The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981-2002

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Abstract

Natural disasters do not affect people equally. In fact, a vulnerability approach to disasters would suggest that inequalities in exposure and sensitivity to risk as well as inequalities in access to resources, capabilities and opportunities systematically disadvantage certain groups of people, rendering them more vulnerable to the impact of natural disasters. In this article we address the specific vulnerability of girls and women with respect to mortality from natural disasters and their aftermath. Biological and physiological differences between the sexes are unlikely to explain large-scale gender differences in mortality rates. Social norms and role behavior provide some further explanation, but what is likely to matter most is the everyday socio-economic status of women. We analyze the effect of disaster strength and its interaction with the socio-economic status of women on the change in the gender gap in life expectancy in a sample of up to 141 countries over the period 1981 to 2002. We find, first, that natural disasters lower the life expectancy of women more than that of men. In other words, natural disasters (and their subsequent impact) on average kill more women than men or kill women at an earlier age than men. Since female life expectancy is generally higher than that of males, for most countries natural disasters narrow the gender gap in life expectancy. Second, the stronger the disaster (as approximated by the number of people killed relative to population size), the stronger this effect on the gender gap in life expectancy. That is, major calamities lead to more severe impacts on female life expectancy (relative to that of males) than smaller disasters. Third, the higher women's socio-economic status, the weaker this effect on the gender gap in life expectancy. In other words, taken together our results show that it is the socially constructed gender-specific vulnerability of females built into everyday socio-economic patterns that lead to the relatively higher female disaster mortality rates compared to men.

Key Words: natural disaster, vulnerability, gender, mortality, socio-economic status

Introduction

The human impact of natural disasters is never entirely determined by nature, but is contingent on economic, cultural and social relations. In this article we address one important, yet hitherto relatively neglected aspect (WHO 2002), namely the gendered nature of disaster vulnerability as revealed by gender-specific disaster mortality. Anderson (2000: 86), in a World Bank publication on managing disaster risk, is adamant that "much more research is needed to fully understand the extent to which gender plays a role in differential casualty rates". This article's analysis provides an important step in that direction. Specifically, we analyze the impact of natural disasters on the so-called gender gap in life expectancy, which is the difference between female and male life expectancy at birth (in most countries women live longer than men).

Our study takes seriously gender as an analytical category. We try to explain the differential impact of natural disasters on female relative to male life expectancy not merely by recourse to different physical exposures and biological or physiological gender differences, but also by the different socially constructed vulnerabilities that derive from the social roles men and women assume, voluntarily or involuntarily, as well as existing patterns of gender discrimination. Our study adopts a vulnerability approach to natural disasters as an analytical concept. Many disaster scholars subscribe to such an approach and have made significant contributions to its development (see, for example, O'Keefe, Westgate and Wisner 1976; Hewitt 1983; Cuny 1983; Wisner, Blaikie, Cannon and Davis 1994, 2004; Varley 1994; Cannon 1994, 2000; Cutter 1996; Fordham 2004). As Cutter (1996: 530) has pointed out, vulnerability "still means different things to different people". We adopt the definition of vulnerability given in Wisner et al. (2004). In their approach, an explanation of "the risks involved in disasters must be connected with the vulnerability created for many people through their normal existence", where vulnerability is defined as "the characteristics of a person or group and their situation influencing their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard" (Wisner et al. 2004: 4 and 11).[1] It follows that the impacts of natural disasters are never merely determined by nature on its own. Indeed, it becomes even questionable whether one can talk of "natural" disasters at all, since Cannon (1994: 14) argues that "there are no generalized opportunities and risks in nature, but instead there are sets of *unequal access to opportunities and unequal exposures to risks* which are a consequence of the socio-economic system" (emphasis in original). In other words, vulnerability, as used in this article, captures the differential exposure to and capacity to cope with risks systematically attributed to people across space and time, which, together with other attributes such as ethnicity or class, is often a function of the individual's gender, the focus of analysis here (see Cannon 1994; Wisner et al. 2004).

There is renewed interest in studying the social impacts of natural disasters across the social sciences. For example, economists have recently studied how a country's low level of economic development, poor quality of governance institutions and high degree of inequality increases the death toll from earthquakes (Anbarci et al. 2005) as well as other types of natural disasters (Kahn 2005). Geographers, sociologists and other social scientists have addressed the vulnerability of certain groups of people to natural disasters (see, among others, Cannon 1994, 2000; Cutter 1996; Mustafa 2002; Wisner et al. 1994, 2004 and references cited therein). Increasingly, even physical geographers and public health scholars acknowledge that a better mitigation of negative disaster impacts is contingent on a better understanding of the socially constructed vulnerabilities of specific groups of affected people (Noji 1997a; Alcántara-Ayala 2002; Degg and Chester 2005a, 2005b). Within the broader field of disaster and environmental change research, an emergent literature addresses the specific vulnerability of women (Cutter 1995; Bolin, Jackson and Crist 1998; Enarson and Morrow 1998; Enarson 1998, 2000; Fothergill 1998; Fordham 1999, 2000, 2004; Enarson and Meyreles 2004; Bradshaw 2004). Our original contribution is to provide the first systematic, quantitative analysis of gender differences in natural disaster mortality. This is of course only one, but due to its far-reaching consequences (life or death) arguably the most important aspect of the gendered impact of natural disasters. Existing studies either do not estimate gender-specific mortality rates and patterns at all (Kahn 2005; Anbarci et al. 2005) or are confined to single events such that no general conclusions can be drawn (Bern et al. 1993; Ikeda 1995; O'Hare 2001; Oxfam International 2005). It is only by quantitative analysis of mortality rates or summary mortality measures such as life expectancy that we can discern whether the anecdotal evidence captures a general trend. We believe that our contribution buttresses Cutter's (2003: 6) claim in her Presidential Address to the Association of American Geographers that "geography has added a technological sophistication to hazards research that is unrivalled among the social sciences" and that "the discipline is rapidly becoming the driving force behind vulnerability science".[2] In linking spatial patterns of disaster risk to human-generated vulnerability, geography is uniquely positioned to study the impact of natural disasters on socio-economic systems and groups of people. One of the "most significant themes" listed by Cutter (2003: 7) is the need "to identify, delineate, and understand those driving forces that increase or decrease vulnerability at all scales". This study identifies one important driving force by demonstrating how low socio-economic status renders women more vulnerable to the mortal impact of natural disasters.

