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Social and Governance Dimensions of Climate Change

Implications for Policy

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Abstract

This paper addresses two vital concerns in the debate on adaptation to climate change. First, how can countries prepare to manage the impact of climate-change induced natural disasters? Second, how can countries ensure that they have the governmental institutions required to manage the phenomenal challenge of adaptation to climate change? A range of economic and institutional measures are tested for their potential effects on natural disaster resilience and the quality of environmental governance. The findings suggest an important role is played by social and political institutions in determining the ability of countries to adapt to climate change and respond to natural disasters, in particular in the degree to which countries have succeeded in gender empowerment and the development of a robust civil society and nonprofit sector. As the climate change challenge moves from that of "proving the facts" to that of "implementing change," the authors suggest that international policymakers, donors, and activists must increasingly focus on building domestic policy environments that are conducive to the delivery of more effective environmental legislation, for example through implementation of gender quotas and provision of support to civil society groups.

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Social and Governance Dimensions of Climate Change: Implications for Policy

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The Stern Review has argued that climate change is the 'greatest and widest ranging market failure ever seen' (Stern et al. 2006). As a result of the emissions released by the past and present population of a subset of the world's nations, future generations across the globe must bear the costs of climate change adaptation, regardless of their degree of responsibility. This is particularly the case among developing countries, whose per capita emissions remain low yet many of which face acute challenges with regard to phenomena such as desertification, rising sea levels, and the frequency of natural disasters. In order to meet such challenges, these countries are likely to require substantial donor aid from international development organizations in the years to come, as well as substantial technical assistance.

One important aspect of adaptation cost is in the form of prevention and response to natural disasters – events involving dramatic though poorly anticipated geographic change such as floods, droughts, heat waves, earthquakes, and tsunamis. Natural disasters are responsible for thousands of deaths every year due to their direct impact on vulnerable communities, and millions of deaths every year due to their indirect effects via damage to health, sanitation, and irrigation infrastructure. Alterations in the climate, or 'climate change,' will produce a higher degree of natural disasters, as these by definition are extreme weather events, where 'extreme' is defined in relation to human expectations and capacities. As low-income societies are increasingly faced with unexpected climatic phenomena, to which their infrastructure is poorly adapted, the rate of natural disasters is expected to increase in coming years. Between 1971 and 1995 these caused an average of 128,000 deaths per year, affected 136 million people, and caused a total $439bn of damages; of those affected by natural hazards between 1971 and 1995, 99 per cent were individuals living in the global South (IFRC 1997).

Section 1.0 of this paper begins by assessing the ability of countries to manage the costs of climate change adaptation, looking at success and failure at managing natural disasters - with 'success' defined in terms of a lower rate of deaths relative to the number of disasters faced by a society. In examining this issue, we use data published by the Centre for Research on the Epidemiology of Disasters as part of their recently assembled EM-DAT database (CRED 2004). As well as including economic and demographic variables (such as income per capita and population density), we assess the role of difference political and social institutions in determining the capacity of societies to respond effectively to the onset of natural disaster, using composite institutional indices developed within the World Bank. Specifically, we make use of the Worldwide Governance Indicators, as measures of different dimensions of state effectiveness (Kaufmann, Kraay and Maastruzzi 2008), and the Indices of Social Development, as measures of such areas as intergroup cohesion and the density of civil society (World Bank 2008).

Having examined the determinants of effectiveness at natural disaster management, Section 2.0 turns to the question of environmental governance – the success or failure of states at achieving climate change mitigation and adaptation tasks, such as limitation of emissions, improvements in air and water quality, recycling. Though analysts and policymakers have often simply taken for granted the willingness and ability of states to

implement the 'right' policies once the science of climate change is adequately proven, neither government commitment to implementing such policies, nor the state capacity to see such policies through to their logical outcomes, can be assumed as given. This paper examines the 'political economy' of country climate change strategies, by presenting findings on cross-country variation in the seriousness and success of governments in responding to environmental management obligations. As measures of environmental governance, we take the Index of Environmental Sustainability (ESI) developed by Yale University (Yale Center for Environmental Law and Policy) and Columbia University (Center for International Earth Science Information Network) in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission, and the Environmental Performance Index (EPI), by the same authors. Again, as independent variables we include economic and demographic controls, but additionally examine the impact of social institutions in determining the robustness of country responses to environmental challenges, in particular such factors such as the development of a robust and independent civil society, that is capable of highlighting failures in environmental stewardship and lobbying for improvements in policies directed to such ends. Once again, we find that social institutions are important in patterning the seriousness of countries in managing climate change challenges.

Taken together, our findings suggests that as the climate change challenge moves from that of 'proving the facts' to that of 'implementing change', international policymakers, donors, and activists must increasingly focus on building domestic policy environments that are conducive to the delivery of more effective environmental legislation, and more comprehensive policy implementation on the ground level. In short, meeting the challenge of global climate change is likely to require substantial institutional capacity building, in addition to international development aid for projects directly aiming to achieve mitigation and adaptation goals.

Section 1.0 Institutional Prerequisites of Natural Disaster Responsiveness

Empirical Literature on the Determinants of Natural Disaster Responsiveness

The Centre for Research on the Epidemiology of Disasters has defined a natural disaster as a 'situation or event which overwhelms local capacity, necessitating a request to national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering' (CRED 2004). Over the last several decades a considerable literature on such disasters has emerged from human geography, sociology, anthropology and economics (Mitchell 1999; Hewitt 1997; Blaikie et al. 1994; Varley 1994; Twigg and Bhatt 1998). Whereas early research on natural disaster risk arose from the natural sciences and stressed geographic and climatic factors as determinants of population risk, more recent work from within the approach known as 'vulnerability analysis' asserts that for there to be a disaster there has to be not only a natural hazard, but also a vulnerable population. This has shifted the locus of research

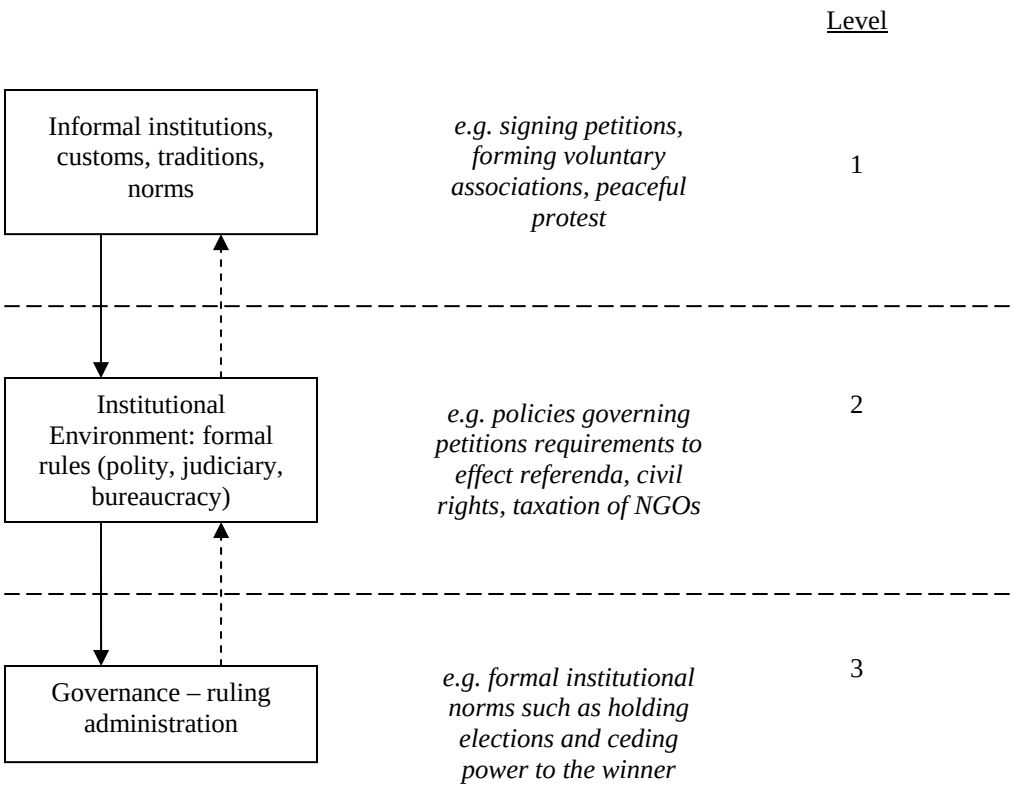
from natural (climatic) factors to socioeconomic and political forces such as population density, poverty, and the existence of a free media and NGO sector. In a review of the more recent literature, Cannon (2000), for example, distinguishes five determinants of population vulnerability: Initial well-being, Livelihood Resilience, Self-protection, Social protection, and Social Capital. Initial well-being refers to the existing human and economic resources possessed by vulnerable population, and can be proxied by measures of prior life expectancy and income per capita. Livelihood resilience refers to the ability of the population to return to its previous set of activities, and depends in part on the nature of the catastrophe. Self-protection refers to the ability of the individual household to prepare in anticipation of eventual disaster, and can be proxied by measures of education and skills. Social protection in this context refers to the efficacy of political institutions in providing disaster relief support, and can be measured by indices of governance (Cannon 2000).

In seeking to understand the vulnerability of populations to natural hazard risks, researchers are increasingly considering the institutional deficiencies which lead groups to become marginalized and then prevented from receiving an effective, organized disaster relief operation. As Nates and Moyer (2005) remark in a review of the causes of a range of recent natural disasters, 'the poor outcome in many of these disasters is not the result of lack of knowledge but rather the result of inaction and poor implementation of the necessary measures to prevent, contain, or mitigate the impact of natural disasters on the populations exposed'. Alternatively put, the high impact of certain disasters reflects institutional failure, both in the preparation and in the response to the occurrence of an extreme hazard event.

