Disasters, riots and political violence in India – A spatiotemporal analysis

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This paper aims to assess whether climate-related natural disasters in India tended to be followed by increased frequencies of Hindu-Muslim riots or political violence in the time period 1980-1995/2004. A quasi-experimental approach using geocoded data with high temporal resolution is used to assess whether events of violence cluster in or near disaster-affected areas. The findings indicate that this is not the case. On the contrary, disaster-affected areas appear marked by a relative absence of political violence for roughly one and a half month after disaster has struck. Hindu-Muslim riots, on the other hand, appears unrelated to disasters. This finding contradicts a number of recent speculations that increased numbers of disasters following climate changes will lead to increased levels of conflict, but are in line with older research in this area.

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INTRODUCTION

It is frequently suggested that the environmental scarcities, shocks and disasters increase the risk of violent conflict, and that climate changes are likely to make such connections more common in the future. In this paper, I look into the role of climate-related natural disasters[2] as potentially significant drivers of violence in India by checking if there is any systematic tendency that episodes of violence tend to cluster in or near disaster-affected areas. I employ a quasi-experimental approach that aims to check if disaster-affected areas have an increased risk of experiencing violence by comparing the spatial distributions of Hindu-Muslim riots and political violence shortly after disasters to the distributions in other time periods.

This approach allows circumventing some aggregation-related problems that face analysis using country-year resolution – the most common approach in quantitative research on civil war – as I am able to check the distance between disasters and episodes of violence in both space and time. This approach also allows analyzing extended time periods, which can be problematic in conventional spatial approaches, thereby combining high-resolution temporal and spatial information in the same analysis. However, it removes the ability to draw any conclusions on why observed patterns behave as they do; the analysis is a bivariate comparison of the relative spatiotemporal distributions (that is, where and when they occur) of disasters and violence, in order to check if there is a systematic tendency that episodes of violence cluster in disaster-affected areas.

If the risk of violence changes systematically in areas that have recently been affected by disaster, compared to other areas and time periods, then the disasters are the most likely cause of this change. The question of why (or why not) such a connection does or does not exist must, on the other hand, be left to other research approaches. The results presented in this paper indicate that climate-related natural disasters do not appear to increase the risk of Hindu-Muslim riots or political violence in India. While Hindu-Muslim riots appear unrelated to disasters, the risk of political violence appears to be lower in disaster-affected areas.

For the analysis, three datasets are used to make two sets of all disaster-violence pairs (dyads). The size of each dataset is therefore the number of disasters multiplied by the number of

[2] Unless otherwise specified, all references to 'disaster' in this paper are to natural disasters that are affected by the climate; storms, droughts, floods, landslides, extreme temperatures and wildfires.

events of violence. The violent events are represented by Hindu-Muslim riots (Varshney and Wilkinson, 2004) and a dataset of political violence (Marshall et al., 2005a). Since social and political consequences of climate changes are an overarching factor of interest in this research, disasters are represented by a set of climate-related natural disasters (floods, droughts, extreme temperatures, wildfires, water-induced landslides and storms) (CRED, 2007).

Compared to all-out civil war, the level of violence in the data used is generally low[3]. Using data on low-level violence enables the analysis to capture smaller incidents that may be thought to escalate to full war at an early stage. First, a full rebellion takes some time to escalate, which may make a potential relation to disasters more difficult to detect. The prospect of detecting a more direct relation should be better when using lower-level violence in the analysis. Also, if climate changes contribute to damaging a country's economy, contribute to generating widespread dissatisfaction and damage the state's capacity to prevent escalation, events that do not escalate today may do so in the future. On the other hand, if disasters do not affect the risk of violence in past and present, it is less likely that they will cause violence in the future (although climate-induced socioeconomic changes such as the ones just mentioned may affect the risk of conflict in unpredictable ways).

In the following, I will give an introduction to theories on the relation between environmental factors, disasters and the risk of violence, before discussing the data and method. Then, descriptive statistics and results are presented in the following sections before the paper ends with a summary and discussion of the main findings and conclusions.

PREVIOUS RESEARCH

While numerous plausible causal connections between disasters and violence have been suggested (Brancati, 2007, Drury and Olson, 1998, Goldstone, 2001:40, Holloway, 1989:220, Homer-Dixon, 1999, Kahl, 2006, Nel and Righarts, 2008), both the strength and the direction of the suggested relation vary. Even for documented cases of unrest following disasters, it is unclear whether they are exceptions or parts of a general pattern. If the cases where disasters appear directly connected to the onset of conflict are exceptions, then with regards to climate changes, there is far less to worry about than if they turn out to be representative of a common pattern. The debate surrounding climate changes and what kind of social and political changes

[3] Although the level of violence is mostly low, it should be noted that in terms of casualties, some of the incidences included are very severe.

one can expect have caused a surge of interest in how factors related to climate affect social and political systems. Some vocal actors have made strong claims about this connection (see for example Obama (2009)). However, the empirical evidence turns out to be mixed at best.

