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Assessing the role of institutions in ensuring environmental performance: a cross-national study of UN Framework Convention on Climate Change

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ASSESSING THE ROLE OF INSTITUTIONS IN ENSURING ENVIRONMENTAL PERFORMANCE: A CROSS-NATIONAL STUDY OF UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

A Thesis

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by
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ABSTRACT

Although past research has emphasized the importance of international environmental agreements in redressing environmental degradation, systematic assessments of regime effects are missing. The central focus of this paper is assessing the effectiveness of international environmental agreements: do international environmental agreements actually improve environmental quality? Most of the research in the field of environmental protection has focused on the role of economic development and the political system. Several studies have found that the relationship between a countries wealth and some pollutants follow an inverted U-shaped curve, popularly known in the literature as the Environmental Kuznets Curve (EKC). Again scholars have also found that democratic countries have better environmental records compared to authoritarian polities.

Using generalized least squares on a panel data set consisting of sixty six countries who were members of the UN Framework Convention on Climate Change, for a time period of ten years (1991-2000), I found that international environmental agreements exert significant influence in ensuring environmental quality. Most importantly, industrialized countries, who are again members of UNFCCC under the Annex 1 category, tend to emit less. Similarly, economic development and a democratic polity also help in ameliorating environmental condition. Therefore, one can conclude that institutions do matter, even if they are non-binding, in bringing about desired changes.

INTRODUCTION

   Despite the paucity of judicial means of dispute resolutions and the ongoing pursuit of developing countries to alleviate their economic conditions, international agreements have been established in increasing numbers in the area of environmental protection. The rapid proliferation of international environmental agreements has led most analysts to focus on their formulation, negotiation and content. Yet little empirical analysis of the effectiveness of these environmental accords has been done so far.

   The central focus of this paper is the effectiveness of these agreements: simply, do international environmental agreements actually improve environmental quality? Effectiveness is defined as the degree to which international environmental accords lead to changes in behavior that helps to solve environmental problem (Victor, Raustiala & Skolnikoff 1998). However, effectiveness does not imply getting rid of the problem altogether.

   This question is interesting because all international regimes face problems with free riders, holdouts and defectors, this is even more so for environmental regimes. Regulation seems to entail large and visible short-term costs to entrenched business interests. It is also viewed as discriminating between rich and poor countries. The benefits are often widely dispersed in time and space, and it is often fairly easy for an actor to extract them without accepting the burdens of compliance.

   Agreements for environmental protection in the contemporary context constitute a type of "soft and functional regimes" (Sands 1993) directed at the control of behavior by states that generally does not present an overt threat to the neighbors. Rather, the principal danger is one of everyday social or economic activity presenting risks within the state in

which it originates, to that states' neighbors and possibly, to the global commons. This is typically the activity's externalities rather than any intent to cause harm or encroach on neighbor's territory that is the cause of concern. Combating environmental problems, therefore, requires coordination amongst the states. In nearly every case, states have organized their responses to transboundary environmental problems through international agreements. The current generation of research, therefore, aims at assessing the effectiveness of these agreements, because as Zürn (1998: 649) concludes in a major review of international environmental policy, regime effectiveness has become the driving force in the analysis of international relations. In this study, I assess the effectiveness of the 1992 United Nations Framework Convention in Climate Change (UNFCCC hereafter) for reducing cardon di-oxide (CO_2) emissions in sixty six countries.

Research so far on ensuring environmental performance has concentrated largely on the role of economic development. A plethora of studies have found that the relationship between a country's wealth and some pollutants follow an inverted U-shaped curve, popularly known in the literature as the Environmental Kuznets Curve (EKC henceforth). Besides being rich, democracies fair better as compared to authoritarian countries in environmental quality. However, systematic analyses of effectiveness of international agreements in ameliorating environmental conditions are missing.

To the end of assessing the role of international multilateral agreements in ensuring environmental performance this paper consists of an empirical analysis of the effectiveness of the UNFCCC in sixty six nations, which are currently parties of the Convention for a ten year period (1991-2000). The next section consists of an overview of the relevant literature in this field, followed by a discussion of the research design used

in this paper. The final section of the paper consists of the interpretation of the findings from the empirical analysis. I conclude this paper by reiterating my argument that participation in international agreements facilitates the process of protecting one's environment from further degradation.

LITERATURE REVIEW

Substantive Debates on Effectiveness of Agreements

International regimes, broadly, are defined as "principles, norms, rules and decision making procedures around which actors expectations converge in a given issue area" (Krasner 1983: 1-2). States create institutions as a means of achieving collective objectives that could not be achieved acting unilaterally. Either directly through international agreements, or through the act of an existing international institution, states establish the new institution's purpose, the scope of its powers and the shape and functions of its organ. Moreover, international agreements orient and coordinate the behavior of states and ultimately of enterprises, non-governmental organizations, individuals, steering behaviors away from activities that are environmentally destructive and towards those that are environmentally benign.

International agreements are, in general, referred to as the governance structures surrounding international conventions and treaties, including norms, rules, principles, and decision-making procedures as well as numerous actors who bring those components to life (Mitchell 2002: 61). Actors, both state and non-state are viewed as complex entities, not simply unitary maximizers (Young; 1972). The main objective of these agreements is to guarantee compliance with established rules, norms and standards and policies in the absence of a world government.

It is generally argued that most of the states and other actors comply with most international laws (Bull 1977). The predictions of Hobbesians notwithstanding, one can observe a considerable degree of compliance on the part of the actors. Young (1979: 31-34) argues that compliance in a decentralized system can result from self-interest

calculations, fear of reprisals by another actor, felt obligation and socialization into a system of rules. Over time expectations converge around sets of rules.