In brief, we find that natural disasters affect women more adversely than men in terms of the effect of disasters on the life expectancy at birth. What this means is that natural disasters on average kill more women than men or kill women at a younger age than men and the more so the stronger the disaster. Yet, the extent to which women are more likely to die than men or to die at a younger age from the immediate disaster impact or from post-disaster events depends not only on disaster strength itself. Rather, the effect of catastrophic events is contingent on the socio-economic status of women in the affected country's society. The higher women's status, the smaller is the differential negative effect of natural disasters on female relative to male life expectancy. What this means is that where the socio-economic status of women is high, men and women will die in roughly equal numbers during and after natural disasters, whereas more women than men die (or women die at a younger age) when the socio-economic status of women is low. These results corroborate a vulnerability approach to natural disasters since the more adverse impact of disasters on female compared to male life expectancy is clearly contingent on the extent of socially constructed vulnerability and there is nothing natural in the gendered impact of disasters on life expectancy.[3]

This article is structured as follows: The next section presents arguments and anecdotal evidence suggesting that natural disasters increase female mortality more than that of men. Two hypotheses are developed from this discussion and are put to an empirical test. The then following section describes the sources of data and the operationalization of the relevant variables for the econometric estimation. A discussion of the appropriate estimation technique is followed by a presentation of results. We conclude by arguing that our study's findings support a vulnerability approach to natural disasters.

Natural disasters and the gender gap in life expectancy

Human beings can and in fact do influence – willingly and unwillingly – the degree to which natural disasters harm people, reduce welfare and cost lives. This section deals with the interaction between natural disasters and societies. For a whole range of reasons, mortality vulnerability to natural hazards is likely to be gender-specific, with women bearing the major burden.

From a conceptual perspective, it seems most fruitful to distinguish between three main causes for gender differences in mortality vulnerability to natural disasters: First, biological and physiological differences between men and women may at times disadvantage women in their immediate response to the disaster. Second, social norms and role behavior may lead to a behavior of women, which increases their vulnerability in the immediate course of the disaster. And third, disasters may lead to shortage of resources of basic need as well as a temporary breakdown of social order, in which case the competition between individuals becomes fiercer and existing forms of gender discrimination become exacerbated and new forms of discrimination can emerge. With the exception of the biological and physiological reasons, the higher vulnerability of women is socially constructed and is due to differences in the socio-economic status of men and women. In the following subsections, we discuss the three main causes in turn. Needless to say, these causes are not independent but may easily reinforce each other. However, for explanatory purposes we discuss them separately and in turn.

Biological and physiological differences

Biological and physiological differences in disaster response capacity can lead to differential mortality rates for three main reasons. First, men can be physiologically better equipped to withstand a disaster's physical impact. For instance, if a woman is less strong than male counterparts, she will be more easily swept away by wind or water. On average, women can run less quickly and climb posts, trees and other rescue points with greater difficulty and lower speed. However, as an Oxfam International (2005) report on the December 2004 tsunami's impact on women in South and South-East Asia demonstrates, differences in self-rescue ability are partly determined by learned skills and therefore not simply down to physiological differences: In affected regions of Sri Lanka swimming and tree climbing were taught predominantly to boys and men to perform tasks "that are done nearly exclusively by men" (Oxfam International 2005: 9), which helped them to survive the waves. Also, as Ikeda (1995: 188) points out, one may ask why the body size of women is on average smaller and lighter.[4] Her study of gender differences in mortality from the 1991 Bangladesh cyclone shows how physical disadvantages interact with social norms and role behavior that put women at a disadvantage in their rescue efforts (we discuss these issues in more depths below). It is thus potentially misleading when a group of public health scholars attribute higher female to male mortality from the same event uncritically "to factors such as physical size, strength, and endurance" (Bern et al. 1993: 75).

Second, men and women have different propensities to die from various diseases, but the implications for gender-specific disaster mortality are ambiguous. With the possible exception of measles, for which some evidence suggests that women might be more susceptible to die from (Garenne 1995), in general men are more prone to acquire and die from parasitic and infectious diseases (Owens 2002). Toole (1997a) in his review of the literature comes to the conclusion that communicable disease epidemics are rare after most natural disasters, with the exception of droughts and famines. On the whole, there is no reason to suspect that diseases related to natural disasters will systematically disadvantage women. Furthermore, in principle, women are at an advantage in famines and droughts also because they can better cope with food shortages due to their lower nutritional requirements and higher body fat, unless they are pregnant or lactating (Rivers 1982). This can explain in part why overall mortality rates for females are often lower in many famines, particularly the very severe ones of the 19th and early 20th century, than they are for men (Macintyre 2002).[5] If, nevertheless, at the same time in some famines more female than male famine victims die at a very young age or as infants, this must be due to discriminatory access to food resources in times of famines with a bias against baby and children girls – see Mariam (1986: 57) for the Ethiopian famine of the early 1970s, Kidane (1989, 1990) for the Ethiopian famine of 1984/85, Greenough (1982) and Agarwal (1990: 225f.) for the Bengal famine of 1943/44 and Dyson (1991a, 1991b) for South Asian famines more generally.[6] There are no reliable statistics on the great Chinese famine of the early 1960s, but the account given by a surviving Chinese peasant woman is revealing: “Families tried to pool their rations and often the husband would rule that any female children should be allowed to die first…” (Becker 1996: 3).

Third, women in the final stages of pregnancy are less mobile and will find it difficult to rescue themselves. Furthermore, large-scale natural disasters can have severe detrimental effects on the social infrastructures of affected countries, reducing access to food, hygiene, health services and clean water (Noji 1997a). Due to their reproductive roles, women are particularly negatively affected if the basic health care infrastructure is severely damaged or health expenditures are reduced to re-allocate public funds for immediate disaster response purposes. The reason is that this will reduce obstetrical care and will increase the number of miscarriages as well as maternal and infant mortality.

Social Norms and Role Behavior

The discussion above would suggest that biologically or physiologically determined sex differences in disaster mortality exist, but that their impact is likely to be weaker than it appears at first sight. Social norms and role behavior might also provide reasons for gendered disaster vulnerability in putting women at a clear disadvantage when it comes to rescue attempts. We stress that even if women follow these social norms and role behaviors seemingly voluntarily, the norms and roles will often derive from the unequal distribution of power between men and women in many societies.

In many countries women are supposed to look after and protect children and the elderly as well as the family's domestic property, which hampers their own rescue efforts in almost any type of natural disaster (Beinin 1981; Schwoebel and Menon 2004; Oxfam International 2005). Dress codes can restrict women's ability to move quickly, while behavioral restrictions can hinder their ability to re-locate without their husband's, father's or brother's consent. For example, in rural Bangladesh women are expected to wear a *sari*, a traditional cloth that hampers running and swimming, and to remain in the *bari*, typically the houses of the family and near kin. This can impede their movement and their access to information about cyclone-induced floods (Ikeda 1995). Others report a social prejudice against women learning to swim, drastically reducing survival chances in flooding (Cannon 2000: 52).

