The Effectiveness of International Environmental Agreements:

Empirical Findings from Treaty-level Panel Data

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Abstract

This study empirically investigates the effectiveness of international environmental agreements (IEA). Although there exists large number of empirical studies regarding IEA effectiveness, much of those studies focus on ratification decisions and regulated environmental behaviors at country level. This approach, however, is limited for investigating the attributes of different treaties and identifying factors affecting the success of IEA. To avoid this limitation, this study develops a treaty-level panel data including 14 environmental agreements adopted and entered into force last 20 years. This aggregated approach enables to look further insights regarding the attributes of each IEA, and identify the factors significantly affecting the effectiveness of agreements.

From our results, several treaty-specific attributes are shown to be significant. Specifically, sanction for non-compliance is the most influential inducement for the effectiveness of IEA. A mechanism of financial assistance for less-capable developing countries is also found to be positive inducement, but mechanism of technical assistance is not significant at any statistical levels. Our results also indicate that involving larger number of countries, especially large-scale fast-growing developing countries such as BRICs, is another significant factor. Although this is not compatible with a strict sanction for non-compliance, introducing well-designed financial mechanism may be one of possible solutions for this incompatibility problem and making the IEA more attractive and effective.

Keywords: environmental governance; international environmental agreements; legalization and compliance; regime effectiveness; treaties

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1. Introduction

As environmental problems becomes out-of-boundaries and more regional and global issues, the international environmental agreements (IEA) has received rapidly increasing attention[1]. This treed is particularly significant since 1990s. From 1990 to 1999, a total of 86 multilateral environmental agreements were adopted. In contrast, only 49 and 56 were adopted in 1970s and 1980s, respectively (United Nations Environment Programme, 2005)[2]. A comprehensive IEA database developed by Mitchell (2002-2010) now includes approximately 1,000 multilateral and more than 1,500 bilateral environmental agreements.

Given greater recognition of the IEA, a number of empirical studies have been conducted, and many of these studies show that the effect of IEA is significant (See Helm and Sprinz, 2000, Mitchell, 2004, Young, 1999 for comprehensive review). Although much of these literatures focuses on single particular treaty such as the Long Range Transboundary Air Pollution (LRTAP), this type of analysis cannot provide overall effectiveness of IEA. To overcome this difficulty, there have been a growing number of studies analyzing more than one environmental agreement in a single analytical framework.

More specifically, quantitative analyses of multiple environmental agreements are of two types. The first type is to assess decisions of ratification and their determinants (For example, Roberts, et al., 2004, Ward, 2006). These studies can provide an important information regarding factors attracting more countries to the treaty, but they do not reveal the relationship between ratification and environmental outcome.

The second type is, as fully described in, to directly analyze the effect of ratification and environmental outcome under different IEAs using multiple regression models. This approach should provide insightful implications regarding ratification-environment relations, but existing studies are quite limited. One exception is Murdoch et al. (2003), they investigated both ratification decisions of the treaties and subsequent environmental behaviors using a set of regression equations. However, they estimated the model for each treaty, and do not combine the treaties. Analyzing different IEA in a single analytical model is difficult due in part because environmental behaviors regulated are different among IEA. They tend to use different units and make comparison study difficult empirically. See Mitchell (2004) for technical discussions.

One of major limitations of these existing literatures is that they do not explicitly consider the attributes, or characteristics of IEA, although they are of great importance in terms of regime effectiveness (Mitchell, 2010). A considerable challenge for the creators of international environmental agreements is how to design mechanisms that deter defection without deterring participation (von Stein, 2008). Relatively ‘‘soft’’ law often garners widespread participation, but it creates few concrete incentives for states to improve behavior. In addition, the effectiveness of IEA depends on factors that negotiators cannot control, such as how many countries contribute the problem, scientific uncertainty about a issue, and the level of concentration of the regulated behavior Weiss and Jacobson (1998). To fill the academic gap and investigate the effects of different attributes on the success of IEA, we need to employ an empirical approach different from past studies.

The objective of this study is to empirically investigate the effectiveness of IEA, using a treaty-level panel data. That is, data is developed using a treaty as a unit of analysis, in contrast to vast majority of studies which use country as an analytical unit. In this study, we develop a panel data including 14 environmental agreements adopted and entered into force last 20 years. The data is then analyzed using the fixed-effects and random-effects models as well as the Pooled OLS. This aggregated approach enables to look further insights regarding the attributes of each IEA, and identify the factors influencing the effectiveness of agreements.

