On the Economics of Regime Design

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Abstract

This paper distills from regime design literature a novel analytical tool, an economic function, by which to normatively assess the efficacy of an international treaty. The *Regime Efficacy Function* (REF) enables practitioners, junior and seasoned alike, to efficiently spot issues and generate policy options. The current pedagogy for studying regime design appears to be a diet of experience and self-study. Certainly, knowledge helps us understand present circumstances by means of analogy and lessons learned. This method has drawbacks as, under novel circumstances, the propensity to investigate and assess what is familiar increases the likelihood that new relationships and their consequences will be overlooked and crucial questions left unasked. The REF remedies this with a simple, four-step qualitative function. By assessing the normative impact of a lesser variable's (decision making, wealth transfers, and implementation timelines, etc.) impact on core variables (equity, legitimacy, appropriateness, and risk), the user derives a possible consequence. Iterated operation of the REF allows even an inexperienced practitioner learn the design of the examine regime, its weaknesses, and how it can be improved to achieve its stated purpose. The REF is deeply contrasted with other models or checklists existing in the literature – they are focused on delivering a result whereas the REF is concerned with delivering analytical capability based on systematic and rigorous observation instead of by analogy to experience or case-studies.

"No man is an island,
Entire of itself,
Every man is a piece of the continent,
A part of the main."
- John Donne, *Meditation XVII*

Introduction

Not too long ago I found myself researching how "Global North" and "Global South" negotiating dynamics influence the content and efficacy of multilateral environmental agreements (MEAs).[1] In essence, I was concerned with the study and practice of regime design. The literature is rich with individual and comparative case studies as well as quantitative assessments of the larger international environmental governance ecosystem.[2] The literature also sports a spectrum of compliance theories rooted in legal, economic, or policy-based schools of thought. The literature also provides taxonomy of various elements that may be included in an MEA, like a secretariat, dispute resolution mechanism, or technical capacity assistance. The literature makes clear that variance in state interests and capacity heavily influences the negotiating process and efficacy of the resulting MEA.[3] In this literature, I endeavored to find synthesis of these considerations and variables: some sort of analytical tool or checklist to synthesize the elements of these regimes. Suppose you have to negotiate a treaty and you have absolutely no understanding of regime design. All you know are the facts and contextual particularities of your issue and the interests of the state parties around the negotiating table. Where do you start? What are important architectural considerations? What is the opportunity cost of choosing one alternative over another?

I found no such synthesis. There are works on regime efficacy within specific subject areas (such as environmental or trade law). These findings, although important, are highly contextual.[4] Other works synthesize quantitative models but by their design to produce discrete predictions they are replete with biases and assumptions.[5] Such models downplay or exclude certain variables and their relationships mirroring the problem of solely relying on experience and case-study knowledge: you only analyze what the model allows, you only issue-spot what you recognize. Nevertheless, they are incredibly useful in identifying relationships between various variables. For example, how effective is an MEA if it commits parties to monitor greenhouse gas (GHG) emissions but some parties are financially strained and the treaty provides no mechanism to address this? This example illuminates the interplay between heterogeneous capacities, compliance costs, and financial incentives or transfers. My concern, however, is the literature's apparent gap in the next

[1] MEAs are legally binding international treaties between two or more states designed to address a collective action problem concerning a general or specific environmental problem. For example, the *Montreal* and *Kyoto* protocols addressed ozone depletion and climate change, respectively.
[2] Kim, "Emergent Network Structure," 980-983.
[3] Sandler, *Global Collective Action*, 142; Eckersley, "The Big Chill," 24.
[4] For example, Miles et al. produced a comprehensive work on what makes an environmental regime effective. Its contextuality renders its findings less applicable to treaty regimes of an entirely different nature. For example, treaties to avoid the double-taxation of dual-citizens. See Miles et al., *Environmental Regime Effectiveness.*
[5] Young, "Effectiveness of international environmental regimes."

logical step: synthesizing the variables exposed across various case studies into analytical models, tools, or even checklists. Without such synthesis, the practice of regime design is fundamentally dependent on each practitioner's personal experience and knowledge of case studies. That is, if the facts and context are not analogous to the practitioner's knowledge, there is presumptively a greater chance for error or omission. There are consequences to this idiosyncrasy, particularly for developing states without experienced practitioners or without the means to hire sufficient expertise.

This paper endeavors to bridge this gap by offering the *Regime Efficacy Function* (REF), an elegant and rigorous tool capable of assisting both non-practitioners and experts alike. The REF is derived from "core" variables often observed directly or indirectly in regime design literature. They are: equity (Eq), legitimacy (L), appropriateness (A), and risk (R). Their arrangement below is used to derive regime efficacy (RE). Together, they subsume all other considerations that are observed in the literature (dispute resolution mechanism, secretariat, monitoring, urgency of threat, homogeneity of party interests, etc).