In many societies there is a traditional division of labor that can disadvantage women in the event of certain natural disasters. Oxfam (2005) reports that many women in rural coastal areas of Indonesia were at home, whereas the men were out at sea fishing or otherwise away from home, when the Tsunami hit the coast. In India they were waiting at the seashore for the fishermen to arrive. In both cases, many more men were spared because the waves only gather height and strength as they approach shore and have their most fatal impact directly at the coast. Similarly, as concerns earthquakes, if men are out in the open or work in more robustly built factories and public buildings while women stay at home in houses and dwellings more easily struck down by earthquakes, then this type of natural disaster is likely to affect women more adversely, given that inadequate building structures are by far the main cause of earthquake fatality (Noji 1997b). Even when men are at home, this does not necessarily mean that they are equally affected as women. In earthquakes in India men reportedly survived better events that hit by night because they would sleep outside and on roof tops during warm nights, a behavior impossible for most women who literally became trapped in their domestic homes (Krishnaraj 1997).

Yet, as with biological and physiological causes for differential mortality rates, a caveat is in place here as well since differences in social roles and behavior need not always affect women more adversely. The effect really depends on the type of natural disaster. In particular, some evidence suggests that more men than women die directly from severe weather events in the United States such as lightning, thunderstorms and flash floods (Fothergill 1998). The same is reportedly true for immediate mortality from Hurricane Mitch in Central America in 1998 (Bradshaw 2004: 25). A likely reason is that on average more men are engaged in outdoors work and leisure activities during such events and are more reckless in their behavior toward risk. While it is difficult to say whether such findings generalize to other societies, the general point remains valid: social norms and role behavior will often put women at greater risk of disaster mortality, but this depends on the type of disaster and its context and at times social norms and role behavior can put men at greater risk instead.

Discrimination in Access to Resources and the Breakdown of Social Order

We have seen so far that biological and physiological differences as well as social norms and role behavior can disadvantage women in the event of natural disasters. Yet, we have also seen that the evidence is ambiguous on whether these differences will affect women more adversely to a large extent.

In this subsection, we argue that while the gender differences in casualty rates result only partly and potentially to a small part from the immediate effects of disasters, i.e. from, for example, collapsing buildings in earthquakes or flooded cities and villages, women are much more likely than men to die after the disaster happened. Those indirect effects can be explained by discrimination in access to resources and the temporary breakdown of social order. To start with, in societies with existing patterns of gender discrimination males are likely to be given preferential treatment in rescue efforts. A telling example is given by a father who – when unable to hold on to both his son and his daughter from being swept away by a tidal surge in the 1991 Cyclone in Bangladesh – released his daughter, because "(this) son has to carry on the family line" (quoted in Haider, Rahman and Huq 1993: 64). Men are also likely to access and allocate the assistance given to affected families. Even in the absence of natural disasters, Sen (1988: 454) finds that "there is a good deal of evidence from all over the world that food is often distributed very unequally within the family – with a distinct sex bias (against the female) and also an age bias (against the children)". Bairagi (1986) reports that female children were more adversely affected by famine in rural Bangladesh than boys. When natural disaster strikes, these pre-existing discriminatory practices become exacerbated and their detrimental health impact on women and girls intensified. Sen (1988: 459) reports how women and girls were systematically disadvantaged by food relief in the aftermath of flooding in West Bengal that destroyed crops and farmland. Enarson and Morrow (1998: 21) refer to a relief worker's finding of discriminatory access to relief supplies in the aftermath of the 1991 Bangladesh cyclone (Khondker (1996: 288) reports similar experiences). Ager, Ager and Long (1995) find in their study of Mozambican refugees in Malawi in the late 1990s that relief policies were biased in favor of refugee men. A fact sheet by the Pan-American Health Organization (2002) would suggest that this anecdotal evidence from a few natural disasters might be representative of a more general trend, also suggesting unequal power structures as the underlying cause: "The majority of relief efforts are intended for the entire population of a disaster-affected area, however, when they rely on existing structures of resource distribution that reflects the patriarchal structure of society, women are marginalized in their access to relief resources".

Natural disasters, if sufficiently strong, can also have both short-term and long-term negative effects on the affected economies (Benson and Clay 2000, 2003; Freeman 2000;

Hines and Jaramillo 2005). Some of these detrimental effects will be compensated for by increased migrants' remittances, foreign lending, aid and investment, but it takes time until they do so (Yang 2005). Women are likely to be adversely affected by damage to economic livelihoods as basic survival strategies such as securing water, food and wood for heating purposes often falls on women, representing an extra burden on top of the caring and nurturing for their family (Enarson 2000). Where natural disasters reduce the purchasing power of households, women can be more adversely affected because in many countries men receive preferential access to resources. When resources become scarcer, then the part of the population suffering from discrimination beforehand will necessarily be hit even harder (see Crow and Sultana (2002) for a study of gender-conflicts in access to water and its uses in Bangladesh). In principle, recovery assistance could be preferentially addressed at those groups most vulnerable to protect them from the negative effect of increased discrimination. Yet, as mentioned above already, instead of being granted a preferential role, women are often marginalized in their access to relief resources (Pan-American Health Organization 2002). Many disaster researchers have noted that in most countries relief efforts are almost exclusively managed and controlled by men, systematically excluding women, their needs, competences and experiences from contributing to these efforts (see, for example, Enarson 2000; Bradshaw 2004).[7]

There is widespread agreement that the poor are more adversely hit by the impact of natural disasters than the better-off.[8] For example, they are less likely to be able to afford housing that can withstand seismic activity, often live in flood- and storm-prone areas as well as on unstable slopes vulnerable to landslides and they have less access to education and financial resources to overcome adverse impacts (Noji 1997a: 12). While some have questioned the full extent to which existing evidence backs up the claim of a strong gender bias in poverty (Chant 2005), there is general agreement that poor people on average are more likely to be female. In combination, this implies that women will be more adversely affected by natural disasters since they are more than proportionally represented among the poor. For instance, O'Hare (2001) finds that the most vulnerable group affected by Hurricane 07B in the Godavari Delta in India were "migrant, scheduled (low) caste women" who formed the major part of the landless agricultural laborers. The vulnerability resulting from predominantly female poverty is not confined to developing countries, however. For example, UNEP (2004) cites a study by the Japanese government stating that during the Kobe earthquake in 1995 1.5 times as many women as men died. In Kobe, many elderly single women died because they lived in poor residential areas, which were more heavily damaged and more likely to catch fire.[9]

Lastly, there is some evidence, if not fully conclusive, that domestic and sexual violence against women increases due to disaster-induced stress, alcohol abuse and the (temporary) breakdown of law and order (Bradshaw 2004). If police, military and fire brigades are unable (or unwilling) to organize the most severely affected regions, then distributive conflicts, theft and open violence are likely to emerge. A collapse of social order may be more likely in countries in which the political authority is weak. However, the Post-Katrina riots in New Orleans have demonstrated that even superpowers are not safe from disaster-related social unrest.