This paper is organized as follows. Section 2 presents a model to examine the effect of treaty attributes and other factors on the effectiveness of IEA. After presenting the model, this section also describes the data and their sources. Section 3 presents the results estimated from the fixed-effects and random-effects models as well as the pooled OLS model. Given interpretation and discussion of the results, section 4 summarizes and concludes this study.

2. Empirical procedures

This section explains empirical procedures conducted in this study. First we present the estimated model. We then describe data and their sources.

The model

Consider the following model explaining the effectiveness of IEA:

$$y_{it} = \alpha + \mathrm{x}_{it}\beta + \mathrm{z}_{it}\gamma + v_i + \varepsilon_{it} \qquad (1)$$

where y_{it} represents the IEA effectiveness, defined by an overall (mean of all ratified countries) change in regulated behavior for treaty *i* in year *t*. If a regulated behavior is pollutant emissions such as the LRTAP and Montreal and Kyoto Protocols, this variable is defined by annual rate of change in emission reduction (not emission itself). If a regulated behavior is conservation such as the Convention of Biological Diversity, this is defined by annual rate of change in increase in protected areas. Thus, higher values of y_{it} indicate greater compliance in regulated behavior for each IEA.

X is a matrix of explanatory variables regarding ratified countries, such as per capita GDP and population. Note that these vary across both time and treaties. Z is a matrix of explanatory variables regarding the attributes of treaty, such as number of ratified countries, sanction procedures for non-compliance, and mechanics for aiding incapable developing countries. Note that some variables in Z vary across treaties but not across time. This is because the characteristics of the IEA are defined when the treaty is adopted, and they do not change unless amendments are proposed and adopted.

In equation (1), $\nu_i + \varepsilon_{it}$ is the residual of the model. ν_i is the treaty-specific residual, which differs across treaties, but constant within any particular treaty (i.e. time-invariant). This ν_i can be viewed as an unobservable heterogeneity of each treaty. There are a number of relevant factors of IEA affecting the effectiveness, but some of those are either not available or cannot observable for researchers. For example, there is no way to collect the variables representing the quality and quantity the secretariat office, and public perception of the treaty are difficult to obtain, or not available at all. However, if they are significant factors affecting the effectiveness, omitting these variables results in biased and inconsistent estimates. This hypothesis is explicitly tested in next section. ε_{it} is the "usual" residual which is 0 conditional mean, uncorrelated with ν_i, and homoskedastic.

If equation (1) is true, then it must be also true that

$$\bar{y}_{it} = \alpha + \bar{\mathrm{x}}_i \beta + \bar{z}_i \gamma + \nu_i + \bar{\varepsilon}_{it} \qquad (2)$$

where $\bar{y}_{it}$, $\bar{\mathrm{x}}_i$, $\bar{z}_i$, and $\bar{\varepsilon}_{it}$ are their means. Subtracting (2) from (1) provides time-demeaned transformation of the variables and results in the following:

$$\left(y_{it} - \bar{y}_i \right) = \left(\mathrm{x}_{it} - \bar{\mathrm{x}}_i \right) \beta + \left(\varepsilon_{it} - \bar{\varepsilon}_i \right) \qquad (3)$$

This is known as the fixed-effects estimator — also known as the within estimator. The major drawback of this model is that, as seen in the equation, this

$$\left(y_{it} - \theta \bar{y}_i \right) = \left(1 - \theta \alpha \right) + \left(\mathrm{x}_{it} - \theta \bar{\mathrm{x}}_i \right) \beta + \left(\mathrm{z}_i - \theta \bar{\mathrm{z}}_i \right) \beta + \left(1 - \theta \right) \nu_i + \left(\varepsilon_{it} - \theta \bar{\varepsilon}_i \right) \qquad (4)$$

where θ is a function of σ_ν^2 and σ_ε^2. If $\sigma_\nu^2 = 0$ (that is, ν_i is always 0), then θ becomes 0 and equation (4) reduces to the OLS. If $\sigma_\varepsilon^2 = 0$ (that is, ε_i is 0), then θ

becomes 1 and the models turns to the fixed-effects estimator. The fixed-effects model is appropriate if the differences between treaties can be viewed as parametric shits of the regression function. In other settings, it might be more appropriate if to view ν_i as randomly distributed across treaties. This assumption will produce the random-effects model. For more technical details of the fixed-effects and random-effects models, see Wooldridge (2001). StataCorp (2009) also offers an excellent summary of the panel data models.