Figure 1: *Regime Efficacy Function*

$$RE = \frac{(Eq + L + A)}{(R + 1)}$$

REF assumes that the "perfect regime" has a normative value of 1.0. This allows for both overprovision and underprovision of core variables; RE of 1.1 is just as ineffective as 0.9. However, modulations do not occur within a vacuum. The REF stresses the complex interdependence between core variables. A change in one triggers a change in one or more of the others. The difference between positive and negative normative changes determines the overall change in RE.

It must be stressed that the REF is *not* a quantitative model or tool. All assessments are qualitative. The REF cannot predict the precise outcome of a modulation, nor is that its purpose. The tool processes normative changes in variables. The user must ultimately determine the magnitude of change in the affected core variables and predict the final result. The REF forces users to consider the possible consequences of any modulation from multiple perspectives. Non-practitioners can rigorously issue-spot and make more informed decisions. Seasoned practitioners can efficiently generate a series of options, complete with possible consequences and their pros and cons. The REF is fundamentally a tool for qualifying opportunity costs, asking the question: if this consideration is changed, how is the rest of the regime's framework impacted – what is the trade-off?

Use of the REF allows us to appreciate and represent the complexity of regime design easily. The sheer volume of considerations in negotiating and implementing any regime is staggering, particularly when the potential parties are heterogeneous in interests and capacity. The REF allows us to easily appreciate that the addition, withdrawal, or variation of any variable impacts the operation of all other variables. For example, when the Global North demanded the International Labour Organization (ILO) adopt minimum standards in order to justify the comparative labor cost advantage of the Global South, the resulting change *increased* the legitimacy of the regime through enhanced objectivity but

simultaneously *decreased* its equity by eroding its capacity for subjectivity.[6] By use of the REF, regime negotiation, construction, and implementation can be more rigorous, systematic, comprehensive, and sensitive to the objective of efficacy.

The paper will proceed as follows. Section II provides a general overview of the *Regime Efficacy Function*. In particular, Section II.3 highlights the REF's substantive contribution to regime design literature by exposing the dangers of overprovision. Section III explores lesser variables in detail and how they impact core variables. Section IV describes the REF's four-stage process. Section V compares the Montreal and Kyoto protocols as a case study to demonstrate how lesser variable modulations play out and impact regime efficacy. Section VI concludes with a discussion on the function's benefits and limitations. This paper stems from a much larger work exploring the history and development of international environmental law and governance.

The Economics of Regime Design

Overview

The REF is an economic function derived from "core" variables often observed directly or indirectly in regime design literature.[7] They are: equity (Eq), legitimacy (L), appropriateness (A), and risk (R). Their arrangement below is used to derive regime efficacy (RE). Together, they subsume all other considerations that are observed in the literature. These considerations are sorted into the lesser variables of "element" and "context" variables.

Figure 2: *Regime Efficacy Function*

$$RE = \frac{(Eq + L + A)}{(R + 1)}$$

Element variables are party-controlled and can be freely modulated (e.g. the decision making mechanism selected). Context variables are generally endogenous to parties and beyond their immediate control (e.g. the heterogeneity between parties or urgency of the threat). In Section II, we examine in greater detail lesser variables and their interplay with core variables.

Any addition, withdrawal, or variation of a lesser variable triggers a normative change ($\Delta\uparrow$ or $\Delta\downarrow$) in a corresponding core value. For example, decision making by consensus is more legitimate than plurality: under consensus, no party can be forced to undertake a decision it does not support. This increase in legitimacy creates a normative increase in the L core variable ($\Delta\uparrow$L).

REF assumes that the "perfect regime" has a normative value of 1.0. This allows for both overprovision and underprovision of core variables; RE of 1.1 is just as

[6] Mendes, *Global Governance, Human Rights and International Law,* 132.

[7] It is an economic model in the sense that it processes considerations of scarcity and opportunity cost.

ineffective as 0.9. However, modulations do not occur within a vacuum. The REF stresses the complex interdependence between core variables. A change in one triggers a change in one or more of the others. Reflect again on adopting consensus decision making instead of plurality. If the regime's parties have heterogeneous interests, rule by consensus gives every party a *de facto* veto. Depending on the urgency and severity of the harm the regime targets (risk-based context variables), this decision may be inappropriate. Obtaining consensus may take too long or may make it difficult to agree to more ambitious, but necessary, commitments: there is a normative decrease in appropriateness ($\Delta\downarrow$A). The difference between $\Delta\uparrow$L and $\Delta\downarrow$A determines the overall change in RE.