One reason for the expectation that natural disasters cause increased levels of conflict in a society appears to be a widespread belief that when humans face adversity, both individual rationality and social norms will break down and a chaotic, state of nature-like situation will arise. Hollywood has produced many examples of how this may look, but movie directors and single politicians are not the only ones who have been expecting social breakdown in the face of adversity. This expectation was one of the foundations of how strategic bombing were conducted during the Second World War and afterwards, and how defense against such bombing was designed (Harrisson, 1978). As hot war was replaced by cold and the threat of nuclear war grew, authorities in the United States worried about how survivors of a nuclear attack could be expected to behave. Again, the expectation was panic, disorder and chaos, which might, among other things, lead to looting and violence. In the 1950s and 60s, a number of research projects were therefore commissioned in order to increase the base of knowledge on what to expect. In addition to studying populations that had been subjected to bombing in England, Germany and Japan, a large number of technological and natural disasters, mainly in the United States, were also studied. The studies found a clear pattern in how both individuals and groups tend to behave in adverse situations - but this pattern strongly contradicted the initial expectations of chaos and disorder. The findings quite consistently pointed in the opposite direction; in such situations, social cohesion seemed to increase rather than decrease (Disaster Research Group, 1961, Fritz, 1961, 1996, Fritz and Marks, 1954, Hirshleifer, 1967, Wallace, 1956).

From the perspective of climate changes, a substantial weakness of these studies is that although extensive, they were almost exclusively conducted in highly industrialized, mainly western countries. It can therefore be questioned whether the conclusions are valid for the poorer countries that are expected to be most severely affected by climate changes. Poverty and inconsistent regime types are, after all, among the most important risk-factors for civil war (Dixon, 2009, Hegre and Sambanis, 2006). While the forms of violence I study in this paper are less severe than all-out civil war, it seems reasonable to expect that poverty and poor governance matter here as well.

A number of studies conducted in the mid 1990s and onwards have concluded that in poor countries, environmental shocks and scarcities can, combined with political and economic factors, cause an increased risk of violence. Thomas Homer-Dixon figures prominently within this research tradition. He points to three sources of environmental scarcities (1999:47f); supply-induced, demand-induced and structural scarcities. Disasters will, in most cases, cause supply to drop, since it becomes more difficult to provide the needed goods. At the same time, previously available resources are likely to be damaged or spent, increasing the demand for replacements. With regards to distribution, it is frequently noted that disasters do not strike evenly, nor does the relief and reconstruction efforts (Cuny and Abrams, 1983, Wisner et al., 2004). Hence, existing inequalities in resource access are likely to be made more evident by disasters, as well-off groups can be thought to use their privileged position to secure their share of the available resources at the expense of less privileged groups, who are also likely to be more severely affected in the first place.

However, it is, in particular in light of the findings that anti-social behavior has dropped in times of adversity, possible to envision a more optimistic scenario as well. If disasters change how privileged and non-privileged people and groups behave in relation to each other, it may also be an opportunity to provide aid and display solidarity. This latter scenario is not necessarily less plausible, and assessing which one is most common should be left to empirical analysis rather than aprioristic assertions.

Homer-Dixon (1999:136) suggests three main types of theoretical connections between scarcities and violence. The first, frustration-aggression theories, suggests that individuals become frustrated and potentially aggressive when they are blocked from fulfilling a strong desire. Homer-Dixon points out relative deprivation as an important subset of this theory. In disaster situations, the deprivation can be relative to both one's own life before the disaster, and to other persons and groups in society. Most climate-related natural disasters have relatively fast onsets, which is argued to be a further risk-factor due to the rapid change to a worse situation (Homer-Dixon, 1999:143). A related aspect that is relevant for natural disasters is, despite the 'natural' component, distribution of blame. The sheer pain of having been exposed to a natural disaster and the loss of loved ones can be thought to generate frustration and anger that is likely to be directed against someone that are perceived as blamable in some way. Authorities may be easy targets of blame for what happened, for example if they are perceived to have been overly unprepared, uninterested or, not least,

biased in relief and reconstruction efforts. However, the flip side should also be kept in mind. Disasters have been described as opportunities for governments to display their competence or incompetence (Goldstone, 2001:46), illustrating the potential for not only losing, but also gaining legitimacy.

The issue of unequal effect mentioned above also relates to Homer-Dixon's second connection between environment and violence; group-identity theories. He argues that scarcities can contribute to strengthening the feeling of ethnic identity, in particular through triggering migration, and that leaders may try to exploit these feelings in ways that make divisions deeper and tenser. In addition to triggering outflows of migrants, disasters may also contribute to strengthening group divisions by affecting social groups unevenly, as the differences will become both more visible and, not least, they are likely to become more painful. If 'they' are perceived to get an unreasonably large share of the remaining resources, aid or reconstruction efforts, the sense of 'we-ness' in excluded groups is likely to be strengthened. This, combined with frustration over missing their part of the pie, may cause groups to take action to redress the injustice, by violent means if necessary.

The last theoretical connection between scarcities and the risk of violence outlined by Homer-Dixon is structural theories. The balance of opportunities and constraints facing rational actors may be tipped in favor of challengers of the existing rule. Homer-Dixon focus mainly on insurgents who, in situations of high grievances and promising opportunities are likely to act violently to redress their grievances (Homer-Dixon, 1999:142f). Disasters that destroy infrastructure (for example storms, but not droughts) have a further potential for triggering low-level violence in that the combination of acute scarcities and reduced governmental capacity to maintain order may increase the risk of looting, which may, in turn, escalate into more serious violence. While this proposition appears plausible, the findings that anti-social behavior is less frequent in the aftermath of disasters should be kept in mind. Also, while the expectation of widespread looting after disasters is common, the empirical validity of this notion has been questioned (Quarantelli, 2008, 2007). Further, while disasters are likely to reduce the coercive power of the state, potential insurgents may face similar problems. Also, in the immediate aftermath of disaster, people may have to spend all their time and energy just trying to stay alive and trying to recover what can be recovered that there is no time left for fighting.

