly influenced by preventive measures and most of the fatalities occur from the event itself. Palliative action comprises mainly post-disaster relief such as building shelters, rebuilding infrastructure and housing, and providing financial assistance. Although some information on financial relief by the government is available, it is impossible to retrieve all the information on the total palliative effort. In addition, using only the data on financial relief would be prone to a measurement error and bias our results. Thus we need to choose a natural disaster where an outcome-based approach can be applied for inference on the preventive as well as palliative effort. An example of such a natural disaster is large-scale diarrhoeal epidemics.

3.1 Data and Variables

Diarrhoeal epidemics include diseases such as cholera, dysentery, and schistosomiases. The major cause is the lack of safe drinking water caused by insufficient infrastructure and bad hygiene as well as large-scale natural disasters. In contrast to natural disasters such as earthquakes and storms, diarrhoeal epidemics allow us to apply an outcome-based approach to analyze the effect of preventive as well as palliative effort. Controlling for a country's predisposition to diarrhoeal diseases via a number of geographic, climatic and socio-economic variables, we are able to identify the impact of media activity, institutional quality and democracy on preventive measures by comparing the probability that an epidemic occurs. Once an epidemic occurred, the outcome of the epidemic (e.g. the number of fatalities) depends on the government's palliative effort (e.g. providing safe drinking water to prevent a further spread of the epidemic, medical assistance).

Our data on cholera epidemics are from the most comprehensive data set on disasters and humanitarian catastrophes, EM-DAT by the Centre for Research on the Epidemiology of Disasters (CRED). EM-DAT has collected around 12,000 reports on the comprehensive list of natural disasters divided into five subgroups of geophysical, meteorological, hydrological, climatological, and biological disasters. A natural disaster has to meet at least one of the following criteria in order to be included in the database: 10 or more people reported killed; 100 or more people reported affected; declaration of a state of emergency; call for international assistance. We use information from EM-DAT to construct two dependent variables. The first one is a dummy variable, *Epidemic*, that switches to 1 if a country suffered from at least one major cholera outbreak in a given year and zero otherwise. The second one is a magnitude variable that accounts for the number of fatalities from a given cholera event, $Ln(1 + fatalities)$. Our data set contains information on 324 major cholera epidemics in 91 countries from 1979 to 2006. The full list is reported in Table 1. Given that we were not able to collect data for all the explanatory variables for all country-year observations used in this study, our baseline estimation uses information on about 200 epidemics. This leads to a total number of country-year observations in the first stage estimation of around 1,960, where 201 observations are coded with $Epidemic = 1$ and the remaining 1,759 are coded

with $Epidemic = 0$.

— Table 1 goes about here. —

Our variable for the quality of democracy, *Democracy*, is constructed from the Polity IV database by Marshall & Jaggers (2005). Polity IV defines democracy and autocracy along a line of different indicators such as the competitiveness and regulation of political participation, the openness and competitiveness of executive recruitment, and the constraints on the executive. We re-scale the original indicator such that it ranges from 0 to 1, with higher values implying more democratic institutions. To account for the quality of institutions in the public sector, we define a variable *Corruption Control*, which is taken from the "Control of Corruption" variable from the governance database developed by Kaufmann, Kraay & Mastruzzi (2008). This indicator reflects perceptions of corruption, conventionally defined as the exercise of public power for private gain. It combines corruption in different areas such as the business environment, political and public area.

Existing empirical studies on the effect of media on economic outcomes use several different variables for media. Besley & Burgess (2002) and Strömberg (2004) use measures of media penetration (e.g. radios or newspapers per capita), while Brunetti & Weder (2003) and Coyne & Leeson (2009) use media freedom variables. Although more recent studies use more detailed information such as actual media content (Snyder & Strömberg 2010), the access to independent media (Enikolopov et al. 2010), or availability of news in the local language (Oberholzer-Gee & Waldfogel 2009), such detailed information is not available at the cross-country level. Thus we use a set of three media variables to proxy both media penetration and media freedom. The first two are quantitative measures of media activity in the country, the number of televisions per 1,000 inhabitants, TV, and daily newspaper circulation per 1,000 inhabitants, $Newspapers$.[14] The data come from Banks (2004) international database. The third variable is a qualitative measure, *Freedom of the press*, and we use the most widely used measure, the 'Freedom of the Press' indicator by Freedom House. This is a composite indicator that combines three sub-components: press laws and regulations; political pressures and controls on the media; economic influences and repressive actions against the press.