Simmons (1998) further elaborates the reasons as to why countries comply with international agreements. According to the rationalist school of thought, international reputation, opportunities of reciprocity and political legitimacy can be considered as some of the reasons why states accede to particular international agreements. Again, the scholars in the domestic legalist school look at distinctive domestic regimes that tend to bind them into a "zone of law" in the conduct of their foreign relations. Consequently, we can assume that the reduction in pollution or reduction in trade in endangered species that we observe is due to several factors, like international agreements.

The last few decades have witnessed a noticeable proliferation of international environmental agreements, as well as growing concern in the academy and policy making circles. The first wave of research in this area was concerned about understanding the conditions under which international environmental agreements were likely to arise (Keohane, Haas and Levy 1993; Sprinz and Vaahoranta 1994; Young 1994). The next generation of research focused on ensuring the implementation of and compliance with these international environmental agreements (Barrett 1994; Jänicke and Weidner 1997; Weiss and Jacobson 1998). At present the scholars in this research program have become more concerned about the actual outcome of these international environmental agreements; i.e. whether or not these agreements have been effective.

The effectiveness of an environmental agreement is a function of how strong the agreements are in terms of the key provisions aimed at addressing an environmental threat, how seriously states implement those provisions, and how amenable to pressure

the states are. Ringquist and Kostadinova (2005: 87) point out that addressing environmental problems effectively requires (a) increased governmental concern regarding the issue; (b) contracts between the national and international levels regarding monitoring and credible commitments; and (c) governing capacity necessary to change policy. International environmental agreements can produce all of these by generating and disseminating scientific research, creating monitoring networks, and the generation of public pressure. However, amongst the current researchers of international institutions there has been a growing skepticism about the actual effectiveness of these environmental agreements (Helm and Sprinz 2000). Nonetheless, in today's world of increasing international economic integration and liberalization, one cannot lose sight of the impact of international institutions.

Studies surrounding environmental protection have mostly emphasized the role of domestic factors, especially economic development in ameliorating environmental conditions. Several scholars have argued that economic growth leads to environmental protection and preservation. The Environmental Kuznets Curve (EKC) hypothesis proposes that there is an inverted U-shaped relation between the various indicators of environmental degradation and income per capita.[1] This implies that economic growth will eventually redress the environmental impacts of the early stages of economic growth and that will, in turn, lead to further environmental improvements in developed countries. Scholars in this research area are unanimous about the fact that economic growth is necessary in order for environmental quality to be maintained or improved.

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[1] This is an essential part of the sustainable development argument as put forward by the World Commission on Environment and Development (1987) in Our Common Future. The EKC is named after Simon Kuznets (1955) who hypothesized that the relationship between a measure of inequality in the distribution of income and the level of income is an inverted U-shape curve.

Grossman and Krueger (1995) and Shafik and Bandyopadhyay (1992) find that after a country's GDP per capita is recorded at around $ 8000, environmental quality is typically seen to improve. Therefore, it is a generally held belief that, even though environmental conditions deteriorate in the initial stages when the economy is growing, environmental condition is expected to improve after a certain point in the growth trajectory (Holtz-Eakin and Selden 1995; Roberts and Grimes 1997). Nonetheless, the hypotheses deduced from the Kuznets curve logic have been largely debated (Arrow *et. al* 1995; Stern, Common and Barbier 1996; List and Gallet 1999; Perman and Stern 2003). Particularly, Harbaugh, Levinson and Wilson (2001) argue that very little empirical support exists for the inverted U-shaped pattern in the relationship between several important air pollutant and national income. Therefore, although there does exist some relationship between economic growth and environmental improvement, it cannot be generalized under all conditions and for all countries alike – one size does not fit all.

Especially for CO_2, the pollutant responsible for global warming, effective price is far from optimal and this pollutant appears to have a monotonic EKC. Also the elasticity of substitution is probably lower and apparent damage is less evident to the regular consumers, both implying a higher turning point in the curve. Traditionally work done in the field of EKC has used longitudinal data with very few control variables, in order to estimate the net impact of income on environmental quality. This has been highly criticized by scholars like Arrow et al. (1995: 92) who observe that "while these studies do indicate that economic growth may be associated with improvements in some environmental indicators, they imply neither economic growth is sufficient to induce

environmental improvement in general, nor that the environmental effects of growth can be ignored".

It has been observed that several of the least developed countries also have become parties to many international environmental accords. This is so because as Bernauer (1995) points out, these institutions as sets of international regulations and organizations that are intentionally established by preexisting actors (states) through explicit, legally or politically binding, international agreements in order to regulate anthropogenic sources of negative externalities affecting the natural environment. As evident, despite economic hurdles, countries deliberately become party to international agreements and comply with them also.

Besides economic development, another domestic factor that is expected to have profound impact on environmental conditions is the type of political system. In a recent study, Waldhoff (2005) shows that domestic regime type has a serious impact on the turning point of the EKC. Waldhoff finds that for democractic countries the turning point is around $ 20,000- 30,000, which rises substantially to $153,000 for autocratic countries. However, it is difficult to find much work done assessing the effects of international environmental agreements in inducing the countries to improve their relative environmental performance. This paper attempts to analyze the effect of UNFCCC, which was concluded and opened for signature in 1992 at the Rio Summit, on CO_2 emissions, which are the most threatening of all Greenhouse gases.

Methodological Debates

The question about the effect of institutions is also a center of a broader debate of international relations theory. Several studies have suggested that international

institutions can have an independent effect on progress in environmental protection under some circumstances (Sand 1990, 1992). These studies further suggest that empirical research, guided by good theory can prove to be a productive way to assess the effect of environmental institution.