The Role of Formal and Informal Institutions in Natural Disaster Response

Accordingly, this background paper seeks to shed further light upon the role of institutions in patterning readiness and responsiveness to natural disaster risks. Our approach follows North (1990) in defining these as the norms and conventions that pattern social behavior, 'the rules of the game in a society [or] the humanly devised constraints that shape human interaction'. Whereas formal institutions are rules enforced by third-party mechanisms, such as a police corps, judiciary, or constitutional council, social institutions generally rely upon tacit norms and expectations. Examples of informal institutions include the practice of signing petitions to protest a policy, joining a neighborhood watch group, or doing business with a member of a different ethnic group. These can be distinguished from formal institutions, examples of which include the requirement to put constitutional amendments to referendum, the power of judicial review, or the existence of legal sanctions against infringement of intellectual property rights. A visual summary is provided in Figure 1.0.

Figure 1.0 Informal Institutions, Policies, and Formal Institutions



Source: adapted from Williamson (2000), "The New Institutional Economics".

We can consider a wide range of reasons why formal institutions, or quality of governance, ought to matter for the capacity of states to respond to environmental hazard events. For example, Sen and Dreze (1989, 1995) have argued that a major contributor to population vulnerability with respect to famine is the degree of transparency in governance and freedom of the press. In countries where the media has been able to report the onset of famine without restrictions and where politicians have electoral incentives to prevent widespread hunger, potential famines are identified early and public interventions are made to support precarious groups and communities. Democratic government and civic rights should therefore facilitate adaptation to climate-induced risks. We should find this effect to be particularly strong in the presence and organization of local and international NGOs, as such organizations provide an important informational role by monitoring and reporting on the degree of risk, as well as disbursing aid and assistance to affected groups (Martin and Taher 2001).

Second, government agencies are often among the first actors involved in disaster relief operations, as the neutrality, commitment, and effectiveness of the bureaucracy and military are crucial for ensuring swift delivery of food aid, population transfer from affected areas, as well as repair to damaged health, irrigation and transportation infrastructure. On the other hand, where local officials are corrupt, funds allocated by international donor organizations and central government agencies for disaster relief are likely to be diverted to private ends, and fail to be disbursed to the affected areas (Martin and Taher 2002).

Besides quality of government, we should expect a range of informal institutions are also relevant to the capacity of vulnerable populations to withstand natural disaster risks. For example, several authors have highlighted the importance of 'social capital', understood as the 'norms and networks that enable people to act collectively' (Woolcock and Narayan 2000) upon the vulnerability of populations to climate risks. Where there are strong local community support networks, in theory people should be able to weather the impact of natural disasters better and be able to recover faster following the event, by pooling welfare risks and cooperating in reconstruction tasks. Adger (2003), for example, argues that social capital is an indispensable precondition to adapting to the effects of global climate change, citing the example of successful adaptation in protecting marine areas in Trinidad and Tobago (Brown et al. 2001, Brown, Tompkins and Adger 2002, Tompkins, Adger and Brown 2002).

Finally, a growing literature focuses on the nature of social institutions, not only within the community, but also within the household. Neumayer and Plümper (2007), for example, provide the latest in a range of studies showing a distinctly gendered pattern to natural disaster impact, and that natural disasters lower the life expectancy of women more than that of men. They also show that in societies where women have higher socio-economic status (SES), this effect is less, and therefore that the overall effect of natural disaster upon mortality rates is reduced. The implication is that norms of gender inclusion are important social determinants of natural disaster resilience.

Data

As a measure of success and failure at managing the effects of climate change, we take the rate of deaths from natural disaster events – that is, the per capita number of deaths arising from floods, heat-waves, tsunami, and earthquakes – for the period 1995-2005. Our source for this measure is the EM-DAT database published by the World Health Organization (WHO 2008), a joint project with the Centre for Research on Epidemiology of Disasters (CRED) at the Catholic University of Louvain in Belgium, which records all events where either 10 people were killed; 100 people were reported affected; there was a call for international assistance; or declaration of a state of emergency. The data used covers the period from 1995-2005, inclusive, from which a single measure is constructed taking an average across the entire decade. In addition, to further ensure that the regression is robust to the inclusion of any individual outlier (high impact disaster) cases,

we take the natural log of the rate of per capita deaths, rather than the raw level[2]. A summary of the numbers of deaths, by event type and by region, can be found in Table 1.0.

We measure the quality of formal institutions using the Worldwide Governance Indicators, released annually by the World Bank (Kaufmann, Kraay and Maastruzzi 2008). The Worldwide Governance Indicators are a set of six composite indices compiled using an unobserved components model based on over 300 items and over 30 data sources, and serve to track the functioning of basic qualities of the state such as the transparency of political processes or the quality of the bureaucracy. From the six indices compiled annually by the project, we include measures for Voice and Accountability, Government Effectiveness and Control of Corruption. The Voice and Accountability measure is an index of the degree of citizen involvement in public decision-making through elections and civic rights; the Government Effectiveness measure is an index of the quality of the bureaucracy and its efficiency in delivering public goods and services; the Control of Corruption measure is an index of the extent to which public officials use their position for private gain, for example through bribes, extortion, and embezzlement (Kaufmann and Kraay 1999).

Finally, we measure informal institutions using the Indices of Social Development (ISD), developed within the Social Development Department of the World Bank (World Bank 2008). The Indices of Social Development combine 200 items, from some 25 sources, into five social institutional clusters: gender equity, intergroup cohesion, interpersonal safety and trust, clubs and associations, and civic activism. For each cluster, items are combined using a latent variables approach, as adopted in the generation of the Worldwide Governance Indicators and Transparency International's Corruptions Perceptions Index (Kaufmann et al 1999, 2007; Lambsdorff 2006). The intuition behind these procedures is that each set of indicators represents some implicit value of the underlying phenomenon in each society, on differing scales, with differing country samples, and with varying degrees of measurement error. The first cluster, gender equity, estimates levels of discrimination against women, and includes data on health, educational, and wage-related gender disparities, as well as data on the norms of discrimination that sustain these over time, such as the proportion of managers who believe men have more right to a job than women, or the proportion of parents who believe that boys should be prioritised in access to education. The second area, inter-group cohesion, reflects the extent of social conflict among ethnic, religious, or other social identity groups, using data on overt conflict, such as ratings on the level of ethnic and religious tensions, or the number of riots, assassinations, and acts of terrorism. The third area, interpersonal safety and trust, is an enhanced measure of general social trust, and brings together standard social trust items with data on the "trustworthiness" of others, based on criminal and related activity. The fourth area, clubs and associations measures the level of engagement in local associations and networks. Strength of community is measured using data on levels of engagement in local voluntary

[2] Regressions models were also estimated using the raw (untransformed) rate of deaths from natural disasters. However, in these models no variables emerge as significant due to the leveraging effect of outliers.

associations, time spent socializing in community groups, and membership of developmental organizations. Finally, the fifth area is the level of civic activism, which measures the extent to which social practices encourage a more active and critical interaction with political authorities. The strength of civil society is measured using survey data on participation in civic activities such as petitions or marches, access to media through newspaper and radio, and the density of international civil society organizations[3] (World Bank 2008). Table 2.0 illustrates the correlations between the various indicators.

Model Specification

The equation to be estimated is given by:

$$(1)\ lnDEATH_i = \alpha + \beta_1 INST_i + \beta_2 lnDISASTERS_i + \beta_3 lnPOP_i + \beta_4 lnPOPDENS_i + \beta_5 GDP_i + \beta_6 GDP^2_i + \beta_7 lnDISASTERS*GDP_i + e_i$$

Where *DEATH* is the rate of deaths from natural disasters and *INST* is an indicator of formal or informal institutions. In addition we include a number of control variables: *DISASTERS* is the number of disasters which occurred during the decade, *POP* is population, *POPDENS* is population density, *GDP* is GDP per capita measured in international dollars, *e* is the country-specific error term and *i* is country i. We also include an interactive term *DISASTERS*GDP*, in recognition of the fact that the impact of the number of natural disasters may vary according to the level of GDP per capita, and in particular that poor countries may be vulnerable to a higher frequency of hazard events. To avoid potential problems with multicollinearity, we include only one of the institutional measures at a time; a final model is included using an interaction between Voice and Accountability and Civic Activism, reflecting the hypothesis that the effect of participative institutions on disaster responsiveness is likely to be greater in societies with well-organized NGO sectors[4]. Finally, in order to overcome potential endogeneity between natural disaster and our independent variables, all the independent variables are lagged to 1995[5]. Our models therefore test the ability of a range of variables to predict the rate of deaths from natural disasters over the course of the subsequent decade.

[3] Civic activism differs from measures of formal political institutions, such as the democracy measure produced as part of the Polity dataset, as it measures the specifically social practices and norms that 'make democracy work'. These informal institutions include a high level of civic informedness regarding political debates and policies, a willingness among citizens to express their views through civic forums such as community meetings or the press, and mobilisation to place pressure on officials to deliver better public services, for example via protest or petition. Studies such as Putnam et al. (1993) have identified these practices as essential for maintaining government efficacy, in addition to the existence of formal rules such as elections and constitutional guarantees of civil liberties, which are captured by the Voice and Accountability measure from the Worldwide Governance Indicators.

[4] A correlation matrix between the social institutional variables in provided in Table 2.0.

[5] The governance indicators are lagged to 1996, the first year for which estimates exist.