Data

To estimate the model presented above, extensive information regarding the IEA and ratified countries need to be collected from various sources. Such information includes three types including: (1) regulated behaviors under the treaty; (2) treaty attributes; and (3) socio-economic conditions of ratified countries. We present these data and their sources below.

(1) Regulated behaviors under the treaty

Different treaties regulate different environmental behaviors. This study collects a wide variety of pollutant emissions and conservation efforts for each of the treaties considered in our analysis. First, for the Protocols related to the Convention on Long-range Transboundary Air Pollution (LRTAP), emission data are obtained from the Centre on Emission Inventories and Projections (CEIP)[3]. However, this officially-reported raw data is inconsistent and/or incomplete in some parties and time periods. To avoid these data problems, as suggested by the CEIP, we use emissions data as used in the EMEP models. These emission data is based on officially reported emissions to the extent possible, but some of the officially reported data have been corrected and/or gap-filled (Centre on Emission Inventories and Projections, 2009)[4]. This emission data from the EMPE models includes all primary pollutants regulated under the LRTAP-related Protocols, those include: Sulphur dioxide (SO_2); Nitrogen oxide (NO_2); Non-methane volatile organic compounds (NMVOC); Persistent Organic Pollutants (POPs); and heavy metals.

For the Montreal Protocol on Substances that Deplete the Ozone Layer and subsequent 4 amendments for each party is collected from Ozone Secretariat website(United Nations Environment Programme, 2010). Although there are a number of different Ozone depleting substances, consumption of Chlorofluorocarbons (CFCs) is used for analysis in this study given data availability and relative importance and depleting potential.

The Basel Convention regulates the transboundary movements of hazardous wastes. A country-level total hazardous waste generation data from 1997 to 2006 is obtained from the Secretariat website (Basel Convention, 2010).

For the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), unlike other pollutants, country-level CO_2 emission data are readily available and there are several sources. In this study, the total emission from is obtained fro the *World Development Indicators* (World Bank, 2009).

Finally, the Convention of Biological Diversity is difficult to analyze quantitatively, because this Convention deals with wide variety of environmental and ecological entity and many of relevant data are not available. We follow the *International Environmental Agreements (IEA) Database* developed by Mitchell (2002-2010) and use the ratio of area protected to maintain biological diversity to surface area. This should be reasonable because maintaining and enhancing areas protected should correlate with various behaviors toward environmental and ecological protection regulated under the Convention. The dataset is also obtained from Mitchell (2002-2010).

(2) Treaty attributes

We use the following 4 explanatory variables regarding the attributes of each treaty. They are mainly adapted from the *International Regime Database* (IRD) developed by Breitmeier et al. (2006). For relatively recent treaties that are not included in the IRD, we code the variables from the original treaty documents and *Register of International Treaties and Other Agreements in the Field of the Environment* published by the UNEP (2005).

Sanction is binary indicator and is 1 if treaty provides a formal compliance mechanism for non-complying countries[5]. *Consider* is 1 if the treaty has a special considerations for developing countries in terms of regulations. For example, Montreal Protocol on Substances that Deplete the Ozone Layer has dual regulations for developing ad developing countries. Such considerations may attract more countries (especially developing countries) to ratify a treaty. *Financial* and *Technical* take a value of 1 if a treaty includes a mechanism for financial and technical assistance for developing countries, respectively.

The data also includes two country-specific dummies. First, *BRICs* is binary indicator, which take a value of 1 if a treaty includes at least one of BRICs countries (Brazil, Russia, India, and China). Next, *US* is also binary variable, taking a value of 1 if the United States ratifies a treaty *i*. These dummies may be significant, at either positive or negative, if a participation of large-scale and fast-growing countries is significant factor for making a treaty effective or ineffective.

(3) Socio-economic conditions of ratified countries

Per capita GDP (2000 constant price) is used for a model as an indicator of average income levels for ratified countries. This variable is taken from the *World Development Indicators* (World Bank, 2009).

3. Results and Discussion

The estimated coefficients and their robust standard errors from the Pooled OLS, fixed-effects, and random-effects models are presented in table 1. First of all, note that the fixed-effects model eliminates any time-invariant variables from analysis. In our case, a total of 6 treaty-specific attribute variables as well as intercept are dropped out from the model.