While estimating the effectiveness of international agreements scholars have faced difficulty is separating out the effects arising out of the regimes itself and those arising out of other factors (Young 2001). Indicators of environmental quality are affected by a number of variables that are independent of these agreements.

International agreements are as effective as parties make them. Weiss and Jacobson identify four factors that affect the effectiveness of an international agreement: (i) characteristics of the activity; (ii) characteristics of the accord; (iii) international environment, and (iv) domestic factors specific to the country (Weiss and Jacobson 1998: 5-7). In this paper, I concentrate on the international and domestic factors for assessing the effectiveness of UNFCCC. The first two factors mentioned by Weiss and Jacobson are left for future research.

In general, effectiveness of these international agreements is analyzed based upon its success at achieving the goals that led to its creation. For example, Helm and Sprinz (1999) have proposed defining effectiveness as the amount of progress induced by the regime toward a regime's collective optimum from a no-regime outcome. On the contrary, Miles and Underdal (2001: 4) attack this argument by using case studies to assess effectiveness on different scales (ranging from 0-4 for behavioral change and 1-3 for environmental improvement) and then normalizing them to a range from 0-1. Both

approaches produce a common metric of effectiveness ranging from no improvement relative to no-regime outcome to full achievement of the collective optimum.

Underdal (2002) further argues that effectiveness of international environmental agreements is a product of the interaction of problem malignancy and the institutional setting created to address the problem. While the core element of problem malignancy is the extent to which rational action of the individual states produces a suboptimal outcome for all. The essence of institutional setting lies in its capacity, or the ability of these institutions to generate resources, establish rules and goals without unanimity among participants, and enforce the terms of the agreements. Regimes that address difficult problems with low levels of institutional capacity would be less effective and vice versa.

The malignant environmental problem addressed in this paper is global warming due to excess emission of carbon-dioxide (CO_2). The international environmental institution developed to take care of this problem was United Nations Framework Convention on Climate Change (UNFCCC) in 1992 at the Earth Summit. Researchers in the EKC program argue that CO_2 has a monotonic EKC. Holtz-Eakin and Selden (1995) estimate quadratic EKCs for CO_2 on panel data showing the very high turning points for this pollutant. They project that the global CO_2 emissions growth continues at a 1.8 per cent per annum for the foreseeable future. This is so because output and population will grow most rapidly in low-income countries with a high marginal propensity to emit. Given such a pessimistic picture one wonders whether there has been or can be any effect of the UNFCCC for these low- income countries. International environmental institutions may be effective in changing this picture.

The conceptualization of institutional effectiveness varies immensely. According to Jacobeit (1998: 300) many scholars have focused on political variables, including those in the economic political domain by Keohane et al. or legal political domain by Victor, and others. Underdal (1997) conceptualizes regime effectiveness as environmental problem solving in terms of relative improvements in counterfactual state of affairs, i.e., the absence of an international regime and in terms of improvement relative to a collective optimum. This criterion evaluates relative progress in environmental protection against the baseline of a world without the institution. This had been the most popular measure used to operationalize regime effectiveness (Helm and Sprinz 1999). Therefore, in this paper attempt has been made to use a measure of regime effectiveness that captures the change brought over from a world without the agreement to a world with the agreement in place, i.e. how much success have been achieved.

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RESEARCH DESIGN

Dependent Variable

The dependent variable I am trying to explain is effectiveness of the climate change regime. According to Mitchell (2002) a dependent variable so designed needs to capture both aspects of success, i. e. how much change the regime/ agreement induced and how hard the change was to induce. As it is difficult to get usable information on the cost required to induce change of behavior, I concentrate on the first aspect of success: how much change the agreement induced. In line with Zürn (1998) and Jacobeit (1998), both of whom regard emission-based approaches to the measurement of international regime effectiveness as promising, I would operationalise the dependent variable as the percentage change of CO_2 emission in each of the sixty-six countries, which are party to UNFCCC, from 1991-2000, compared to the base year 1990 (refer to Appendix I for more detailed discussion of the variables and Appendix II for the name of countries and their year of ratification).

In order to correctly assess regime effectiveness the model should consist of essentially three elements: policy factors, external environmental factors, and national capacity and development factors (Ringquist and Kostadinova 2005: 93; Weiss and Jacobson 1998). UNFCCC required that upon ratification committed signatories' governments should move towards a voluntary "non-binding aim" to reduce atmospheric concentrations of greenhouse gases with the goal of "preventing dangerous anthropogenic interference with Earth's climate system." These actions were aimed primarily at industrialized countries, with the intention of stabilizing their emissions of greenhouse gases at 1990 levels by the year 2000; and other responsibilities would be incumbent upon all UNFCCC parties

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(UNFCCC 1992). Since not all the signatories ratified the Convention at the same time, a model was devised to measure the relative progress made in signatory states before and after ratification. Moreover, percentage reduction of emissions is considered to be a better measure for assessing the impact of environmental agreement, as measuring only the absolute differences would not reveal a very clear picture.

Regressing this dependent variable on a set of independent and control variables including at least one agreement-related variable, would then allow using the regression co-efficient (b) on agreement-related variable as a metric of effectiveness of that agreement that would be comparable across the unit of analysis (Mitchell 2002).