Results

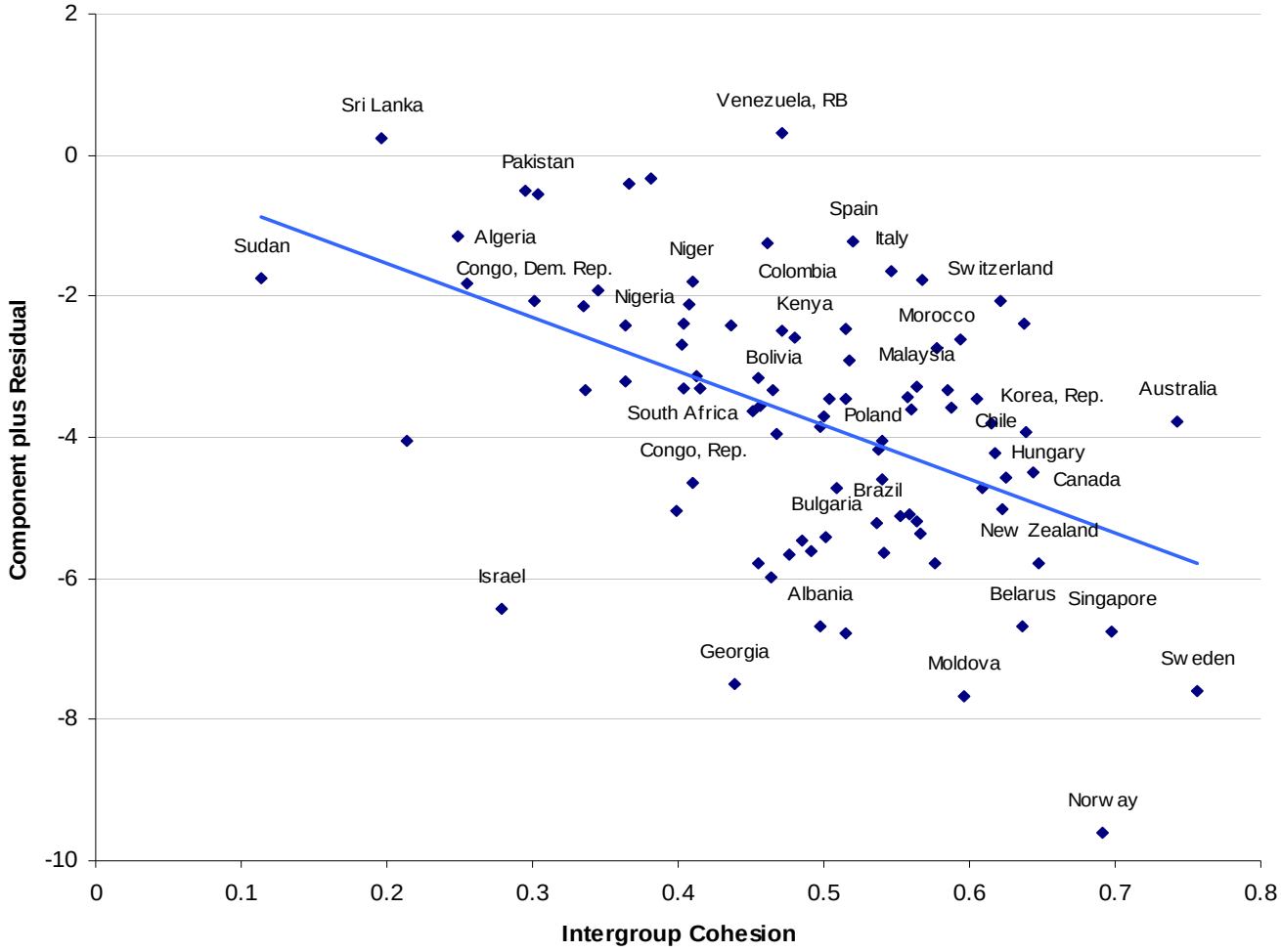
The results of these regressions are shown in Table 3.0. Our findings can be summarized as follows:

First, intergroup cohesion is very significantly associated with effective disaster relief. In societies with pervasive tensions between ethnic and religious groups, the rate of deaths from natural disasters is substantially elevated (Figure 2.0). The coefficient for intergroup cohesion of –7.663 implies that a one standard deviation improvement on this measure would result in a 0.95 fall in the log rate of natural disaster deaths, or a fall from the maximum recorded rate of deaths in the sample of 8,900 per 100,000 (registered by Indonesia), to a much lower level of 3,441 per 100,000. The p-value of 0.000 implies a very low likelihood of this finding being due to random error. Examination of the residual plot shows no evidence of individual cases leveraging the result. The strong association between intergroup tensions and death from natural disasters may be due to several factors. First, in societies where ethnic and sectarian tensions lead to conflict or partial secession, government agencies and humanitarian organizations face great difficulties in disbursing emergency relief due to the precarious security situation. Second, poor inter- and intra-community relations may also affect the recovery process, as conflict-ridden communities fail to achieve the coordination required in order to manage the post-crisis challenges[6]. Third, the onset of a natural disaster may exacerbate existing tensions and stimulate the outbreak of conflict. As a result, fragile states and conflict-affected regions are especially at risk of the consequences of climate change.

Second, participative governance increases the effectiveness of disaster relief - but only in the presence of a robust civil society. The coefficients in Model (ix) for Voice and Accountability, Civic Activism, and their interactive term imply that among democracies (countries with a Voice and Accountability score of 1.5) a one standard-deviation increase in the level of civic activism results in a 1.019 fall in the log rate of natural disaster deaths, or a fall from the maximum recorded rate of deaths in the sample of 8,900 per 100,000 (registered by Indonesia), to a much lower level of 3,214 per 100,000. However, this effect diminishes to zero among polities whose score on Voice and Accountability approximates the global mean. Both democratic institutions and a democratic culture, characterized by a high density of civic organizations and norms of political activism, are required in order to ensure prompt, efficient, and accountable government responses to disaster risk management. Civil society organizations cannot operate effectively under authoritarian regimes, yet neither can democratic institutions deliver unless a civil society exists capable of monitoring the public use of funds and pressuring politicians into action (Putnam 1993, Inglehart and Welzel 2005).

[6] Research has shown strong linkages from ethnic fractionalization to poor governance outcomes in the form of clientelism, corruption and reduced government effectiveness (Alesina et al. 2003), though admittedly the coefficients for the governance variables are not significant when included individually in these regressions, suggesting a direct effect from social institutions to natural disaster vulnerability.

Figure 2.0: Partial Correlation (Residual Plot) between Intergroup Cohesion and (log) rate of deaths from natural disasters.



Third, gender equity is significantly associated with country resilience to natural disasters. In accordance with earlier work on the effect of women's empowerment on natural disaster recovery, the coefficient for Gender Equity is significant in reducing the rate of deaths. Policies designed to improve women's education and eliminate discrimination in work, family, and public life ensure women are not made to suffer disproportionately the consequences of natural disaster (Neumayer and Plümper 2007), and are able to play an effective role in securing the wellbeing of themselves and their children, following a disaster event.

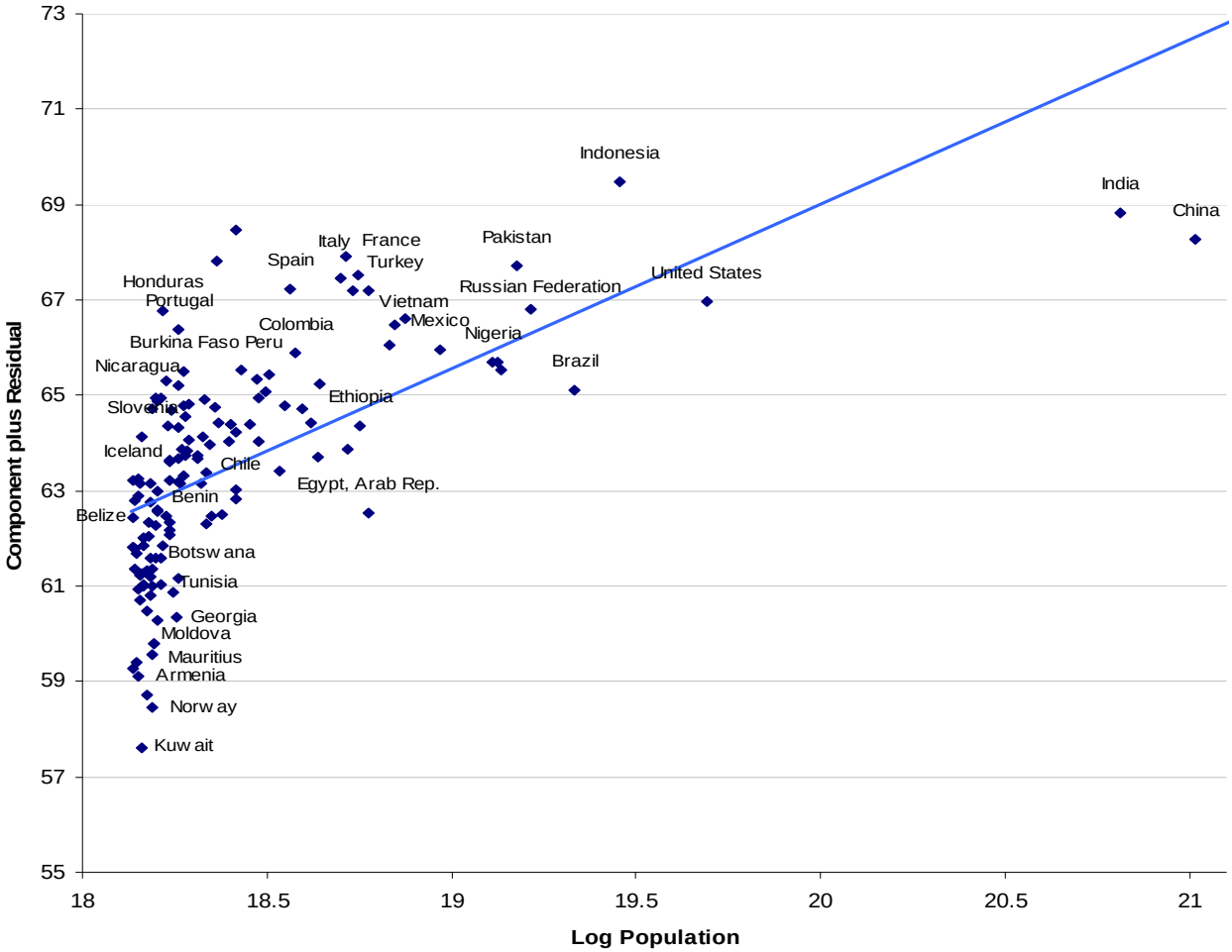
Fourth, larger states (measured by log population) suffer a higher rate of deaths from natural disaster than smaller states[7]. The average coefficient for (log) population of -3.06 implies that a state with population of 60m and the mean death rate of 15 per 100,000, would, all else equal, experience a 248 per 100,000 rate were its population 150m. Examination of the residual plot shows that this is not a finding leveraged by a single outlier, but by a number of cases, which include India, China, Bangladesh, Indonesia, and the Russian Federation (see Figure 3.0)[8].