The first set of additional control variables accounts for geographic and climatic variations that explain a country's predisposition to diarrhoeal diseases. Given that most diarrhoeal diseases are waterborne, we use the country's mean distance to the nearest inland navigable river (Gallup, Sachs & Mellinger 1999), *Distance to river*, and GIS-information on the country's exposure to flood risk (Dilley et al. 2005), *Flood Distr.* In addition, we account for continent specific fixed effects.[15] Our set of socio-economic controls contains the natural log of GDP per capita (in constant US dollar), population density, government expenditure as a fraction of GDP, and the proportion of population with access to safe drinking water. All of these variables are taken from the World Development Indicators (World Bank 2008). The definition of all the variables used in this study and their data sources are summarized

[14]We also used another media variable, radios per 1,000 inhabitants, but did not obtain any significant results.

[15]Alternative geographical and climatic variables such as absolute latitude, fraction of population living in the tropics, precipitation and mean temperature are not statistically significantly different from zero.

in Appendix B. Table 2 presents the descriptive statistics.

— Table 2 goes about here. —

3.2 Empirical Strategy

Our model consists of two stages. The first stage (*outbreak stage*) defines the cases where an actual cholera epidemic broke out. The selection variable is a latent variable y_1 that equals one if at least one cholera epidemic was reported.

$$y_1 = \begin{cases} 1 & \text{if} \quad Epidemic, \\ 0 & \text{if} \quad no\ Epidemic. \end{cases} \tag{5}$$

The second stage (*magnitude stage*) specifies that fatalities are observed only if an epidemic broke out.

$$y_2 = \begin{cases} Fatalities & \text{if} \quad Epidemic, \\ - & \text{if} \quad no\ Epidemic. \end{cases} \tag{6}$$

Based on the above, we have the following system of equations:

$$y_1 = \mathbf{X_1'}\boldsymbol{\beta} + u_1, \tag{7}$$

$$y_2 = \mathbf{X_2'}\boldsymbol{\gamma} + u_2 \tag{8}$$

where $\mathbf{X_i'}$, $i = 1, 2$, are vectors of explanatory variables, $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are vectors of coefficients to be estimated, and u_i, $i = 1, 2$, are the error terms for the first and the second stage, respectively. As shown in our theoretical model, the outcomes in the outbreak and magnitude stage are correlated: the first-order conditions in (3) and (4) show that e_1 and e_2 both depend on the same set of parameters and the choice of e_1 depends on the subsequent choice of e_2. This suggests that the error terms u_1 and u_2 are correlated as well. We make the standard assumption that the errors are jointly normally distributed and homoscedastic so that

$$\begin{bmatrix} u_1 \\ u_2 \end{bmatrix} \sim \mathcal{N}\left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix} \right\} \tag{9}$$

where ρ denotes the correlation between the first and second stage errors. For example, at the beginning of a rainy season, a country may experience above-average rainfall and, as a result, its government anticipates a higher likelihood of a cholera outbreak. Based on this expectation, the government may decide on additional palliative measures such as increased supply of bottled water or medicine to mitigate the effects of an epidemic. This unobserved government expectation is captured by the error terms u_1 and u_2. If the unobserved, unusual rainfall patterns push the government to stock up additional palliative measures and the government's anticipation about a higher likelihood of cholera outbreak turns out to be correct, the error terms will be negatively correlated as more palliative effort reduces fatalities. This

would result in $\rho < 0$. Alternatively, cholera outbreaks and resulting fatalities are often driven by unique combinations of local socio-economic conditions and regional short-term climatic conditions that we are unable to control for. An example would be an outbreak of regional violence combined with heavy rainfall in the region. In this case ρ would have a positive sign. In either case, $\rho \neq 0$ indicates that OLS yields inconsistent estimates of $\boldsymbol{\gamma}$.

