Coping with creeping catastrophes: National political systems and the challenge of slow-moving policy problems

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1. Introduction

Catastrophes are usually associated with phenomena like tsunamis, earthquakes or asteroid impacts – disasters that happen rapidly with immediately visible impacts. A different logic is involved when problems and challenges evolve incrementally, in slow-motion, and when they only become visible over long periods (Pierson 2004). Jared Diamond recently referred to such changes as "creeping normalcy" (Diamond 2005). Changes are perceived as normality if they happen in unnoticed increments. This concept was used to explain the varying adaptation capacities of human societies to long-term environmental changes.

A powerful metaphor illustrating the inherent dangers of such processes is the boiling-frog allegory. Al Gore was using it in his movie "An Inconvenient Truth". If a frog is thrown into a pan of boiling water, it will immediately jump out, but if you put a frog in a jar of warm water and gradually heat it to boiling, the frog will stay until it boils to death. The frog's nervous system is apparently impervious to changes in temperature until their fatal consequence because it happens piecemeal-incrementally. Anthony Giddens was quick to baptize this temporal dilemma as the "Gidden's Paradox", stating that, "since the dangers posed by global warming aren't tangible, immediate or visible in the course of day-to-day-life, however awesome they appear, many will sit on their hands and do nothing of a concrete nature about them. Yet waiting until they become visible and acute before stirred to serious action will, by definition, be too late" (Giddens 2009: 99).

In the evolution of human societies, there are a number of processes that exhibit this pattern of "creepiness". The above-mentioned climate change is just the most broadly discussed social and political problem of this kind. Other creeping catastrophes could be increasing social stress produced by aging societies, the slow accumulation of toxic chemicals in the environment and food chain, or global pandemics like SARS and AIDS combined with increasing antibiotics resistance. All these processes have in common that they evolve "bit-by-bit", are cumulative, and possibly result in disastrous long-term consequences.

In this paper, we are not so much interested in the material side of this process pattern, but rather in its political and social consequences. We try to determine if and how societies and their political systems differ in the capacity to detect such creeping problems early. We suppose that these differences are related to variations in their "nervous systems of governance", which control perception and adaptive behavior (Ashby 1956; Deutsch 1963). We are interested in how this social cybernetics is generated by internal differentiation and integration of societal mechanisms and how these "neuronal networks" perceive, communicate, and act. A key question is: Do democratic political systems, where political power is dispersed and shared among many, perform better with the perception of creeping challenges, or do we find examples of effective "eco-dictatorships"? Does decentralization and multilevel differentiation show adaptive advantages, as it is not only claimed by

recent management tracts (Brafman & Beckstrom 2006), but also by prestigious nobel laureates such as Elinor Ostrom (2010)?

Based on a comparison of national policies related to global warming, the paper will discuss and then develop some hypotheses detailing how, why, and under which conditions differently structured policy systems show varying performance. In a first section we will outline an analytical framework how political systems deal with this kind of long-term risks, and how differently structured systems have adaptive advantages and disadvantages. In the subsequent section we test some of these hypotheses related to the climate change topic with two types of macro-comparative analysis. We argue that internal structures and external factors both contribute to the varying pace and degree of governmental reaction. We will conclude with a list of weaknesses and limits these macro-quantitative models exhibit and propose some complementary research strategies.

2. Societal development and adaptation

The issue of political adaptation to environmental changes is a rediscovery within the last decade. During the 1960s, it was an important concept within the developmental theory of political systems (Almond 1965; Parsons 1964). In the last decade, it reentered the discussion with respect to the adaption of political systems to significant economic and political transformations (Grote, Lang & Schneider 2008), and it became a particularly powerful concept with respect to the impact ecological transformations have on political systems' environments (Folke, Hahn, Olsson & Norberg 2005).

Traditional social theory strongly focused on the construction and maintenance of order. The question of how societies successfully overcome structural and behavioral changes in order to cope with critical problems was only raised in a few "grand theories". One of these theories is Marxism, which holds the optimistic belief of a teleological sequence of changes in economic systems and forces of production. These are ultimately driven by social conflict, where the whole process leads to an increasingly powerful mastery of nature and society. The other approach with a similar teleological content is systems theory. It emphasizes general adaptive capacities and openness of social and political systems, the latter of which are based on increasing structural and functional differentiation (Almond 1965; Deutsch 1963; Parsons 1964).

A serious problem with traditional systems theory is that systems and systemic processes, for the most part, remain "black boxes" in which actors, relations and mechanisms are opaque (Bunge 1996). In this respect, we use basic ideas of governance theory to identify varieties of actors with different functions and institutional structures enabling communication, integration and long-term adaptation (for an overview see Schneider & Bauer 2007).

A fundamental problem from this point of view is to understand under which conditions societies attain complete adaptive failures, i.e. "collapse". Historical analysis has demonstrated that there are many reasons for the collapse of past societies. External factors threatening the existence of a society are, for example: climate change, hostile neighbors, depletion of vital resources, natural catastrophes and a variety of economic factors (Diamond 2005; Tainter 1988). In addition to these environmental challenges, internal societal tensions such as class conflict and elite misbehavior may also lead to collapse. Since we are not interested in all reasons for failure but rather in sociopolitical ones, we concentrate on typical social processes that are related to *societies' perception and responses to critical problems*.