Although most of the assertions listed above appear plausible, and several of the connections have been documented (Homer-Dixon, 1999, 1994), the question of whether these occurrences are exceptions or parts of a general pattern is still open. The apparent debunking of plausible-sounding and widely believed myths of post-disaster behavior by disaster sociologists in the 1950s and 60s is a sobering reminder that our preconceptions may be wrong, even if they sound plausible. While case studies that describe how environmental factors can lead to violence are important and necessary, large-n studies should also be conducted in order to learn more about to what extent single connections are exceptions or parts of a more general pattern. If they turn out to be exceptions, as has been suggested by recent studies (Nardulli and Leetaru, 2010, Slettebak and de Soysa, 2010), then future research emphasis can be put into studying the differences between cases where violence occurred and cases where it did not. I do not expect disasters to be main drivers of violence. The important question, in particular when keeping the expected effects of climate changes in mind, is whether disasters have a substantially important impact relative to other important factors such as economic conditions and governmental competence.

DATA AND METHOD

For the analysis, I construct two datasets of event-pairs, or dyads, where climate-related disasters (CRED, 2007) are coupled with Hindu-Muslim riots (Varshney and Wilkinson, 2004) and political violence (Marshall, et al., 2005a). In both the dyadic datasets constructed for the analysis, each incidence of violence is coupled with each disaster, yielding about 82 000 disaster-violence dyads for each set. For each dyad, the distance in space and time between disaster and violence is measured as the number of kilometers and days from each disaster to each episode of violence. This means that if the episode of violence in a dyad happened before the disaster, the temporal distance is negative, while spatial distances are always positive.

If disasters significantly increase the risk of violence, then the spatiotemporal distribution of disasters should leave an imprint in the spatiotemporal distribution of violent events. That is, assuming that disaster-induced violence happens in or near the area directly affected by the disaster, the distribution of geographic disaster-violence distances will be somewhat shorter in the immediate aftermath of disasters than in other time periods. The high resolution of the data used in this study allows a quasi-experimental approach, where the distribution of violence shortly after a disaster can be compared to the distribution in time periods where it

seems clear that the disasters did not cause the violence. Since all factors that change systematically from immediately before to immediately after natural disasters are, in all likelihood, caused by the disasters, a systematic clustering of violence in disaster-affected areas would provide strong support for the proposition that disasters contribute to igniting the types of violence included here.

Most of these disaster-violence dyads are irrelevant for analysis, either because of the incidence of violence happened before the disaster (negative temporal distance, applies to about 50% of the dyads), because so much time passed from disaster to violence that it is unreasonable to assume that the disaster contributed to causing the violence, and/or because the geographical distance is very long. Hence, the total number of dyads is far higher than the number of relevant dyads. When all are kept in the dataset, this is partly in order to avoid imposing artificial limits to the analysis, and partly to keep a sample of irrelevant dyads that can be used as a base of comparison for the dyads that have so short spatial and temporal (positive) distances that it seems plausible that the disasters may have contributed to triggering the violence.

I am deliberately vague on the spatial and temporal thresholds used in these descriptions, because I have no information that indicate how far away from a disaster area or for how long a disaster should be expected to affect the risk of conflict. A large number of different thresholds are therefore tested. A large share of the datasets, containing the dyads where one can confidently assume that the disaster did not play any part in triggering the violence, is used as a basis of comparison for the distribution of cases where the distances in space and time are such that the disaster may be thought to have affected the incidence of violence in question. For example, if disasters cause the risk of Hindu-Muslim riots to increase immediately, then dyads with a temporal distance (from disaster to riot) of between zero and ten days should display shorter mean geographic distances than dyads with temporal distances of, for example, between minus ten and zero (that is, immediately before disasters). Similarly, dyads with short positive temporal distances should have significantly shorter spatial distances than samples with substantially longer or negative temporal distances. Below, this is tested, partly using simple descriptive statistics, and partly using Monte Carlo simulation. While this approach is useful for checking how disasters and episodes of violence are distributed relative to each other is space and time, it is not able to contribute to explaining *why* the observed tendencies occur, nor is it able to assess the relative explanatory power of

disasters compared to other phenomena. Rather, it is a simple test of whether the risk of violence in a given area changes systematically from the period immediately before to the period immediately after the disaster. For more on riots in India, see for example Brass (2003), Tambiah (1996) or Wilkinson (Wilkinson, 2006, 2008).

The expectation that frictions between societal groups will be increased after disasters can, in the Indian context, plausibly be expected to imply increased tension between Hindus and Muslims. If climate-related natural disasters do affect the level of tensions, this should be discernable as an increased likelihood of encountering Hindu-Muslim riots in or near disaster-areas within a reasonable timeframe after disaster has struck. The information on Hindu-Muslim riots is compiled from the Bombay edition of The Times of India and covers the time period from 1950 to 1995 (Varshney and Wilkinson, 2004). For events to be included, two criteria must be fulfilled: they must be violent, and Hindus and Muslims must confront each other at some point during the violence (Wilkinson, 2006) For the purposes of this paper, the early end-date is one of the main disadvantages of this dataset. This is partly because more recent information is unavailable, and partly because it overlaps poorly with the geocoded dataset on natural disasters, which starts in 1980. While it is unfortunate that not more data is available, the 701 events that contained sufficient information to be geocoded (96% of the total sample for 1980-95) should constitute a large enough sample to detect if there are any significant trends that these riots cluster in the aftermath of disasters. When combined with the 118 recorded climate-related natural disasters that struck India in this period, this yields 82 718 riot-disaster dyads.

