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## **Multi-Lateralisms: Explaining Variation in Regime Instruments**

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## **THE HARVARD PROJECT ON INTERNATIONAL CLIMATE AGREEMENTS**

The goal of the Harvard Project on International Climate Agreements is to help identify key design elements of a scientifically sound, economically rational, and politically pragmatic post-2012 international policy architecture for global climate change. It draws upon leading thinkers from academia, private industry, government, and non-governmental organizations from around the world to construct a small set of promising policy frameworks and then disseminate and discuss the design elements and frameworks with decision-makers. The Project is directed by Robert N. Stavins, Albert Pratt Professor of Business and Government, John F. Kennedy School of Government, Harvard University. For more information, see the Project's website: <http://belfercenter.ksg.harvard.edu/climate>

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# Multi-Lateralisms: Explaining Variation in Regime Instruments

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## **Abstract**

Different international regimes are built from legal instruments that vary in terms of whether they are multilateral or bilateral. We investigate the reasons for such variation. The choice between multilateralism and bilateralism is a function of the trade-off between each instrument's relative flaw—multilateralism is wasteful in incentives whereas bilateralism multiplies transaction costs. We illustrate some of these propositions by looking at four regimes: foreign direct investment, human rights, climate change, and international trade.

International regimes are built on instruments that vary in terms of whether they are multilateral, bilateral or a combination thereof. For example, the current trade regime has a strong multilateral component as its core, centered on the World Trade Organization (WTO), while the foreign direct investment (FDI) regime is mostly constituted of bilateral agreements. Notably, many regimes combine two or more instruments: the nuclear nonproliferation regime combines a multilateral treaty with bilateral deals pursued mostly by the United States (Verdier 2008).

Moreover, it is important to note that the type of instrument on which a regime rests does not seem to correlate with the strength or depth of the regime—the foreign investment regime *prima facie* is no weaker than the trade regime. In other words, multilateralism, defined as the signature of one treaty by a large number of countries, is not merely a more advanced state of regime development than more decentralized alternatives.

From a legal perspective, the question of "lateralism" points to the scope of the legal rules in force: do they apply to two countries or to many? From a bargaining perspective, it points to the negotiating format that presided over the creation of the regime, as captured by the arrangement at the negotiating table. With multilateral agreements, many governments negotiate around a single table; with bilateral agreements, governments negotiate in sets of two across many tables. States must coordinate on this decision before they can make substantive rules and institutional design choices, which may in turn be influenced by the format adopted.

From a normative perspective, the question of lateralism relates to whether countries should be treated equally under international law or differently based on disparities in capacity or power. Multilateralism, according to Ruggie, implements "generalized principles of conduct" whereas bilateralism "differentiates relations case-by-case based principally on a priori particularistic grounds or situational exigencies" (1992: 571). How this issue is addressed in practice is usually seen as a result of prevailing norms or of bargaining power, with some states advocating more uniform rights and obligations and others calling for differential treatment. We argue that the outcome is also influenced by the variables highlighted here and hence by efficiency concerns.

Why do regimes vary in terms of their lateralism? We investigate the reasons for such variation and argue that the mix of lateralisms in an international regime is a function of two variables: transaction costs and a new concept—the member surplus. The member surplus captures the idea that the multilateral strategy can be wasteful in incentives, since incentives are calculated to elicit the participation of the state that is burdened with the highest cost of compliance, thereby creating rents for the other members. The bilateral strategy, in contrast, allows the customization of rights and obligations to each individual member state. But because the bilateral strategy is more wasteful in

transaction costs than the multilateral strategy, states face a trade-off.

This allows us to make three claims: (1) multilateralism is most attractive with high transaction costs and a low member surplus, (2) bilateralism is more likely to obtain when transaction costs are low and the member surplus is high, and (3) when both transaction costs and the member surplus are high, we encounter combinations of multilateralism and bilateralism. Such combinations come in two forms, regimes that contain a mix of multilateral and bilateral agreements and regimes that rely on multilateral agreements that are customized to the needs of different members. We develop a formal model to capture the logic behind these institutional outcomes.