Why should large states be less apt at managing natural disasters? A tentative interpretation of this finding can be advanced in terms of political economy: larger states are less responsive to natural disaster events, as the discrepancy between the unit of impact (a region or group of cities) and the unit for which the government is responsible (the entire country) is greater. In large states, this lower incidence between the unit of government and the impact of the natural disaster reduces the ability and the incentive of the state and its disaster relief agencies to respond promptly and effectively to the disaster incident. After all, many emergency relief agencies and mechanisms, such as the army or civil service, are controlled by central government rather than by local authorities. This relationship appears to hold among both developed and developing nations. Thus among high income countries, the United States has the highest number of deaths per capita (due, in this time period, to the aftermath of Hurricane Katrina); states with the lowest per capita rate of death, by contrast, are almost all small countries such as Iceland, Ireland, or Norway. Likewise, among low and medium income nations the countries with the highest rate of death in natural disaster are disproportionately the large states, such as China, India, and Indonesia, while a number of small low-income states fare as well as their counterparts in Western Europe. It may thus be that where the unit of impact and the unit of governance are convergent, states may be more likely to react effectively to natural disasters, whereas when the unit of governance and the impact zone of the disaster event are not convergent, governments may be slower and less effective in their disaster response. This finding remains tentative, though may have important implications for the impact of such institutional reforms as devolution upon state capacity to address extreme climatic events.

[7] This is not simply an artifact arising from the transformations applied to the data. Indeed, when the log transformation on both the dependent and independent variables is removed, the effect becomes far more significant. In our sample of data, larger states simply seem to have a higher rate of death from natural disaster than smaller ones.

[8] After removing any combination of the 'large' developing countries (India, China, Russia, Bangladesh, Indonesia) from the model, we find that the coefficient for log population remains significant at the 0.001 level.

Figure 3.0: Partial Correlation (Residual Plot) between country size (log population) and (log) rate of deaths from natural disasters.



Fifth, our results show that income per capita is significantly positively associated with a lower rate of deaths from natural disasters, though the squared term is signed in the opposite direction. Substantively interpreted, this means that there are rapidly diminishing marginal returns to economic development. Beyond income per capita of $5,000 at purchasing power parity, the effect of further growth on natural disaster resilience slows, and beyond $10,000 further change is incremental. To put these figures in perspective, the estimated effect of moving from GDP per capita of $1,000 to $5,000, is the same as the effect of moving from $5,000 to $30,000. Advancing from a lower to medium-income economy reduces substantially the level of vulnerability to natural disaster, but beyond this point further economic development has little or no positive effect in reducing the rate of deaths. The fact that citizens of high income economies have lower risk of death from natural disasters is to be explained, not by their relative affluence, but by the better governance and more robust social institutions to be found in such cases.

Sixth, poorer states are more vulnerable to the *frequency* of natural disasters than are wealthier states, as shown by the coefficient for the interactive effect between (log) number of disasters and GDP per capita.

Policy Implications

The findings reported in the above section might lead us to suggest the following conclusions. Our findings on gender are in line with those reported by Neumayer and Plümper (2007) regarding differences in male-female mortality rates following natural disasters. We are able to reaffirm their conclusion that universal female education, as well as legislation to empower women in the home, politically, and in the labor market, can help to make societies more resilient to the onset of natural disaster.

Second, our findings suggest a very important priority for conflict resolution and reconciliation in ongoing and post-conflict countries. Overcoming natural disasters requires collective action: where the institutions allowing collective action are severely deficient, as is the case in societies riven by intercommunal conflict, and even the partial secession of a region of the country, societies are acutely vulnerable.

Third, the regression coefficients suggest polities may be more resilient if they devolve political responsibility for natural disaster response to lower units of government, though of course, devolution does not substitute perfectly for having a smaller state. Exactly which level to devolve to may be difficult to determine precisely, as there is a trade-off between resource mobilization (easier to achieve at higher units of government) and the incentive to address the crisis (stronger at lower levels of government).

Fourth, we confirm at the cross-country level the famous hypothesis made by Sen and Dreze (1989, 1995) regarding the relationship between democracy and natural disaster vulnerability, though refine their argument in an important fashion. The mere existence of elections and constitutional rights is not in itself enough to ensure effective public response to disasters, if these are not supplemented by civic networks and associations capable of making democracy work. Indeed, the interaction term in our model implies that such fragile democracies perform worse than stable authoritarian regimes, though neither is as effective in natural disaster response as effective democracies combining representative institutions with engaged civic actors. Meanwhile, our results imply that attempts at bolstering civil society in authoritarian states are unlikely to deliver positive changes unless accompanied by genuine political reform allowing such groups to operate critically and independently.

Finally, also important to note are those institutions which are not significantly associated with natural disaster vulnerability. As with Chase and Labonne (2008), we fail to find a direct link from the strength of close or ‘bonding’ ties (such as within a family or community) to the ability to withstand external shocks - but ‘bridging’ ties, such as between ethnic groups, between men and women, or between domestic and international civil society actors, do appear to enhance resilience. The ability to withstand shock events

depends upon the ability to mobilize resources from outside the affected group, and where these ties are absent groups stand particularly vulnerable.

Section 2.0 Toward Better Environmental Governance

Research thus far suggests an important role is played by institutions in determining the readiness of countries to withstand the shocks associated with climate change. In this section, we broaden our enquiry to examine the institutional preconditions of 'environmental governance' a concept than encompasses not merely the capacity to adapt to climate change induced shocks, but also the management of natural resource endowments, past and present pollution levels, environmental management efforts, contributions to protection of the global commons, and a society's capacity to improve its environmental performance over time (YCELP 2005).

Why do some countries have higher levels of environmental sustainability than others? In answering this question, this section of the background paper draws from the findings of Dulal, Foa and Knowles (2008), in which the authors test for significant associations between recent measures of environmental governance and the quality of social and political institutions.

Previous Literature on Social Institutions and Environmental Governance

Previous studies have proven inclusive regarding its institutional preconditions of environmental governance. Grafton and Knowles (2004) analyze the relationship between social capital and national environmental performance for a sample of 35 countries, with their data sample being made up largely of high-income countries. Their social capital data are taken from the third wave of the World Values Survey (Inglehart et al. 2000). They employ three different proxies of social capital: *WVSTRUST*, *WVSCIVIC* and *WVSASSOC*. WVS*TRUST* measures the proportion of the population who answer "most people can be trusted" to the question 'generally speaking do you think that most people can be trusted, or that you can't be too careful in dealing with people?' *WVSCIVIC* is an index measuring the extent to which people think certain behaviors (such as cheating on your taxes, or avoiding a fare on public transport, if you had the chance) can be justified. *WVSASSOC* measures the extent of membership of different voluntary groups (such as church or religious groups and sports clubs). These social capital proxies were first used in cross-country empirical work by Knack and Keefer (1997), in the context of explaining cross-country differences in the rate of economic growth.

Grafton and Knowles find a significant *negative* correlation between both *WVSTRUST* and *WVSASSOC* and the ESI, which is counter to expectations, but a significant positive correlation between *WVSCIVIC* and the ESI. Grafton and Knowles also analyze the relationship between what they term 'public social capital' and the environment. Public social capital is proxied by a measure of democratic accountability and a measure of the extent of corruption, though both proxies are generally insignificant. Of the other control

variables they include (such as income per capita, measures of ethnic and religious diversity and population density), only population density (with a negative sign) and income per capita (with a positive sign) are significant in the majority of specifications. Grafton and Knowles (2004, p.366) argue that their 'findings provide very little empirical support for the hypothesis that higher levels of social capital and related variables improve cross-national environmental quality' but note that these results should be regarded as preliminary. It may be that empirical specifications of social capital have failed to identify the correct institutions: and in particular, given the strong association between *WVSCIVIC* and the ESI, that an excessive focus has been placed on 'social' norms such as trust or community life, rather than 'sociopolitical' institutions such as civil society organization and activism.

A related literature analyses the effect of democracy on cross-country environmental outcomes. It is possible that in a democracy citizens are more informed about environmental issues (due to freedom of the press, for example) and can express their preferences regarding environmental issues at the ballot box (Payne, 1995). In addition, to the extent that environmental issues often have a long-run focus, and that autocratic leaders are more short-sighted than the median voter, democracies may enjoy better environmental outcomes than non-democracies (Congleton, 1992). A counter argument would be that democratic leaders are often only elected for a few years, while autocratic leaders stay on for decades, thus the incentive would be for the unaccountable democratic leader to make a quick profit by selling natural resources before they are voted out of office – a version of the tragedy of the commons. On the other hand, to the extent that democracy is associated with free market economies with little regulation, this may lead to market failures which place pressure on the environment (Neumayer, 2002). Contrary to this, western liberal democracy tends to be associated with clearer and more stable property rights, leading to greater incentives for protection and sustainable use of natural resources. Hence, in theory, democracy could have either a positive or negative effect on environmental performance.