The second dataset on violent events (Marshall, et al., 2005a) is intended as a less specific "catch all"-measure of low-level violence. While the dataset on Hindu-Muslim riots should be expected to capture identity-based friction well, it may be too specific to capture the more general increase in risk of violence that can be expected if disasters increase frustration and opportunities for violence. The inclusion criteria in this set is that the events must be violent (leading to at least one death or substantial property destruction) and inherently political. That is, it must be "performed by or for a distinct societal group with the intent of affecting existing political relations between that group and government authorities or another societal group" (Marshall et al., 2005b:1). This dataset covers 1960-2004, and therefore overlaps well with the disaster data (which covers 1980-2004). However, it was far more difficult to geocode than the data on Hindu-Muslim riots; of the 743 events included in the relevant time

period, only 352 had information on location that was sufficiently accurate for geocoding. Hence, almost 53% of the data were lost. While this is unfortunate, the data loss appears random in space and time[4]. Since the only criteria of the violence that is of interest in this paper is where and when it happened, this means that the data is diluted, but still representative. Coupled with the 234 climate-related natural disasters recorded for India in this period, the second dyad-set contains 82 368 disaster-violence dyads.

The data on natural disasters originate from EM-DAT (CRED, 2007) and cover the time period 1980-2007. Only disaster types that are expected to be affected by global warming are included; storms, floods, droughts, landslides and extreme temperatures (heat and cold waves). The data are geocoded as polygons[5] indicating the area that is covered by each disaster. Unfortunately, some of the disasters have inaccurate descriptions of which areas they cover, leading some of the polygons to be quite crude. The number of disasters display quite a bit of variation from year to year, but no clear upwards or downwards trend. The mean number of disasters per year for 1980-2004 is 8.4, with a standard deviation of 2.5. Most of the disasters have a short duration; 154 of the 234 disasters lasted only one day. 23 lasted more than two weeks, while the three longest lasted 93, 122 and 154 days (one drought and two floods). In order to be included in the EM-DAT disaster database, an event must fulfill at least one of the following criteria: ten or more persons reported killed, 100 or more reported affected, declaration of a state of emergency and/or a call for international assistance.

The consequence-focused definition of disaster used by EM-DAT implies that severe weather events are evaluated by the effect they have, not their physical force. Since the issue of interest is how they affect human behavior, this definition appears more appropriate than using a measure of purely physical criteria (such as cyclone wind-speed, millimeters of precipitation or how many square kilometers of land that are inundated during a flood). The focus on consequences also means that vulnerability and level of adaptation is accounted for, since only the events that had sufficiently severe consequences were included. It is important to keep this distinction in mind; the number of *disasters* depends not only on the number of severe weather events, but also on the number of people (and the amount of property) that are in a vulnerable situation in an area that is exposed to severe weather events.

[4] In terms of in which year and state the events take place, the geocoded sample is almost identical to a number of random samples of similar size from the total dataset.
[5] The data were geocoded by Bianca Tzscherlich and Rainer Koch, and kindly made available to me by Jan Ketil Rød, Department of geography at NTNU.

CONSTRUCTION OF THE DATASET

For the datasets on violence events, each event was assigned geographical coordinates based on the name of the location given in the dataset – typically village or city. The coordinates were mainly retrieved using GeoMaker (2009), but in some cases they were retrieved from www.fallingrain.com or from maps. Then, the minimum great circle distance[6] from each disaster to each incidence of violence was recorded using the spDistsN1-function of the sp package (Pebesma and Bivand, 2005) in R (R Development Core Team, 2008). Since the disaster data are coded as polygons covering the area affected by disaster, the distance was calculated by filling each disaster polygon with 500 evenly distributed control points, and then measuring the distance from the point representing a violent event to the nearest control point within a polygon. For measuring temporal distances, the dates for each event were recalculated as the number of days since 1 January 1980, and the number of days between each event was calculated on this basis.

Neither riots nor disasters are randomly distributed across space, but depend on the distributions of population, causes of violence and vulnerability and exposure to severe weather events. Therefore, the observed post-disaster distribution of riots cannot be compared to a random distribution; it will inevitably be significantly different. Instead, the distribution of disaster-violence distances in time periods where it appears reasonable to suspect a relation (that is, after disaster but not very long after) is compared to distributions where it would be unreasonable to expect a relation (such as for events of violence occurring before the disasters or a long time afterwards). While events of violence that happened before a given disaster were obviously not caused by it, the question of how long the disaster may continue to affect the risk of conflict is less clear. Since I am mainly looking for fairly direct links between disaster and violence, the main emphasis of the analysis has been on the first weeks after disaster, but a wide range of thresholds, from very short up to one year have been tested. Also, due to the risk that existing relations are drowned in noise from distant, irrelevant cases, excluding dyads where the distance from disaster to violent event is large has also been tested. Again, a number of thresholds have been considered, without much difference in the results; higher distance thresholds mean that the mean distances increase, both before and after