The next section situates our topic in the theoretical literature. We then introduce the notions of transaction cost and member surplus and present a formal model and a set of predictions that flow from it. In an empirical section, we demonstrate the plausibility of our claims in the context of four prominent regimes: the foreign direct investment regime, the human rights regime, the climate change regime, and the trading regime. A penultimate section offers an extension of the model to incomplete information and the concluding section highlights implications for our understanding of international institutions.

## 1 Lateralisms in the Literature

We adopt the standard definition of international regimes, which grounds them in some sense of general obligation related to a particular norm or principle (Krasner 1983, Keohane 1984). Our approach complements work on regimes that views them as created by a hegemonic state (Krasner 1976, Keohane 1984), a small group of great powers (Snidal 1985), the market-oriented Anglo-Saxon subset (Cowhey and Klimenko 2000), or the North at large (Sell 2007). Most regimes, we think, have at their origins a market imperfection, making a mutually efficient outcome unreachable through standard competitive behavior. Most regimes are also organized by a small group of founders who try to enlist the cooperation of a larger group of followers or regular members. The founders take the lead on account of their larger resources, greater interest in the regime, or principled concern over the issue.

Most treatments of international regimes assume that they rest on multilateral agreements. Those that examine variations tend to look over time and argue that given historical periods can be characterized as more or less multilateral (Ruggie 1992, Finnemore 2003, Yarbrough and Yarbrough 1992). Like Kahler (2004), we take much more seriously the possibility that these outcomes are not mutually exclusive but can coexist at a given point in time and even within a given regime. Kahler (2004) points to institutional variation in today's global governance, ranging from "multilateralism" to "reliance on national capabilities," bilateralism, and networks. Likewise, students of

international standards stress the mix of governance structures (see Genschel 1997). We also build on Conybeare’s (1980) insight that decentralized bargaining offers a viable substitute for multilateral agreements in some situations.

The paper adds to the growing IR literature on institutional design, which explains variation along dimensions such as centralization, hierarchy, legalization, flexibility, and independence (Koremenos, Lipson and Snidal 2001; Lake 1999; Goldstein et al. 2000; Rosendorff 2005). The variation in legal instruments through which states participate in regimes has not received much attention in this literature to date, though Pahre comes close with his discussion of centralized versus decentralized bargaining, as does Milner in her study of bilateral and multilateral aid (Pahre 2001, Milner 2006). Also, some legal scholars view the limited use of bilateralism as a constructive complement to multilateral regimes, as in the case of trade (Hudec 1990, Sykes 1992). The work that most directly addresses our subject is by Rixen and Rohlffing (2005), who argue that bilateral bargaining is good for allocating distributive issues while multilateral bargaining is necessary to reduce transaction costs.

In general, the “rational design” literature does not appreciate the substantial variation in how regime rules are negotiated and how international law is made. Aside from being interesting in its own right, the format of negotiations has important effects on institutional outcomes insofar as it shapes some of the variables commonly used to explain them, such as uncertainty about other actors’ preferences and behavior (which is reduced in bilateral settings) and the presence of monitoring and enforcement problems (which are most pronounced in multilateral settings) (Koremenos, Lipson and Snidal 2001). The most direct effect of lateralism is on the number of actors involved in a negotiation, which may influence the likelihood or depth of cooperation and the degree of institutional centralization required to manage it (Oye 1986; Kahler 1992; Downs, Rocke and Barsoom 1998; Koremenos, Lipson and Snidal 2001). In other words, many of the variables treated as exogenous in the extant literature are partly the product of negotiation and instrument selection choices examined here. Variation in lateralisms can be thought of both as an outcome to be explained and as an intervening variable between fundamental political factors—issue characteristics and state interests—and other institutional design questions of interest.