What is relatively well documented is that law and order are difficult to sustain when victims of natural disasters have to seek refuge in makeshift refugee camps often far away from their home cities or villages (Phuong 2004). In overcrowded camps anarchy rules leaving unaccompanied women and girls particularly vulnerable to sexual abuse and rape. In addition, women and girls are also more negatively affected by the often appalling health and hygienic conditions in refugee camps, as already pointed out above. This situation can become exacerbated if culturally binding norms allow certain forms of female hygienic care only under conditions of privacy and separation from men, which are often impossible to maintain in refugee camps. Toole (1997b) reports mortality rates from several refugee camps that are up to 100 times higher than the normal mortality rate in the country. Data disaggregated according to gender is very rare, but Toole reports data from a Burmese refugee camp in Bangladesh where female infants were twice as likely to die than male infants and the mortality rates of females above the age of five was 3.5 times higher than that of males.

Hypotheses

Biological and physiological differences between men and women, social norms and roles, which restrict the behavior of men and women differently, emergent resource shortages and the temporary breakdown of social order jointly suggest that more women and girls than men and boys die during and after natural disasters or die at a younger age. Yet, the theoretical considerations of the previous sections also suggest that this effect is conditional on the socio-economic status of women and gender relations in the society affected by the disaster. Therefore, we postulate two hypotheses concerning the impact of natural disasters on the gender gap in life expectancy:

Hypothesis 1: Natural disasters reduce the life expectancy of women more than that of men and the effect is increasing in disaster strength.

This is partly because only larger disasters will kill enough people overall to leave their mark on our life expectancy measures but, more importantly, also because only larger disasters lead to the breakdown of infrastructure and law and order and to the drastically intensified competition for food and other scarce resources leaving women in societies with rampant discrimination against females more vulnerable to disaster-induced mortality.

Hypothesis 2: Natural disasters reduce the life expectancy of women relative to that of men the more the lower is the socio-economic status of women.

We expect that women are more adversely affected by natural disasters where female discrimination is more widespread before the onset of natural disaster events. Where there is a pro-male bias in "normal" periods, such bias will become reinforced and exacerbated in after-disaster periods (Drèze and Sen 1989: 55; Bolin, Jackson and Crist 1998: 42). Women are more adversely hit by natural disasters if gender inequalities in access to information and economic resources and inequalities in personal freedom of choice before, during and after disasters create a "gendered disaster vulnerability" (Enarson 1998).

Research Design

Following on from the formulation of testable hypotheses in the preceding section, here we discuss how we measure and operationalize the three main concepts of our analysis.

Measuring Disaster Strength

For most countries in the world, natural disasters are a relatively common event. Our source, the Emergency Disasters Data Base (EM-DAT), collected at the University of Louvain, Brussels, currently includes around 9,700 natural disasters from 1900 to present. Due to limited data availability on our measure of women's socio-economic status, our sample is restricted to the period 1981 to 2002. The sample still covers 4,605 natural disasters since the coverage of natural disasters in EM-DAT is not very comprehensive for the first few decades of the last century. EM-DAT is the only global data set of natural disasters that is publicly available. Two other global data sets are maintained by private re-insurance companies (Swiss Re and Munich Re), but no public access is granted (Guha-Sapir and Below 2002).

To be recorded in the database, an event must fulfill at least one of the following conditions: a) ten or more people reported as killed; b) 100 people reported as affected; c) a state of emergency has been declared; or d) the country has issued a call for international assistance. Clearly, with the latter two criteria the inclusion of an event in the database is partially endogenous to the response of governmental authorities in affected regions, states or countries. Platt (1999) shows for the case of the United States how the political struggle over who pays how much for the costs of natural disasters influences the likelihood of an event being declared a "major disaster". It is probable that political considerations will affect the likelihood of declaration of state of emergency or, depending on the circumstances, a call for international assistance, in other countries as well. We see no reason why this should bias our results since such political considerations are unlikely to be systematically correlated with our variables of interest. Nevertheless, we will show below that our results uphold if we restrict the sample to observations with ten or more people killed.

Most disasters take place in large countries, with the US (442) leading the list followed by India (293) and China (125). On the bottom end of the number of disaster ranking, we find microstates but also Finland (1), Turkmenistan (2) and Sweden (4). Ethiopia (311,286), Sudan (158,252) and Bangladesh (149,225) had the most victims in absolute numbers, while the respective figure for the USA is 8,001 disaster victims. Accordingly, we find relatively poor countries suffering relatively more from disasters in terms of people killed than relatively rich countries. With drought- and famine-ridden countries leading the loss of victims per disaster (Ethiopia 4716, Sudan 3297, Mozambique 2374), only about 18 people die from the average disaster in the US.

The number of deaths per disaster offers just a poor description of the nature of our data. In fact, while most natural disasters cost few if any lives, the three most severe disasters – the droughts in Ethiopia and Sudan in 1984 and the flood in Bangladesh in 1991 – account for almost half of all fatalities in our sample. In other words, severe disasters are rare events. As a consequence, the distribution of the disaster strength variable is extremely skewed. It follows that we need to carefully check the validity of our results with regards to the leverage that certain influential observations might have on the results (see our bootstrap estimations below).

In operationalizing the EM-DAT data we have made three important choices: First, for the purpose of this study, we decided not to focus on a specific disaster type but to consider all types for which EM-DAT provides information together. Our measure of natural disasters includes droughts, earthquakes, epidemics, extreme temperatures, famines, fires, floods, insect infestations, landslides, volcano eruptions, waves/surges, and wind storms. Table 1 provides some summary statistics on each disaster type. We recognize that famines in particular are often triggered by both natural factors and human-made decisions, but like Drèze and Sen (1989) we believe that these events cannot be neatly separated into "human-made" and "nature-made" types. We exclude disasters triggered by technological hazards such as the large-scale industrial accidents of Bhopal or Chernobyl since they are clearly human-made. Our decision to address all natural disasters together makes it impossible to detect differences between the effects of various disaster types on the gender gap in life expectancy, but we believe that this is inevitable for essentially two reasons. First, the variance of some subcategories of natural disasters is too low to allow sufficiently efficient estimation. Second, the EM-DAT unique categorization of each natural disaster into a specific disaster type is open to contestation. A natural disaster is thus, for example, a drought or a famine or a flood even though in the actual event most people might die from epidemics.