The REF privileges analytical and inductive skills over subjective experience and case-study knowledge. Consider the example below:

Suppose you are a novice practitioner and have been given little, if any, instruction from your government as to what they want to see in the new treaty. At the very least, armed with nothing but the REF, the negotiating facts and context, and your own faculties, you can model every element variable proposed by other parties and determine its impact on regime efficacy, both in general and with regard to your own interests. Suppose a proposed element variable is a commitment to reduce greenhouse gas (GHG) emissions. You use the REF and ask, "Is that equitable? Emissions will retard my nation's economic growth and really it is the opposing developed states that made this environmental mess in the first place." You counter that the request is inequitable to developing states and request assistance with implementation. The opposing parties offer financial transfers, technology transfers, or a delayed implementation schedule. You run each proposed element variable through the REF and generate a series of possible outcomes, complete with pros and cons for each option that you can take back to your chief negotiator or government for action:

- Financial transfers: help subsidize economic activity but may not be appropriate for moving the economy away from polluting processes ($\Delta\uparrow$Eq, $\Delta\downarrow$A).
- Technology transfers: subsidize expensive R&D and provide a pathway to medium to long-term economic and sustainable growth ($\Delta\uparrow$Eq, $\Delta\uparrow$A). However, they do not address the short-term economic concerns of your people ($\Delta\downarrow$L).
- Delayed implementation schedule: puts off the economic costs of compliance but depending on the severity and urgency of the harm being addressed by the treaty, inaction now may aggravate the collective action problem and require even greater and costlier remediation in the future ($\Delta\uparrow$Eq, $\Delta\uparrow$R, $\Delta\downarrow$A).

The above example demonstrates the REF's efficient framework through which considerations are processed. More importantly, it demonstrates how little experience or case-study knowledge is required to ask the right questions and conduct a rigorous, inductive investigation. That is not to say the REF renders experience and case-study knowledge obsolete. On the contrary, experience and case-study knowledge play an important role in maximizing the REF's potential. Section IV examines in detail how the REF is utilized. For now, we turn to a closer examination of the core variables and the internal logic of the REF model.

The Core Variables and How They Operate

The four core variables of equity, legitimacy, appropriateness, and risk are distilled from regime design literature.[8] Across case studies, they stand out as the principle "macro" considerations with which researchers are either directly or indirectly concerned. I use the term "macro" to mean that core variables possess an over-arching, malleable characteristic capable of subsuming lesser, more specific, variables. Hence the taxonomy of "core" and "lesser" variables. We examine each core variable in greater detail below.

Equity: Equity is synonymous with fairness. Under equity, a lesser variable's modulation is applied against the regime's context. This includes the interests, capacity, and history of regime parties as well as all other lesser variables already part of the regime. The key question to ask when processing modulation in a lesser variable is how will the rights, obligations, and relative power or influence of parties be impacted. If these considerations are modulated in accordance with a party's interests or capacity, we observe an increase in equity. This appears always to cause an opposite change in legitimacy.

Considerations of equity are often in tension with legitimacy, particularly concerning rights and obligations. In the international environmental context, Global South states are often held to objectively lower standards, receive greater financial and technology transfers, and/or enjoy preferential implementation schedules. This certainly increases fairness given that Global North states have the means and capacity to adhere to higher standards and are proportionally more responsible for past pollution. Nevertheless, differentiated rights and obligations erode an equal rule of law. Rules should be applied equally to states as they are all equals before international law, irrespective of their subjective differences. Hence differentiated rights and obligations reduce the regime's legitimacy.

Legitimacy: As stated above, the legitimacy variable is concerned with the extent to which parties are subject to the same rights and obligations and their relative power and influence. Power and influence subsumes the crucial consideration of how decisions are made. The greater say the party has in the final decision, the more legitimate the regime.

Consider the United Nations regime. All members are part of the General Assembly (UNGA) but only some sit on the Security Council (UNSC) of which even fewer have permanent seats. The UNGA may only make non-binding declarations. UNSC decisions bind all parties of the regime and can even be taken directly against non-parties (who have no representation, which is an issue of "external efficacy," a matter we discuss later). UNSC decisions require support from at least nine of fifteen members, including no votes against by the five permanent members. Even if binding decisions were taken at the UNGA level, any formula short of consensus is less legitimate to some extent as opposing parties can be oppressed by the majority. This may frustrate equity where the plurality of parties share interests relative to a minority, the need for consensus granting any member of the latter group a *de facto* veto. This issue has been prevalent for over a decade in the, now comatose, Doha negotiations of the World Trade Organization. Notwithstanding the inherent tension between equity and legitimacy, situations may arise where modulations

[8] Oberthur, "Clustering of Multilateral Environmental Agreements: Potentials and Limitations;" Sandler, *Global Collective Action*.

may increase both. Replacing plurality with consensus can improve legitimacy and equity when parties are relatively homogenous in their interests, if not capacities.