## **2 Transaction Costs and the Member Surplus**

One of the key concepts that generate our results, transaction costs, is commonly used in the regimes literature and requires little introduction. The second concept, member surplus, is new and in need of lengthier introduction. The trade-off that these two factors produce and the various solutions that are conceivable provide the basis for our theoretical claims.

Our definition of transaction costs is borrowed from Williamson's (1985) work. Transaction costs are "the costs of negotiating, drafting, and safeguarding an agreement," with safeguarding broadly defined to include whatever it takes to make the agreement enforceable—the setup and running costs of monitoring, dispute settlement, renegotiation in the face of uncertainty, and, in Williamson's terms, "the bonding costs of effecting secure commitments." While some safeguarding costs are only incurred after an agreement is reached, the prospect of facing such problems complicates and prolongs matters during the negotiation phase (Fearon 1998). We especially focus on those transaction costs that have scale economies in the sense that they make the signing of  $n$  dyadic treaties costlier than the signing of one treaty with  $n$  participants. All the costs so far mentioned meet the scale economy condition.

The multilateral strategy has the advantage of saving on transaction costs. This is true because only one set of negotiations is required and because most multilateral treaties incorporate international organizations that facilitate further decision-making and provide economies of scale in monitoring and dispute resolution. The bilateral strategy, in contrast, multiplies transaction costs, since a new contract has to be negotiated, drafted, and safeguarded for each participant.

However, the multilateral strategy will be expensive for the founder in another sense—this is where the member surplus comes in. Multilateralism in its pure form offers only one deal and this deal is the same for everyone. As a result, participants are offered an incentive that is calculated to be just enough to elicit the participation of the state that is burdened with the highest cost of compliance. The problem is similar to the one that occurs in competitive markets, where the law of one price for a particular good confers a surplus on all producers who would have been willing to sell for less. This surplus is known in economics as the "producer surplus."<sup>1</sup> In direct analogy, we call it the "member surplus." Unlike the multilateral approach, the bilateral approach is immune to the member surplus because it gives to each state the incentive it needs to participate and no more.

To see this, imagine a situation with no transaction costs. Then the principal would always prefer the bilateral approach to the multilateral approach. This is easily seen in Figure 1, featuring on the horizontal axis an ordering of all members according to their compliance cost  $z$  and on the vertical axis the cost to the founder  $t(z)$ : the higher the member's compliance cost, the higher the cost to the founder of soliciting its participation. Integer  $N$  is a point on the  $z$  axis representing the compliance cost of the  $N^{th}$  and most expensive member to be included in the regime. The cost of wooing countries with compliance cost less than or equal to  $N$  by means of a multilateral contract

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<sup>1</sup>The producer surplus is the amount that producers benefit by selling at a market price that is higher than they would be willing to sell for.

is equal to the  $Nt(N)$  rectangle, because the multilateral approach forces the founder to pay the transfer it pays to the  $N^{th}$  member to all other members. In contrast, by means of bilateral contracts alone, this same cost would be equal to  $\sum_1^N t(z)$ , the triangle situated below the curve, only half the size of the rectangle. In other words, the various transfers would be calibrated to be just sufficient to achieve each member's participation. The triangle above the curve is the member surplus that results from the multilateral approach.