We follow the two-stage procedure of Heckman (1976) and Heckman (1978) to overcome this problem. In the first stage, we estimate eq. (7) using a probit estimator. The predicted values of $\boldsymbol{\beta}$, $\hat{\boldsymbol{\beta}}$, are then used to calculate the inverse Mills ratio, $\lambda = \phi(\mathbf{X_1'}\hat{\boldsymbol{\beta}})/\Phi(\mathbf{X_1'}\hat{\boldsymbol{\beta}})$, where ϕ denotes the pdf and Φ, the cdf. In the second stage, we augment eq. (8) by λ and estimate the following equation using OLS:

$$y_2 = \mathbf{X_2'}\boldsymbol{\gamma} + \rho\lambda + \epsilon. \tag{10}$$

The application of a sample selection model requires unique information in the explanatory variables $\mathbf{X_1'}$ and $\mathbf{X_2'}$ to separately identify the parameters in the outbreak and magnitude stage. A major trigger for cholera epidemics is an external shock to a country's supply of safe drinking water. Natural disasters, floods in particular, are considered to be one of these shocks. In order to account for the magnitude of a flood, we use the number of fatalities from a flood and take its natural log, $Ln(Flood\ Kills)$. Major floods can damage water and sanitation infrastructures causing a contamination of drinking water and food. Flood victims then run the risk of cholera infection from ingesting contaminated water and food. Cholera has a rather short incubation period of between 1 and 5 days, which makes it hard for the government to control the outbreak of an epidemic. However, quick palliative effort such as the distribution of potable water and immunization can limit further transmission of the disease. In addition, emergency disease surveillance helps to decrease the fatality rate (Woodruff, Toole, Rodrigue, Brink, Mahgoub, Ahmed & Babikar 1990). Therefore, one could argue that $Ln(Flood\ Kills)$ fulfills the exclusion criteria. In addition, using $Ln(Flood\ Kills)$ in the second stage regressions shows no correlation between the selection variable and number of fatalities from cholera.[16]

4 Results

The results from the first-stage estimation are presented in Table 3. Columns (1) - (6) show separately the estimated coefficients for each of the three key variables, *Democracy*, *Corruption Control* as well as the set of media variables *TV*, *Newspapers*, *Freedom of the Press*. Columns (7) and (8) present the estimates for the full specifications.

The coefficient estimates for *Democracy* and *Corruption Control* in columns (1) and (2) are consistent with our theoretical predictions. That is, more democratic countries appear to experience more cholera epidemic[17] while countries with better quality of institutions are less likely to have cholera outbreak. The coefficients for TV and $Newspapers$ are not significantly

[16] The results are available upon request.

[17] Another possible interpretation is that the observed negative association between democracy and cholera outbreak could reflect the likelihood that an epidemic is actually reported and hence recorded on EM-DAT. For example, some autocratic regimes might be reluctant to admit that their countries are experiencing an epidemic.

different from zero (columns (3) and (4)), which does not change even after controlling for freedom of the press (columns (5) and (6)). The results from the full specifications (columns (7) and (8)) show that the effect of democracy is not significant once we control for variations in media and institutional quality. Among the control variables, *Access to drinking water* has a statistically strong and negative coefficient. *Government Expenditure* also reduces the likelihood of epidemic outbreak, while a country's exposure to flood risk weakly increases the likelihood of epidemic outbreak. Our selection variable $Ln(Flood\ Kills)$ is strongly significant and has the expected sign.

— Table 3 goes about here. —

Let us now turn to the second-stage estimation where the dependent variable is based on the number of fatalities from the epidemic, $Ln(1 + Fatalities)$. The results are reported in Table 4. Once more, columns (1) - (6) show separately the estimated coefficients for each of the three key variables while columns (7) and (8) show the results for the full specifications. The results are mostly consistent with our theoretical predictions. The coefficient for *Democracy* is negative and significant at the 10% level (column (1)). In contrast to the outbreak stage, less corruption does not have a significant effect on cholera fatalities. More media access has a significant negative effect on cholera fatalities: the coefficient for TV is negative and always statistically significant at the 1% level, while the coefficient for *Newspapers* is significant at the 5% and 10% level, depending on the specification. On the other hand, freedom of the press does not have a significant impact on cholera fatalities. This could be because the quality of media, like the quality of institutions, could be less of an issue at the time of crisis.