Previous empirical work on the relationship between democracy and the environment across countries is inconclusive, with measures of democracy being positive in some studies and negative in others. There is some evidence that whether democracy has a positive, negative or insignificant effect depends on which environmental outcomes are being explained. Midlarsky (1998) finds a significant negative correlation between democracy and CO_2 emissions and soil erosion by both water and deforestation, but a significant positive relationship between protected land area and democracy. Neumayer (2002) finds a significant positive correlation between democracy and environment commitment (as proxied by whether countries have signed multilateral environmental agreements). Frederiksson et al (2005) find that the number of environmental lobby groups has a negative effect on the lead content of gasoline, but only in countries with a high degree of political competition (as proxied by the percentage of votes not going to the ruling party). Scruggs (1999) finds an index of corporatist political institutions and environmental group membership to be significantly positively correlated with an index of environmental outcomes for a sample of 17 industrialised countries. Torras and Boyce (1998) find that countries with higher levels of political and civil liberties tend to have

lower emissions of a number of pollutants, especially in low-income countries. The findings regarding democracy and civil society suggest that the institutional preconditions of environmental governance are complex, and that only in particular contexts – such as the existence of a well-organized, informed civil society – do participative political institutions deliver a higher quality of environmental governance.

The Relationship between Social Institutions and the Environment

If the empirical links from institutions to environmental governance remain ambiguous, the theoretical links are better established. In this section of the paper we present arguments as to why higher quality social institutions may be beneficial for environmental outcomes.

Gender Participation

A growing literature supports the view that societies with greater gender inclusion may achieve better environmental outcomes. Especially in rural areas of developing countries, rural women depend on communal resources for subsistence needs, due to the lack of access to private land, employment, and other productive assets (Agrawal, 1994). Prasal et al (1987) attribute this close relationship to necessity. Based on their four village study in rural Nepal, they report that women have a more responsible attitude towards forests than men because it plays an important role in their daily lives. As female children and women are responsible for collecting firewood and fodder, additional hardship they and their children would face as a result of depleted forests would motivate them to become more responsible than their male counterparts. Thus, the division of labor within the household and women's responsibility towards procuring resources such as water, fuel and wood, make women both more dependent on common property resources and at the same time more vulnerable to the negative externalities of natural resource degradation (Manion, 2002). Forest protection movements such as "Chipko", in what is now known as the Uttarakhand Hills in India, in which women play a major role, confirm women do understand vulnerabilities and can mobilize and demonstrate in favor of environmental protection, if needed (Karan, 1994).

Molinas (1998) in an empirical study drawing on data from 104 peasant cooperatives in Paraguay, finds that the degree of cooperation within these cooperatives increases with the level of female membership. Turning to groups concerned specifically with the environment, Westermann et al. (2005) compare the performance of 46 natural resource management (NRM) groups across 20 countries in Latin America, Africa and Asia. They find that women's groups tend to behave more collaboratively and have greater capacity to sustain collective action than groups made up entirely of men, or mixed groups containing both men and women.

Turning to evidence from the experimental economics literature, Andersen et al (2008) play a public goods game in three different regions in India, and find that fewer people

free ride in regions where women are more empowered. Differences in the extent of free riding were greater across regions (with different levels of female empowerment) than they were between men and women within the same region. [9] This is an important finding, as it suggests that studies using micro-level data on individuals from the same region will fail to identify the full effect of female empowerment on environmental issues. Cross-regional or cross-country studies may be more informative about this relationship.

The arguments summarized above suggest that women may be more conscious of environmental issues than men. If this is true, then we would expect that excluding women from full participation in decision making will have a negative effect on environmental measures.

Trust, Cooperative Norms and Reciprocity

People are more likely to act in the common interest when they have a high degree of trust in others. Even the slightest doubt in the mind of people that others in their community are not trustworthy will result in the breakdown of cooperative norms, including those with respect to the environment. High degrees of trust and cooperation also reduce transactions costs, making it easier to resolve collective action problems.

Katz (2000) details a number of informal rules and norms that have evolved to govern the use of communally owned forests in the Western Highlands region of Guatemala. For example, many communities allow members the unrestricted right to gather fallen trees and branches for firewood, as long as the wood is only for the use of their family, but the felling of a live tree requires the authorization of a local committee. The existence of such norms presupposes either a high degree of trust that others will adhere to these norms, or sanctions against those who fail to adhere to the norms. The trust required for cooperative norms to be sustained may well be the result of intergroup cohesion, which may itself result from the density of local networks.

Possibilities for Collective Action

Theoretically, given that most environmental resources are common property resources, their sustainable use and protection requires collective action. That is, one would expect *a priori* that communities with higher quality institutions that promote collective action would do better on environmental management. This theoretical argument is supported by micro-evidence. For example, based on case studies in Sri Lanka and Indonesia, Isham (2002) demonstrates that differences in social capital can explain differences in indicators of environmental quality, such as access to clean water, and suggests that investment in social capital should be considered alongside potential investment in physical and human

[9] Experiments which focus on whether females contribute more to the public good than males from the *same* region typically find little or no difference between the genders (see Croson and Gneezy, 2008, for a review of this literature).

capital during the planning of development projects. Also in Sri Lanka, research by Uphoff and Wijayaratna (2000) shows that cooperation between rural farmers over sharing access to water can lead to an increase in agricultural yield even in the drought season.

Gebremedhin et al. (2003) empirically demonstrate that connectedness in the community, in the sense of the extent to which members of the community interact with each other, plays an important role in redressing resource degradation and increasing community wealth. Katz (2000) finds that open access resources are much better managed in the Western Highlands region of Guatemala, where she argues social capital is high, than in the El Petén region, where the level of social capital is lower. She suggests (p.121) that "where social capital exists among natural resource users, it fosters a sense of ownership and respect for boundaries, and provides the foundation for use rules, monitoring, and enforcement mechanisms which helps preserve the natural resource base. In contrast, an absence of social capital in a situation where property rights is poorly defined can lead to resource mining in both private and common property regimes."

As argued above, clubs and associations and civic activism capture the contribution of social institutions to the possibility of collective action. When there is a high degree of engagement with the local community, be it through formal or informal networks, this is likely to make it easier to resolve collection action problems, such as the management of common property resources or internalizing externalities that are localized in nature. Dealing with these issues at a national level requires a high degree of engagement with political authorities.

Data Used and the Empirical Model

In order to measure the determinants of environmental governance, our measures of environmental policy effectiveness are the Environmental Sustainability Index (ESI), developed by Yale University (Yale Center for Environmental Law and Policy) and Columbia University (Center for International Earth Science Information Network) in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission, and the Environmental Performance Index (EPI), developed by the same authors. The Environmental Sustainability Index is a composite index tracking 21 elements of environmental sustainability covering natural resource endowments, past and present pollution levels, environmental management efforts, contributions to protection of the global commons, and a society's capacity to improve its environmental performance over time (YCELP 2005). Whereas the ESI was developed to evaluate environmental sustainability relative to the paths of other countries, the EPI uses outcome-oriented indicators, working as a benchmark index that can be more easily used by policy makers, environmental scientists, advocates and the general public (YCELP 2008).

The equation to be estimated is given by:

$$(2) \qquad ENVGOV_i = \alpha + \beta_1 SOC_i + \beta_2 INDUST_i + \beta_3 lnPOPDENS_i + \beta_4 VOICE_i + \beta_5 GDP_i + \beta_6 GDP^2_i + e_i$$

Where *ENVGOV* is the measure of environmental governance and *SOC* is an indicator of social institutions. In addition we include a number of control variables: *INDUST* is the share of industry in GDP, *POPDENS* is population density, *VOICE* is a measure of the extent of democracy, using the Worldwide Governance Indicator for Voice and Accountability, *GDP* is GDP per capita measured in international dollars, *e* is the country-specific error term and *i* is country i. Full definitions of all variables, and information on data sources, are given in the appendix. To avoid potential problems with multicolinearity, we include only one of the five social institutional measures at a time.

Our dependent variables are the Environmental Sustainability Index (ESI) for 2005, and the Environmental Performance Index (EPI) for 2006[10]. Our choice of control variables is largely guided by past cross-country empirical work on environmental outcomes (see, for example, Grafton and Knowles, 2004; Midlarsky, 1998). *GDP* and GDP^2 are included to control for the possibility of an environmental Kuznets curve. The environmental Kuznets curve hypothesis posits that there is an inverted-U relationship between environmental degradation and income per capita (see, for example, Dasgupta et al, 2002; Torras and Boyce, 1998), implying a U-shaped relationship between income per capita and the ESI/EPI. It also seems likely that countries that are more densely populated are likely to suffer from more environmental pressure, all else equal. Hence, we include the log of population density as a control variable. We also include industry value added as a share of GDP to control for the possibility that industrial activity places more pressure on the environment than does either the agricultural or services sectors of the economy.

Empirical Results

The empirical results obtained from OLS estimation of equation (2) are reported in Tables 4.0 and 5.0, with each column of the table including a different social institutions measure. Table 4.0 reports the results for the *ESI*, and Table 5.0 for the *EPI*. Preliminary testing suggested some problems with heteroskedasticity, hence the t-statistics reported are based on heteroskedasticity-consistent standard errors, following White (1980). Civic Activism and Gender Equity are both statistically significant in either table, with the expected positive sign. The remaining three social institutions indicators are all statistically insignificant.

Turning to the results for the other control variables, population density is negative and significant at the one percent level in all specifications, confirming that densely populated countries tend to have poor environmental outcomes, all else equal. The democracy variable is also positive and significant in all specifications, suggesting more democratic

[10] 2006 is the first year for which the EPI has been produced.