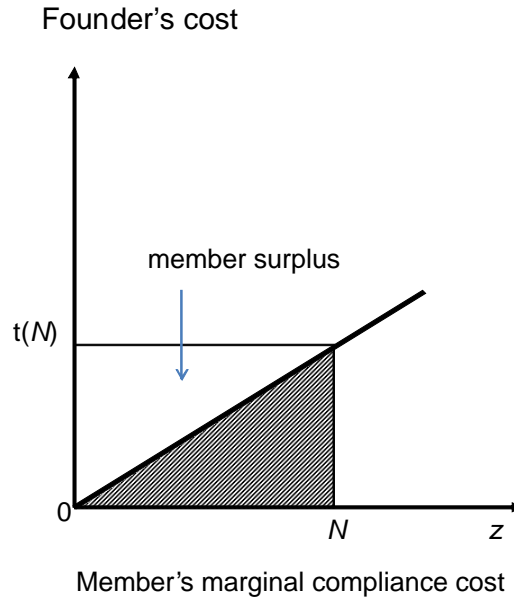


Figure 1: The Member Surplus

With a transaction cost  $T$  significantly different from 0, however, the  $N$  bilateral contracts could be costlier than one multilateral contract for everyone. This case is represented in Figure 2A, where the cost of the multilateral contract is the same as before plus the transaction cost incurred once ( $Nt(N)+T$ ), while the cost of the bilateral contracts is the former triangle augmented with the transaction cost incurred  $N$  times ( $\sum_1^N t(z) + NT$ ). Clearly, the latter is bigger than the former; using bilateral deals for all is costlier than multilateralism.

There is a higher value of  $N$  past which the bilateral approach becomes the less costly of the two again. Indeed, as  $N$  increases, it is easy to verify that so does the relative size of the  $c b t(N)$  triangle relative to the  $cde$  triangle. In

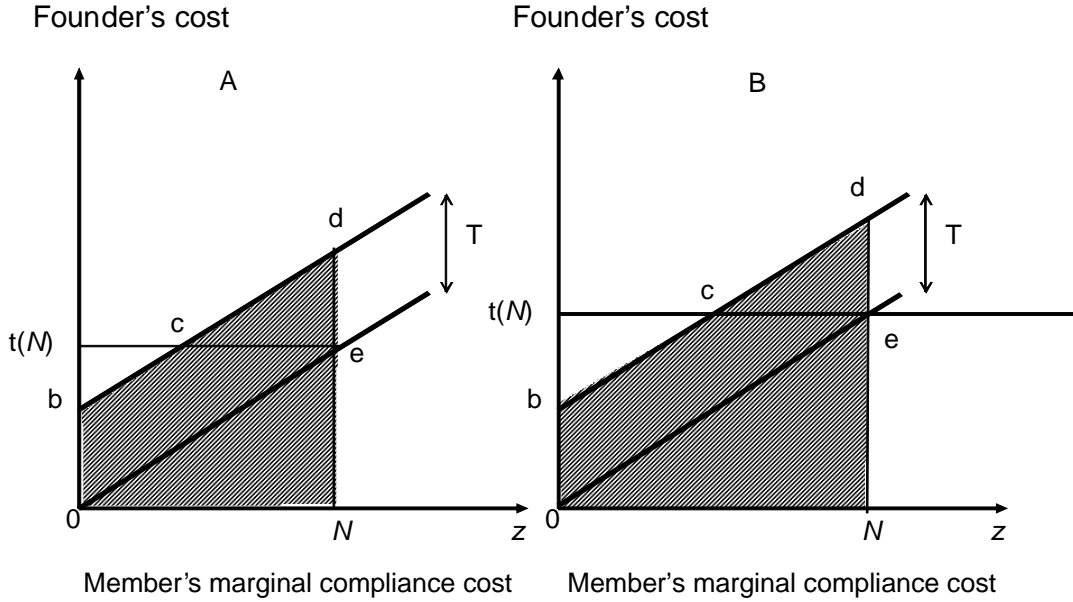


Figure 2: Trade Off Between Member Surplus and Transaction Costs in Pure Regimes

Figure 2B, we same graph is drawn so that the founder is indifferent between offering members a multilateral or  $N$  bilateral incentives.

We have assumed so far that the choice between multilateralism and bilateralism was of the either-or type. We now investigate the possibility of combining instruments, that is, offering both multilateralism and bilateralism to various members. Two options need be considered depending on whether it is the low or high cost members who are given a bilateral deal.