Similar to the results from the first-stage regression, the coefficient for *Democracy* becomes insignificant once we control for corruption and media as shown in columns (7) and (8). This suggests that variations in media access dominate the effect of democracy on palliative effort and hence cholera fatalities. This is consistent with the general thrust of our argument. The incumbent's choice of palliative effort is partly driven by re-election concerns. However, re-election concerns matter only if voters are informed about the incumbent's effort; facing re-election does not drive the incumbent to exert positive effort if the electorate remains uninformed. Given that the media are one of the major channels that inform voters about the provision of public goods, they provide a necessary condition for re-election concerns to motivate the incumbent. The Wald test rejects the null hypothesis that $\rho = 0$ indicating that sample selection is a problem in our case. In addition, ρ is negative which suggests that the unobservables in the outbreak and magnitude stage are negatively correlated.

— Table 4 goes about here. —

Next we report the results from additional tests. First, we present the second-stage OLS results that do not account for sample selection. They are shown in the first two columns in Table 5. Second, we apply a negative binomial (NegBin) model for the second stage where the dependent variable is $Fatalities$. In our baseline model, we have transformed the original variable $Fatalities$ to $Ln(1 + Fatalities)$, which can lead to biased results. Therefore our first robustness check is to estimate the second stage using a negative binomial estimator

and *Fatalities* as the dependent variable. The results are presented in the last two columns in Table 5. Although the size of the coefficients changes slightly, the sign and significance stay the same or even improve.

— Table 5 goes about here. —

As the second robustness check, we replace the variables for democracy and corruption control by alternative institutional variables to check whether our findings are sensitive to the choice of these variables. The results are reported in Table 6. In columns (1) and (2), *Democracy* is replaced by the number of veto players, *Checks & Balances*, developed by Beck, Clarke, Groff, Keefer & Walsh (2001). In columns (3) and (4), the Heritage Foundation's index, *Freedom from Corruption*, is used instead of *Corruption Control*. All of our results stay qualitatively the same although our original choice of institutional variables yields stronger coefficients in terms of statistical significance. We further check the sensitivity of our results to the choice of the first-stage selection variable by replacing the number of flood kills by the number of people affected by floods. The results in columns (5) and (6) show that this selection variable also has a positive coefficient, albeit significant only at the 5 % and 10% level depending on the specification. Once again, our main results remain the same.

— Table 6 goes about here. —

5 Conclusion

This paper has studied how media and democracy influence government action around the time of a natural disaster. The central elements in this relationship are the media's role as the provider of information to voters about government action and the quality of democracy that pertains to how relevant election results are. Our theoretical model has shown that more media activity and more democratic institutions both contribute positively to the government's palliative effort exerted after the disaster. However, the effects of media and democracy on the government's preventive effort made before the disaster are negative. We have provided empirical evidence based on major cholera epidemics around the world, which partially supports these hypotheses.

Although we have not provided a normative analysis in this paper, we argue that public policy influenced by media coverage can be susceptible to inefficiency insofar as the media's objectives deviate from social welfare. Even when efficiency requires more preventive effort as is the case in some epidemics, the government with re-election concerns may divert resources away from the preventive effort if the palliative effort receives more media coverage and is therefore more likely to be a vote winner. The situation worsens in a society where election results are more relevant to who holds power, which we interpret in a narrow sense as a more democratic society. To the extent that voters gather information mainly through the media, and profit-maximizing media selectively report news that may not be in the best interest of the society as a whole, the perils of media-based democracy are unlikely to disappear. We conjecture that media diversity in response to reader heterogeneity is one possible way out of the problem since, as shown by Mullainathan & Shleifer (2005), reader heterogeneity leads

to segmented media content which, in the aggregate, provides a balanced perspective. We leave this for future research.