To identify an appropriate model for our analysis, we conduct the Wu-Hausman test for the fixed-effects and random-effects models. Under the null hypothesis, the two estimates should not differ systematically and a test can be based on the difference[6]. The test statistic is sufficiently small to accept null hypothesis, indicating that there is no systematic difference in the estimated coefficients among the fixed-effects and random-effects models. We then conduct the Lagrange multiplier test for an existence of the random-effects[7]. The null hypothesis of no random-effects is rejected at more than 1% significance level. This indicates that the use of random-effects model is appropriate for our analysis. This also indicates that using the Pooled OLS model is not appropriate for this analysis. This is because an unobserved heterogeneity among treaties, v_i, is significant component of the model. We thus examine the fixed-effects or random-effects models for further details to find the most appropriate model in this study.

Next, using the random-effects model, we interpret the estimated coefficients and their significance to identify the factors affecting the effectiveness of IEA. Overall, the models fit the data reasonably well. Many of coefficients are significant at 1 or 5 statistical level and their signs are almost as expected. Specifically, the coefficient of *Sanction* is positive and its marginal effect is highest among all other treaty-specific variables. Although many of existing IEA do not include sanction measures for greater participation in the treaty, our results strongly indicate that this is counterproductive in terms of regime effectiveness.

Table 1. The estimated results of IEA effectiveness equation (heteroskedasticiy robust standard errors in parentheses)

Dependent variable: overall changes in regulated behavior (CRB)

Variable	Pooled OLS	Fixed-effects	Random-effects
Constant	0.696	—	-0.079
	(2.110)		(0.140)
Ratified	-0.001 **	0.012 ***	0.013 ***
	0.000	(0.005)	(0.005)
Sanction	0.233 ***	—	0.720 ***
	(0.012)		(0.010)
Consider	0.188 **	—	0.240 **
	(0.099)		(0.144)
Financial	0.367 *	—	0.443 ***
	(0.209)		(0.121)
Technical	0.010	—	0.011
	(0.044)		(0.029)
GDPPC	-0.020	-1.218 *	-1.450 *
	(0.016)	(0.730)	(0.786)
Non-OECD	0.004	0.004	0.004
	(0.076)	(0.087)	(0.060)
BRICs	0.191 ***	—	0.161 ***
	(0.038)		0.032
US	0.195	—	0.171
	(0.285)		(0.222)
n	157	157	157
within R^2		0.468	0.470
between R^2		0.607	0.673
overall R^2	0.434	0.499	0.572

Note: One, two, and three asterisks indicate statistical significance at 10, 5, and 1% level.

The coefficient of *Financial* is significant at 1% and its marginal effect is second highest among treaty-specific variables. This indicates that a mechanism for financial assistance for non-complying countries is a positive inducement for the effectiveness of IEA. This is expected because a number of developing countries do not ratify treaties due to insufficient financial resources to meet environmental behaviors regulated by the treaty. In contrast, the coefficient of *Technica*l is not significant at any significance levels.

The sign of *Consider* is positive and it is highly significant. There are several IEA including such considerations. For example, *Chlorofluorocarbons (CFCs) Phase-out Management Plan* under the Montreal Protocol for the Ozone depleting substances have different targets and schedules for developed and developing countries. Such flexibility is attracting more countries to participate, and shown to be positive inducement for making treaties effective.

Ratified represents a number of ratified countries for a treaty and its coefficient is positive and highly significant. Furthermore, the coefficient of *BRICs* is also positive and highly significant. These results suggest that the treaty is more likely to be effective if it attracts more countries. This is particularly true if a treaty can attract large-scale fast-growing countries such as BRICs. On the other hand, the coefficient for *US* is not significant at any statistical levels.

4. Summary and Conclusions

There has been a number of studies conducted empirical investigation of IEA effectiveness, but much of those studies focuses on ratification decisions and regulated environmental behaviors at country level. This approach is effective to explore the factors affecting each country's ratification decisions, and subsequent environmental behaviors. However, this is limited for looking into various attributes of each treaty and identify factors relevant to the success of IEA.

This study empirically investigates the effectiveness of IEA by developing a treaty-level panel data that includes 14 IEA adopted and entered into force last 20 years. This aggregated approach, using a treaty as a unit of analysis rather than country, enables to look further insights regarding the attributes of each IEA, and identify the factors significantly affecting the effectiveness of agreements.

From our results, several treaty-specific attributes are shown to be significant. Specifically, sanction for non-compliance is the most influential inducement for the effectiveness of IEA. A mechanism of financial assistance for less-capable developing countries is also found to be positive inducement, but mechanism of technical assistance is not significant at any statistical levels. Our results also indicate that involving larger number of countries, especially fast-growing developing countries such as BRICs, is another significant factor. Although this is not compatible with a strict sanction for non-compliance, introducing well-designed financial mechanism may be one of practical solutions for this incompatibility problem and making the IEA more attractive and more effective.