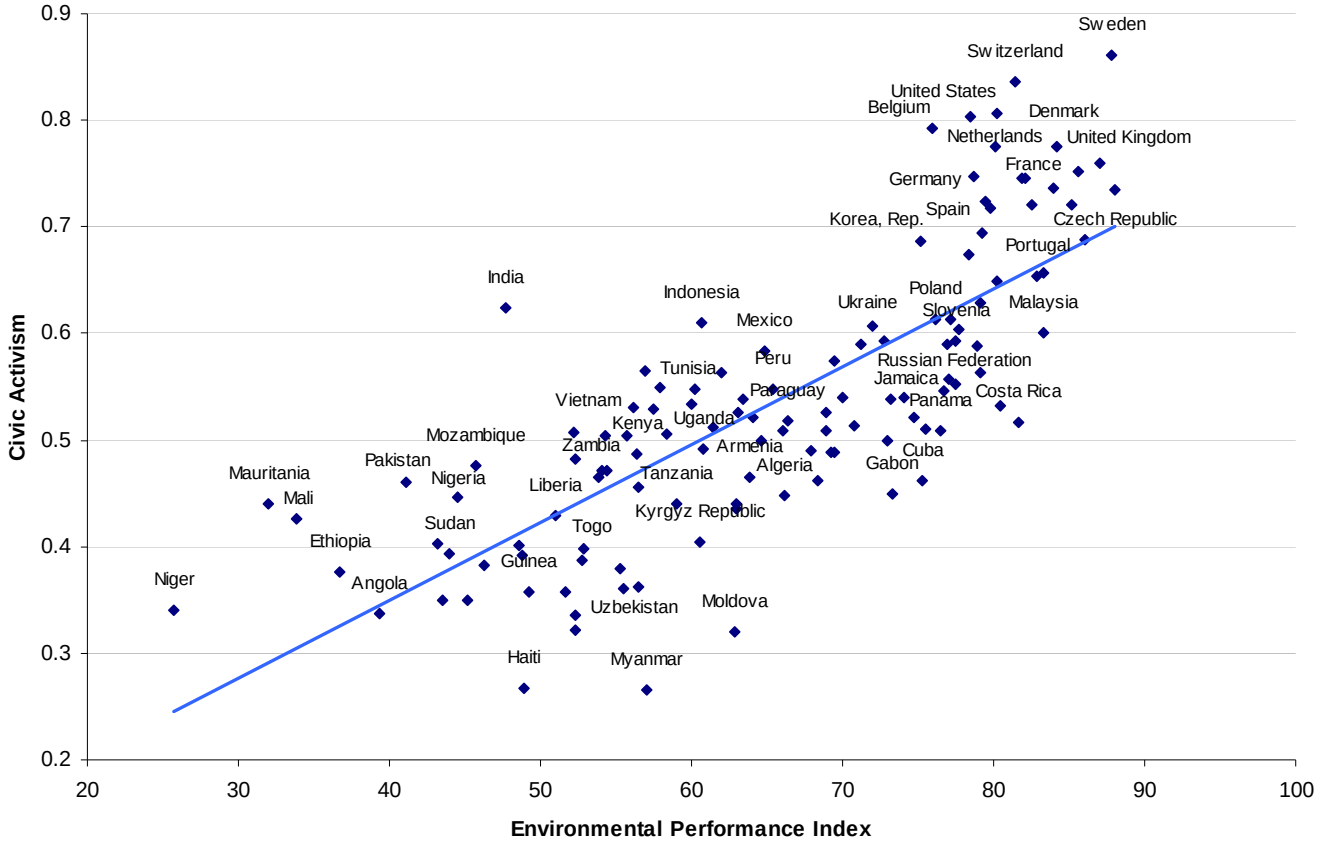
countries have higher levels of environmental sustainability, all else equal. *GDP* and GDP^2 are nearly always insignificant, suggesting there is no evidence of an environmental Kuznets curve. The share of industry in GDP is only significant at the ten percent level, when Clubs and Associations is the social institutions proxy. The R^2 ranges from 0.537 to 0.564, depending on which of the social institutions measures are included. Hence, approximately half of the cross-country variation in the ESI can be explained by the variables included in our regression model.

Turning to the EPI (Table 5.0), we can see that the coefficients for population density and democracy (proxied using the *Voice and Accountability* indicator) are no longer significant. We might expect that population density would not be associated with environmental performance in the same way that it is associated with environmental sustainability, though no simple interpretation can be given of the loss of the democracy coefficient. However, once again civic activism and gender equity are significantly positively associated with a more robust record of environmental governance.

The two tables of results discussed above imply that some forms of social institutions are significantly correlated with environmental performance, whereas others are not. The positive correlation between Gender Equity and both *ESI* and *EPI* may be evidence that women tend to be more protective of the environment than are men, which means that in countries where women have a greater say in society this is associated with better environmental performance. Based on the coefficients on Gender Equity from Table 4.0, a one standard deviation increase in Gender Equity is associated with an increase in the ESI of 1.96 percentage points.

Turning to Civic Activism (see figure 4.0), this measure of social institutions was statistically significant with a positive sign whether ESI or EPI was the dependent variable. A significant positive correlation on Civic Activism implies that the ESI will be higher in countries where citizens are engaged in the political process, having controlled for whether a country is an electoral democracy or not, though of course the evidence suggests that democratic government helps foster civic networks and activities over time (Bernhard and Karakoç 2007). Based on the Table 4.0 results, a one standard deviation increase in Civic Activism is associated with an increase in the ESI of 2.30 percentage points.

Figure 4.0 Scatterplot of Civic Activism (2005) and the Environmental Performance Index (2006)



The level of electoral democracy is significantly positively correlated with the ESI in virtually all regressions run. In column (i) of Table 4.0, both Civic Activism and democracy are statistically significant with positive point estimates. This implies that *both* whether a country is democratic (as measured by the *Voice and Accountability* index) and the extent to which individuals engage with the political process (as measured by the index of civic activism) are important in explaining cross-country environmental performance.

Institutions and Climate Change Mitigation

If institutions have any role in bringing about improved environmental governance, this should imply some observable association, over time, between the presence of certain norms and concrete indicators of environmental performance. We can examine further whether such an association is observable, by taking data on reductions in carbon intensity (the ratio of gross domestic product to carbon emissions) over time.

Table 6.0 presents the results of a series of regressions with the change in carbon intensity from 1995 to 2005 (whereby 1995 = 1.00), and as our independent variables a range of controls and institutional variables lagged to the start of the period (1995).

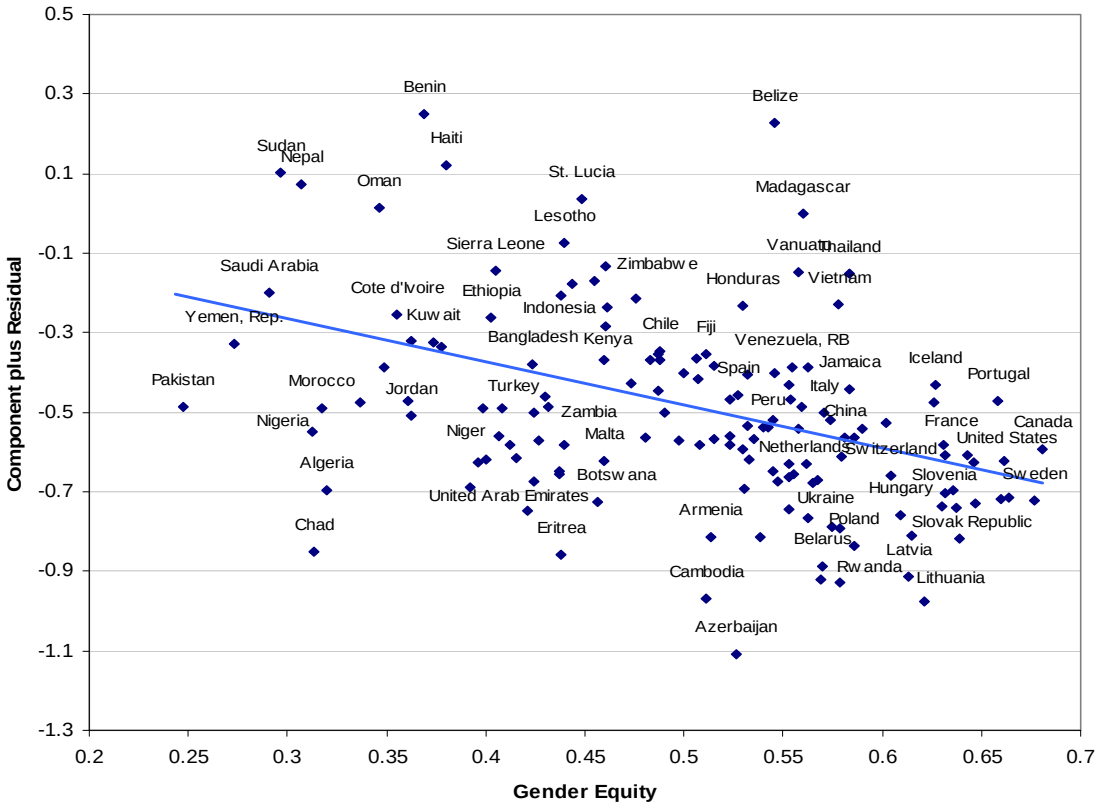
These regressions indicate that short-term (one-decade) changes in carbon intensity are determined by a number of omitted variables and/or stochastic variation, as shown by the low coefficients of determination (r-squared) for these models, which range from 0.02 to 0.19. Given this, we must be careful not to make undue inferences from the coefficients.