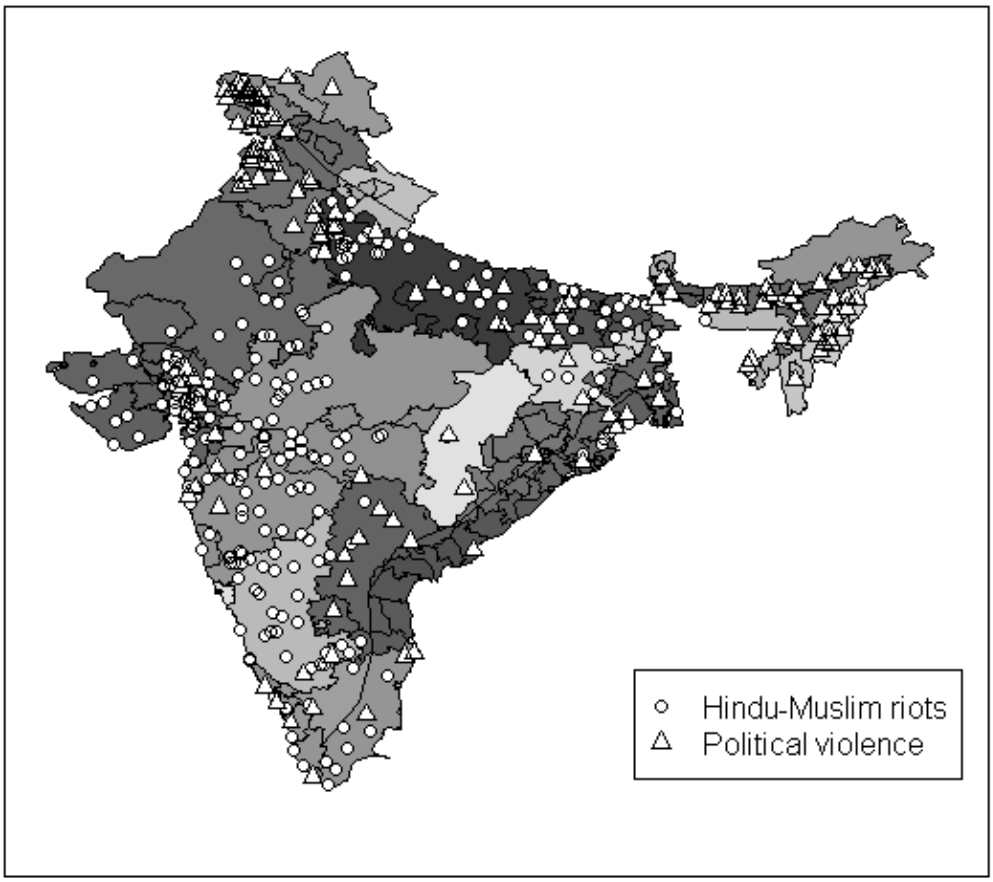
[6] A potential future improvement is to measure distances along roads and railroads rather than the straight line approach used here.

disaster. The relation between the before and after-distances, which is the interesting part, is largely unchanged.

DESCRIPTIVE STATISTICS

Below, descriptions of the distribution of Hindu-Muslim riots, political violence and climate-related natural disasters in India are presented, before the post-disaster distributions of violent events are compared to the distributions in periods that are not affected by these disasters in the next section.

Figure 1: Spatial distribution of disasters, political violence and Hindu-Muslim riots[7]



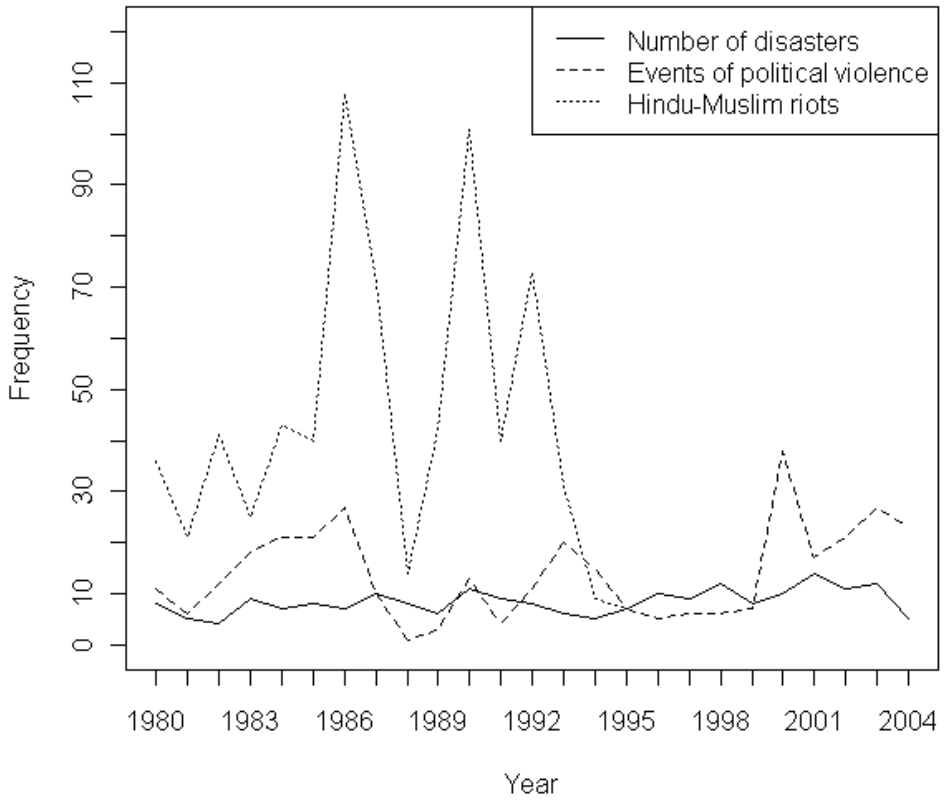
Darker map shading indicates more disasters

The main clusters of political violence are in the north (mainly Kashmir) and in the eastern states, while Hindu-Muslim riots are mainly distributed across the northern states and the western and southwestern areas, with a pronounced cluster in Gujarat. The map does not point towards any strong relation between climate-related natural disasters and these forms of

[7] Note that, although they frequently match each other, the borders in the map are the edges of disaster polygons, not Indian states.

violence, although this way of comparison is too crude to draw any conclusions on such a relation. Also, since no temporal information is included here, there is no way of knowing whether events of violence in disaster-affected areas have followed in the wake of the disasters, or at completely different time-points.