Complex societies develop differentiated political and cultural rule systems to cope with critical threats and problems. Why can a society fail in this respect? When we think of which essential parts of the problem-solving process can go wrong, we can separate the factors in a sequence of

four phases (Diamond 2005). Some of these phases are well known in the "policy cycle" literature of political science (May & Wildavsky 1979).

First, a society can *anticipate* a problem. But this can fail due to several reasons: One is that a society has no prior experience of a given problem and cannot imagine the possibility of its occurrence. Another cause is reasoning by false analogy (Diamond 2005). While analogy is a well-known technique for the solving ill-structured problems (Simon 1973), such constructions may be false and consequently suggest inappropriate strategies.

In a next step, a society has to *perceive* a problem when it occurs. Once having anticipated a phenomenon, perception can still fail because the anticipated phenomenon is not recognized as a problem, or the dimensions of the problem are not fully understood. There are several reasons for a failure of perception. 1/ The material origins of a problem can be imperceptible; 2/ Cultural and political factors can be responsible that an objective problem is subjectively not perceived as such; 3/ A failure to perceive a problem may be implied in its temporal pattern: If it grows incrementally, "bit-by-bit", and if these changes are concealed by continual fluctuations, even if there is an exponential growth during the first stages, societies may conceive this as "normalcy".

The third step is the *actual solving* process through collective action. Many societies fail at this stage, often due to conflicts of interest (often based on distributive effects of problem-solving), to incompatible problem-solving philosophies, or due to coordination problems. Other possible reasons are described in models on social traps and dilemmas like the prisoners' dilemma or the logic of collective action. Finally, failure can also emerge from irrational behavior based on non-adaptive norms and values (Diamond 2005).

Even if a society has anticipated, perceived, and communicated the problem and controls the relevant resources, failure is still possible because the problem can be *beyond the solving capacities*. It could simply be too expensive to solve, efforts could be "too little, too late", or the solution could "disimprove" the situation.

Modern societies are differentiated and many heterogeneous agents and rule-systems contribute to the problem solving process. Following the "Nerves of Government" analogy introduced by Deutsch, the various parts of a society are integrated in a central nervous system, communicating observations and perceptions between the components and controlling its collective behavior, which should contribute to problem-solving and adaptation (Deutsch 1963). But to avoid the functionalist blind alley of thinking society as super organism with a centralized brain, a more suitable concept is the "policy network" as outlined by Kenis/Schneider (1991): "The core of this perspective is a decentralized concept of social organization and governance: society is no longer exclusively controlled by a central intelligence (e.g. the State); rather, controlling devices are dispersed and intelligence is distributed among a multiplicity of action (or "processing") units. The coordination of these action units is no longer the result of "central steering" (…) but emerges through the purposeful interactions of individual actors, who themselves are enabled for parallel action by exchanging information and other relevant resources" (an overview give Lang & Leifeld 2007; Schneider, Janning, Leifeld & Malang 2009).

3. Capacities of problem-solving: hypotheses and conjectures

Which roles and functions do the various societal agents – government, science, the media, and NGOs) - have in the above-mentioned stages of problem-solving? Is it possible to relate the varying capacities to cope with creeping problems to their structural features (e.g. relational patterns and resource distributions)? In the following section, we apply the policy network perspective and derive some hypotheses associated to varying capacities of national political systems when coping with this specific type of policy problems.

3.1 Anticipation

There are only two ways of anticipating a problem which has not yet become manifest. The first is to rely on introspection or a kind of supra-natural "revelation knowledge". The other is predictive knowledge based on empirical evidence. Problems can frequently be anticipated through scientific forecasts, and science then works as an early warning system. In this instance, science as a cultural subsystem of society is considered to be a crucial part of the perceptual apparatus. However, as we will argue, scientific anticipation alone is not a decisive factor for an effective start to societies' problem-solving process: it must be considered in conjunction with the importance a given society attributes to scientific knowledge. Even if we assume that science is able to predict the slowly emerging problem correctly, the early anticipation of a problem will fail to become socially relevant if a society does not consider science to be an authoritative and credible tool for at least approximately true "knowledge-making".

We there can therefore conjecture that the more advanced science systems in national societies are, the greater reputation and status they will exhibit, and the more likely it then is that problems get correctly anticipated. The issue, however, is how to measure these differences from a macro-comparative perspective. While the measurement of reputation is difficult in all respects, a straight measure would be the number of researchers in a country. However, as this figure highly correlates with a country's general development level, a proxy for the position of the science system in a country could be its GDP per capita.

3.2 Perception

Perception is the core around which cybernetic metaphors such as nerves and neurons gravitate. Two crucial aspects are considered: First, we analyze conditions for the *scientific* perception of a given problem. Second, we emphasize *societal* perception of facts and analyze mechanisms through which they become socially relevant. The first is primarily a scientific task whereas the second refers to how sensitively mass media, social movements and interest groups function as societal "neurotransmitters" that link a change in environmental conditions to a credible threat. Aside from the above-mentioned channels of interest intermediation transforming scientific findings in generalized knowledge, science may also be directly drawn into policy networks: Science may be an influential agent by producing and communicating relevant knowledge. If the network operates effectively, relevant information may diffuse faster among political actors and the politicization of a given problem should be easier than in tightly controlled autocratic or hierarchical systems. Assuming that this network argument is true, we expect a government to be more sensitive to climate change problems when there are more possibilities of getting access to the political agenda via decentralized policy networks.