Before closing this study, it must be pointed out that this study is limited in terms of the number of IEA considered for our empirical analysis. The most recent version of the *IEA Database Project* (Version 2010.1) includes about 1,000 multilateral, and more than 2,500 bilateral agreements for various environmental and ecological issues (Mitchell, 2002-2010). Although many of those agreements cannot be a subject of analysis due to lack of relevant data, relevant information have become more and more accessible recently, due to several efforts including the *International Regimes Database* and *IEA Database Project*[8]. Updating the panel data and reanalyze the effectiveness using wider variety of IEA would be an important extension of this paper.

Notes

[1] Mitchell (2003) defines that agreements consist of: (1) instruments designated as convention, treaty, agreement, accord, and protocols and amendments to such instruments; (2) instruments establishing intergovernmental commissions; (3) instruments, regardless of designation, identified as binding by reliable sources (e.g., by a secretariat, UNEP, or published legal analysis); or (4) instruments whose texts fit accepted terminologies of legally binding agreements.

[2] Hereafter, the IEA is referred to as multilateral environmental agreements, those include the Conventions, Agreements, Protocols, and Amendments. The bilateral environmental agreements are not considered in this study.

[3] This data is officially submitted by the parties to the LRTAP Convention to the European Monitoring and Evaluation Programme (EMEP) via the United Nations Economic Commission for Europe (UNECE)

[4] For technical details of emissions data and their generation process, see European Monitoring and Evaluation Programme (2008) Emission Inventory Review 2008. Available at, http://www.ceip.at/fileadmin/inhalte/emep/pdf/Inventory_Review_2008.pdf.

[5] In the IRD, a formal compliance is categorized by different types of provisions to achieve compliance. Those types include: (1) suspension of membership rights; (2) exclusion from membership; (3) imposition of financial/economic punishments; (4) Support for capacity building to enhance compliance, and others.

[6] See Wooldridge (2001) for technical details.

[7] We use the LM test developed by Baltagi and Li (1990), which modifies an original test proposed by Breusch and Pagan (1980). The modified test allows for unbalanced data and reduces to the standard formula when data is balanced panel. See StataCorp (2009) for technical details.

[8] Information associated with the attributes of IEA has been relatively easy to obtain, because they are available from official treaty documents. Data missing problem is particularly serious for information regarding the changes in environmental behaviors regulated by the treaty.

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Appendix
International environmental agreements used in this study
(Ratified countries as of January 1, 2010)*

1. **Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on the Reduction of Sulphur Emissions or Their Transboundary Fluxes by at least 30 percent**
   - Primary objective: To provide for a 30 per cent reduction in sulphur emissions or transboundary fluxes by 1993.
   - Date of adoption: July 8, 1985
   - Date of entry into force: September 2, 1987
   - Ratified countries: 28
   - Pollutant used for analysis: SO_2 (Gg)

2. **Protocol to the 1979 Convention on Long-range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes**
   - Primary objective: To provide for the control or reduction of nitrogen oxides and their transboundary fluxes.
   - Date of adoption: October 31, 1998
   - Date of entry into force: February 14, 1991
   - Ratified countries: 27
   - Pollutants used for analysis: $NO+NO_2$ (Gg)

3. **Protocol to the 1979 Convention on Long-range Transboundary Air Pollution Concerning the Control of Emissions of Volatile Organic Compounds or Their Transboundary Fluxes**
   - Primary objective: To enhance the framework for the control of long-range transboundary air pollution.
   - Date of adoption: November 18, 1991
   - Date of entry into force: September 29, 1997
   - Ratified countries: 22
   - Pollutant used for analysis: Non-methane volatile organic compounds (NMVOC) (Gg)

4. **Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Further Reduction of Sulphur Emissions**
   - Primary objective: To set out measures to control and reduce sulphur emissions in order to protect human health and the environment from adverse effects.
   - Date of adoption: June 14, 1994
   - Date of entry into force: August 5, 1998
   - Ratified countries: 26

* The objective of each IEA is taken from UNEP (2005).

