

# Agree to Disagree? Making sense of Vagueness in International Environmental Agreements

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  - Literature on Vagueness in Delegation Models
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# Introduction: The transformation of Global Environmental Politics

- Environmental politics map in the old configuration:
  - Negotiations consist mainly of the European countries (in the 1980s) and in particular Germany, France and the UK as the main players, later in the 1990s they negotiate as the European Union and the US appears as a key player → a small number of pivotal players.
  - The power to destroy was typically quite evenly distributed
  - Environmental preferences are generally high
  - Institutional capacity of negotiations was typically large.

- The negotiations resulted in agreements specifying precise commitments for the signatories :

***(Montreal Protocol, 1987)***

*.. the signatory states shall accept a series of stepped limits on CFC use and production, including:*

*from 1991 to 1992 its levels of consumption and production of the controlled substances in Group I of Annex A do not exceed 150 percent of its calculated levels of production and consumption of those substances in 1986;*

*from 1994 its calculated level of consumption and production of the controlled substances in Group I of Annex A does not exceed, annually, twenty-five percent of its calculated level of consumption and production in 1986.*

*from 1996 its calculated level of consumption and production of the controlled substances in Group I of Annex A does not exceed zero.*

***the 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes*** - Convention on long-range transboundary air pollution:

*The Parties shall reduce their national annual sulphur emissions or their transboundary fluxes by at least 30 per cent as soon as possible and at the latest by 1993, using 1980 levels as the basis for calculation of reductions.*

# Introduction: The transformation of Global Environmental Politics

- In the recent years, this scene has evolved:
  - number of players has increased
  - varying environmental preferences
  - varying power to destroy
  - varying *and* uncertain institutional capacities
- Examples include deforestation, desertification and Climate change negotiations.

- In Article 7 of **The Paris Agreement**, a set of commitments and guidelines for adaptation efforts is laid out :

*Parties acknowledge that adaptation action should follow a country-driven, gender-responsive, participatory and fully transparent approach..*

*Parties recognize the importance of support for and international cooperation on adaptation efforts..*

*Parties should strengthen their cooperation on... assisting developing countries Parties in identifying effective adaptation practices..*



# Institutional Capacity: What we know

- This paper defines institutional capacity as the extent to which a state is able to achieve its desired policy outcome.
- The aim is to analyze **the link between heterogeneity in institutional capacities of the negotiators and the degree of vagueness** in the resulting environmental agreement.
- The assumption that countries negotiate over a degree of precision, rather than a (uniform or differential) commitment level reflects the style in which the **Paris Agreement** was set up.
- In doing so, it contributes to the literature on International Environmental Agreements (IEAs) and on vagueness in the principal-agent models.

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# Formation, content and compliance with IEAs

- Models analyzing IEAs can be broadly divided into:
  - **Membership/Participation models** (Zeew, 2008; Finus, 2003)
    - deal with the free-rider incentive not to participate in the IEA and free ride on participants' abatement efforts as they generate positive spillovers.
    - Most common tradition is to determine the maximal number of the countries which would voluntarily be part of an IEA
    - The number of participants forming a stable coalition is determined by the **internal and external stability criteria**.
    - Compliance here is exogeneous.

- These models predict that a self enforcing IEA will be signed only by a small number of countries (Barrett, 1994).
- To explain the high participation frequently observed, different **incentive instruments** are introduced into the analysis:
  - the use of (monetary) side payment schemes (Barrett, 2003).
  - issue linkage, a negotiation process on multiple issues (e.g. on the protection of the environment and trade)
  - technological transfers for the abatement process across countries.

## ● Compliance models

- Deal with the incentive not to comply with the obligations agreed upon in an IEA.
- Participation here is exogenous
- Test credible threats and sanctions : Penance and Penance-m strategies

## Choice of abatement effort within the coalition

- A **uniform abatement effort** or emission quota or is derived from **joint welfare maximization** of coalition members.
- Allowing for heterogeneity in abatement costs → analyze relative desirability of uniform vs. **differential abatement quotas**.
- However, empirical studies on the Montreal Protocol (Murdoch and Sandler, 1997), the Helsinki Protocol (Murdoch and Sandler, 1997), or the Kyoto Protocol (Bohringer and Vogt, 2004) suggest that coalitional abatement is neither optimal nor is its allocation cost-effective.
- To accommodate for this observation, some models assume bargaining over uniform quotas (Finus, 2005) and perhaps closer to our model is the idea that uniform quotas may form a focal point during negotiations simplifying the co-ordination of expectations between countries (Schmidt, 2001).