This argument is also valid at the global level. In the contemporary "global society", science is part of the world polity in which information exchange cannot be restricted to national boundaries (Drori, Meyer, Ramirez & Schofer 2003; Fisher 2003). Problem perception in one national science system quickly diffuses to other regions and countries, and this diffusion is particularly strong if countries are members of intergovernmental organizations such as the OECD, European Union, or specialized organizations such as the IPCC. These organizations not only facilitate but also sponsor exchange and cooperation in scientific knowledge-making and diffusion (Beck 2010).

Empirical studies have shown that countries vary greatly in the way their scientists perceive the problem of climate change. However, these differences do not fully capture the national variations in perception. The latter has to be related to socio-political communication by intermediaries like social movements, interest groups, political parties and mass media, but also to the general cultural background in which a given problem such as climate change emerges (Verweij et al 2006). Social movements are not just "problem communicators", they also help to frame and crystallize issues,

making them socially relevant (Moser 2007). In the case of global warming, green NGOs are of particular importance (Carpenter 2001; Fisher 2003; Keohane 2002). Since major impacts of climate change will not occur in the near future, the topic is less tangible to the public and various stakeholders. Green NGOs therefore have to work for a sustained problem perception. Compared to single issue campaigning generally associated with the approaches of NGOs to environmental and public risks, climate change "ushers in a new era of engagement" (Gough & Shackley 2001).

It is not surprising that green social movements are closely linked with green parties. Since environmental problems and in particular global warming imply long-lasting and high-risk problems, the emergence of green parties from social movements can be understood as a consolidation of this issue area. In line with our neural model, we assume that the more numerous and politically integrated social movements and green parties are in a given society, the better and more stable the societal perception of global warming will be.

Another risk transmitter is the media. It has a crucial function as a source of information and opinion about scientific findings for citizens (Carvalho 2007; Weingart, Engels & Pansegrau 2000). Public perception of this domain is significantly influenced by the representation of scientific knowledge transmitted through various means of mass communication (Corbett & Durfee 2004; Krosnick, Holbrook & Visser 2000). In this respect mass media are also important for the understanding of perceived risks, and it is obvious that only individuals who understand the complex relation between causes and effects are willing to take action to impede the risk (Stamm, Clark & Eblacas 2000).

The ways in which people think about environmental problems is not necessarily accurate or complete. Nevertheless, these cognitive processes are likely to influence both the willingness and ability of societal agents to participate in problem-solving. We consequently assume that uncensored media coverage has two effects on problem perception: It transforms scientific perception of a problem into a general societal perception, and it also contributes to the understanding of the nature of the problem and thereby motivates collective action. The relation between these factors can be expressed in the following hypothesis: The better the understanding of the issue of global warming, the more likely it is that a society will take action to prevent the problem, and without a free press, the step from scientific perception to social perception is less likely. Therefore we believe that the greater the freedom of press in a society is, the more likely the societal perception of a creeping problem will be.

3.3 Agenda setting

The intermediate step between societal perception and a policy solution is the shift from the social to the political realm in problem-processing. A first stage in this process is the transformation of the issue to a topic on a political system's priority list. Communication science and policy research call this process "agenda-setting" (Kingdon 2003). A jump on the political agenda may be triggered through communication by non-governmental actors and mass media. But agenda-setting may also originate from the inside of politics – the bureaucratic or parliamentary arena. Another powerful trigger is the environment of a political system, as it is emphasized in the literature on policy transfer, diffusion, and convergence (Holzinger & Knill 2005).

There are several dimensions where political systems can differ with respect to the openness and permeability of their policy-agendas. One important factor is the access of social movements and NGOs to participation in policy networks. Political systems vary widely in terms of their degree, how they integrate new and rather weak interests (Kriesi 1995). In this respect it seems reasonable to assume that inclusion-prone or consensus-oriented political systems incorporating all actors concerned in policy processes are likely to perform better in the political perception of societal problems (Dryzek 2009; Jost & Jacob 2004; Scruggs 2003). While this "openness" is difficult to meas-

ure in a quantitative perspective, a proxy measure could be Lijphart's Index on consensus democracy (Lijphart 1999).

3.4 Problem-solving

Once a problem is on the political agenda, the struggle for a policy solution is often a process which is driven by conflicting interests and the quest for power. Accordingly, it seems to be appropriate to take the institutional structures of governmental systems (in the narrow sense) into account. A classical political question is if the dispersion and sharing of political power enhances or reduces the capacity for collective action (Norris 2008). In the political science literature there are two contrasting hypotheses: 1\ Tsebelis' veto player model states that an increasing number of veto players in a political system reduces its capacity to changing the status quo by collective action (Tsebelis 2002). 2/ Lijpharts studies on democratic systems point to performance advantages of decentralized political systems where power is shared among many actors and different levels (Lijphart 1999; Wälti 2004). Power dispersion sums up the arrangement of executive power, party systems and electoral regimes, interest group structures, but also the vertical division of power in federal systems. From this perspective, there are two major streams of argumentation: On the one hand, it is conceivable that "majoritarian systems" with only one real center of power is able to produce policy solutions faster and more radical than consensus models. On the other hand, governments in more consensus-oriented democracies, which have to look at several different actor positions when designing a policy in a deliberative way, could be affiliated with more encompassing, mature, and long-term policy solutions. In such arrangements, electoral cycles and pressures have less impact than in majoritarian democracies, which are more short-term oriented. For instance, a minority party like the Greens in Germany can be considered more influential in consensus systems because they, at the very least, must be integrated in policy-making, whereas in majority systems environmental problems could be ignored.