Appropriateness: Appropriateness examines whether a modulation fits the context or objective of the regime or the interests or needs of parties. It is a question of, "Given the scenario, is this the right policy tool?" The stronger the relationship between the regime's objective and the parties' abilities, the more appropriate the modulation. For example, it would make sense for a regime designed to track GHG emissions to have reporting and monitoring infrastructure, perhaps manifested as an international organization. However, it may be imprudent to locate that infrastructure in a party state that either has limited financial or human capital resources to support it. This issue could be remedied by adding a cost-sharing mechanism into the regime and possibly even technical expertise, training, or transfers.

Risk: Unlike the other core variables, risk is predominantly concerned with processing context variables: circumstances removed from the immediate control of parties. Certainly, parties are to varying extents directly responsible for collective action problems, such as environmental degradation, nuclear proliferation, or airport security. However, because their remediation requires collective action and because they are the object of the regime, they are treated as mostly endogenous to party agency. Instead, element variables reflect parties' agency and what they can do to remedy the collective action problem.

Risk modulates when either a party action or omission impacts the probability of harm occurring, or its severity, or the harm's schedule (urgency). For example, if the projected depletion of international fish stocks is inaccurate, risk falls ($\Delta\downarrow R$), triggering overprovision ($RE > 1.0$). Conversely, if the rate of change in the climate is underestimated, existing regime provisions will be insufficient to achieve the objective in time ($\Delta\uparrow R > (\Delta Eq + L + A = 0) = \Delta\downarrow RE$). The risk variable serves as a "reality check" on the proposed regime infrastructure: will the provisions meet the objective or are they overkill, given the context?

The variables' arrangement and operation in the function is crucial to understanding the internal logic. Because a normatively perfect regime has a RE value equal to 1.0, the REF must be capable of the following:

1. Aggregate all lesser variables
2. Detect overprovision
3. Erode the value of element variables (Eq, L, A) if context variables increase (R)
4. Inflate the value of element variables (Eq, L, A) if context variables decrease (R)

The first capacity ensures that the REF computes all considerations. The more that must be assessed outside of the REF the farther we move away from the function itself and introduce more imprecision. This movement occurs because non-REF considerations are not processed against the core variables but rather their product (RE) – returning us to the practice of asking, does this consideration improve or erode efficacy? This initial question is distinct from the objective and systematic questioning applied by REF. As discussed in detail in Section IV, use of the REF begins with the question of which core variable(s) does a modulation impact and how (positive or negative change).

Regardless of the answer, the user is immediately forced to go through the remaining variables and continue asking questions: given the context is it appropriate, fair to parties, a legitimate result, or does this change the context? All that should occur outside the REF is the final determination of the magnitude of change in each value, resulting in either Δ↑RE or Δ↓RE.

Capacity to detect overprovision is an important contribution of REF to regime design literature. Simply put, overprovision is when "too much" has been put into the regime, creating inefficiency that erodes overall effectiveness. For example, assume a regime has a secretariat that is funded by parties and, in this case, suppose we compute its impact on RE under the appropriateness (A) core variable. If the secretariat receives more income than it needs to effectively carry out its task, this may lead to an unnecessary expansion of the regime's bureaucracy. At the very least, parties have fewer resources to spend on other initiatives thereby increasing the compliance costs of this hypothetical regime. In either case, we track the overprovision under an increase to appropriateness (Δ↑A).

The alternative method to tracking overprovision is to decrease core variables. If too much funding is provided, we could decrease appropriateness instead of increasing it, given that RE 0.9 is equivalent to RE 1.1. By ejecting overprovision, we would hold RE 1.0 as a perfect or "complete" regime. In that case, we could rewrite REF as (Eq + L + A – R). However, by method of mere summation, we lose the nuance of detecting regimes that were already perfect and that the regime's objective can be accomplished with less. By the summation method, we could be endlessly trying to reach 1.0 by adding more into the regime to compensate for the inefficiency of having too much in the first place (deadweight losses). The REF as I have arranged it allows us to recognize that the remedy is to withdraw element variables, in whole or in part.

Regime design literature recognizes that overprovision is an inefficient allocation of resources. However, I have been unable to find clear recognition that it also erodes regime efficacy. Below are three examples of how overprovision is harmful.

> Example 1: A consensus based voting system is more legitimate than a majority based system: no party can be oppressed by the majority. Therefore, we can say a shift from majority to consensus produces an increase in L. Because REF forces us to consider the interplay with other core variables we can efficiently and systematically evaluate the wisdom of the decision. Is the regime's objective addressing a pressing issue (R) and if so, is consensus an appropriate mechanism? If heterogeneity of interests is too high (e.g. some may suffer less harm, or may even benefit, from the risk) giving each party a *de facto* veto may not be appropriate (Δ↓A). Therefore, if Δ↑L < Δ↓A relative to (R+1), then Δ↓RE. However, if the opposite is true, then Δ↑RE.
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> Example 2: Suppose the harm addressed by an MEA falls or is otherwise reduced. This causes a normative decrease in R. If no changes are made to the regime's elemental variables, the result of Δ↓R while Eq + L + A remains constant is Δ↑ RE. Financial, scientific, logistical or other resources are no longer being provided efficiently. Recalibration is necessary.
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> Example 3: Suppose a funding mechanism is added to address the disparity in capacity between Global North and Global South parties: Δ↑Eq. However, the

funding mechanism may not be appropriate for various reasons. For example, Global South states may need technology transfers, not money: Δ↓A.