# Literature on Vagueness in Delegation Models

- Vagueness in the principal-agent framework has two political purposes:
  - it enables the principal to deal with his **limited policy expertise** (e.g. court and legislature, or legislature and bureaucrat; however, legislatures and executives do not confront the same constraints as they have committees providing them with policy recommendations (Epstein and O'Halloran, 1999; Huber and Shipan, 2002).
  - it helps the principal maintain an **institutional prestige** in the face of potential opposition (Carrubba 2005; Staton 2006; Vanberg 2005).
- But vagueness also **undermines the principal's control over policy outcomes** as it allows the agent to use this discretion to promote his own interests.

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# The Moderator, Representatives and Pivotal Agents

- A multi-stage game of the formation of an IEA is considered.
- There is a set of countries,  $N$ , that join the negotiation table to negotiate over the degree of precision, denoted  $a$ , in the elaboration of the standards agreed upon in the treaty.
- A **moderator** conciliates between the different opinions during the negotiations and insures the purpose of the agreement is met.
- There are two agents per country who have different roles in the political process:
  - 1 Country  $i$ 's **representative**,  $R$ , who is in charge of the negotiation and of implementing the chosen policy.
  - 2 The **pivotal agent** in country  $i$ , denoted  $P$ , whose preferences are decisive in the ratification decision and who formulates the unilateral policy in case of non-ratification.

# Heterogeneous Institutional Capacities

- Each country chooses its abatement *policy*,  $p_i > 0$ , which results in abatement *level*,  $q_i$  such that :

$$q_i = p_i + \lambda_i$$

- $\lambda_i$  is a country-specific shock, it represents country  $i$ 's **institutional capacity** → we deviate from the literature on IEAs by assuming abatement outcomes to be non-observable.
- $\lambda_i$  is drawn from a continuous distribution with cdf  $G(\cdot)$  with mean zero, only  $P_i$  and  $R_i$  learn the realization of  $\lambda_i$

# Cooperative and Non-Cooperative Policies

- Utility function of the pivotal agent in country  $i$  is given by:

$$U_i^P(p_i) = b(q_i(p_i) + \sum_{j \neq i}^N E(q_j)) - \frac{c}{2} p_i^2$$

where linear benefits from abatement and increasing and convex abatement costs are assumed.

- The **non-cooperative policy** : if country  $i$  is not bound by an agreement, the pivotal agent chooses the unilateral policy to solve:

$$\max_{p^i} U_i^P \iff p^{NC} = \frac{b}{c}$$

- For a given number  $\hat{n} \leq N$  of signatories, the **cooperative policy** would, *optimally*, be set as to solve:

$$\max_{p^i} \sum_{i=1}^{\hat{n}} [b(q_i(p_i) + \sum_{j \neq i}^N E(q_j))] - \frac{c}{2} p_i^2 \iff p^C = \frac{\hat{n}b}{c}$$

# Temporal and Information Structure

- Both the pivotal agent and the representative of country  $i$  privately learn their  $\lambda_i$ .
- An agreement is negotiated by the  $N$  representatives. The agreement that has the following structure: it specifies a standard for abatement policy,  $\frac{\hat{n}b}{c}$ , that depends on the number of ratifying countries at equilibrium that comes with a degree of precision that allows for some discretion in the implementation of the recommended standard.
- Given the degree of vagueness of the agreement language, each representative makes a policy suggestion  $p_i^A(\lambda_i)$  to the pivotal agent in his country.
- Pivotal agents of the  $N$  negotiating countries decide whether they ratify the proposed agreement. Ratification is assumed to take place simultaneously.
- Ratifying countries implement their respective  $p_i^A(\lambda_i)$  while all other countries implement  $p^{NC}$ .

# The Moderator's Objective

- The moderator sets the optimal  $a$  as to maximize:

$$U^A(a) = - \underbrace{\left[ \sum_{i=1}^N (p_i + \lambda_i) - \sum_{i=1}^N (q^C(N)) \right]^2}_{\text{policy payoff}} - \underbrace{ak \left[ \sum_{i=1}^{n(a)} (\bar{q}^C - q_i(p_i)) \right]^2}_{\text{institutional concerns}}$$

- a greater political loss is incurred for the agreement as total abatement level diverges from its ideal point  $\sum_{i=1}^N (q^C)$ .
- $a \in [0, 1]$  **represents the degree of precision** in the agreement language. ( $a = 0$  is a perfectly vague agreement)
- The parameter  $l$  indicates how much noncompliance concerns are valued over policy concerns (importance of the agreement to the public opinion, to transmit a message.. )