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Table 1: List of countries and number of epidemics

Country	**Epidemics**	**Country**	**Epidemics**
Afghanistan	6	Lao PDR	3
Algeria	2	Latvia	1
Angola	3	Lesotho	2
Argentina	1	Liberia	8
Bangladesh	14	Madagascar	1
Benin	4	Malawi	6
Bhutan	1	Malaysia	1
Bolivia	3	Mali	4
Botswana	1	Marshall Islands	1
Brazil	4	Mauritania	3
Burkina Faso	4	Mauritius	1
Burundi	5	Mexico	1
Cambodia	3	Micronesia. Fed. Sts.	1
Cameroon	8	Mongolia	1
Cape Verde	1	Mozambique	11
Central African Republic	1	Nepal	4
Chad	6	Nicaragua	2
Chile	1	Niger	12
China	2	Nigeria	10
Colombia	2	Pakistan	3
Comoros	3	Panama	2
Congo. Dem. Rep.	10	Peru	4
Congo. Rep.	3	Philippines	2
Cote d'Ivoire	5	Russian Federation	1
Djibouti	3	Rwanda	5
Ecuador	3	Sao Tome and Principe	1
El Salvador	2	Senegal	5
Equatorial Guinea	1	Sierra Leone	5
Ethiopia	3	Somalia	9
France	1	South Africa	3
Gabon	1	Sri Lanka	1
Ghana	5	Sudan	5
Guatemala	3	Swaziland	2
Guinea	6	Sweden	1
Guinea-Bissau	6	Tajikistan	4
Honduras	1	Tanzania	10
India	9	Togo	4
Indonesia	7	Turkey	1
Iran. Islamic Rep.	1	Uganda	8
Iraq	1	Ukraine	1
Jamaica	1	United Kingdom	1
Japan	1	United States	1
Jordan	1	Venezuela. RB	2
Kenya	5	Zambia	7
Korea. Dem. Rep.	1	Zimbabwe	7
Korea. Rep.	1	**Total**	**324**

Table 2: Descriptive statistics

Obs.	**Variable**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
Ln(1+Fatalities)	324	3.741	2.052	0.000	9.183
Democracy	271	0.515	0.294	0 .000	1.000
Corruption Control	223	-0.824	0.595	-2.090	2.250
TV	320	6.6687	10.765	0.000	90.380
Newspapers	315	0.277	0.608	0.000	5.788
Freedom of the Press	231	60.368	19.478	8.000	100.000
Ln(GDP p.c.)	281	10.072	2.758	3.576	16.169
Population Density	299	110.348	180.886	1.471	990.366
Access to drinking water	280	62.054	19.083	19.000	100.000
Distance to river	316	1049.170	714.691	55.171	3227.860
Government Expenditure	279	12.687	5.790	0.000	36.501
Flood Distr.	314	4.434	2.706	0.000	10.000
Ln(Flood Kills)	324	1.505	2.196	0.000	7.894

Table 3: Outbreak Stage - Heckman First Stage

Dependent variable: $P(Epidemic_{it} = 1)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Democracy	0.434***						0.392	0.377
	(0.153)						(0.277)	(0.278)
Corruption		−0.259**					−0.354***	−0.362***
Control		(0.112)					(0.131)	(0.136)
TV			−0.003		−0.002		0.005	
			(0.004)		(0.005)		(0.006)	
Newspapers				−0.042		−0.022		0.080
				(0.072)		(0.084)		(0.077)
Freedom of					−0.001	−0.001	−0.001	−0.001
the press					(0.003)	(0.003)	(0.005)	(0.005)
Ln(GDP p.c.)	−0.019	0.003	−0.011	−0.012	−0.010	−0.011	−0.001	−0.008
	(0.018)	(0.019)	(0.017)	(0.017)	(0.020)	(0.020)	(0.021)	(0.022)
Population Density	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Access to	−0.010***	−0.008**	−0.007***	−0.008***	−0.009***	−0.010***	−0.008**	−0.009**
drinking water	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Distance	0.000	0.000	−0.000	−0.000	0.000	0.000	0.000	0.000
to river	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Government	−0.030***	−0.017**	−0.029***	−0.028***	−0.029***	−0.025**	−0.015	−0.013
Expenditure	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.010)	(0.010)	(0.012)
Flood Distr.	0.049**	0.055*	0.042*	0.047**	0.045*	0.052**	0.071**	0.076**
	(0.023)	(0.028)	(0.022)	(0.023)	(0.025)	(0.026)	(0.029)	(0.031)
Ln(Flood Kills)	0.082***	0.082***	0.080***	0.073***	0.083***	0.077***	0.089***	0.084***
	(0.020)	(0.024)	(0.019)	(0.020)	(0.023)	(0.024)	(0.024)	(0.024)
Continent FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N	1984	1438	2213	2146	1592	1545	1247	1215