Finally, the division of (Eq + L + A) by (R + 1) conveys that greater risk necessitates greater commitment. Likewise, lesser risk necessitates downsizing commitment. If the content and operation of a regime remains constant (ΔEq + L + A = 0), then overprovision occurs if the threat subsides or passes. Underprovision occurs if the threat grows ("you are doing too much, wasting resources;" "you are not doing enough"). Each scenario erodes efficacy. Mathematically, a perfectly effective regime of 1.0 when risk is 0 would be less effective if risk increased because 1/(0+1) = 1 and 1/(ΔR↑+1) = <1.

Taxonomy of Lesser Variables and their Relationship with Core Variables

The REF processes three types of variables: core, element, and context. Both element and context variables are categorized as "lesser" variables in that they are subsumed and processed by the core variables. Element variables are party-controlled and can be freely modulated (e.g. the decision making mechanism selected). Context variables are generally endogenous to parties and beyond their immediate or direct control (e.g. heterogeneity between parties or urgency of the threat).

Regime design literature recognizes element variables as "organizational" or "functional" components of a treaty.[9] Organizational elements pertain to the decision making and administrative structure of a regime, such as how decisions are made or where meetings are held, by who and on which issues. Functional elements pertain to the implementation of the regime's objective such as funding mechanisms or implementation reviews.[10] When combined, these two groups of element variables enable a regime to prepare and coordinate decisions, implement reviews or compliance, and implement supporting mechanisms.

No variable is an island: any change in element or context variables impacts the normative value of core variables. The initial change of a core variable feeds back into the design, impacting one or more other core variables. Below is a non-exhaustive list of element and context variables drawn from throughout this paper. Some exposition is provided for lesser variables.

[9] Oberthur, "Clustering of Multilateral Environmental Agreements," 317-323.
[10] Ibid.

Element or Context Variable	Connected Core Variable
Compliance costs	o Eq, A
Decision making mechanism	o L, Eq, A
Differentiated rights and obligations	o L, Eq, A
Dispute resolution mechanism	o L, A (Allow parties to hold others accountable, improving legitimacy by upholding the rules. The exact procedure and available remedies may erode the efficacy of the mechanism, rendering it less appropriate.)
Domestic interests	o Eq
Enforcement mechanism	o L, Eq, A (This includes obligations to implement domestic mechanisms.)
Existence and location of secretariat	o Eq, A (Various treaties, particularly MEAs, perform similar functions. Some regimes consolidate or share resources.[11] The appropriateness of the new regime even being created, or expanded, is captured by the lesser variable of external efficacy.)
Existence and role of sub-committees	o L, Eq, A (Larger, more complex regimes like the UN or WTO may require a large bureaucracy to support decision making, review and generation of recommendations or other information).
Existence of similar treaty mechanisms (External efficacy)	o A (Where existing regimes already do similar work, it may be more prudent to augment their mandates and resources than establishing a new regime. Aggregation of regimes reduces compliance costs (avoids redundancy) and secretariats may benefit from

[11] Kim, "Emergent Network Structure," 980-983.

	economies of scale. External efficacy controls for overprovision in regimes themselves, helping stem negotiation fatigue and total international participation costs.)
Existing treaty compliance costs	o A
Financial needs and contributions	o L, Eq, A
Geographic coverage	o Eq, A, R (Where is the harm and is it containable?)
Homogeneous and heterogeneous interests of parties	o L, Eq, A
Internal Efficacy	o A (Discussed below)
Monitoring and reporting	o L, Eq, A
Negotiation fatigue	o A
Non-participants	o L, Eq, A, R Failure to include certain states can drastically undermine RE. For example, a major polluter's non participation in a GHG emissions reduction treaty: o Renders the regime less legitimate as key polluters are not subject to the rules o Is unfair for some states to restrict their own economies while non-participants do not o A regime that does not include all key polluters may no longer be an appropriate instrument by which to address the objective. o Continued pollution by non-participants may exacerbate the existing harm.
Severity of harm	o R
Treatment of non-participants	o L, Eq, A, R

Universality of impact	o Eq, A, R (Who will be impacted and to what degree? Will some parties benefit from the harm?)
Urgency of harm	o R

Applying the Regime Efficacy Function

Applying the REF consists of four steps: 1) modulation of lesser variable; 2) impact on primary core variable; 3) reaction by other core variables; and 4) recording or prediction. This process can be repeated as many times as necessary to map out the contents of the regime and their normative impact on RE. The process may also be repeated to process counterfactuals and generate alternative options. I examine each step in greater detail below:

1. Modulation of Lesser Variable
   - Select an existing or proposed element variable or observed or hypothesized change in a context variable.
   - Determine the status of its modulation: addition, withdrawal, or change (increase/decrease).