# The Representative's Preferences

- Given a degree of precision  $a$ ,  $R$  chooses a policy  $p_i$  that maximizes his utility given by the quadratic loss function:

$$U_i^R(p_i; a) = \underbrace{-(q_i(p_i) - q_i^{NC})^2}_{\text{policy payoff}} \underbrace{-ar(\bar{q}^C - q_i(p_i))^2}_{\text{institutional concerns}}$$

- The parameter  $r > 0$  which denotes the politician's cost of defying the agreement once it has been ratified (possible trade sanctions, loss of credibility in international negotiations... )
- if  $a = 0$ ,  $R_i$  is allowed to implement any policy without cost since no policy is incompatible with the agreement.

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# The Policy Proposal

- For a given level of precision,  $a$ ,  $R_i$  makes a policy offer  $p_i^A$  to the Pivotal agent such that:

$$p_i^A(a) = \underbrace{(1 - \gamma)p^{NC} + \gamma p^C}_{\text{discretionary policy of the average type } \bar{p}^A} - \underbrace{\gamma \lambda_i}_{\text{Conformity adjustment term}} \quad (1)$$

where  $\gamma = \frac{ar}{1+ar}$  is the weight attributed to cooperation.

- if agreement adopts a completely vague language,  $R_i$ 's best response is  $p^{NC}$  which would result in  $q_i^{NC}$ .
- As  $a$  - and  $\gamma$ - increases, pressure to move policy towards the cooperative policy increases.
- However, the ability of the agreement to pressure  $R_i$  is limited by the cost he incurs for defying the agreement; even for  $a = 1$ ,  $R_i$ 's best response is  $\frac{p^{NC} + r(p^C - \lambda_i)}{1+r}$  which approaches  $\bar{q}^C$  only as  $r$  becomes arbitrarily large.



# The Ratification Decision

- Pivotal agent in country  $i$  ratifies the agreement, for a given degree of precision a given expected number,  $\hat{n}$ , of ratifying countries, whenever:

$$U_i^P(p_i^A; \hat{n}) \geq U_i^P(p^{NC}; \hat{n} - 1)$$

- By joining the agreement,  $P_i$ :
  - incurs a cost of the increased policy effort  $\rightarrow$  this increase in cost being lower for a country with a higher  $\lambda$
  - benefits from increased level of abatement due to both his own increased policy level and through inducing a higher standard for all participants.
- Precisely,  $P_i$  ratifies the agreement if  $\lambda_L(a, \hat{n}) \leq \lambda_i \leq \lambda_H(a, \hat{n})$   
 where  $\lambda_L(a, \hat{n}) = \frac{b}{c}[(\hat{n} - 1) - \sqrt{\frac{2(\hat{n}-1)}{\gamma}}]$  and  
 $\lambda_H(a, \hat{n}) = \frac{b}{c}[(\hat{n} - 1) + \sqrt{\frac{2(\hat{n}-1)}{\gamma}}]$

There exists two possible equilibria in this case. Assume minimum ratification threshold is set to ensure the equilibrium will be that with the high participation

$$n(\gamma) = \frac{4N^2 b^2}{\alpha^2 c^2 \gamma} b \sqrt{\frac{1 - \alpha^2 c^2 \gamma}{2N^2 b^2}}$$

## Lemma

*Given a uniform distribution of institutional capacities, increased precision in the agreement results in*

- *less participation: a smaller number of countries ratifying the agreement,*
- *participation being restricted to countries with relatively lower institutional capacity.*

## Optimal level of Vagueness

- Introducing the subgame perfect equilibrium in the objective function of the moderator:

$$EU^A(a) = -\frac{b^2}{c^2} [N^2(N-1)^2 + \frac{2}{3}n^2(n-1)\frac{ar + \frac{k}{r}}{1 + ar}] \quad (4)$$

- From the maximization problem, we get

$$EU^{A'}(a) = -\frac{2}{3}\frac{b^2}{c^2}\Phi(a^*) = 0$$

where  $\Phi(a^*)$  is an implicit function of  $a^*$  and the parameters and  $\Phi'(a^*) > 0$ . Precisely,

$$\Phi(a^*) = [(ar + \frac{k}{r})(3n^2 - 2n)n_a + \frac{1 - k}{1 + ar}n^2(n - 1)] = 0$$

# Comparative Statics

## Lemma

*Given a uniform distribution of institutional capacities, the more noncompliance concerns are valued over policy concerns - i.e. the larger the  $k$  -the more vagueness is required in the agreement.*

- **Intuition:** Apart from the direct effect of reducing  $a$  to keep institutional prestige in case of noncompliance, a high degree of vagueness increases participation and, particularly, of the high types who now have a double motive to participate: induce participation of the low types who tend to over-deliver, without putting too much emphasis on conformity. Hence, the average institutional capacity of participants is raised which raises the expected average abatement outcome within the coalition.