< Insert Table 1 around here >

Second, since our theoretical considerations suggest that the impact on the gender gap in life expectancy increases with the magnitude of disaster, we cannot simply use dummy variables for disaster events, but need a measure of disaster strength instead. We consider the number of people killed (rather than, for example, the number of people being affected) as the most important information of the magnitude of a disaster. We believe that the number of people killed is a better proxy of disaster strength because it is by far less arbitrary than the accounts of the number of people affected. EM-DAT defines the category of affected people as all those requiring immediate assistance. But the number of affected people, thus defined, is much more difficult to estimate and estimates from different sources will vary much more dramatically than the number of people killed. Guha-Sapir and Below (2002) provide some evidence that the number of people killed can be estimated with higher accuracy than the number of people affected. In a comparative analysis of the way disasters in four disaster-prone countries are recorded in EM-DAT and the data sets maintained by Munich Re and Swiss Re, they found that estimates of the number of people killed for the same disasters were fairly close across the three data sets, whereas the estimates of the number of people affected varied widely and sometimes by orders of magnitude. Quarantelli (2001: 326) in his critique of disaster statistics also agrees that "figures on deaths are certainly the most reliable". Of course, we agree with his verdict that even estimates of fatality figures are often subject to uncertainties and, sometimes, deliberate distortions, possibly on average tending to overestimate true casualty figures (Quarantelli 2002: 329). The number of killed persons as our disaster strength variable is therefore a proxy rather than an exact measure of the severity of disaster and there is likely to be measurement error in the variable. However, as long as the error is not systematically correlated with the gender gap in life expectancy, for which we see no reason why this should be the case, the measurement error will make our estimates less efficient, but will not bias them.

Third, we divide the number of people killed by total population size of the country hit by the disaster. The use of per capita data is analytically warranted since the influence of natural disasters on an affected country's life expectancy not only depends on the magnitude of the disaster but also on the population size of the affected country. Everything else being equal, disasters of a given size reduce the life expectancy the more, the smaller is the population size of the country under observation. The same should hold true when we consider the gender gap in life expectancy rather than life expectancy itself. A disaster that has no influence on the life expectancy can hardly affect the gender gap.[10] Ideally, we would have life expectancy data for sub-national regions, so that we could easily estimate the immediate and lingering consequences of a disaster on the affected population. Unfortunately, this information does not exist. The data we have allows analyzing only the average life expectancy at the level of the nation state. Hence, our disaster strength variable is the cumulated number of people killed by all natural disasters in a given year divided by the affected country's total population.

The Gender Gap in Life Expectancy

To measure the size of the gender gap, we employ data provided by the US Census's International Data Base (IDB), which to our knowledge is the most reliable source for life expectancy data in panel form. In comparison to data provided by the World Bank (2004), the IDP is much better maintained and has by far less missing data. The IDP was created for scientific purposes – in response to the information requirements of International Program Center (IPC) staff to meet the needs of organizations that sponsor research efforts. The IDB combines data from country sources (especially censuses and surveys) with IPC's estimates and projections, which are based on available census data and group cohort population projection techniques to compute data between the censuses. These projections are based on country-specific fixed-slope logistic interpolations in the years between national censuses. Moreover, recent population and socio-economic trends are taken into account "if the projected trends are plausible" (US Census 2004: B5). For instance, projection of fertility utilizes trends in age at marriage, the percentage of women using contraception, existence and scope of family-planning programs and data on educational attainment are used in life expectancy calculations.[11]

The gender gap in life expectancy shows large variations across time and space. On average, women's life expectancy is 4.69 years higher than that of men. However, in 64 out of 2266 country-years men actually lived longer than women. In Bangladesh, India and Nepal this phenomenon is common and can possibly be attributed to the traditional cultural bias against females in these countries. In all other cases a higher male than female life expectancy is the exception rather than the rule. On the other end of the spectrum, the gender gap is largest in post-transition Russia. The life expectancy difference between Russian women and men peaked in 1994 reaching an extraordinary 13.74 years.[12] Noteworthy, countries from the former Soviet Union hold 49 of the top 50 country-years in terms of gender gap – the notable exception being Guatemala in 1981. In all these cases, women lived about 70 to 75 years while men on average died at the age of 60 or before.

We use as our dependent variable the ratio rather than the absolute difference in years of female to male life expectancy. The reason is that, under certain conditions[13], changes in the absolute difference of female to male life expectancy can be a misleading indicator of the health effects of events. Therefore, if we measured the gender gap as the absolute difference between the life expectancies of women and men, it is possible that even though an equal number of men and women die, the gender gap is still decreasing. This, in turn, implies that it is possible that male and female life expectancy can decrease by the same number of years and yet more men had died than women. Furthermore, equal proportional decreases in male and female life expectancy will lead to a larger absolute fall in the life expectancy of the gender with the higher ex ante life expectancy – typically the female life expectancy. This problem is accounted for if we measure the gender gap as the ratio of female to male life expectancy. To be on the safe side, we additionally add the absolute change in population life expectancy as a regressor. In simulations, we found that using the life expectancy ratio and controlling for the absolute changes in population life expectancy removes the distortions that result from the computation of life expectancies.

While at least in our view the IDB data is superior to all alternatives, it does not come without potential drawbacks. Most importantly, the analyses of IDB data must almost necessarily suffer from correlated errors, since models that are used to predict the values of a certain variable can neither avoid systematic errors nor can it guarantee serial independence of observations. The imputed data for year t+1 cannot be independent of the observation in year t, may that year be imputed or not. Any regression analysis based on this data inherits these systematic errors. Fortunately, since we have panel data we can use a random-effects estimator with an assumed first-order autoregressive error that deals with the problem of auto-correlation (see the description of the estimation procedure below).

Women's Socio-Economic Status

To measure the socio-economic status of women in society we use a measure of women's economic and social rights, taken from Cingranelli and Richards' (2004) Human Rights Database. Using the annual United States State Department's *Country Reports on Human Rights Practices*, Cingranelli and Richards code a discrete variable for economic and social rights that each takes on one of four values. We add both variables to create a combined measure of women's socio-economic rights. The appendix provides details on the range of rights covered and the coding scheme used. Unfortunately, this variable is only available for

1981 onwards, which restricts our analysis to the years 1981 to 2002, after which we have no information on other variables either.