Figure 2: Temporal distribution of disasters, political violence and Hindu-Muslim riots



Peaks in the number of disasters followed by peaks in the number of violent events would yield some support for the proposition that disasters are important triggers of violence. The plot of annual distributions of disasters, riots and political violence does not indicate any such tendency, thereby pointing towards that disasters are not significant drivers of violence in India. However, a relation between disasters and violence may possibly be concealed by the level of aggregation and absence of spatial information in this plot.

Figure 3: Disaster-violence distances before and after disasters

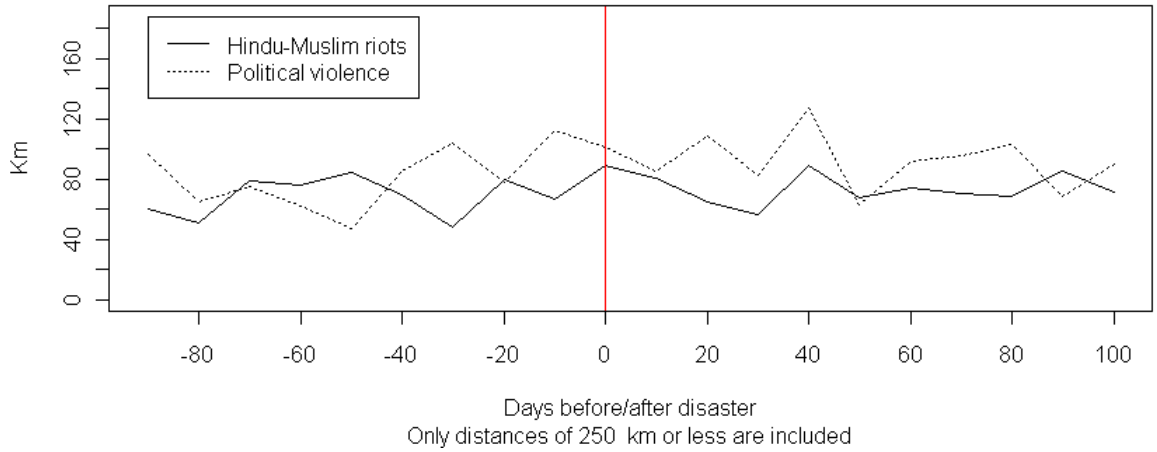


Figure 3 shows the distribution of disaster-riot distances in dyads that have a distance of 250 km or less and a time difference between -100 and 100 days (-100 means that the violent event happened 100 days before the disaster, and vice versa). Assuming that all the relevant factors that change systematically from immediately before to immediately after the disaster are affected by the disaster, a significant relation between disasters and the risk of violence should cause the distance to drop markedly in the time period immediately after disaster has struck.

While the distribution of distances is affected by the distance threshold, the main pattern is that the distances from disasters to events of violence drop from when the temporal distance is increased from zero to positive. However, there are a number of caveats to keep in mind. First, for the political violence, the decline is part of a trend that starts at about ten days before the disasters. This trend can therefore hardly be claimed to be caused by the disasters – although the possibility of fighting due to anticipation of a disaster could be considered. Climate-related disasters can, after all, generally be predicted some time in advance. However, the second, more serious caveat to keep in mind is that the variance both before and for a longer time after time zero is at least as large as shortly after time zero. This indicates that even if the disasters have some effect on the risk of violence, the effect appears small. That being said, while the shift in the trend for Hindu-Muslim riots at time zero appears likely to be a coincidence, it should not be dismissed entirely without further investigation.

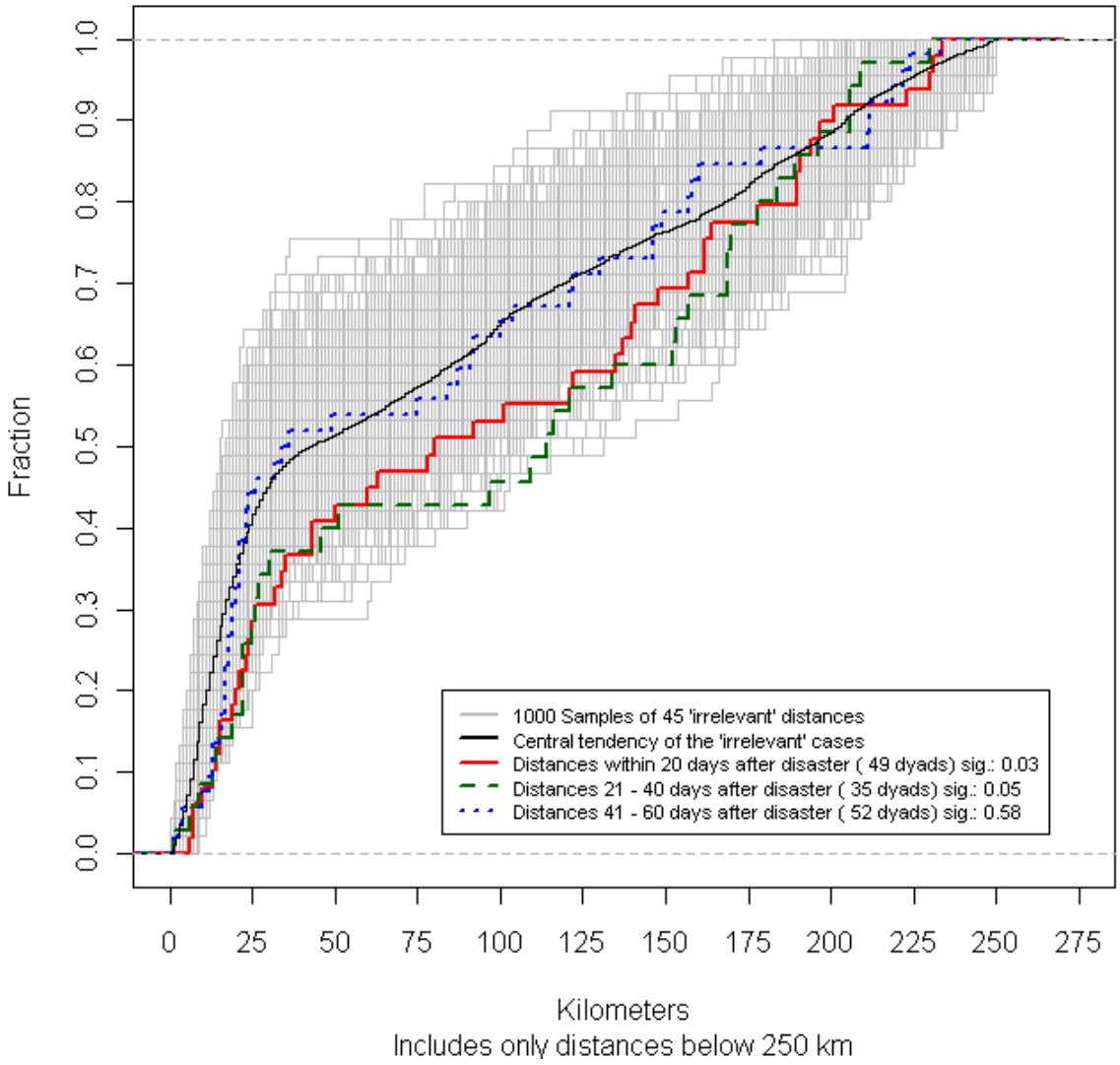
In sum, the descriptive statistics does not indicate a relation between disasters and the risk of conflict in India. However, the proposition should not be dismissed entirely without running more formal tests. These are presented in the following section.