Notes: Robust standard errors are reported in the parentheses. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table 4: Magnitude Stage - Heckman Second Stage

Dependent variable: $Ln(1+Fatalities)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Democracy	−1.281∗						−0.219	−0.238
	(0.691)						(0.928)	(0.954)
Corruption		0.230					0.810	0.516
Control		(0.349)					(0.564)	(0.477)
TV			−0.045∗∗∗		−0.038∗∗∗		−0.051∗∗∗	
			(0.012)		(0.012)		(0.017)	
Newspapers				−0.352∗		−0.411∗∗		−0.462∗∗
				(0.201)		(0.194)		(0.219)
Freedom of					0.001	0.001	0.007	0.002
the press					(0.009)	(0.009)	(0.017)	(0.016)
Ln(GDP p.c.)	−0.058	−0.037	−0.066	−0.037	−0.027	−0.007	−0.056	−0.024
	(0.065)	(0.068)	(0.059)	(0.062)	(0.062)	(0.064)	(0.069)	(0.072)
Population Density	−0.001	0.000	−0.002	−0.002	−0.000	−0.000	−0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Access to	−0.013	−0.009	−0.004	−0.017	0.002	−0.005	−0.004	−0.009
drinking water	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.014)	(0.015)
Distance	−0.001∗∗	−0.000	−0.000	−0.001∗∗	−0.000	−0.000	0.000	−0.000
to river	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Government	−0.029	−0.024	−0.009	−0.015	−0.004	−0.012	−0.039	−0.044
Expenditure	(0.032)	(0.024)	(0.030)	(0.031)	(0.026)	(0.026)	(0.029)	(0.029)
Flood Distr.	−0.063	−0.185∗∗	−0.120	−0.058	−0.194∗∗	−0.160∗	−0.256∗∗	−0.201∗
	(0.088)	(0.090)	(0.086)	(0.089)	(0.084)	(0.090)	(0.106)	(0.103)
Continent FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
ρ	−0.773∗∗∗	−0.847∗∗∗	−0.816∗∗∗	−0.801∗∗∗	−0.866∗∗∗	−0.838∗∗∗	−0.872∗∗∗	−0.849∗∗∗
	(0.126)	(0.070)	(0.089)	(0.109)	(0.065)	(0.078)	(0.089)	(0.095)
Wald Test[a]	10.68∗∗∗	24.96∗∗∗	18.43∗∗∗	13.08∗∗∗	25.49∗∗∗	21.39∗∗∗	12.83∗∗∗	13.35
N	201	170	224	222	176	174	148	146

Notes: [a] The Wald test is for the null hypothesis that $\rho = 0$. Robust standard errors are reported in the parentheses. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table 5: Robustness Test - Alternative Estimators