Control Variables

Life expectancy and the gender gap therein are a product of geographical, social, economic and political influences. Some of these influences could be correlated with the variables of our main interest. For instance, the expected number of deaths in a disaster is negatively related to the wealth of the country. Omitted variables correlated with the exogenous variables of interest cause bias when they also exert an influence on the dependent variable. To minimize bias, we follow two strategies: First, climatic and other geographical differences as well as genetic conditions can impact the gender gap in life expectancy and are (approximately) time-invariant (UN Population Division 1988). We therefore include regional dummy variables in our estimations. Second, with per capita income, political stability and the level of political suppression we add three important time-variant control variables. Data on per capita income is taken from World Bank (2004). Regime stability is defined as the number of years since the most recent three-point change on the so-called Polity score, which is a measure of institutionalized democracy and autocracy popular in political sciences, or the end of transition from a period of lack of stable political institutions (data from www.cidcm.umd.edu/inscr/polity/). Political suppression is measured by data provided by Freedom House (2004), which bases its scale on expert judgment of the extent of violation of civil and political rights in countries.

Other socio-economic variables of potential additional interest, such as health expenditures, access to food, and safe water and clean sanitation are not available for many countries in our sample. Moreover, while the severity of disasters is partly determined by per capita income (Kahn 2005) and (possibly) the level of democracy, the infrequent outbreak of disasters eliminates the potential correlation between our control variables and disaster strength. In fact, the correlation coefficient between the disaster strength and the control variables does not exceed 0.06 in our sample. Thus, from an econometric point of view, the inclusion of these variables is therefore neither recommended nor warranted.

Estimation Procedure

Our data set consists of annual observations at the country level over the years 1981 to 2002 for up to 141 countries, but the amount of information available for each country may vary. It thus consists of what is commonly known as cross-national, time-series or unbalanced panel data. Analysis of panel data has to deal with the two classical problems of serial correlation and various types of unit heterogeneity. To obtain unbiased and efficient estimates of the model at hand, the estimation procedure of choice has to resolve both problems without causing too many unwanted side effects (Adolph et al. 2005; Plümper et al. 2005). As mentioned already we use a random-effects estimator with an assumed first-order autoregressive error that deals with the problem of auto-correlation. To account for some heterogeneity across countries, we include regional dummy variables. The regions are North America, Central America, South America, Western Europe, Eastern Europe, West Africa, Southern Africa, Northern Africa, West Asia, South and East Asia, and Australia and Oceania.

Estimation Results

Main Results

Our theory predicts a significantly negative effect of the disaster strength variable on the gender gap in life expectancy, and a significantly positive interaction effect of women's rights and disaster strength. Table 2 reports the results from two estimates: model 1 is the baseline model that merely includes disaster strength, women's socio-economic rights and their interaction effect, while table 3 adds the control variables. A comparison of the two models shows that the addition of the controls makes practically no difference to the results on our main variables of interest.

< Insert Table 2 around here >

Table 2 lends support to our hypotheses. We find that the gender gap in life expectancy declines with disaster strength (hypothesis 1). We also find that a higher level of women's socio-economic rights offsets the negative effect of natural disasters on women, which supports our second hypothesis. The coefficient has the expected positive sign and size.[14] It suggests that the adverse effect of natural disasters on the gender gap in life expectancy is conditioned upon the socio-economic status of women in society. In countries with better rights for women, the adverse impact of natural disasters on women's life expectancy relative to men vanishes.

Robustness analysis

We conducted a number of robustness tests – see table 3, which starts by replicating our model 1 for comparative purposes.

< Insert Table 3 around here >

We find that the negative effect of natural disasters on the gender gap in life expectancy decreases with higher levels of women's socio-economic rights. Western countries are characterized by both low natural disaster intensity (in terms of people killed relative to population size) and high women's socio-economic rights. This begs the question whether our results are perhaps driven by the inclusion of this group of countries in our sample. To check this, in model 2 we exclude Canada, the United States, Western European countries as well as Japan, Australia and New Zealand from the sample. The results are hardly affected. Next, we have mentioned above that what counts as a natural disaster in our source, EM-DAT, can be triggered by the declaration of a state of emergency or a call for international assistance, which may be subject to political considerations. Another criterion – number of people killed is ten or more – is far less subject to political influence, unless a country manages to hide or artificially inflate disaster deaths. To check that declarations of state of emergency and calls for international assistance do not bias our results, we include in model 4 only observations with ten or more people killed. The results uphold. In model 5 we exclude droughts and famines from the definition of natural disasters, as these are events of a more chronic nature. In model 6, we do the opposite and exclude all natural disasters other than droughts and famines. In model 5, the disaster strength variable and its interaction effect become marginally insignificant. However, this is due to the increase in the standard error following the reduction in the variance of the disaster variable for the remaining disaster types, which renders estimation less efficient. Importantly, the coefficients remain very similar. Results from model 6 are again similar to results from model 1.

We have noted already that severe natural disasters are a rather rare event. While the main results reported above support our theoretical expectations well, the question is whether they are driven by a few very influential disaster observations. To check this, we now apply a bootstrap estimation of standard errors. The purpose of this test is to see whether the statistical significance of our main variables of interest is robust or is due to the particular population sample at hand. To save space, we report only results of applying the bootstrap test on results of model 1. Applying it to the results for model 2 as well makes little difference. The bootstrap is a re-sampling technique, which sheds some light on the distributional properties of statistics, but it is also useful as a means of obtaining more robust standard errors. The bootstrap algorithm draws repeated re-samples (with replacement) from the given population, and then estimates the model at hand. Hence, the sample that we estimate always has the same size as model 1, but the composition of the samples varies, because a single observation from the original dataset can be drawn repeatedly (which implies that other observation will not be included in that estimate). Commonly used replications are 100, 500, or 1000. The t-statistics averaged across a series of say 1000 samples necessarily have a larger standard error than the model estimated on the basis of the total population. Table 4 reports results on our variables of interest from the bootstrap test with 1000 replications. They suggest that the disaster strength variable and its interaction effect with women's economic rights remain statistically significant even if the standard errors are bootstrapped. Moreover, we find that the bias corrected estimates of our coefficients and the standard errors diverge no more than moderately from the results reported in table 2. It is typically assumed that if the bias is larger than 25 percent of the standard error of the sampling distribution, the bias corrected confidence intervals are likely to be more appropriate than the normal confidence intervals. In our case, the bias is smaller than 25 percent. Our interpretation of model 1 thus remains valid. In other words, we can be fairly certain that the statistical significance of our main variables of interest do not depend on outliers.