ANALYSIS

In order to take both spatial and temporal elements of the distributions into account, the distribution of disaster-violence distances for dyads where the event of violence may plausibly have been affected by the disaster (that is, the violence happened relatively shortly after the disaster, in or relatively near the directly affected area) are compared to the distribution of distances in dyads where it feels safe to conclude that the disaster did not affect the violence. These 'irrelevant' dyads are the ones where the episode of violence happened before the disaster, or where one year or more passed from disaster to violence. While disasters have been argued to have influenced violence on far larger timeframes than one year[8], I consider low-level incidences such as the types of violence included in this study most likely to occur within a short timespan after a disaster (a number of different thresholds have been tested, with similar results).

[8] See for example Dore (1986) or Drury and Olson (1998)

Figure 4: Distances from disasters to political violence events

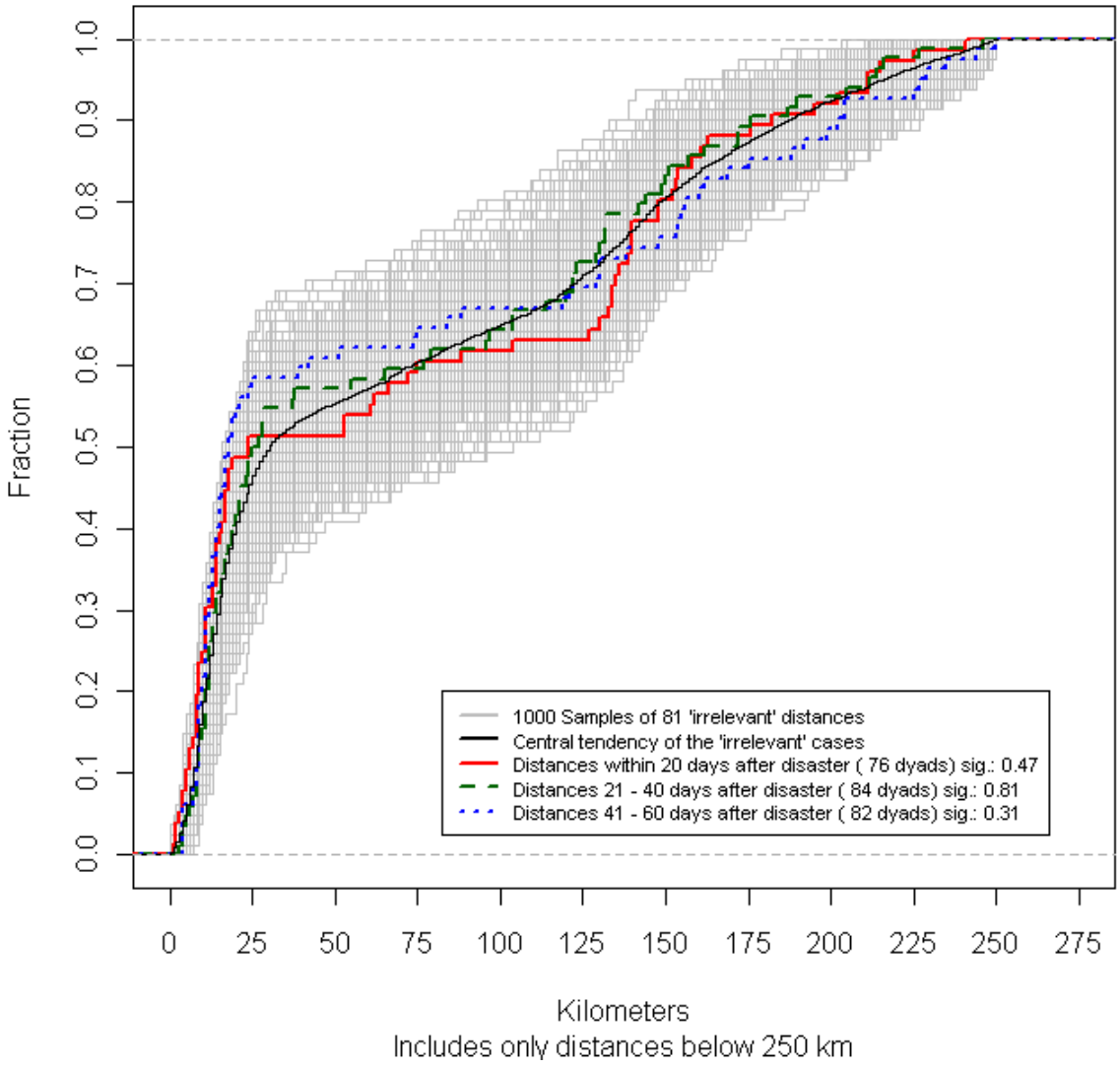


In figure 4, the distribution of distances from disasters to political violence for three time periods shortly after disaster are compared to 1000 samples of 45 randomly chosen 'irrelevant' distances. A strong tendency that disasters trigger political violence in the immediate aftermath of the disasters should cause the disaster-violence distances shortly after a disaster to be substantially shorter than in other periods. In the plot, this would manifest itself as the post-disaster curves rising more steeply than the distance curves from the 'irrelevant' samples. Similarly, a negative relation between disasters and the risk of violence would manifest itself as less violence in disaster-affected areas shortly after disasters, which would cause the post-disaster curves to rise less steeply than the 'irrelevant' curves.

As can be seen from figure 4, the observed distributions of distances shortly after disasters do not rise more steeply than the central tendency of the 'irrelevant' cases. On the contrary, to the extent that there is any difference, there appears to be less episodes of political violence in

areas that has recently been struck by climate-related natural disasters. This tendency is fairly evident for periods 0-20 and 21-40 days after disaster, while the distribution of distances for the 41-60 days period is very similar to the central tendency of the 'irrelevant' cases. This indicates that disasters appear to reduce the likelihood of experiencing political violence, but that the effect lasts less than two months. This interpretation is supported by a number of re-specifications of the model with different time thresholds (not shown). The level of significance[9] depends on the specification, but is generally around the 95% level.

Figure 5: Distances from disasters to Hindu-Muslim riots



The negative relation between disasters and political violence is not mirrored by the findings for Hindu-Muslim riots. The observed distributions of disaster-riot distances are quite similar to the central tendency of the 'irrelevant' cases, indicating that climate-related natural

[9] Estimated using the Mann-Whitney test.

disasters does not appear to affect the likelihood of experiencing Hindu-Muslim riots in India substantially. A number of different specifications were tested, with little effect on the results.

DISCUSSION / CONCLUSION