This said, the most striking finding is the very significant positive association between gender equity and reductions in carbon intensity. A priori, this may be due to one of two reasons. First, the particular role of female legislators and decision-makers regarding environmental policy, discussed in the above section on gender participation. Second, the role that gender empowerment may have in encouraging economic growth through the expansion of the (more carbon neutral) service sector[11]. In addition, it is also possible, given the high estimated error term, that the gender equity variable is collinear with an omitted determinant of carbon intensity, such that the association is spurious. However, examination of component-plus-residual plot for the gender term in this regression (figure 5.0) does not yield any clear suggestions as to what such a confounding variable might be.

For example, one alternative hypothesis might be that oil-producing states in the Middle East are responsible for the effect, as these societies are low on gender equity yet high on carbon intensity. However, examination of the residual plot does not confirm this interpretation: while Middle Eastern oil producers are generally very low with respect to gender equity, there is no clear pattern regarding changes in carbon intensity: some states (Saudi Arabia, Sudan) have increased their carbon intensity of GDP, yet others (Algeria, United Arab Emirates) have seen substantial reductions. Another hypothesis is that the association is due to the coincidence of high gender equity in transitional (post-communist) economies, where the industrial sector shrunk very rapidly during the 1990s. This association is accurate, yet the coefficient is also driven by other cases: this includes most states in Western Europe and North America. The link between gender equity and falling carbon intensity therefore may reflect some aspect of the extent to which women's employment reflects more carbon neutral, service sector jobs, the growth of which sector has been fastest in the states of Northern America and Northern Europe.

[11] A reverse causal path from expansion of the service sector toward higher scores on gender equity is less likely however, as while service sector expansion may indeed encourage greater female employment, the index of gender equity is primarily composed by non-labor market indicators, such as gender disparities in health and education, levels of gender-based violence, and the prevalence of discriminatory attitudes.

Figure 5.0 Partial Correlation (Residual Plot) between Gender Equity (1995) and Change in Carbon Intensity (1995-2005)



Social and Governance Dimensions of Climate Change: Implications for Policy

Much of the discussion in the early climate change literature, and more recently within the public debate, has focused on the science of climate change. However, as the discussion has moved from 'proving the facts' to implementing mitigation and adaptation policies, it has become increasingly important to be conscious of the political economy of climate change decisions - both in terms of the factors which determine the willingness of political elites to implement mitigation and adaptation policies, and in terms of the ability of the state to then put into effect such policies.

This paper makes a modest contribution to the ongoing analysis of the social and political contexts in which states act so as to reduce the negative environmental impact of their economic activities. The results of the cross-country regressions presented in this document are not to be considered as definitive, but do suggest a number of hypotheses regarding the causal determinants of proactive environmental policy. We find that variation across countries appears to be broad, wide-ranging across several policy measures, and systematic.

First, the results suggest that ‘democracy’ in itself is not a sufficient precondition for either good environmental policy, or effective response to climate-change induced disasters. Democracies can be effective where civil society groups are able to highlight abuses of authority and represent citizen interests, but can be unresponsive where small groups are able to capture the policy process. Instead, development practitioners ought to focus instead on the conditions in which participative government can work more effectively toward climate change responses; the results in this paper suggest that democracies function best where there is a strong and robust independent civil society (section 1), and that the empowerment of women ensures better environmental governance, better response to (climate change induced) disasters, and a better track record in achieving climate change mitigation objectives through a lower carbon intensity of GDP (section 2). Suggested policy outcomes based on these inferences would include quotas for women’s parliamentary representation, and ‘gender development,’ in the sense of achieving more comprehensive and universal educational enrollment among females.

Second, while we find that certain social institutions matter, we do not find strong evidence that traditional conceptions of ‘social capital’ - understood simply in terms of engagement in local community and voluntary life – can much help improve environmental performance. A variable for generic associative activity is not found to be significant as a determinant of either environmental governance or effectiveness in responding to natural disasters, while it is strongly *negatively* associated with improvements in reducing carbon intensity over the decade 1995-2005. Rather, the social institutions that policymakers should seek to transform concern generic, cross-cutting ties such as the empowerment of women, improving interethnic relations or development of (political) civil society. Again, the suggested policy outcomes would include gender development, and support for projects aiming at the strengthening of civil society and the cooperation of different ethnic or religious groups, such as by sponsoring truth and reconciliation programs in post-conflict states where such institutions exist, or the judicial system in countries where post-conflict restitution of injustices remains incomplete.

Finally, as a recurring finding is the positive effect of gender equity upon environmental performance, whether measured in terms of disaster response, indices of environmental governance, or reductions in carbon emissions relative to GDP. While the causality behind this relationship may be different in each case, this suggests in important role for women in the effort to achieve comprehensive responses to climate change mitigation and adaptation challenges.

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Appendix 1. Data Definitions and Sources

Civic Activism	A composite index measuring the extent to which social practices encourage a more active and critical interaction with political authorities. For this cluster, 31 items have been taken from 8 independent sources, yielding sufficient data to rate 181 separate countries: the average number of items per country rated is 7.7. (Source: World Bank, 2008).
Intergroup Cohesion	A composite index measuring the extent of social conflicts among ethnic, religious, or other social identity groups. For this cluster, 21 items have been taken from 9 independent sources, yielding sufficient data to rate 159 separate countries: the average number of items per country rated is 11.2. (Source: World Bank, 2008).
Clubs and Associations	A composite index measuring the level of engagement in local associations and networks. For this cluster, 41 items have been taken from 5 independent sources, yielding sufficient data to rate 87 separate countries: the average number of items per country rated is 17.3. (Source: World Bank, 2008).
Interpersonal Safety and Trust	A composite index measuring the level of general social trust. Included in this subindex are data on citizens' trust in their society, neighbors, and community, together with data on crime victimization and estimates of homicide and other forms of general interpersonal aggression. For this cluster, 41 items have been taken from 11 independent sources, yielding sufficient data to rate 158 separate countries: the average number of items per country rated is 12.9.
Gender Equity	A composite index measuring the level of discrimination against women. For this cluster, 24 items have been taken from 6 independent sources, yielding sufficient data to rate 185 separate countries: the average number of items per country is 12.5. (Source: World Bank, 2008).
DISASTERS	Number of drought, earthquake, extreme temperature, flood, wave/surge, wild fire, and wind storm disaster events, 1995-2005. (Source: Centre for Research on the Epidemiology of Disasters).
DEATH	The natural logarithm of the rate of deaths from drought, earthquake, extreme temperature, flood, wave/surge, wild fires, and wind storms, over the period from 1995 to 2005 inclusive (source: Centre for Research on the Epidemiology of Disasters).
ESI	Environmental Policy Index for 2005. The ESI is a composite index of environmental measures compiled by the Centre for International Earth Science Information Network (CIESIN) at Colombia University in collaboration with the World Economic Forum. (Source

	www.yale.edu/esi/).
EPI	The Environmental Performance Index (EPI) is a method of quantifying and numerically benchmarking the environmental performance of a country's policies. The EPI was developed by Yale University (Yale Center for Environmental Law and Policy) and Columbia University (Center for International Earth Science Information Network) in collaboration with the World Economic Forum and the Joint Research Centre of the European Commission. Indicators used in the EPI are grouped into the categories of: environmental burden of disease; water pollution; air pollution; biodiversity; productive natural resources; and climate change.
GDP	The GDP per capita at purchasing power parity (PPP) in 2005, in constant 2000 US dollars (Source: World Development Indicators, 2008).
INDUST	Industry in value added, as a percentage of GDP. Includes value added in mining, manufacturing, construction, electricity, water and gas (Source: World Development Indicators, 2008).
lnPOP	Natural logarithm of total population in 2005 (Source: World Development Indicators 2008).
lnPOPDENS	Natural logarithm of population density in 2005. Population density is midyear population divided by land area in square kilometres (Source: World Development Indicators, 2008).
VOICE (Voice and Accountability)	A composite index measuring perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media (source: Kaufman, Kraay and Maastruzzi 2008).
Control of Corruption	A composite index measuring perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (source: Kaufman, Kraay and Maastruzzi 2008).
Government Effectiveness	A composite index measuring perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (source: Kaufman, Kraay and Maastruzzi 2008).

Appendix 2. Tables

Table 1.0: Total Deaths from Natural Disaster Events 1995-2005, by Type and by Region

	Drought	**Earthquake**	**Extreme Temperature**	**Flood**	**Wave / Surge**	**Wild Fires**	**Wind Storm**	***All Categories***
South Asia	200	103262	10148	24805	52293	38	20033	*210779*
Middle East and North Africa	12	33434	97	4230	0	47	234	*38054*
OECD (1990 members)	0	5585	72136	889	0	144	4778	*83532*
East Asia and Pacific	740	4694	101	24673	176533	324	16316	*223381*
Latin America and Caribbean	53	2975	1109	38402	10	72	25461	*68082*
Europe and Central Asia	2	20515	4524	1345	0	59	484	*26929*
Sub-Saharan Africa	958	76	90	6852	309	67	1435	*9787*
Total	*1965*	*170541*	*88205*	*101196*	*229145*	*751*	*68741*	*660544*

Source: EM-DAT Database.

Table 2.0 Correlation Matrix between Indicators of Social and Governance Institutions

	Government Effectiveness	Control of Corruption	Voice and Accountability	Intergroup Cohesion	Civic Activism	Gender Equity	Interpersonal Safety and Trust	Clubs and Associations
Government Effectiveness	1.00							
Control of Corruption	0.92	1.00						
Voice and Accountability	0.73	0.82	1.00					
Intergroup Cohesion	0.57	0.58	0.58	1.00				
Civic Activism	0.73	0.75	0.66	0.44	1.00			
Gender Equity	0.50	0.51	0.60	0.54	0.52	1.00		
Interpersonal Safety and Trust	0.62	0.57	0.34	0.26	0.45	0.12	1.00	
Clubs and Associations	0.22	0.26	0.18	0.02	0.31	-0.04	0.23	1.00

Note: Pairwise correlation coefficients.