< Insert Table 4 around here >

Conclusion

Geographers and other social scientists have argued for many years that there is little natural about the impact of natural disasters on affected people. As O'Keefe, Westgate and Wisner (1976) have put it in the title of their early contribution to *Nature*, "taking the naturalness out of natural disasters" is what is needed. Natural disasters do not affect people equally as if by an arbitrary stroke of nature. Instead, the disaster impact is contingent on the vulnerability of affected people, which can and often does systematically differ across economic class, ethnicity, gender and other factors.

In this article, we addressed one specific impact of natural disasters (disaster mortality) and how it affects women differentially from men. We observed a systematic effect of disaster strength on the gender gap in life expectancy if the disaster affected societies, in which the socio-economic status of women is low. In such societies, natural disasters will kill, directly and indirectly via related post-disaster events, more women than men or will kill women at a younger age than men. These findings support a vulnerability approach to natural disasters. There are few reasons why female life expectancy should be systematically more adversely affected by natural disasters than that of men were it only for reasons determined by nature, such as biological and physiological differences that on average disadvantage women and girls relative to men and boys. A systematic effect on the gender gap in life expectancy is only plausible if natural disasters exacerbate previously existing patterns of discrimination that render females more vulnerable to the fatal impact of disasters. That this is no mere speculation is demonstrated by the fact that the adverse impact of disasters on females relative to men vanishes with rising socio-economic status of women. We acknowledge, however, that much more inter-disciplinary research between medical and social scientists is needed to fully understand the interplay between mortality and gender in the presence of natural disasters. We also need more research to fully understand why and how disaster strength interacts with mortality in general and with female mortality in particular.

Our findings require relevant stakeholders to go beyond technical fixes in dealing with natural disasters. True, the underlying cultural, social and economic patterns that lead to a low socio-economic status of women and thereby generate their specific vulnerability to natural disasters are not easy to deal with. But this does not mean that nothing can be done. Our finding that, on average, large natural disasters lower the life expectancy of women more than that of men and particularly so where women have a lower socio-economic status implies that policy makers, non-governmental organizations and the academic community need to pay closer attention to the gendered nature of disaster vulnerability. Such attention should focus on the special medical, economic and security needs of women in the aftermath of disasters as well as on mechanisms to ensure fair and non-discriminatory allocation of relief resources. Developing such policies will not entirely prevent the adverse impact of large-scale natural disasters on women in societies where their everyday socio-economic status is low. Such policies should, however, reduce the excess disaster mortality of women compared to that of men.

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NOTES

1 We agree with Varley (1994: 4f.) that the vulnerability approach as an analytical concept is applicable even if one does not subscribe to the critique of capitalism embraced by some of its proponents (see Wisner 2000a, 2000b and references cited in Varley 1994: 4). Albala-Bertrand (1993) applies the vulnerability approach within the framework of mainstream economics.

2 Cutter (2003: 7-8) herself describes a number of most significant themes for a geographical research agenda of vulnerability science.

3 See Plümper and Neumayer (2006) for similar results on the influence of militarized conflict on the gender gap in life expectancy.

4 Indeed, based on twin research, medical research has demonstrated that 'environmental factors' (year of birth, region, childhood living conditions, and education) influenced body-height (Silventoinen et al. 2000). This research shows that biological sex differences are not independent of gender relations – though of course gender differences fall far short of explaining physical differences across sexes in its entirety.

5 Other reasons include the typical out-migration of men, which makes them vulnerable to accidents, attacks and the acquisition of infectious diseases, as well as the reduced fertility rate of women during famines compared to non-famine years (Dyson 1991b; Macintyre 2002).

6 De Waal (1989), however, finds no significant sex differences in child excess mortality in his case study of famine mortality during 1984/85 in Darfur, Sudan, except for the age group between five and nine where more boys seem to have died.

7 While Aquino et al. (1992) argue that unequal distribution of resources leads to less cooperation, Kramer (1990) demonstrates that not only does an increase in resource scarcity foster cooperation, the increase in cooperation may even partly offset the adverse effects of scarcity. More recently, Hausken (1999) has shown that within-group competition increases if between-group competition becomes fiercer. His findings suggest that resource scarcity may actually increase both cooperation and conflict in a society. Our argument here is consistent with all these diverse arguments and findings, as we simply claim that if resources become scarce, distributive issues become more important. Under this condition, the extent of cooperation determines how many individuals will suffer; societal norms, however, determine which individuals will suffer the most.

8 This is true even for highly developed countries like the United States as the televised pictures of New Orleans in the wake of hurricane Katrina showed so vividly. The overview article by Fothergill and Peek (2004) demonstrates that this represents a general pattern.

9 Seager (2005) in a commentary published by the Chicago Tribune presented anecdotal evidence according to which most people trapped in New Orleans in the aftermath of hurricane Katrina were (black) women (see also Seager 2006). She estimates that 80 percent of those who did not leave the city within time were women and speculates that a similar ratio will apply to the sex difference in fatalities. However, at least as concerns direct and identified victims from Katrina, the statistics published by the State of Louisiana's Department of Health and Hospitals would suggest that while the victims were predominantly old and African American, an about equal number of men and women died (http://www.dhh.louisiana.gov/offices/publications/pubs-192/Deceased%20Victims_2-23-2006_information.pdf - last accessed 11 July 2006). The possibility remains that more women may have died in the aftermath of and as the indirect consequence of Katrina.

10 The argument that the average life expectancy may remain constant if the female life expectancy declines while the male life expectancy increases is not valid, because natural disasters do not increase the life expectancy of a large subgroup of the population.

11 Recently, the World Health Organization has developed new data on Disability Adjusted Life Years (DALYs) lost that represent a very comprehensive and data-intensive measure with less measurement errors than the standard life expectancy measures. DALYs are calculated for individual major disease categories and reflect the years of life lost due to death in the fatal cases as well as the expected disability caused by a disease in non-fatal cases. The great disadvantage is that DALYs are not yet available over a longer period of time, allowing only a cross-sectional analysis, which is a major drawback as explained in the text. Also, while non-adjusted life expectancy is theoretically inferior to disability-adjusted life expectancy, we note that the WHO itself has pointed out that the two are very highly correlated (Mathers et al. 2001, figure 4).

12 Reasons were manifold. While Andreev et al. (2003) hold the Russian health care system responsible, other sources report a steep increase in alcohol abuse and deaths from organized crime (McKee 1999).