In this paper, I have investigated if there is a systematic tendency that the risk of Hindu-Muslim riots or episodes of political violence is affected by climate-related natural disasters. The analysis used a quasi-experimental approach, comparing the distribution of disaster-violence distances shortly after disasters to the distribution in time periods where the disasters are considered unlikely to affect the risk of violence. A large number of alternative specifications were tested, yielding mainly the same results; for the time periods included in this analysis, climate-related natural disasters do not appear as significant drivers of Hindu-Muslim riots and political violence in India. On the contrary, to the extent that there is any relation between climate-related disasters and the risk of the types of violence analyzed in this paper, it is that the disasters appear to *reduce* the likelihood of political violence[10] in the immediate post-impact period in a disaster-affected area.

The approach using geocoded data with a high temporal resolution enables, to the extent data accuracy permits, a precise comparison of the distribution of violence shortly after disasters have struck to other time periods. The main source of uncertainty is the accuracy of the polygons indicating the disaster-affected areas. These vary from being very specific to quite crude, depending on how much information about location that is included for each disaster. While this is likely to make the analysis less effective, there is no reason to suspect that it introduces systematic bias; the distances are simply fuzzier in the disaster end of the measurement. From the perspective of this paper, it would be desirable if disaster-data collected in the future contain better geo-referenced information – or, perhaps more simple, information on names of as many as possible of the areas affected, so that each analyst can consider the extent of the different disasters.

Given the quasi-experimental nature of this paper, the base of evidence here is not sufficient for attempting to explain *why* Hindu-Muslim riots or political violence does or does not occur. Still, the direction of the results lends more weight to the suggestion that social cohesion tends to increase after disasters than to the arguments that adversity will tend to cause friction and

[10] Defined as "performed by or for a distinct societal group with the intent of affecting existing political relations between that group and government authorities or another societal group" (Marshall and Marshall 2005b).

increased levels of violence. Although single cases where disasters have triggered violence do exist, the samples used in this paper appear sufficient to indicate that for India, such cases are exceptions rather than parts of a common pattern. In light of the threat expected from climatic changes, this is relieving. India is expected to be hit hard by climate changes, and will likely face enough challenges even if the increased frequency and severity of climate-related disasters that are expected to follow climate changes does not trigger more violence.

While the expectation that adversity breeds violence appears widespread, and moving climate issues into the security agenda may give them more of the attention they deserve, this is not unproblematic. Even without violent conflict, “silent” problems such as disease, malnutrition and natural disasters are major killers today and will remain so well into the foreseeable future, with or without climate changes. Also, without good reasons to believe that climate change-related problems lead to increased risk of conflict, making such claims runs the risk of turning focus away from well-known risk factors (such as economic and political factors) as well as failing to hold responsible governments accountable for problems caused mainly by bad governance, not climate changes. That being said, potential connections between climate changes and the risk of armed violence should be studied closely in order to assess if there are areas where policymakers can intervene in order to prevent future conflict from arising.

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