4. The case of climate change: Applying macro-quantitative analysis

The previous sections sketched a theoretical framework for system analysis. We argued that different political and social systems structures contribute to both the varying pace and degree of governmental reaction in coping with long-term risks. To illustrate our point, we will now discuss the pressing issues of climate change and show some analytical results. We summarize our inquiries with a list of findings and weaknesses, and we conclude with a prospect to complementary research strategies.

The issue of anthropogenic global warming was first hypothesized by the Swedish physicist and chemist Svante Arrhenius about 100 years ago. But only since two or three decades, climate change has been perceived as a pressing global risk to be tackled both on the national and the global level of world society. However, various countries react rather differently to this common challenge. We will try to test whether this variation is caused by political characteristics of these countries.

4.1 Hypotheses and Operationalizations

Successful coping - our explanandum - is measured by two dependent variables: The first is the duration between the agreement on the Kyoto protocol (11 December 1997) and the date of ratification, acceptance, accession or approval of the protocol measured in days. These time spans show which countries are early adopters and which countries are laggards. The second dependent variable is the change in CO_2 emissions per capita between 1990 and 2004. This is not a measure of the policy output but rather the policy outcome. A recent analysis using a policy output index was provided by Bättig and Bernauer (2009).

Our assumption is that governments are able to control the level of CO_2 emissions if they only assign a high priority to this risk. Our first hypothesis is that open, democratic countries with high degrees of civil rights, pluralism and freedom of press might be more likely to have a lively public debate about the threat. We use readily available measures of good governance (Kaufmann et al 1999), electoral participation (Vanhanen 2000), and the Failed States Index as indicators of the nation states' capacity to serve as the arena of extensive public discourse. We expect democratic countries to actively engage in climate protection policy while authoritarian countries rather shy away from becoming very active.

The second construct is the collective action capacity of countries. In this respect we use Lijphart's executives-parties dimension (Lijphart 1999). We also tried Tsebelis' veto player data, but the number of observations (21 polities) is too small for this type of analysis (Tsebelis 2002).

Economic and interest group pressures are captured by an admittedly "distant indicator" measuring the share of the industrial sector in an economy. We hypothesize that if there is a large industrial sector, business interests are more likely to exert pressure on national governments. On the other hand, if agriculture and the service sector are bigger, domestic pro-industry interest group pressure will be less powerful, and the government will be more active in the promotion of climate protection policies. An economic catch-all variable is the gross domestic product per capita. This variable might exert multiple influences: If people in a country are rich, they are more likely to have post-materialist attitudes. At the same time, wealth is correlated with democracy, in order for the post-materialist electorate to assert its positions. The argument is that societies with a high GDP per capita do not have to face any severe problems and can concentrate on less urgent and instantaneous matters like climate change.

The final hypothesis to be tested is the level of risk-exposure of each country. Very small countries with less than one million inhabitants are often directly threatened by extreme weather conditions or rising sea levels. This is captured by a dummy variable indicating whether the population size of a country is below one million. In addition, we will include the absolute level of CO_2 emissions as a control variable: Countries with a large amount of emissions are presumably more likely to produce larger changes in emissions than countries with a low emission level. This is due to the higher variance of large numbers.

4.2 Why are countries early adopters or laggards?

The pace of government activity can be assessed by looking at the Kyoto survival data. Since all countries have not ratified the protocol, this data is right-censored. We therefore use the Kaplan-Meier approach (see Efron 1988 with further references to survival analysis), and report the density and the survival functions in figure 1.

The first plot shows the hazard rate of all countries. The number of new adopters increases to a certain level (the early adopters), remains constant until there is a large increase in accessions, possibly induced by the first wave of adopters, and decreases again. However, there is a third wave of late adopters before fewer and fewer countries ratify the protocol that is puzzling. What factors – beside diffusion – are responsible for early versus late adoption? We include several of the above-mentioned covariates in our model and estimate their effect one by one. Plots 2 to 6 present our findings. The black survival rate represents the 0 of a dummy variable, while the red line is the 1 of the same dichotomous variable.

In the second graph, energy use (kg oil equivalent) per $1,000 GDP was dichotomized at the median value of the distribution in order to partition countries into a group of energy-efficient users (value 0) and one of rather inefficient countries (value 1). There is a clear difference in the survival rates of the two groups: Over the whole time period, wasteful countries are laggards (the red lad-

der). This could be due to country-internal characteristics such as strong industry lobbying or an electorate that benefits from low energy-efficiency (e.g. cheaper fuel).