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# Empirical Analysis

- Our theoretical model has some interesting empirical implications that we attempt to test.
  - First, an increased level of precision in the agreement is likely to result in more abatement and hence more effective agreements.
  - Second, given a relatively precise agreement, countries with higher institutional capacity are more likely to ratify since the required policy adjustments are less costly for this group.
  - Third, the probability of ratifying a relatively precise agreement depends on the distribution of the signatories (or potential ratifiers); a country is more likely to ratify a relatively precise IEA when its institutional capacity is relatively close to that of the other ratifiers.
  - Fourth, environmental negotiations North/North, South/South or between countries with relatively similar levels of institutional capacity have a comparative advantage, in terms of precision, participation level and effectiveness, compared to the case where the distribution of institutional capacity is rather uniform.

# Methodology

- Five IEAs are considered for the empirical analysis: Vienna Convention (1985), Montreal Protocol (1987), United Nations Framework Convention for Climate Change (1992), Kyoto Protocol; (1997) and Paris Agreement (2015).
- For each IEA, a vagueness index is constructed based on six criteria:
  - 1 Specificity of Controlled Substances and Time Schedule
  - 2 Numerical Mitigation Targets
  - 3 Clarity of implementation mechanism
  - 4 Reporting, Monitoring and Review Process
  - 5 Sanctions for non-compliance
  - 6 Incentives for developing countries

# Baseline Specification

- The baseline specification proves the existence of a bandwagon effect in the ratification decisions, proving the positive strategic effect referred to as the *raising the bar* effect.

Table 1. Agreements Ratification – Baseline Specification

	Kyoto	Paris	Montreal	UNFCCC	Vienna	Any agreement
Ln(Ind)	0.0352** (0.0155)	0.0123* (0.00701)	0.00132 (0.0161)	0.00524 (0.0135)	0.0192 (0.0160)	-0.0126 (0.00934)
Ln(GDP)	0.0301** (0.0148)	0.0105 (0.00672)	0.0124 (0.0155)	0.0160 (0.0129)	0.0342** (0.0154)	0.00384 (0.00896)
Num. Ratifiers	0.00511*** (0.000184)	0.00484*** (9.29e-05)	0.00500*** (0.000195)	0.00508*** (0.000158)	0.00510*** (0.000190)	1.050*** (0.0263)
Constant	-1.369*** (0.328)	-1.183*** (0.149)	-0.410 (0.343)	0.433 (0.287)	-0.0123 (0.342)	-0.0881 (0.201)
Country dum.	YES	YES	YES	YES	YES	YES
Year dum.	YES	YES	YES	YES	YES	YES
Observations	6,118	6,118	6,118	6,118	6,118	6,118
R-squared	0.811	0.910	0.763	0.847	0.767	0.633

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



- Increased vagueness results in a lower probability of ratification..

Table 2. Agreements Ratification – Vagueness

	Kyoto	Paris	Montreal	UNFCCC	Vienna	Any agreement
Ln(Ind)	0.0397*** (0.0149)	0.0172*** (0.00536)	0.00412 (0.0159)	0.00746 (0.0133)	0.0204 (0.0160)	-0.00276 (0.00185)
Ln(GDP)	0.0257* (0.0143)	0.00588 (0.00514)	0.00977 (0.0153)	0.0139 (0.0127)	0.0330** (0.0153)	-0.00546*** (0.00178)
Vagueness	-0.529*** (0.0241)	-0.561*** (0.00868)	-0.325*** (0.0258)	-0.257*** (0.0215)	-0.147*** (0.0259)	-1.138*** (0.00300)
Country dum.	YES	YES	YES	YES	YES	YES
Year dum.	YES	YES	YES	YES	YES	YES
Observations	6,118	6,118	6,118	6,118	6,118	6,118
R-squared	0.825	0.947	0.769	0.851	0.768	0.986

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

- whereas large institutional differences reduce the likelihood of ratification.