I had to restrict my sample to sixty-six countries due to non-availability of data for all the 189 countries who are currently member of the UNFCCC. Data for the total CO_2 emission for the entire sample was taken from World Development Indicators 2004.[2]

Independent and Control Variables

The above discussion delineates the chief explanatory variable of this study, i.e. membership in international environmental institutions (Mem_{it} membership in UNFCCC for country i in year t). Besides testing the hypothesis that international agreements are effective in ameliorating environmental conditions, this intuitively also helps us to evaluate the theory that holds that regimes only influence the behavior of those states legally bound by a given rule. This variable is coded as 1 for the $country_i$ the year after that country ratifies UNFCCC and 0 for the period prior to that. Conventional wisdom guides us that there would be passage of some time after which a noticeable impact of the agreement on a country's environmental performance can be noticed. Therefore, another

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[2] East and Central European countries have been not included due to non-availability of data for the years under study. Moreover, most of these countries were under transition during this time period. Including these countries could have skewed the results.

important independent variable would be membership counter coded as 0 up to the year a country ratifies the Convention and the number of years it had been a party up until 2000. This would help to capture the trend effect (Lewis-Beck1986). If our assumption is correct then the coefficients for the membership counter variable should show a negative sign, implying: (i) countries when member to an international agreement would perform better, i. e. reduce CO_2 emission; and (ii) longer they are member of the agreement an improvement can be observed in their performance. Moreover, a time counter variable is also included, coded as1 through 10 for each country. This is another way to see the direction of a country's performance over time.

Young (2001) pointed out that conceptualizing the no-regime outcome in terms of interactive decision-making among self interested states leads us to focus only on policy games themselves and to neglect a number of other driving forces — demographic, economic and technological – that interact to produce important environmental impact. Therefore, GDP per capita (GDP_{it}) of these countries in all the years is included as the control variable. This would also help us to evaluate national capacity of the countries included. Data on this variable is also taken from the World Development Indicators 2004. As the relationship between income and environmental quality is assumed to be curvilinear a squared term of the GDP per capita is also included. If EKC truly holds for CO_2 emissions, then the coefficient of the former should be positive, while for the latter or the squared term should be negative indicating that pollution rises in the initial phase of economic growth, eventually reaching a plateau and then decreasing.

Another measure of national capacity can be economic growth of a country. There are two competing hypotheses in this area (Jahn 1998): on the one hand, countries with high

economic growth would be better equipped to combat environmental pollution. On the other hand, rich countries have higher levels of consumption, which can further lead to environmental degradation. In order to check the validity of these hypotheses a second model is used including economic growth.

The countries included in the study are divided into two groups under the Framework Convention – Annex I and non Annex (UNFCCC 1992). The Annex I countries are the economically and technologically advanced countries for whom it was mandatory to reduce their emissions to 1990 level by 2000. Therefore, the study includes another independent variable called Annex, coded as 1 for the Annex I countries and 0 otherwise. If economic improvement begets better environmental performance, then Annex should be negatively related to the dependent variable. As it is already assumed by many scholars that industrialized or Annex I countries would perform better, an interaction term is also included with membership. If the assumptions so far hold true that developed countries have better environment, then we can expect that the interaction term would be negatively related to the dependent variable implying the industrialized, rich nations emit less.

Other control variables that follow from the theory are share of industry in the country's GDP, percentage of urban population, and type of political system (Waldhoff 2005). Including these variables ensures some amount of control over the domestic and external environment (Ringquist and Kostadinova 2005: 93). Percentage of industry in a country's GDP measures industrial activity, which can be a potential source of excessive pollution. This variable should be positively related to CO_2 emissions. However, this measure for industrial activity does not account for energy efficiency, i. e. reducing use

of coal and fossil fuel, which are the principal emitters of CO_2. Nonetheless becoming energy efficient is an important tactic employed by the countries to reduce CO_2 emissions. Hence, coal and fossil fuel consumption can be considered endogenous to Convention ratification. Data for this variable has been taken from the World Development Indicators 2004.

Again there exist substantial amount of literature claiming that political factors, like political stability, democratic polity, have a bearing on the environmental quality of the nation (Jänicke 1992; Sprinz 1998; Waldhoff 2005). Waldhoff (2005) argues that coupled with wealth of a nation, democratic polity, along with its free press and presence of various interest groups, has had good effect in reducing pollution. The polity variable in the study is a measure of how democratic a country is on a scale of -10 to +10. Data has been taken from POLITY IV project (refer to appendix I). This variable presumably should show negative relation with the dependent variable implying lower scores on the scale means poor environmental quality.

Much can be said about urban population. Environmentalists have for a long time debated the role of urban sprawl in the developed countries. With the growing wave of economic liberalization, this has now become a characteristic of developing nations also. Growing urban population is definitely a precondition of growing environmental pollution. Hence, this variable should be positively related to the pollution levels. Again, political economists like Barro (1998) argue that urbanization is one of the indicators of a country's economic development. As already mentioned, one of the assumptions in this paper is that industrialized country pollute less, we can expect that high percentage of

urban population would imply less emission. Data for this variable is also available from the World Development Indicators 2004.

Generalized least squares on a panel data for sixty six countries for ten years have been applied on the following model:

$$Y_{it} = \alpha + \beta` X_{it} + U_t + \varepsilon_{it}$$

Where, Y_{it} = Percentage of CO_2 emissions compared to 1990 as the base year;

X_{it} = Matrix of all independent variables;

U_i = Random disturbances characterizing the i th observation and is constant through time.[3]

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[3] Fixed effects model was not included due to technical problems.

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
DV	660	.344	.502	-.455	4.913
Mem	660	.598	.490	0	1
Mem_Counter	660	2.169	2.293	0	8
Annex	660	.318	.466	0	1
Interaction	660	.2060	.404	0	1
GDP percapita	660	7593	10561	135.01	44798.75
GDP pc – sq	660	1.69e+08	3.54e+08	18227.81	2.01e+09
Pop	660	54.73	23.19	5.31	97.33
Industry	660	29.54	7.91	9.22	53.54
Polity	659	6.27	5.69	-9	10
GDP growth	660	-.186	2.850	-14.89	26.35
Time_counter	660	5.5	2.87	1	10

RESULTS AND ANALYSIS

Table 2 and 3 reports results, coefficients, Z scores and standard errors (in parentheses), for the full sample of sixty-six countries.