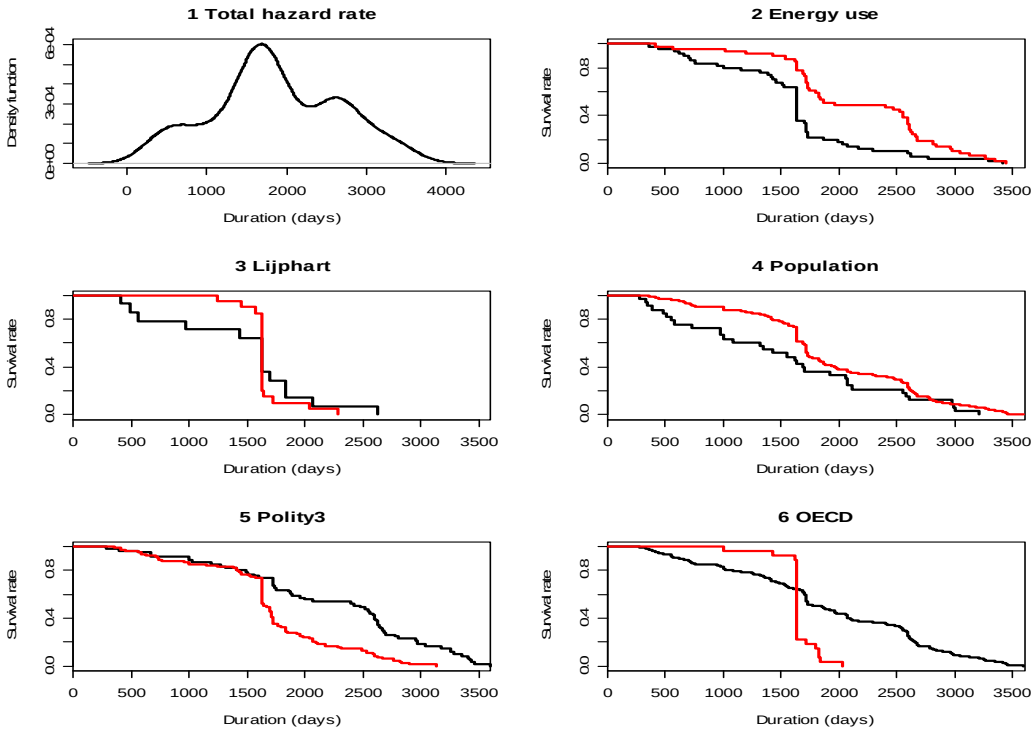

Figure 1: Results of the survival analysis

In the third graph, we test Lijphart's executive-parties dimension. It is evident that consensual political systems are slower in the beginning and then adopt the Kyoto protocol almost all at once while executive systems start earlier and show more continuity. This supports the claim that governments with a higher capacity to make decisions react faster to the long-term problem of climate change.

The fourth plot shows a dummy variable for population size. Countries with less than one million inhabitants are represented by the black curve, others by red. Small countries appear to adopt the protocol earlier, which might be due to the fact that many of them, like Fiji or the Caribbean countries, are directly threatened by a rise of the sea level or extreme weather conditions. In the first years after the agreement the adoption rate is rather rapid.

The fifth part of the figure shows the Polity III index, again dichotomized at the median value. This index captures whether a country is democratic or autocratic. During the first half of the process, democratic (red curve) and autocratic countries (black curve) perform identically, but then the democratic countries appear to have reached a certain critical mass, and many democracies adopt at the same time or shortly afterwards. The process is then slowed down again. This pattern is strongly consistent over all democracy measures we have tested (see Annex #). The finding generally suggests that the more stable, participatory and effective a political system is, the more likely it is that the Kyoto protocol will be ratified rapidly, particularly after the initial spin-off after about 1,550 days.

The last plot draws an even clearer picture: OECD countries were extreme laggards before most of them ratified the protocol simultaneously. In fact, OECD membership accounts for much of the variance in the previous plot. This suggests the role of the OECD as an instrument that facilitates

common framing and tackling of the problem, culminating in a generalized belief and policy congruence of the member countries.

This part of the analysis has provided some clues of how political systems cope with long-term risks. Important factors preventing governments from becoming active seem to be domestic political pressure, consensual institutions and a lack of decision-making capacity, a low magnitude of the problem for the country at risk, and finally a lack of political openness to have a public debate about the problem. Note, however, that these findings are merely correlations, and we do not know in how far each effect is persistent if all other proposed variables are held constant.

4.3 Why do countries change policies to a stronger extent than others?

The ratification dates of the Kyoto protocol are only one indicator of fighting against climate change. In fact, this does not say anything about how countries change their emission rates and why some countries show incremental and others radical policy change. In order to assess this variance, we will look at the absolute per capita change in CO_2 emissions between 1990 and 2004. Some countries decrease their emissions while others increase them. For mathematical reasons (the logarithm of negative values is not defined) we concentrate on predicting the magnitude of emission change, i.e. the absolute values.

Figure 2 gives an overview on the dependent variable ("CO_2 change") as well as some selected independent variables. The lower triangle consists of row- and column-wise scatter-plots, the upper triangle shows the correlation coefficients, and the diagonal cells include variable codes and histograms. The assumption is that the cross-sectional variance is much higher than longitudinal changes within the countries. Therefore we can rely on indices from slightly different years as rough measures.