2. Impact on Primary Core Variable
   - Having determined the nature of the modulation in the lesser variable, the user applies the change to the most relevant, or primary, core variable.
   - The primary core variable is whichever consideration (rule of law/L, fairness/Eq, appropriateness/A, or risk/R) is intentionally targeted for change by the lesser variable.
     - E.g.: If the proposed element variable is to transfer technology from developed parties to less-developed parties to assist them with the regime objective, the intent is to increase fairness (Δ↑Eq).
   - Two or more core variables could contend for primary consideration status. It is unnecessary to determine primacy precisely as the modulation is processed through all remaining core variables in step three.
     - E.g.: If the proposed element variable is to reduce funding for the regime by Global North parties so their contributions match that of Global South parties, Δ↑L, Δ↓Eq, or Δ?A could all be primary core variables.
   - In the example above, the normative change to A is unclear ("?"). This occurs because there is not yet enough context. Therefore, it is prudent to consider A under step three with the remaining core variables. Processing the modulation in the lesser variable and its impact on the

primary core variable will yield additional questions and context when further processed through reacting core variables (step three). This additional information helps clarify obscurities.

3. Impact on Reacting Core Variables
   - Having determined the primary core variable and applied the lesser variable's modulation to it, the user asks themselves how this change in the regime design is likely to impact the remaining core variables.

4. Recording or Prediction
   - Recording
     - The user records all the likely normative changes to the four variables.
     - The user returns to step one with an alternative modulation to the same lesser variable or altogether new modulation.
     - The user records the respective results of these investigations.
   - Prediction
     - The user selects a processed modulation and, based on their reasoning, experience, and knowledge of case-studies, predicts the likely impact to the regime from either their state's subjective perspective, the perspective of any other party, or in general;
     - The user can further group and predict the impact of multiple processed modulations.
   - By either recording or prediction, the user generates alternatives that can be assessed against one another to determine which course of action is best.
   - Unlike the previous three steps, personal experience and case-study knowledge play a fundamental role in improving predictive accuracy.

The modulation of any lesser variable affects the operation of all others – some more, some less. This interdependence is observed in step three. Variable interdependence is a fundamental principle of the REF and is a distinct addition to reliance on experience and case-study knowledge. The REF helps the user systematically confront the most substantial considerations in a treaty, embodied in the core variables, and ask questions. Each question begets another question and results in the user continuously processing modulations through the function. Not only does this improve their understanding of the regime's operation, but they also begin to recognize abstract relationships between variables and how they are influenced by context. This is a form of knowledge very similar to experience and case-study knowledge. The important difference being that experience and case-study knowledge confirm the presence of such a relationship, as opposed to an inductive assumption, and allow the user to more accurately predict the impact of the relationship on other variables or overall regime efficacy.

The alternatives that step four generates can be assessed from multiple perspectives: your state, opposing states or negotiating blocs, a neutral perspective, or even non-participants. "Effectiveness" can be individually assessed. To some parties or non-participants, the regime's inability to reach decisions may be a good thing. For example, suppose a party is an early member to a regime. These initial parties establish the rules, infrastructure, rights and responsibilities of the regime. If a party is interested in preserving the original arrangement, decision making by consensus would be important to them as it

would confer a veto. This reveals a tension between individual (maximizing advantage in terms of one's own goals) and group-oriented (capacity to meet the regime's stated objective(s)) effectiveness. The risk of pursuing individual effectiveness is that you may impair the regime to the point it cannot function, thereby depriving benefits previously received. Ostensibly, the more parties try to influence the regime design towards their individual needs, the more likely the regime will lose group-oriented effectiveness. We recognize this tension as "internal efficacy," another lesser variable. Whereas external efficacy is a consideration of whether the new regime is prudent, given the mandates and capabilities of existing regimes, internal efficacy is a consideration of whether the regime is prudent given the interests of parties. Internal efficacy is concerned with the bargaining "zone of agreement." If Party A demands more than Party B is willing to give, there is no zone of agreement. For example, if you are selling me a truck and the lowest price you are willing to take is $2,000 and the most I am willing to pay is $1,800, we have no zone of agreement. Where individual interests are too far apart, the regime may be watered down (commitments are much less ambitious) and there may be no formal enforcement mechanism. For example, the purpose of the Paris Accord is to reduce party GHG emissions, yet parties did not commit to legally binding targets.[12] Therefore, insofar as internal efficacy is concerned vis-à-vis the stated purpose of the regime (reduce GHG emissions), the regime has limited effectiveness. Internal and external effectiveness question the appropriateness of the new regime's existence, given the internal and external contexts, respectively.