In a first case, it is the high cost members who are treated differently. The founder offers multilateralism to all members while reserving the right with a subset of them to top off the multilateral deal with bilateral ones. Consider Figure 3A: the  $N$  members are offered the multilateral deal, while each of the  $N - x^*$  members is offered a bilateral incentive in addition.<sup>2</sup>

<sup>2</sup> $x^*$  is endogenously determined through a minimization of the founder's cost subject to all members complying: roughly,  $x$  is the member's compliance cost for which the additional surplus generated under a multilateral instrument is equal to the transaction cost generated by a bilateral instrument. It can also be verified that the mixing of the two types of instruments is more efficient than the use of either one alone.

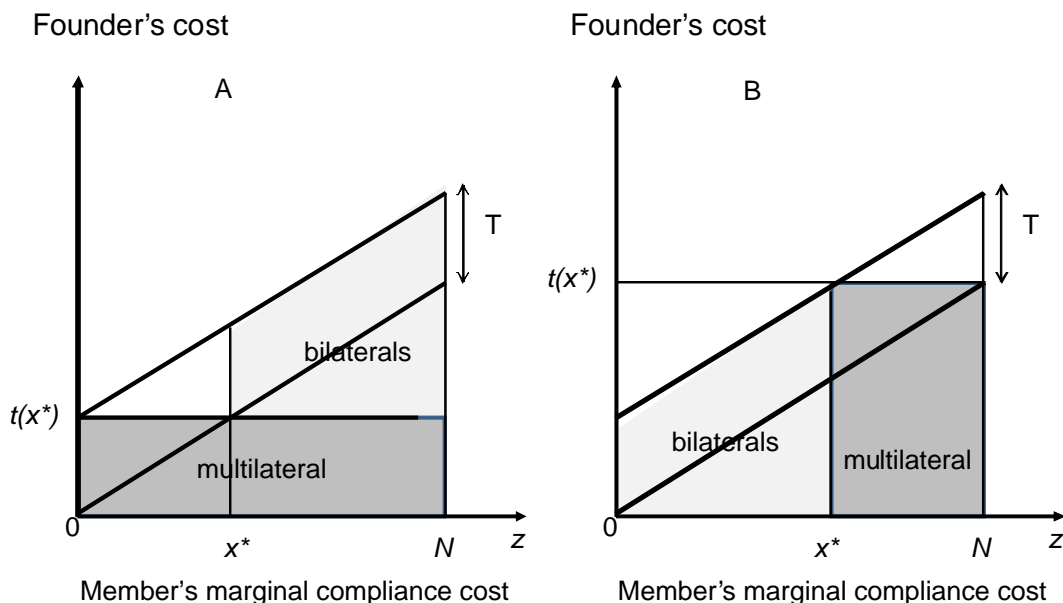


Figure 3: Regimes Combining Instruments

In a second case, it is the low-cost members who receive the customized deal. This case is represented in Figure 3B, where, unlike the prior case of Figure 3A, there is no common multilateral deal shared by all members.

The two options raise the question of their respective occurrence. To that effect, it is important to note that, as the two panels of Figure 3 suggest, the two regimes have the same cost for the founder—the aggregate shadowed areas add up to the same on both sides. This indifference is not inevitable, but reflects the assumption we made in drawing all the figures so far that the compliance function  $t(z)$  is linear. The linearity assumption makes the relative intensity of the member surplus constant across the membership range. Since the transaction cost is also constant across the range, the trade-off between member surplus and transaction cost is also constant.

The linearity assumption, so far made for reasons of exposition, is not necessarily a realistic one. It is unlikely, indeed, that compliance costs would be distributed homogeneously. Convexity is a more common distribution; sketched in Figure 4A, a majority of countries more or less share a moderate cost of compliance, except for a minority that face very high costs. Convexity divides the range into two sub-ranges. The left side features a rather flat dis-

tribution of compliance costs for which the member surplus is less likely to be of concern than the transaction costs—multilateralism is the more appropriate instrument in that region. The right side features a steep distribution, with a serious potential cost in member surplus, a problem to which bilateralism is the more efficient response.