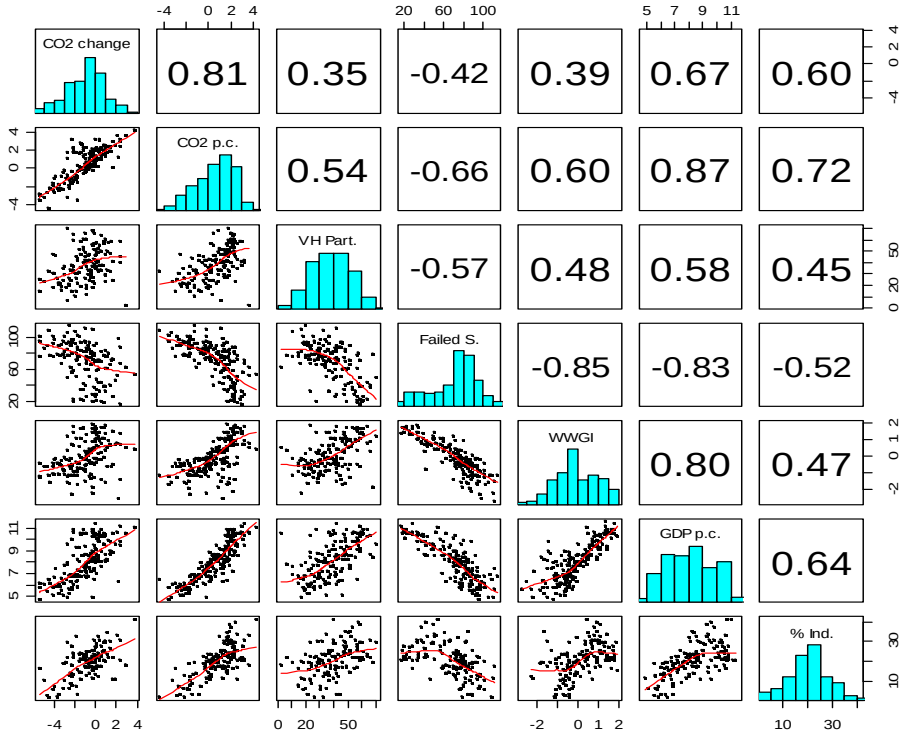

Figure 2: Associations between the variables

We see three things in the scatterplot matrix: 1/ Magnitude of change is strongly correlated with the total level of emissions of a country. The explanation is straightforward: If country A has an emission level of 5 and country B an emission level of 20, it will be easier for country B to have a change of 5 than for country A. In other words, larger values also have a larger variance. 2/ Absolute CO_2 change per capita is correlated with a number of democracy and economic variables. The impact of these factors is examined below. 3/ The dependent variables show a high degree of overlap, which is a sign of collinearity.

Table 1 presents the results of several linear models. Due to multicollinearity, models 1 to 6 include only two independent variables each: the absolute emission level, which is necessary to hold the effect of large baseline values constant (see above), and one measure of democracy or economy in each model. We can clearly see that both have an effect: The more democratic a country is (and the better the participation of the people and the regulatory quality of the governments is), the stronger is the magnitude of change in emissions (models 1 to 4). This effect is consistent over almost all measures of democracy we have tested (for a list, see Appendix). The World Bank HDI, which incorporates economic, technological, health-related and political factors, shows a highly significant effect (model 5), just like GDP per capita alone (model 7). The effect of GDP per capita might be attributed to post-materialist values or fewer competing risks (no civil wars or health problems).

Table 1: Results of the linear models

	Dependent variable: Magnitude of change in CO2 emissions from 1990 to 2004 (log)							
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Failed States Index	-0.014*							
	(0.006)							
Vanhanen: Electoral Participation		0.025**						
		(0.009)						
World Wide Governance Indicators:			0.313*					-0.734***
Regulatory quality			(0.143)					(0.170)
World Wide Governance Indicators:				0.400**				
Government effectiveness				(0.134)				
Human Development Index					5.825***			
					(0.741)			
Share of secondary sector (industry)						0.104***		
						(0.018)		
GDP per capita (log)							0.640***	1.001***
							(0.084)	(0.116)
CO2 emissions per capita in 1990 (log)	0.129***	0.151***	0.131***	0.120***	0.047*	0.072**	0.028	0.018
	(0.025)	(0.029)	(0.025)	(0.023)	(0.023)	(0.022)	(0.025)	(0.024)
Intercept	-0.563	-2.478***	-1.511***	-1.464***	-5.380***	-3.144***	-6.265***	-9.161***
	(0.518)	(0.348)	(0.156)	(0.153)	(0.495)	(0.331)	(0.626)	(0.895)
Multiple R^2	0.30	0.28	0.28	0.30	0.47	0.41	0.46	0.51
Adj. R^2	0.29	0.27	0.27	0.29	0.46	0.40	0.45	0.50
N	149	132	159	162	151	122	161	159
F	31.16	25.14	30.91	34.04	66.7	42.37	66.65	55.13
Df	147	130	157	160	149	120	159	156

*** p< 0.001, ** p < 0.01, * p < 0.05

The effect is, however, not rooted in lower pressure of organized industry interests due to the lower amount of heavy industry because this is already held constant in the absolute emission level variable. Unless we look at the micro or meso level within the countries, it is hardly possible to distinguish between the possible mechanisms.