Table 2 shows that membership in the UNFCCC has significant impact on environmental quality. The memberships counter variable shows that pollution or emission have a decreasing trend over the years and is highly significant. As hypothesized, the longer that countries are member of the environmental agreement, the better they perform. Figure 1 further substantiates that after UNFCCC came into place in 1992, there has been a visible change in the emission patterns of the countries in the sample. Around 1990-92, the percentage of CO_2 emission, as compared to 1990, was clustered around -0.5 and + 0.5. But with the passage of time, there developed two separate clusters of countries. Although the time counter variable is positively and significantly related to the dependent variable implying the emissions increase considerably with the passage of time, we can conclude that the presence of an effective environmental agreement would mitigate that result.

The environmental performance of a country is further improved by its economic development. As the coefficient on the Annex variable show in table 1, that it significantly matters whether or not a country is in the Annex 1 category or not; Annex 1 being the group of developed, industrialized countries. Moreover, looking at the interaction term one can clearly say that a country which is industrialized and also a member of the international agreement like UNFCCC would definitely perform better compared to developing or non Annex 1 countries.
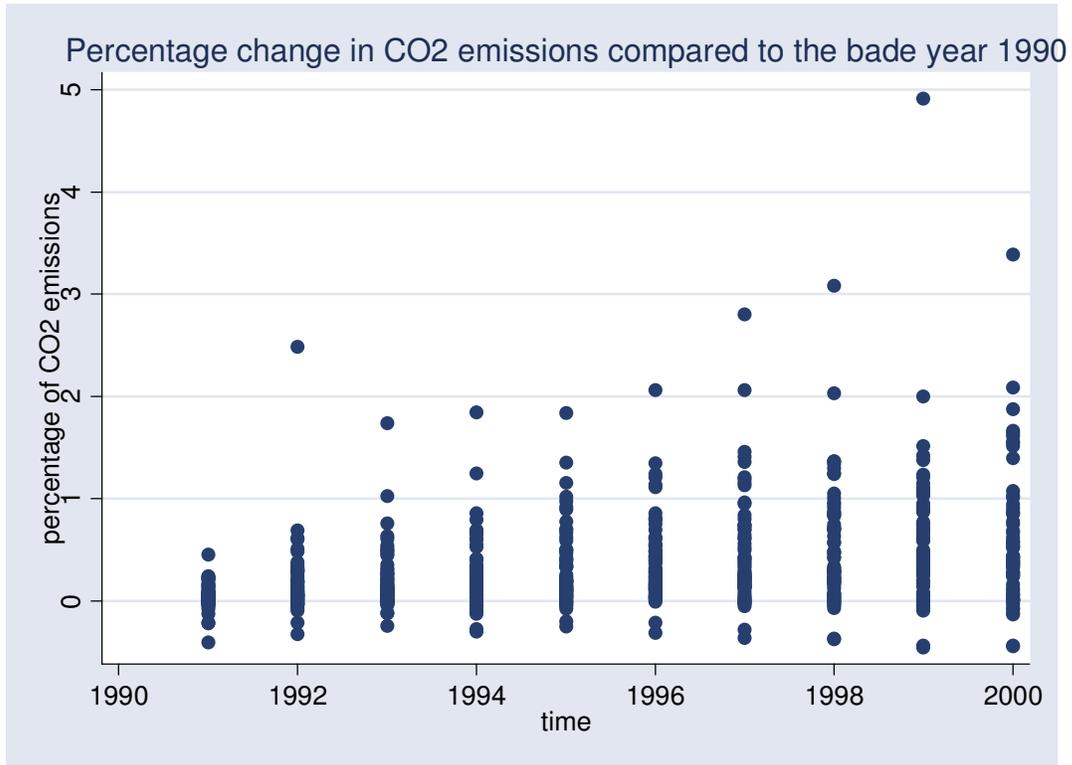
Figure 1: Percentage change in CO_2 emissions compared to base year 1990

Table 2: Effect of UNFCCC on CO_2 emissions for all countries 1991-2000

Variables	Co-efficients	z
Membership	.129 (.06)	2.14**
Membership counter	-.033 (.016)	-2.00**
Control Variables- *International Regime Effect*		
Annex	-.182 (.065)	-2.78**
Membership * Annex	-.315 (.072)	-4.32***
Time counter	.082 (.013)	5.87***
Domestic Regime Effects		
GDP percapita	9.31e-06 (8.75e-06)	1.06
GDP percap-sq	-2.09e-11 (1.73e-10)	-1.21
Urban Population	-.001 (.0013)	-1.75*
GDP percapita*Pop	3.79e-08 (9.39e-08)	0.40
Industry	.0007 (.0021)	0.34
Polity	-.008 (.0037)	-2.17**
Constant	.084 (.087)	0.97

*** p< .01; ** p<.05; *p<.1
N = 659
Wald $\chi 2$ = 285.55***

The above-mentioned argument, in part, supports the EKC hypothesis. Although, GDP per capita and its square terms individually does not reach statistical significance, further analysis show that these variables are jointly significant. A likelihood ratio test between the unrestricted and restricted (dropping GDP per capita and its square) models yield highly significant test statistic. This implies that with increase in GDP per capita a country would initially experience an increase in pollution, which eventually reaches a plateau and then starts phasing out. Intuitively, this result reveals that after a nation has met its subsistence requirements, it would become more concerned about the environment. However, the argument made in this paper should be treated as a complement to the EKC assumption. Improving national capacity can definitely help in ameliorating environmental degradation. Similarly, participation in international environmental agreements can further accelerate the process.