Case-Study: Collective Action Programs & Regime Design in the *Montreal* and *Kyoto* Protocols[13]

Both the *Montreal* and *Kyoto* protocols concern the environmental impacts of human made emissions. *Montreal* is concerned with ozone-depleting substances (ODS) and *Kyoto* with GHGs. The contextual comparison of *Montreal* against *Kyoto* is an appropriate case-study to practically observe the kinds of considerations and questions the REF helps the user draw out.

ODS and GHG emissions are a transboundary harm: a type of collective action problem that cannot be resolved by one party alone.[14] Because resources are limited, each party must have incentives equal to or greater than its costs to participate. Our ecosphere is an impure public good meaning that it can sustain reasonable use by all parties without detracting from the potential use of others. However, a certain rate of pollution will eventually exceed the ecosphere's regenerative capacity, the result of which we experience as climate change, failing fish stocks, holes in the ozone layer, lower biodiversity, etc.[15]

Incentives may vary. For example, the US ardently refused to sign *Kyoto* because large polluters like China and India were held to standards lower than fully industrialized

[12] Paris Agreement.
[13] Montreal Protocol; Kyoto Protocol; see also Cameron, "Globalization and the Ecological State."
[14] Sandler, *Global Collective Action*, 212-213.
[15] Ibid.

states, giving them a competitive advantage.[16] In that regard, the U.S.' position on *Kyoto* and climate change relative to *Montreal* and the ODS seems paradoxical. Both transboundary harms appear similar in nature. In *Montreal*, not only was the U.S. content for large developing polluters like China and India to be subject to different standards but the U.S. also, in part, *funded* them. The table below is synthesized from Sandler's analysis of negotiating differences between *Montreal* and *Kyoto*.[17]

Montreal Protocol	***Kyoto Protocol***
o Emissions concentrated to a few countries	o Nearly every country contributes to emissions
o All states lose from ozone thinning	o Winners and losers from global warming
o Commercial gains from substitution	o No commercial gains from substitution
o Resolved uncertainty in terms of processes and consequences	o Unresolved uncertainty in terms of processes and consequences
o Leadership by key polluters	o Lack of leadership by key polluters
o Some reversibility within 50 years	o No reversibility within 50 years
o Decision makers more informed about benefits than costs	o Decision makers more informed about costs than benefits
o Relatively few activities add to ozone depletion	o Many activities add to global warming

In the previous sections we processed various lesser variables through the REF, each run of the function yielding valuable insights into abstract relationships between variables. Applying the REF to the provisions of *Montreal* and *Kyoto*, given their contexts above, we derive important relationships:

- Broader participation introduces greater heterogeneity of interest and capacity;
- interests can be diametric and therefore require greater incentives to promote participation;
- lack of cost-offsetting commercial benefits means parties that place greater value on sustainability must offer greater incentives to parties that do not;
- states desiring sustainability require assurances others will not freeride on unilateral or varied reductions to capture competitive gains;
- are the objectives/consequences clear and are they tied to appropriate mechanisms?

The REF cannot discretely compute how each of these relationships and considerations impact a modulation. Rather, the function enables the user to identify relationships and spur them towards asking additional questions, which in turn generate

[16] "Bush: Kyoto Treaty would have hurt economy," June 30, 2015.
[17] Sandler, *Global Collective Action*, 224.

alternative outcomes and policy options. The REF enables an inexperienced practitioner to move systematically through the regime's architecture and normatively assess its efficacy against its stated purpose. This case study and Sandler's comparisons serve to illustrate that so long as a user is seized with the context of their negotiation, they can use the function to identify and flag relationships that will likely improve or harm regime efficacy.

Conclusion – Benefits and Limitations of the REF

The Regime Efficacy Function is accessible, rigorous, and, most importantly, neutral. The model does not inherently favor any core or lesser variable over another, nor is it context-dependent. Although authors have indeed synthesized important considerations or checklists for regime design, these observations and recommendations are drawn from treaties of a particular subject matter (e.g. environmental treaties, trade treaties, bilateral investment treaties, etc.).[18] Their relevance and predictive power dissipate the further they are removed from their operating context and assumptions. Likewise, other works which attempt to synthesize key considerations or a checklist lose value when they privilege one or several considerations above others. For example, asserting legitimacy matters more than equity. The loss of value occurs because other works, just as well researched and reasoned, claim the opposite: pay more attention to equity than legitimacy. The privileging of certain considerations over others mirrors the same issue with over-reliance on experience and case-study knowledge: the issues you see, the questions you ask, and remedies you formulate are biased towards what the model can produce or what you have seen occur in the past. So, when faced with a context inappropriate for the model or outside the realm of the user's experiences, either the user asks the wrong questions or does not ask questions at all.