A highly significant association is present in model 6, the share of the secondary sector. Countries with much industry tend to produce more extreme changes in their level of emissions than agriculture- or service-oriented economies when the total level of emissions is held constant. This finding deserves further investigation. When economic and political factors are combined, half of the variance can be explained (model 8). Both factors are highly significant, but the total level of emissions, that has to be held constant, is not significant anymore. Regression diagnostics indicates that the model is properly specified.

As in the survival analysis, we have tested Tsebelis' veto player data and Lijphart's executive-parties dimension, but this time no effect can be detected. It seems that the pace of becoming active is related to the capacity of a government to decide effectively, but that the magnitude of change is not related to it. Domestic political configurations hence deserve closer attention in future research.

Our cross-sectional analysis supported the result of the survival analysis that democracy matters. Our findings are thus similar to Bättig and Bernauer's (2009) conclusions. The capacity of polities to deliberate in parliaments and publics about upcoming long-term risks affects their climate policy behavior.

Both types of macro-quantitative analysis - survival analysis and the cross-sectional models - have generated six major findings:

1. Democracy clearly matters. The more democratic a country is, the faster it will react to problems and the more radical the policy change will be. We interpret this as the capacity of governments to have public debates and to include various interests and opinions.

2. The decision-making capacity of governments seems to affect the pace of governmental action, but not the magnitude of change. Decision-making capacity is measured in terms of Lijphart's executive versus consensual dimension as well as the energy efficiency of countries.

3. International or supranational organizations such as the OECD or EU serve as forums for policy coordination and collective risk processing. The largely simultaneous Kyoto protocol ratification of all OECD member countries shows that risk processing is not restricted to the national public discourse but entails international negotiations as a form of swarm intelligence.

4. Being at risk makes polities respond faster but not more intensively. Very small countries like Antigua and Barbuda or Fiji are among the first adopters of the protocol, but their magnitude of change is low, even if controlled for total emissions. This might be due to their low democracy scores, as discussed above.

5. Economic well-being as measured by GDP per capita plays an ambiguous role. An explanation has to take into account that the effect appears when examining the magnitude of change, but not the pace of policy action.

6. Democracy and economy as defined above can only be used to predict the magnitude of emission change, but not the direction of change. This is a theoretical puzzle that might be addressed in case studies of specific countries.

In conclusion, we have found substantial evidence that democracy and economic development clearly matter. The general tendency is that wealthy countries with participatory democracies are more committed to climate protection than countries with semi-democratic or authoritarian structures.

4.2 Limits and Drawbacks

A general problem in this analysis, however, is that the independent variables not only explain the dependent variables, but also explain each other (i.e. *multicollinearity).* In this respect it is difficult to differentiate between democracy and economy. Supporting the famous Lipset hypothesis (Lipset 1959), recent studies have shown that democracy and economic development are closely related (Norris 2008; Przeworski 2000). In the cross-sectional analysis above, a separate model was therefore estimated for every indicator, showing that a democratic and economic effect is indeed at work. The way to go from here is to develop testable theoretical implications from the theory, i.e. what would also be true if the capacity of political systems for public debate was responsible for the reaction of countries?

A further limitation is associated with the *independence of cases* problem. In inferential statistics, observations are assumed to be independent from each other. Not only in the context of globalization such *independency* between political systems is doubtable: Great powers have the ability to create and enforce international norms. Globalization and Europeanization make this even more problematic, since inter- and supranational organizations can harmonize policies by collective decision mechanisms. In this context developed countries offer other countries development assistance and expect their compliance in the international arena (e.g. the "adaptation fund" initiated at the Bali summit or the "forest carbon partnership" offered by the German government and the World Bank). Russia's ratification of the Kyoto protocol in November 2004 was tied to the issue of Russian WTO accession as a package deal. Once such incentives are offered to less wealthy and less democratic countries, the variance between countries cannot be reliably explained anymore on the grounds of democratic and economic mechanisms in a simple cross-sectional design. It might be possible to solve this problem of autocorrelation, which is also known as Galton's problem, by identifying and incorporating the underlying mechanisms of diffusion (Jahn 2006).

Another type of problem is related to the operationalization of some variables: Emissions are policy *outcomes* rather than policy *output*. But even when we are able to measure outputs in terms of "policy commitment", the varying effectiveness of policy instruments (e.g. emission trading) is not taken into account. As for the independent variables, we cannot ascertain whether GDP per capita, for instance, has an effect on voters' values, i.e. post-materialism, and on the possibility to assert these values in a participatory political system (since democracy and wealth are correlated), or whether it is just a proxy for development, i.e. fewer competing societal risks promote a higher priority of climate change in governmental policy-making. This leads to the multicollinearity issue again, which in the last instance is a theoretical rather than a methodological problem.

A final difficulty is that countries are exposed to a variety of simultaneous challenges. Some of these have a global scope like environmental issues and some do not or hardly exceed state boundaries, e.g. civil wars, economic decline or demographic change. The role of these *competing risks* in causing governments to act has largely been neglected. Governments face tradeoffs when anticipating and fighting risks, i.e. they will only see the most pressing problems and neglect others. If a government has to suppress upcoming ethnic tensions, for instance, it will assign a very low priority to climate change, given the time, staff and budget constraint. Climate change is only one of

these risks. If one tries to infer more abstract mechanisms from this single case, one might face an extreme small-n problem. In other words, we cannot be sure that our theory and our findings equally apply to other creeping catastrophes.