13 Changes in mortality rates of a specific age cohort affect also person-years lived of older age cohorts due to changes to the number of survivors to older age and this has a larger effect on life expectancy at birth if the life expectancy of the age cohort is higher (Preston et al. 2001: 64). Natural disasters would

lead to relatively larger changes in the gender gap in life expectancy if the persons killed have not yet reached age cohorts that show large gender differences in mortality rates. For example, if most individuals killed in a disaster and its aftermath are below 30 years old and if women above 30 are less likely to die at a certain age than men of the same age and women's life expectancy at birth is higher, then the change in the absolute difference between female and male life expectancy is a biased proxy for the mortality rates of that conflict.

14 Given the estimated coefficients, theoretically there exist combinations of high values of both disaster strength and women's economic rights that would suggest an overall increase in the gender gap in life expectancy. However, such combinations do not exist in our sample.

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Table 1. Summary Statistics on Natural Disasters in Sample.

Disaster type	Total no. of events	Total no. of deaths	Total no. of people affected
Drought	240	556,687	1,388,252,544
Earthquake	350	107,050	52,661,238
Epidemic	317	105,678	13,346,403
Extreme temp	108	16,897	6,120,497
Famine	36	11,524	57,332,711
Flood	938	119,707	1,731,081,382
Insect infestations	42	0	2,200
Landslide	182	14,228	1,122,215
Volcano	48	25,053	2,501,368
Waves/surges	12	2,724	12,919
Wild Fire	103	624	3,523,398
Wind Storm	1,121	87,029	340,100,574

Table 2. Natural Disasters and the Change in the Gender Gap in Life Expectancy.

	model 1	model 2
change in population life expectancy	0.028	0.028
	(0.009)**	(0.009)**
disaster deaths per thousand people	-0.732	-0.729
	(0.081)**	(0.081)**
women’s socio-economic rights	-0.049	-0.045
	(0.030)	(0.030)
disaster deaths * women’s socio-economic rights	0.365	0.365
	(0.052)**	(0.052)**
per capita income		-0.000
		(0.000)
political stability		-0.005
		(0.004)
level of political freedom		-0.072
		(0.021)**
Number of observations	2266	2241
Number of countries	141	141
R^2	0.29	0.28
Wald chi-square test	190.1**	206.3**

Notes: Estimations include regional dummy variables and constant (coefficients not reported)
**=p<0.01 (two-sided z-test), standard errors in brackets

Table 3. Extended estimation results.

	model 1	model 3	model 4	model 5	model 6
change in population life expectancy	0.028	0.030	0.017	0.036	0.026
	(0.009)**	(0.011)**	(0.033)	(0.010)**	(0.009)**
disaster deaths per thousand people	-0.732	-0.743	-0.377	-1.005	-0.772
	(0.081)**	(0.095)**	(0.123)**	(0.692)	(0.083)**
women's socio-economic rights	-0.049	-0.050	-0.135	-0.028	-0.045
	(0.030)	(0.039)	(0.066)*	(0.030)	(0.030)
disaster deaths * women's socio-economic rights	0.365	0.385	0.178	0.326	0.431
	(0.052)**	(0.065)**	(0.075)*	(0.241)	(0.060)**
Number of observations	2266	1491	894	2266	2266
Number of countries	141	117	121	141	141
R^2	0.29	0.28	0.29	0.29	0.29
Wald chi-square test	190.1**	146.9**	77.4**	108.9**	193.5**

Notes: Estimations include regional dummy variables and constant (coefficients not reported) **=p<0.01 *=p<0.05 (two-sided z-test), standard errors in brackets

Table 4. Estimation results with bootstrapped standard errors.

	observed	bias	std. error	confidence	interval	
beta coefficients						
disaster deaths per thousand people	-0.7448	0.1342	0.6685	-2.0565	0.5670	(N)
				-1.7311	0.3787	(P)
				-1.7653	0.3511	(BC)
women's economic rights	-0.0484	-0.0025	0.0390	-0.1248	0.0281	(N)
				-0.1319	0.0214	(P)
				-0.1291	0.0215	(BC)
disaster deaths * women's economic rights	0.3615	-0.0730	0.3250	-0.2763	0.9993	(N)
				-0.1830	0.8356	(P)
				-0.1595	0.8702	(BC)
standard errors						
disaster deaths per thousand people	0.0762	0.0232	0.0764	-0.0737	0.2261	(N)
				0.0486	0.3538	(P)
				0.0490	0.3634	(BC)
women's economic rights	0.0284	-0.0011	0.0029	0.0227	0.0340	(N)
				0.0215	0.0332	(P)
				0.0236	0.0351	(BC)
disaster deaths * women's economic rights	0.0488	0.0119	0.0315	-0.0130	0.1105	(N)
				0.0341	0.1623	(P)
				0.0310	0.1176	(BC)

N = normal   P = percentile   BC = bias corrected

Appendix. Coding scheme for Cingranelli and Richards' (2004) women's rights measures

The measure of economic rights covers the following:

- Equal pay for equal work
- Free choice of profession or employment without the need to obtain a husband or male relative's consent
- The right to gainful employment without the need to obtain a husband or male relative's consent
- Equality in hiring and promotion practices
- Job security (maternity leave, unemployment benefits, no arbitrary firing or layoffs, etc.)
- Non-discrimination by employers
- The right to be free from sexual harassment in the workplace
- The right to work at night
- The right to work in occupations classified as dangerous
- The right to work in the military and the police force

The measure of social rights covers the following:

- The right to equal inheritance
- The right to enter into marriage on a basis of equality with men
- The right to travel abroad
- The right to obtain a passport
- The right to confer citizenship to children or a husband
- The right to initiate a divorce
- The right to own, acquire, manage, and retain property brought into marriage

- The right to participate in social, cultural, and community activities
- The right to an education
- The freedom to choose a residence/domicile
- Freedom from female genital mutilation (FGM) of children and of adults without their
- consent
- Freedom from forced sterilization

The coding of the variables is as follows:

(0) There are no economic (social) rights for women under law and systematic discrimination based on sex may be built into the law. The government tolerates a high level of discrimination against women.

(1) There are some economic (social) rights for women under law. However, in practice, the government *does not* enforce the laws effectively or enforcement of laws is weak. The government tolerates a *moderate level* of discrimination against women.

(2) There are some economic (social) rights for women under law. In practice, the government DOES enforce these laws effectively. However, the government still tolerates a *low level* of discrimination against women.

(3) All or nearly all of women's economic (social) rights are guaranteed by law. In practice, the government fully and vigorously enforces these laws. The government tolerates none or almost no discrimination against women.