A plain criticism of the REF is that it assumes each core variable merits equal consideration. This observation would only be relevant if the purpose of the function was to predict the optimal selection of lesser variables and their optimal calibration. In fact, the REF is completely disinterested in the answer. Rather, it is concerned with the capacity to generate possible answers. The question of which core variable matters more is organically addressed by moving from step two to step three, factoring for interdependence. Step three is particularly useful to a seasoned practitioner who can determine that in *this* context, equity is much more important than legitimacy and so the marginal trade-off for Eq > L is greater. However, unlike models or checklists which presume a hierarchy of considerations, the seasoned practitioner is not systematically led *away* from alternative considerations.[19] There is great value in the ability to comprehensively issue-spot and generate both questions and alternatives. This value is distinct and separate from the ability to predict outcomes with precision. Models or checklists that privilege some variables over others operate quantitatively. They are concerned with producing *an* answer and so their methodology must take on certain assumptions in order to narrow the degree for error.

[18]Young, "Effectiveness of international environmental regimes."

[19] The presumed hierarchy in a checklist can either be explicit or implicit. An explicit hierarchy is a *de jure* categorization of some items as being more important than others. An implicit hierarchy exists by the inherent choice of which items to include and which to exclude.

Indeed, the design of the REF is malleable to the inclusion of additional core variables if a user believes a lesser variable is in fact crucial enough to be a core variable. Examples would be internal or external efficacy or compliance. Additions to the numerator field (Eq + L + A +….) do nothing to erode the interplay between steps two and three: interdependence persists.

Another criticism is the subjective interpretation of what *is* legitimate, equitable, or appropriate? This is another argument that loses significant relevance because the REF is not interested in generating an answer. A higher margin of error is tolerable in the assumed normative changes.

The REF distills from regime design literature the principle considerations, or core variables, critical to achieving efficacy. It is a life-vest to the inexperienced practitioner, who could otherwise be swept away in the staggering volume of considerations known to regime design. It affords them an efficient and comprehensive issue-spotting and option-generating tool. For the experienced practitioner, it is a neutral and simple tool they can use in novel circumstances when their more quantitative and specialized, but biased, tools are insufficient. Moreover, because the REF is not concerned with processing real changes in variables but rather normative ones, experienced practitioners can very quickly identify the *possible* consequences of any action.

In closing, governments with fewer resources or senior negotiators and analysts would benefit most from adding the REF to their policy analysis toolbox. Ostensibly, junior negotiators and analysts can spend more time running each proposed treaty provision through the function, thereby generating potential consequences and options for limited senior personnel to analyze and provide further instruction.

Bibliography

"Bush: Kyoto Treaty would have hurt economy – President condemns climate change treaty, dependence on middle east oil." *NBC News, June 30, 2015*: http://www.nbcnews.com/id/8422343/ns/politics/t/bush-kyoto-treaty-would-have-hurteconomy/#.VwsPuZXmrIU.

Cameron, James. "Globalization and the Ecological State." *Review of European Community & International Environmental Law* 8, no. 3 (1999): 243-250.

Eckersley, Robyn. "The Big Chill: The WTO and Multilateral Environmental Agreements." *Global Environment Economics* 4, no. 2 (2004): 24-50.

Kim, Rakhyun. "The Emergent Network Structure of the Multilateral Environmental Agreement System." *Global Environmental Change* 23, no. 5 (2013): 980-991.

Kyoto Protocol to the United Nations Framework Convention on Climate Change, 11 December 1997, UN Doc FCCC/CP/1997/7/Add.1 Dec. 10, 1997; 37 ILM 22.

Mendes, Errol P. *Global Governance, Human Rights and International Law: Combating the Tragic Flaw*. New York: Routledge, 2014.

Miles, Edward; Steinar Andresen, Elaine Carlin, Jon Skjaerseth, Arlid Underal, and Jorgen Wettestad. *Environmental Regime Effectiveness*. Cambridge, Ma: MIT Press, 2001.

Montreal Protocol on Substances that Deplete the Ozone Layer, 16 September 1987, 1522 UNTS 3; 26 ILM 1550.

Oberthur, Sebastian, "Clustering of Multilateral Environmental Agreements: Potentials and Limitations." *International Environment Agreements: Politics, Law, and Economics* 2, no. 4 (2002): 317-340.

Paris Agreement, 11 December 2015, UN Doc FCCC/CP/2015/L.9.

Sandler, Todd. *Global Collective Action*. Cambridge: Cambridge University Press, 2004.

Young, Oran. "Effectiveness of international environmental regimes: existing knowledge, cutting-edge themes, and research strategies." *Proceedings of the National Academy of Sciences* 108, no 50 (2011): 19853-19860.