Table 3. Agreements Ratification – Institutional Differences

	Kyoto	Montreal	UNFCCC	Vienna	Any agreement
Ln(Ind)	0.0376 (0.0373)	-0.0466* (0.0248)	-0.0294 (0.0236)	-0.00495 (0.0246)	-0.0363** (0.0152)
Ln(GDP)	-0.0668 (0.0454)	-0.107*** (0.0300)	-0.0661** (0.0287)	0.0710** (0.0298)	-0.0132 (0.0184)
Inst. Diff.	-0.0157* (0.00867)	0.0121 (0.00831)	0.00222 (0.00695)	-0.0146** (0.00647)	-0.0175*** (0.00594)
Constant	2.112** (0.973)	2.568*** (0.644)	2.712*** (0.610)	-0.269 (0.633)	1.476*** (0.391)
Country dum.	YES	YES	YES	YES	YES
Year dum.	YES	YES	YES	YES	YES
Observations	2,715	2,715	2,715	2,715	2,715
R-squared	0.727	0.726	0.733	0.726	0.449

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

- The same results hold in the full specification model.

Table 4. Agreements Ratification – Full Specification

	Kyoto	Montreal	UNFCCC	Vienna	Any agreement
Ln(Ind)	0.0661* (0.0344)	-0.0376 (0.0244)	-0.0213 (0.0233)	-0.00387 (0.0246)	-0.00605 (0.00402)
Ln(GDP)	-0.0469 (0.0419)	-0.100*** (0.0296)	-0.0617** (0.0283)	0.0716** (0.0298)	0.00447 (0.00486)
Vagueness	-1.091*** (0.0517)	-0.330*** (0.0367)	-0.302*** (0.0351)	-0.0396 (0.0370)	-1.107*** (0.00605)
Inst. Diff.	-0.0152* (0.00799)	0.0144 (0.00818)	0.00508 (0.00686)	-0.0143** (0.00647)	-0.00330** (0.00157)
Num. Ratifiers	0.00393*** (0.000211)	0.00253*** (0.000632)	0.00394*** (0.000631)	0.00576*** (0.000665)	-2.341*** (0.112)
Constant	0.855 (0.924)	2.253*** (0.659)	2.330*** (0.629)	-0.665 (0.662)	3.330*** (0.195)
Country dum.	YES	YES	YES	YES	YES
Year dum.	YES	YES	YES	YES	YES
Observations	2,715	2,715	2,715	2,715	2,715
R-squared	0.768	0.735	0.741	0.726	0.961

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

# Vagueness and Effectiveness of IEAs

- Vagueness increases CO2 emissions and hence reduces the effectiveness of IEAs.

Table 5. Effectiveness of Environmental Agreements

	Ln(CO2)	Ln(CO2)	Ln(CO2)	Ln(CO2)
Ln(Ind)	0.0869*** (0.00661)	0.0219** (0.00870)	0.0870*** (0.00661)	0.0215** (0.00869)
Ln(GDP)	-0.0560*** (0.00318)	-0.0865*** (0.00538)	-0.0590*** (0.00368)	-0.0935*** (0.00601)
Institutions		-0.000260 (0.00320)		-0.000616 (0.00320)
Vagueness			0.0213 (0.0134)	0.0316*** (0.0121)
Constant	1.437*** (0.0771)	2.359*** (0.130)	1.505*** (0.0879)	2.523*** (0.144)
Observations	5,291	2,669	5,291	2,669
R-squared	0.082	0.096	0.082	0.098
Number of code	193	171	193	171

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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# Concluding thoughts

- Asymmetric and uncertain institutional capacities are key in explaining the evolution of global environmental politics.
- IEAs in the recent years tend to be vague due to the heterogeneity in institutional capacities of the emerging key players in environmental negotiations (e.g. China and India), which results in less compliance.
- Environmental negotiations between countries with relatively skewed distributions of institutional capacities (negotiations North/North, South/South or at an even narrower scale) have a comparative advantage in terms of precision, participation level and hence effectiveness.

# Concluding thoughts

- In crafting IEAs, the tradeoff between compliance versus policy concerns ought to be carefully considered. The *pledges* approach of the Paris Agreement clearly reflects a need for a harmonized global environmental action rather than a particular abatement outcome.
- It would be perhaps interesting to analyze the model in a dynamic setting to capture the idea of the Conference of the Parties (CoPs) whereby signatories meet to revise the degree of vagueness agreed upon. What would then determine the time path of vagueness?