	OLS	OLS	NegBin	NegBin
Dependent variable:	*Ln(1+Fatalities)*	*Ln(1+Fatalities)*	*Fatalities*	*Fatalities*
Democracy	0.648	0.551	1.061	0.893
	(0.808)	(0.854)	(0.908)	(0.892)
Corruption	0.084	−0.112	−0.175	−0.699
Control	(0.353)	(0.335)	(0.548)	(0.560)
TV	−0.039***		−0.090***	
	(0.014)		(0.030)	
Newspapers		−0.333*		−0.897***
		(0.177)		(0.327)
Freedom of	−0.003	−0.005	0.002	−0.012
the press	(0.013)	(0.013)	(0.019)	(0.019)
Ln(GDP p.c.)	−0.090	−0.065	−0.135**	−0.100*
	(0.070)	(0.075)	(0.059)	(0.057)
Population	0.001	0.001	−0.001	−0.001
Density	(0.001)	(0.001)	(0.001)	(0.002)
Access to	−0.016	−0.021	0.000	−0.018
drinking water	(0.011)	(0.013)	(0.015)	(0.015)
Distance	0.000	0.000	0.000	0.000
to river	(0.000)	(0.000)	(0.000)	(0.000)
Government	−0.074**	−0.070**	−0.073***	−0.081***
Expenditure	(0.032)	(0.032)	(0.023)	(0.022)
Flood Distr.	−0.150*	−0.114	−0.065	0.029
	(0.081)	(0.086)	(0.122)	(0.155)
Continent FE	*Yes*	*Yes*	*Yes*	*Yes*
N	148	146	148	146

Notes: Robust standard errors are reported in the parentheses. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table 6: Robustness Test - Alternative Political, Corruption and Dependent Variables

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)
$Ln(1+Fatalities)$						
			Magnitude - Second Stage			
Checks & Balances	0.078	0.119				
	(0.080)	(0.077)				
Democracy			0.241	0.082	−0.097	−0.122
			(0.842)	(0.884)	(0.899)	(0.934)
Freedom from Corruption			0.016	0.022∗		
			(0.011)	(0.012)		
Corruption Control	0.853∗	0.575			0.720	0.424
	(0.458)	(0.412)			(0.492)	(0.442)
TV	−0.047∗∗∗		−0.050∗∗∗		−0.050∗∗∗	
	(0.015)		(0.014)		(0.016)	
Newspapers		−0.500∗∗		−0.604∗∗∗		−0.431∗∗
		(0.201)		(0.219)		(0.208)
Freedom of the press	0.016	0.012	0.012	0.014	0.003	−0.001
	(0.012)	(0.011)	(0.015)	(0.015)	(0.016)	(0.016)
Other Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
ρ	−0.863∗∗∗	−0.813∗∗∗	−0.746∗∗∗	−0.724∗∗∗	−0.853∗∗∗	−0.822∗∗∗
	(0.086)	(0.107)	(0.139)	(0.165)	(0.096)	(0.106)
Wald Test[a]	14.97∗∗∗	12.98∗∗∗	9.20∗∗∗	9.09∗∗∗	13.73∗∗∗	8.84∗∗∗
N	164	163	145	143	148	146
$P(Epidemic_{it}=1)$			**Outbreak - First Stage**			
Checks & Balances	0.051∗	0.045				
	(0.030)	(0.031)				
Democracy			0.284	0.269	0.396	0.390
			(0.272)	(0.273)	(0.278)	(0.279)
Freedom from Corruption			−0.007∗	−0.007∗∗		
			(0.003)	(0.003)		
Corruption Control	−0.375∗∗∗	−0.384∗∗∗			−0.356∗∗∗	−0.368∗∗∗
	(0.128)	(0.133)			(0.130)	(0.136)
TV	0.004		0.004		0.005	
	(0.006)		(0.005)		(0.006)	
Newspapers		0.078		0.039		0.080
		(0.079)		(0.079)		(0.076)
Freedom of the press	−0.005	−0.004	0.001	0.001	−0.001	−0.001
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Ln(Flood Kills)	0.073∗∗∗	0.068∗∗∗	0.089∗∗∗	0.089∗∗∗		
	(0.025)	(0.026)	(0.027)	(0.026)		
Ln(Flood Aff.)					0.022∗∗	0.019∗
					(0.010)	(0.010)
Other Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N	1390	1363	1292	1266	1247	1215

Notes: [a] The Wald test is for the null hypothesis that $\rho = 0$. Robust standard errors are reported in the parentheses. ∗∗∗, ∗∗, ∗ indicate significance at the 1, 5 and 10% level, respectively.