Besides membership and economic development, some of the other variables also show interesting results. For example, percentage of urban population is negative and significant. Contrary to what environmentalists argued, urban sprawl is seen to reduce pollution for all the countries. One explanation for this finding is that urbanization is largely related to modernization and development (Barro 1998). So when we see that a large percentage of people live in urban area, one assumes that the country is developed to some extent and is slowly becoming energy efficient.

This is further strengthened by the results of the polity score. It shows that countries low on the polity score would pollute more, i.e. democratic countries significantly pollute less compared to authoritarian countries. Waldhoff (2005) argues further that for a democratic country the turning point is reached at a lower level of GDP per capita, but

for an authoritarian country the cut-off point is much high. This reflects the fact that even for a developing country, with a democratic polity, improvement of environmental conditions would start earlier than any other authoritarian developing country. Therefore, a case can be made from here that as and how a country democraticizes and urbanizes, it would slowly become more environmentally aware.

However, Table 3 shows some changes in the earlier results. After including GDP growth variable in the same model, the sign changes on the membership counter variable. This new results imply that longer the countries are member they pollute more. This might be due to the heavy emphasis of developing countries in the sample. The poor and developing countries, although members of multilateral institutions tend to involve in higher economic activities leading to higher pollution. The change in result might also be due to multi-colleniarity. The economic growth variable, as coded in this paper, is positively correlated with most of the other independent and control variables. Nonetheless annex and the interaction term remain negatively and significantly related to the dependent variable. Therefore, industrialized countries that are also member of the UNFCCC would emit less. Another change in result is that percentage of urban population loses its significance, but retains its directional relationship with the dependent variable.
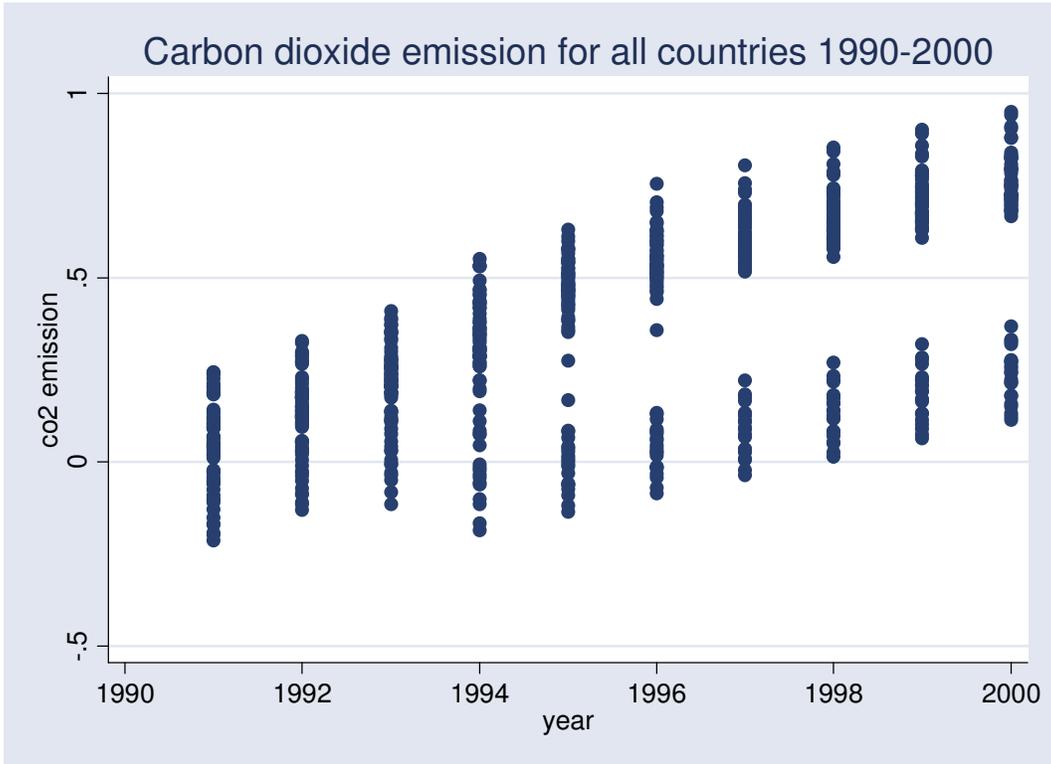
Figure 2: CO_2 emissions as predicted by the model

Table 3: Effect of UNFCCC on CO_2 emissions for all countries 1991-2000 (with GDP growth)

Variables	Co-efficients	z
Membership	.260	4.50***
	(.06)	
Membership counter	.037	3.25**
	(.011)	
Control Variables- *International Regime Effect*		
Annex	-.203	-3.08**
	(.066)	
Membership * Annex	-.333	-4.46***
	(.074)	
Domestic Regime Effects		
GDP growth	.004	0.67
	(.006)	
GDP percapita	6.75e-06	1.08
	(6.27e-06)	
GDP percap-sq	-6.34e-11	-0.36
	(1.75e-10)	
Urban Population	-.001	-1.53
	(.0009)	
Industry	-.0010	-0.48
	(.0021)	
Polity	-.0077	-1.97**
	(.0039)	
Constant	.359	4.85***
	(.074)	

*** $p < .01$; ** $p < .05$; *$p < .1$

N = 659

Wald $\chi 2$ = 241.06***

CONCLUSION AND FURTHER IMPLICATIONS

The principal explanatory variable for assessing the effectiveness of the UNFCCC did show significant impact in bringing about desired changes in a world with the institution. Again, to be borne in mind that economic development and a democratic polity are potential facilitators in the process of attaining better environment.