5. Conclusion

Better data and more advanced methods undoubtedly lead to advancements in the social sciences to explain why some institutional structures produce better results or why some policy instruments have a better effect. Macro-quantitative analysis in our context supposes that we are able to find generalizable quasi laws in societies of the kind "an increment of x in democracy leads to an increment of y in CO2 reduction". The problem is first, that this macro-relationship is intermediated by so many additional variables inside the black box of national political systems. From a pure macro perspective, one can only guess some internal mechanisms, such as: wealthy voters who have post-materialist attitudes and promote green policy, or wealthy countries usually have fewer competing societal risks and can prioritize less urgent matters like climate change, etc. The second problem is that a hidden assumption supposes some kind of homogeneity at the different stages of democratic development. However, countries at the same democracy level might have quite different party systems, interest group structures, and various ways of integrating science and social movements in policy formulation. With respect to the homogeneity assumption, there might be big differences between policy sectors which already had been emphasized in the debate on meso-corporatism in the late 80s. Findings in one sector can be very different from findings in another sector (Grote, Lang & Schneider 2008).

In this respect it might be hasty to transfer macro-quantitative findings on general environmental policy to the climate change policy domain (cf. Dryzek 2009), since the issue at stake, actor constellations and communication structures between major components of the political system are quite diverse. For this reason, we argue that qualitative or quantitative case studies can provide more accurate insights into domestic processes, and lead to a better qualitative foundation of the mechanisms. Macro-quantitative studies should be triangulated with meso-level studies using "nested analysis" (Lieberman 2005): After conducting a preliminary large-n analysis, one should go down to the level of "on- and off-the-line" individual cases, refine the model, develop implications and then test them again on the macro level in a large-n analysis.

Such case studies may concentrate on some of the following aspects, which cannot be included in a pure macro-comparative analysis. 1\ What role does policy coordination between the countries play from the perspective of national states? 2\What is the role of specific institutions like the parliament, the executive government, direct participation of the electorate, or the integration of scientific consulting, social movements, interest groups and the media in agenda-setting and policy-making? 3\ How does the public discourse about risk evolve, and what organizations have an interest in promoting a given position? Can this be aggregated to an across-country pattern? 4\What different interest or discourse configurations can we identify in the countries? Policy network analysis might be a valuable tool for the investigation of this question. Do certain configurations or the intensity of cleavage lines affect the policy outcome if compared on a macro scale?

Many of these questions can be answered by analyzing the actor constellations and networks in the formulation and implementation of these policies (Schneider, Janning, Leifeld & Malang 2009). Although this method is increasingly used in policy analysis, its analytical power is still not fully taped.

Table 2: Description of Data and Sources

Variable	Variable code	Description	Unit and value range	Source
Independent variables				
CO2 change	-	United Nations Millenium Development Goals Indicators: Carbon dioxide emissions (CO2), change from 1990 to 2004 in absolute figures	metric tons of CO2 per capita (CDIAC) +313.18 to +366.84	http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749
CO2 emissions per capita in 2004 (log)	CO2 p.c.	United Nations Millenium Development Goals Indicators: Carbon dioxide emissions (CO2), the total amount of CO2 emissions per capita in 2004	metric tons of CO2 per capita (CDIAC) Log. scale: -5.91 to +3.38	http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749
CO2 emissions per capita in 1990 (log)	CO2 p.c. 1990	United Nations Millenium Development Goals Indicators: Carbon dioxide emissions (CO2), the total amount of CO2 emissions per capita in 1990	metric tons of CO2 per capita (CDIAC) Log. scale: -5.91 to +3.38	http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=749
Dependent variables				
Freedom house Index	FHI	Freedom house Index of political rights and civil liberties	+1 to +7	http://www.freedomhouse.org/
Polity III index	Polity	Polity III Index; always the latest polity ending in 1994	-88 to +10	http://www.systemicpeace.org/polity/
Failed States Index	Failed S.	Failed States Index 2007	+17.1 to +113.7	http://www.fundforpeace.org/
Vanhanen Index: Electoral Participation	VH Part.	the Vanhanen Index of electoral participation 2000	+2.27 to +70.16	http://www.prio.no/CSCW/Datasets/Governance/Vanhanens-index-of-democracy/
World Wide Governance Indicators: Government effectiveness	WWGI GE	World Bank: World Wide Governance Indicators 2007; government effectiveness in 2006	-2.19 to + 2.29	http://info.worldbank.org/governance/wgi/
World Wide Governance Indicators: Regulatory quality	WWGI RQ	World Bank: World Wide Governance Indicators 2007; regulatory quality in 2006	-2.70 to + 1.95	http://info.worldbank.org/governance/wgi/
Human Development Index	HDI	United Nations: Human Development Index 2007/2008 (data from 2005)	+0.336 to +0.968	http://hdr.undp.org/en/statistics/data/
Share of secondary sector	"% Ind.	Share of the secondary (industrial) sector. ILO Key Indicators of the Labour Market Programme. Indicator 4: Employment by Sector: industry percent (t2)	+2.1 to +41.0	http://data.un.org/
GDP per capita (log)	GDP p.c.	gross domestic product per capita in 2006	Log. scale: +4.74 to +11.54	http://data.un.org/

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