Appendix A

In our model, the preventive effort can reduce the likelihood of disaster while the palliative effort can reduce the size of actual damage. We now discuss briefly the case where the probability of disaster α is exogenous and the incumbent's effort in both stages reduces the size of actual damage. The net damage from disaster is then $\gamma k - f(e_1, e_2)$ where f is strictly increasing in each argument and strictly concave. To simplify notation, we assume $\epsilon(m) = 1$ for all m. Since the probability of disaster is exogenous and so is the incumbent's utility in the non-disaster event, the opportunistic incumbent chooses (e_1, e_2) to maximize $V(e_1, e_2) = \alpha\big\{P(e_2; m, \delta, \gamma)\Omega - \theta[\gamma k - f(e_1, e_2)] - (1+\tau)e_2\big\} - (1+\tau)e_1$. Then $V_{e_1e_1} = \alpha\theta f_{e_1e_1} < 0$, $V_{e_2e_2} = \alpha(P_{e_2e_2}\Omega + \theta f_{e_2e_2}) < 0$ and $V_{e_1e_2} = \alpha\theta f_{e_1e_2}$. Thus $V_{e_1e_2}$ is positive (negative) if e_1 and e_2 are complements (substitutes) in the sense that $f_{e_1e_2} > (<)\ 0$. Following similar steps as in the proof of Proposition, we can show $\frac{\partial e_2}{\partial m} = (-\alpha V_{e_1e_1} P_{e_2m}\Omega)/|H| > 0$, hence more media activity unambiguously increases the palliative effort. For the preventive effort, we have $\frac{\partial e_1}{\partial m} = (\alpha V_{e_1e_2} P_{e_2m}\Omega)/|H|$. Thus the preventive effort increases (decreases) in media activity if e_1 and e_2 are complements (substitutes). Comparative statics results with respect to δ are similar. For τ, we have $\frac{\partial e_1}{\partial \tau} = (V_{e_2e_2} - \alpha V_{e_1e_2})/|H|$ and $\frac{\partial e_2}{\partial \tau} = (\alpha V_{e_1e_1} - V_{e_1e_2})/|H|$. Thus both e_1 and e_2 decrease in τ if they are complements. When they are substitutes, the sign of each derivative depends on the relative magnitude of $V_{e_1e_1}$, $V_{e_2e_2}$ and $V_{e_1e_2}$. For example, if the utility from holding office (Ω) is large enough and $|f_{e_1e_2}|$ is large relative to $|f_{e_1e_1}|$ and $|f_{e_2e_2}|$, then better institutions (low τ) can increase the palliative effort but reduce the preventive effort. In sum, the incumbent's effort choice in this case hinges on the interaction between the preventive and palliative effort.

Appendix B

Variable	Description	Source
Epidemic	Dummy variable. 1 if country i experienced at least one cholera outbreak in year t; 0 otherwise	EM-DAT, CRED (2008)
Fatalities	Total number killed by cholera epidemic	EM-DAT, CRED (2008)
Democracy	Revised Combined Polity Score (Polity2) Higher values indicate better political institutions.	Marshall & Jaggers (2005)
Control of corruption	Perception of corruption, defined as the exercise of public power for private gain.	Kaufmann et al. (2008)
TV	Televisions per capita (in '000)	Banks (2004)
Newspapers	daily newspaper circulation per 1,000 inhabitants	Banks (2004)
Freedom of the press	Freedom house press freedom index 0 (most free) to 100 (least free)	www.freedomhouse.org
GDP	Real GDP per capita (US dollars in 2000 prices)	World Bank (2008)
Population Density	Population per square km	World Bank (2008)
Distance to river	Mean distance to nearest inland navigable river (in km)	Gallup et al. (1999)
Access to drinking water	Percentage of population with access to safe drinking water	World Bank (2008)
Government expenditure	Ratio of government expenditure to GDP	World Bank (2008)
Flood distribution	GIS-DATA on spatial flood risk Country mean, higher values indicate higher risk	Dilley et al. (2005)
Flood Kills	Total number killed by floods	EM-DAT, CRED (2008)
Checks & Balances	Number of veto players	Beck et al. (2001)
Freedom from corruption	Freedom from corruption based on International Corruption Perception Index	http://www.heritage.org/index/
Flood aff.	Total number affected by floods	EM-DAT, CRED (2008)