However, these results should not be over exaggerated. International agreements, of all kinds, have their own drawbacks. Although we find that UNFCCC has been quite effective in reducing CO_2 emissions in the member countries, one cannot ignore the fact that it is only the beginning. Moreover, environment is considered to be a public good, which would require more commitment on the part of the member nations to make them effective in achieving its objective.

Weiss and Jacobson mention that in order for an international agreement to be effective, it needs to account for the characteristic of the problem. In this paper, emphasis was placed on the part of the actors in making this agreement effective. A close analysis of the characteristics of the accord also warrants attention in order to keep it effective in future.

Even for that matter national capacity of the actors was aggregated into two variables: economic development and political system. It is to be borne in mind that in order to implement the provisions of the agreement successfully, member countries will have to develop their infrastructure base, promulgate legislation in support of those provisions, and ensure stringent mechanisms of monitoring and investigation. Future research should make an attempt to include these factors also within national capacity.

Several things remain on the part of the framers of these agreements. An analysis of these agreements reveals that to be effective the agreements should be able to overcome two most important obstacles: political complexity and scientific uncertainty. On the former, international efforts are needed to address the political aspect of global warming, which requires close cooperation among the developed and the developing nations. Scientific uncertainty can be overcome by channeling more research grants into this area.

Financial mechanism of the regimes/ agreements can be expected to have great impact on its effectiveness, especially for developing countries, like the global environmental fund (GEF) or the Montreal Fund under the Montreal Protocol. UNFCCC does not provide anything even remotely similar to these to its members. As has been evident from the findings here that member countries are attempting to fulfill the requirements of the agreements, better provisions of the agreement, like financial help, can accelerate the process further.

In addition to the above-mentioned provisions, the agreement should be able to respond to non-compliance in a facilitative way. Sanctions are not considered to be an effective mechanism in ensuring compliance, and in turn effectiveness. There should be mechanisms both for reward and punishment in-built in the agreements to entice the member countries.

In the absence of a supranational authority, institutions can play an extremely effective role in directing states' behavior. However, mindless negotiations of these multilateral agreements will not get us far. Along with the framers, member countries also have a distinct role to play. Keeping all these factors in mind, I conclude by reiterating my

argument that along with economic development and democracy, participation in multilateral agreements would bring about desired environmental benefits.

REFERENCES

Arrow, Kenneth, Bolin, B., Costanza, R. Dasgupta, P., Folke, C., Holling, C., Jansson, B. O., Levin, S., Maler, K. G., Perrings, C., Pimentel, D., 1995 "Economic growth, carrying capacity and environment"; *Science*, Vol. 268.

Bernauer, Thomas 1995 "The Effect of Environmental Institutions: How we might learn more" *International Organization*, Vol. 49 No. 2.

Chayes, A and Chayes, A. H 1991 "Adjustment and Compliance Processes in International Regulatory Regimes" in Jessica Tuchman (ed.) *Preserving the Global Environment: The Challenge of Shared Leadership*; New York, W. W. Norton & Co.

Chayes, A and Chayes, A. H 1998 "The new sovereignty: Compliance with international regulatory agreement", Cambridge MA: Harvard University Press.

Cole, M et.al. 1997 "The EKC: an empirical analysis"; *Environment and Development Economics*, Vol. 2.

Dryzek, John 1987 "Rational Ecology: Environment and Political Economy"; New York: Basil Blackwell Inc.

Fisher, R. 1981 "Improving compliance with international law"; Charlottesville: University Virginia Press.

Gareth Porter, Janet Welsh and Pamela Pamela Chasek, 2000 "Global Environmental Politics"; 3rd ed., Colorado: Westview Press.

Hovi, Jon, Sprinz, Detlef and Arild Underdal 2003 "The Oslo-Potsdam Solution to Measuring Regime Effectiveness: Critique, Response and Road Ahead"; *Global Environmental Politics,* Vol. 3, No. 3.

Hovi, Jon, Sprinz, Detlef and Arild Underdal 2003 "The Oslo-Potsdam Solution to Measuring Regime Effectiveness: A rejoinder to Oran Young" *Global Environmental Politics,* Vol. 3, No. 3.

Jacobs, Michael (ed.) 1997 "Greening the Millennium: The New Politics of Environment"; Oxford: Blackwell Publishers.

Jacobson, Harold and Weiss, Edith B 1998 "Engaging countries: strengthening compliance with international environmental accords"; Cambridge MA: MIT Press.

Jahn, Detlef 1998 "Environmental Performance and Policy Regimes: Explaining variations in 18 OECD-countries"; *Policy Sciences*, Vol. 31.

Krasner, Stephen 1983 "Structural causes and regime consequences: Regimes as intervening variable".

List, John and Gallet, Craig 1999 "The Environmental Kuznets Curve: Does one size fit all?" *Ecological Economics*, Vol. 31.

Mitchell, Ronald 2002 "A Quantitative Approach to Evaluating International Environmental Regimes"; *Global Environmental Politics*, Vol 2. No. 4.

Ringquist, Evan and Kostadinova, Tatiana 2005 "Assessing the effectiveness of International Environmental Agreements: The Case of Helsinki Protocol"; *American Journal of Political Science*, Vol. 49 No.1.

Rosendorff, Peter and Milner, Helen 2001 "The Optimal Design of International Trade Institutions: Uncertainty and Escape"; *International Organization*, Vol. 54, No. 4.