- Pollutant used for analysis: SO_2 (Gg)

5. **Protocol to the 1979 Convention on the Long-range Transboundary Air Pollution on Persistent Organic Pollutants (POPs)**
   - Primary objective: To control, reduce or eliminate discharges, emissions and losses of persistent organic pollutants.
   - Date of adoption: November 18, 1991
   - Date of entry into force: September 29, 1997
   - Ratified countries: 21
   - Pollutants used for analysis: Dioxide, hexachlorobenzene (HCB), Polycyclic aromatic hydrocarbon (PAH), Polychlorinated biphenyl (PCB) (Gg)

6. **Protocol to the 1979 Convention on the Long-range Transboundary Air Pollution on Heavy Metals**
   - Primary objective: To control emissions of heavy metals caused by anthropogenic activities that are subject to long-range transboundary atmospheric transport and are likely to have significant adverse effects on human health or the environment.
   - Date of adoption: Jun 24, 1998
   - Date of entry into force: December 29, 2003
   - Ratified countries: 22
   - Pollutants used for analysis: Palladium (Pd), Cadmium (Cd), Hydrargentum (Hg)

7. **Montreal Protocol on Substances that Deplete the Ozone Layer**
   - Primary objective: To protect the ozone layer by taking precautionary measures to control global emissions of substances that deplete it.
   - Date of adoption: September 16, 1987
   - Date of entry into force: January 1, 1989
   - Ratified countries: 196
   - Pollutant used for analysis: Chlorofluorocarbons (CFCs) (ODP Tons[†])

8. **London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer**
   - Primary objective: To strengthen the control procedures under the Montreal Protocol on Substances that Deplete the Ozone Layer (1987), to extend the coverage of the Protocol to new substances and establish financial mechanisms for the Protocol.
   - Date of adoption: June 29, 1990
   - Date of entry into force: August 10, 1992
   - Ratified countries: 194
   - Pollutant used for analysis: Chlorofluorocarbons (CFCs) (ODP Tons)

9. **Copenhagen Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer**
   - Primary objective: To strengthen the control procedures under the Montreal Protocol

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[†] Metric tons of Ozone Depleting Substances (ODS) weighted by their Ozone Depletion Potential (ODP).

on Substances that Deplete the Ozone Layer (1987) to extend the coverage of the Protocol to new substances.
- Date of adoption: November 25, 1992
- Date of entry into force: June 14, 1994
- Ratified countries: 191
- Pollutant used for analysis: Chlorofluorocarbons (CFCs) (ODP Tons)

10. Montreal Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer
- Primary objective: To further strengthen the measures for the implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer.
- Date of adoption: September 17, 1997
- Date of entry into force: November 10, 1999
- Ratified countries: 179
- Pollutant used for analysis: Chlorofluorocarbons (CFCs) (ODP Tons)

11. Beijing Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, 1999
- Primary objective: To strengthen the control measures under the Montreal Protocol.
- Date of adoption: December 3, 1999
- Date of entry into force: February 25, 2002
- ratified countries: 161
- Pollutants used for analysis: Chlorofluorocarbons (CFCs) (ODP Tons)

12. Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal
- Primary objective: To set up obligations for State Parties with a view to: (a) reducing transboundary movements of wastes subject to the Basel Convention to a minimum consistent with the environmentally sound and efficient management of such wastes; (b) minimizing the amount and toxicity of hazardous wastes generated and ensuring their environmentally sound management (including disposal and recovery operations) as close as possible to the source of generation; (c) assisting developing countries in environmentally sound management of the hazardous and other wastes they generate.
- Date of adoption: March 22, 1989
- Date of entry into force: May 5, 1992
- ratified countries: 167
- Pollutants used for analysis: Total Hazardous Waste Generation (1,000 tons)

13. Convention on Biological Diversity
- Primary objective: To conserve biological diversity, promote the sustainable use of its components, and encourage equitable sharing of the benefits arising out of the utilization of genetic resources. Such equitable sharing includes appropriate access to genetic resources, as well as appropriate transfer of technology, taking into account existing rights over such resources and such technology.
- Date of adoption: June 5, 1992

- Date of entry into force: December 29, 1993
- ratified countries: 187
- Pollutant used for analysis: Ratio of area protected to maintain biological diversity to surface area (%)

14. Kyoto Protocol to the United Nations Framework Convention on Climate Change

- Primary objective: To provide for policies and measures to undertake the commitment in Article 4 of the Convention, by setting quantified limitation and reduction objectives within specified timeframes for their anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.
- Date of adoption: December 11, 1997
- Date of entry into force: February 16, 2005
- Ratified countries: 186
- Pollutant used for analysis: CO_2