Table 3.0: Determinants of the Rate of Deaths from Natural Disasters, 1995-2005

	Institutional Measure								
	(i) *Civic Activism*	(ii) *Gender Equity*	(iii) *Clubs and Associations*	(iv) *Intergroup Cohesion*	(v) *Interpersonal Safety and Trust*	(vi) *Voice and Accountability*	(vii) *Government Effectiveness*	(viii) *Control of Corruption*	(ix) *Interactive Hypothesis*
Civic Activism, 1995	-1.225 (2.207)	––	––	––	––	––	––	––	-0.28 (2.218)
Gender Equity, 1995	––	-4.562* (2.017)	––	––	––	––	––	––	––
Clubs and Associations, 1995	––	––	3.334 (1.668)	––	––	––	––	––	––
Intergroup Cohesion, 1995	––	––	––	-7.663*** (1.831)	––	––	––	––	––
Interpersonal Safety and Trust, 1995	––	––	––	––	-4.626 (2.508)	––	––	––	––
Voice and Accountability, 1996	––	––	––	––	––	0.034 (0.28)	––	––	2.209* (0.847)
Government Effectiveness, 1996	––	––	––	––	––	––	-0.284 (0.335)	––	––
Control of Corruption, 1996	––	––	––	––	––	––	––	-0.462 (0.327)	––
Voice and Accountability, 1996 * Civic Activism, 1995	––	––	––	––	––	––	––	––	-4.832** (1.713)
Disaster events per capita (1995-2005), logged	3.44* (1.359)	3.741* (1.505)	5.737* (2.536)	4.759 (2.448)	4.02 (3.39)	3.856** (1.417)	3.954** (1.442)	4.809** (1.713)	4.954** (1.479)
Log population, 1995	3.268*** (0.461)	3.45*** (0.454)	2.782*** (0.617)	2.274*** (0.527)	2.774*** (0.653)	3.2*** (0.456)	3.218*** (0.458)	3.423*** (0.483)	3.154*** (0.454)
Log population density, 1995	0.128 (0.12)	0.19 (0.122)	0.388* (0.176)	0.156 (0.15)	0.292 (0.21)	0.099 (0.12)	0.108 (0.121)	0.195 (0.134)	0.113 (0.118)
Log GDP per capita, PPP 1995	-9.081** (2.89)	-8.401** (2.914)	-4.54 (5.351)	-9.366* (4.073)	-8.138 (6.199)	-8.904** (2.943)	-10.167** (3.167)	-10.693** (3.351)	-16.258*** (3.82)
Log GDP per capita, PPP^2 1995	0.176 (0.144)	0.141 (0.132)	-0.272 (0.228)	0.079 (0.17)	0.046 (0.255)	0.102 (0.146)	0.181 (0.158)	0.175 (0.169)	0.471* (0.188)
Log GDP per capita, 1995 * Disasters per capita (1995-2005), logged	-0.423** (0.158)	-0.423* (0.177)	-0.654* (0.282)	-0.576* (0.288)	-0.53 (0.377)	-0.487** (0.164)	-0.499** (0.169)	-0.551** (0.201)	-0.612** (0.174)
Constant	5.133 (19.108)	4.144 (20.645)	9.525 (35.327)	36.647 (30.854)	12.12 (44.02)	8.065 (19.585)	12.598 (20.281)	19.042 (23.01)	45.411 (23.498)
Adj. R^2	0.413	0.414	0.407	0.484	0.4	0.439	0.432	0.411	0.435
N	145	140	76	88	75	150	148	127	144

Notes: Dependent Variable is per capita deaths from natural disasters (1995-2005), logged.

***, ** and * indicate significance at the 0.1 percent, 1 percent and 5 percent levels respectively (on the basis of a two-tailed test). N denotes the sample size.

Table 4.0: Determinants of the Environmental Sustainability Index (ESI)

	Institutional Measure				
	(i) *Civic Activism*	(ii) *Gender Equity*	(iii) *Clubs and Associations*	(iv) *Intergroup Cohesion*	(v) *Interpersonal Safety and Trust*
Social Institution Measure	18.249*	18.982**	0.384	4.605	4.593
	(9.191)	(6.119)	(3.864)	(6.597)	(8.446)
INDUST	-0.031	-0.048	-0.014	-0.039	-0.016
	(0.05)	(0.049)	(0.055)	(0.051)	(0.057)
ln*POP*	-3.121***	-3.047***	-3.186***	-2.78***	-3.224***
	(0.571)	(0.538)	(0.619)	(0.553)	(0.601)
VOICE	3.385**	3.291***	3.573**	3.961***	4.128***
	(1.001)	(0.917)	(1.322)	(0.906)	(1.064)
GDP	-0.318	-0.397	-0.178	-0.113	-0.222
	(0.236)	(0.26)	(0.33)	(0.251)	(0.268)
GDP^2	0.012	0.016*	0.013	0.009	0.012
	(0.007)	(0.007)	(0.009)	(0.007)	(0.007)
Constant	55.663***	55.712***	63.825***	60.466***	62.416***
	(5.102)	(3.269)	(4.869)	(5.021)	(3.649)
R^2	0.55	0.563	0.564	0.537	0.556
N	108	118	82	115	106

Notes: heteroscedasticity-consistent t-statistics are given in parentheses. ***, ** and * indicate significance at the 0.1 per cent, 1 per cent and 5 per cent levels respectively (on the basis of a two-tailed test). N denotes the sample size. Variable abbreviations are as defined in the text.

Table 5.0: Determinants of the Environmental Performance Index (EPI)

	Institutional Measure				
	(i) *Civic Activism*	(ii) *Gender Equity*	(iii) *Clubs and Associations*	(iv) *Intergroup Cohesion*	(v) *Interpersonal Safety and Trust*
Social Institution Measure	38.425**	26.359**	-2.316	3.131	-11.884
	(14.363)	(8.245)	(6.281)	(9.131)	(9.999)
INDUST	-0.024	-0.069	-0.088	-0.046	0.028
	(0.078)	(0.079)	(0.09)	(0.082)	(0.083)
ln*POP*	0.069	0.388	-0.817	0.614	0.185
	(0.797)	(0.725)	(0.857)	(0.767)	(0.811)
VOICE	1.464	1.352	-0.079	2.262	1.827
	(1.463)	(1.344)	(2.045)	(1.365)	(1.488)
GDP	2.303***	2.529***	2.923***	2.958***	2.689***
	(0.417)	(0.395)	(0.474)	(0.426)	(0.423)
GDP^2	-0.059***	-0.058***	-0.061***	-0.068***	-0.057***
	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)
Constant	34.723***	39.405***	56.948***	47.647***	55.699***
	(7.935)	(5.388)	(6.366)	(6.758)	(4.961)
R^2	0.709	0.719	0.72	0.701	0.689
N	101	111	75	107	98

Notes: heteroscedasticity-consistent t-statistics are given in parentheses. ***, ** and * indicate significance at the 0.1 per cent, 1 per cent and 5 per cent levels respectively (on the basis of a two-tailed test). N denotes the sample size. Variable abbreviations are as defined in the text.

Table 6.0: Determinants of Change in Carbon Intensity (Ratio of GDP to Carbon Emissions), 1995-2005

	Institutional Measure							
	(i) *Civic Activism*	(ii) *Gender Equity*	(iii) *Clubs and Associations*	(iv) *Intergroup Cohesion*	(v) *Interpersonal Safety and Trust*	(vi) *Voice and Accountability*	(vii) *Government Effectiveness*	(viii) *Control of Corruption*
Civic Activism	0.325 (0.268)	––	––	––	––	––	––	––
Gender Equity	––	-1.012*** (0.228)	––	––	––	––	––	––
Clubs and Associations	––	––	0.519*** (0.13)	––	––	––	––	––
Intergroup Cohesion	––	––	––	-0.344 (0.204)	––	––	––	––
Interpersonal Safety and Trust	––	––	––	––	-0.146 (0.21)	––	––	––
Voice and Accountability	––	––	––	––	––	0.043 (0.029)	––	––
Government Effectiveness	––	––	––	––	––	––	-0.003 (0.041)	––
Control of Corruption	––	––	––	––	––	––	––	-0.01 (0.035)
Log population	-0.055 (0.05)	-0.041 (0.046)	-0.027 (0.038)	-0.02 (0.046)	0.005 (0.042)	-0.028 (0.047)	-0.041 (0.048)	-0.011 (0.045)
Population density	0.017 (0.015)	0.019 (0.014)	0.026 (0.014)	0.001 (0.017)	0.017 (0.017)	0.019 (0.014)	0.02 (0.015)	0.018 (0.014)
Log GDP	0.264 (0.286)	0.079 (0.261)	0.644 (0.324)	-0.264 (0.312)	0.025 (0.367)	0.243 (0.27)	0.171 (0.308)	-0.197 (0.293)
Log GDP squared	-0.019 (0.018)	-0.003 (0.016)	-0.038* (0.019)	0.015 (0.019)	-0.001 (0.021)	-0.017 (0.016)	-0.012 (0.019)	0.01 (0.018)
Constant	0.893 (1.439)	1.717 (1.367)	-1.672 (1.557)	2.628 (1.608)	0.633 (1.764)	0.609 (1.439)	1.016 (1.487)	1.983 (1.421)
N	153	146	80	160	79	159	158	132
R^2	0.03	0.15	0.19	0.03	0.02	0.04	0.03	0.04

Notes: Dependent Variable is Change in Carbon Intensity (1995-2005), relative to base year (1995)
***, ** and * indicate significance at the 0.1 percent, 1 percent and 5 percent levels respectively (on the basis of a two-tailed test). N denotes the sample size.