Sands, Philippe 1993 "Greening International Law", Earthscans Publications Ltd., London.

Scruggs, Lyle 1999 "Institutions and Environmental Performance in seventeen Western Democracies".

Selden, Thomas and Song, Daquing 1994 "Environmental Quality and Development: Is there a Kuznets Curve for Air Pollution emissions?" *Journal of Environmental Economics and Management*, Vol. 27, No. 2.

Shafik, N., and Bandyopadhyay, S., 1992 "Economic growth and Environmental Quality: Time series and cross-section evidence"; World Bank, Policy Research Working Paper # WPS904.

Simmons, Beth 2000 "International Law and State Behavior: Commitments and Compliance in International Monetary Affairs"; *American Political Science Review*, Vol. 94, No. 4.

Simmons, Beth A. 1998 "Compliance with international agreements"; *Annual Review of Political Science*, Vol 1.

Sprinz, Detfel F. 2000 "Research on Effectiveness of International Environmental Regime: The State of Art", Paper presented at Final Conference of EU concerted effort on Regime Effectiveness, Barcelona.

Sprinz, Detlef and Helm, Carsten 1999 "The Effect of Global Environmental Regimes: A Measurement Concept"; *International Political Science Review,* Vol.20, No.4.

Sprinz, Detlef and Helm, Carsten 2000 "Measuring the Effectiveness of international environmental regimes"; *Journal of Conflict Resolution*, Vol. 44 No. 5, October.

Stern, David 1998 "Progress on Environmental Kuznets Curve?" *Environment and Development Economics*, Vol. 3.

Suri, V. and Chapman, D., 1998 "Economic growth, trade and energy: Implications for the Environmental Kuznets Curve"; *Ecological Economics*, Vol. 25 No. 2.

Tuchman, Jessica 1991 "Preserving the Global Environment: The Challenge of Shared Leadership"; New York, W. W. Norton & Co.

Underdal Arild 1997 "Patterns of Effectiveness", Paper presented at the Annual meeting of ISA, Toronto.

Underdal, Arild 1992 "Concept of Regime Effectiveness"; *Cooperation and Conflict*, Vol. 27, No. 3.

Waldhoff, Stephanie 2005 "The Effect of Regime Type on EKC for Carbon-di-oxide emissions" Paper presented at MPSA, April 7.

Young, Oran R 1979 "Compliance with Public Authority: A Theory with international application"; Baltimore: John Hopkins University Press.

Zürn, Michael 1998 "The Rise of International Environmental Politics: Review of Current Research"; *World Politics*, Vol. 50, No. 4.

APPENDIX 1: VARIABLE DESCRIPTION

Variables	Description
Dependent Variable	Percentage change of Carbon-di-oxide emission in 66 countries from 1991 to 2000, compared to 1990 as base year.
Explanatory variables	
Membership	Ratifying UNFCCC; coded 0 until the year a country ratifies and 1 thereafter
Membership counter	Measures number of years after each nation ratified the convention
Control Variables	
Annex	Coded as 1 for industrialized countries in Annex 1 category under UNFCCC and 0 otherwise
GDP per capita	GDP per capita for all nations (in 1995 USD)
GDP per capita sq	Squared transformation of GDP per capita, included to capture non-linear relationship between income and pollution as hypothesized by EKC
Urban Population	Percentage of population living in urban areas
Polity	Polity2 variable: Computed by subtracting AUTOC from DEMOC; normal range polity scores are imputed for coded "-77" and "-88" special polity conditions, polities coded "-66" on the POLITY variable are left blank
Industry	Percentage share of the industrial sector of a country in its total GDP
Time counter	Numbered 1-10 for the 10 yrs time period for each panel to capture trend of CO_2 emissions
GDP growth	Percentage change in GDP compared to a base year 1990

APPENDIX II: COUNTRIES AND YEAR OF RATIFICATION

CID	Country	Year of Ratification
Annex I		
66	Austria	1992
2	Belgium	1996
8	Bulgaria	1995
11	Canada	1992
16	Denmark	1993
20	Finland	1994
21	France	1994
24	Greece	1994
28	Hungary	1994
30	Ireland	1994
31	Italy	1994
33	Japan	1993
41	Netherlands	1993
42	New Zealand	1993
44	Norway	1993
50	Poland	1994
51	Portugal	1993
52	Romania	1994
55	Spain	1993
57	Sweden	1993
62	United Kingdom of Great Britain and Northern Ireland	1993
Non Annex 1		
65	Argentina	1994
1	Bangladesh	1994
3	Benin	1994
4	Bhutan	1995
5	Bolivia	1994
6	Botswana	1994
7	Brazil	1994
9	Burundi	1997
10	Cameroon	1994
12	Chile	1994
13	China	1993
14	Colombia	1995
15	Costa Rica	1994
17	Dominican Republic	1998
18	Ecuador	1993

CID	Country	Year of Ratification
19	El Salvador	1995
22	Gambia	1994
23	Ghana	1995
25	Guatemala	1995
26	Guinea	1993
27	Honduras	1995
29	India	1993
32	Jamaica	1995
34	Jordan	1993
35	Madagascar	1999
36	Malawi	1994
37	Malaysia	1994
38	Mali	1994
39	Mauritius	1992
40	Mexico	1993
43	Nicaragua	1995
45	Panama	1995
46	Papua New Guinea	1993
47	Paraguay	1994
48	Peru	1993
49	Philippines	1994
53	Senegal	1994
54	South Africa	1997
56	Sri Lanka	1993
58	Thailand	1994
59	Trinidad & Tobago	1994
60	Tunisia	1993
61	Uganda	1993
63	Uruguay	1994
64	Vietnam	1994

VITA

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