Less common yet possible is the reverse, concave case represented in Figure 4B, where most countries have high compliance costs, except for a few blessed with very low ones. The optimal distribution is the reverse of the convex case: bilateral instruments are used to address the acuity of the member surplus with low compliance cost members, whereas the multilateral instrument is targeted to the flatter area of the curve where transaction costs are more of a problem than the member surplus. We believe that the most common cases are of the convex type and base our reasoning hereafter on the case of the convex distribution.

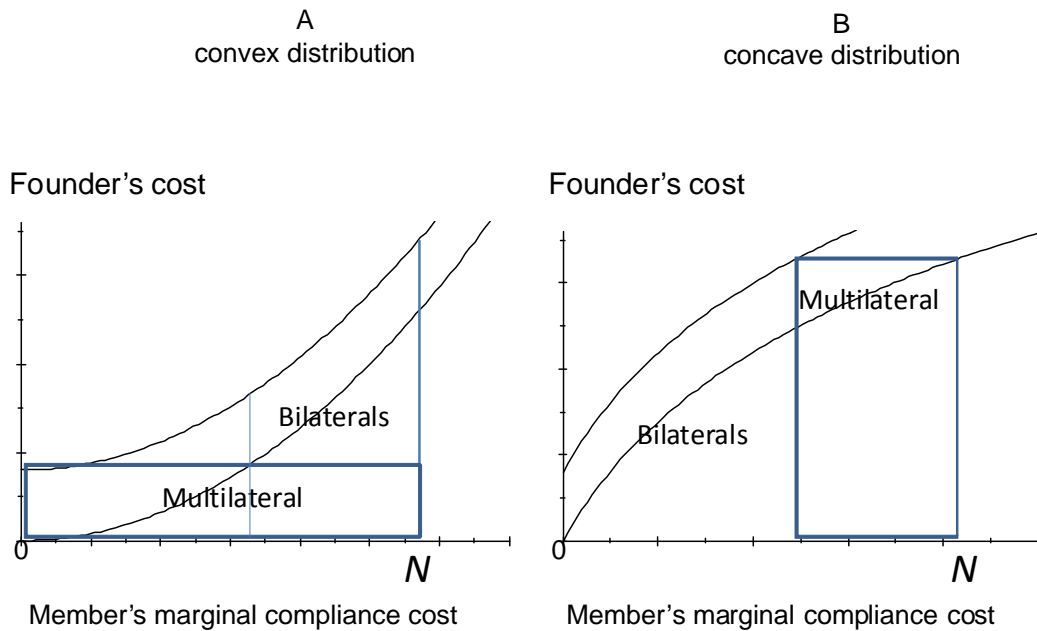


Figure 4: Curvature and Instrument Mix

There is one last assumption we have made but which can now be discarded, the idea that the founder seeks to include all potential members in the regime. In reality, a third possibility is open to the founder: exclusion. The founder need not provide an incentive to all countries but may exclude as many as

it wants. Exclusion offers the advantage of reducing the founder’s cost of building the regime and, given a convex distribution, would typically affect states with the highest marginal costs of compliance—precisely those which would be candidates for bilateral deals.

The final template, of a regime combining multilateralism, bilateralism and exclusion is shown in Figure 5. On the left-hand side of the graph, in the  $[1, x]$  segment, the incentive that has to be given to the member is sufficiently low that it makes sense to seek compliance by offering a single generic contract, minimizing transaction costs, yet providing a surplus to all the agents to the left of  $x$ . In the middle part of the graph, in the  $[x + 1, y]$  interval, the incentive is too high in relation to the fixed transaction cost for overlooking the surplus. Rather than offering a more generous multilateral contract, the founder merely supplements the existing multilateral contract with bilateral ones, an approach that economizes on the member surplus (since the bilateral contracts are customized to each member of the interval) yet is wasteful in transaction costs. Finally, on the right-hand side of the graph, in the  $[y + 1, N]$  interval, the incentive is so high that the founder is better off excluding potential members. To put it succinctly, the regime should obey the following generic condition  $0 \leq x \leq y \leq N$ , with  $x$  the member that makes the founder indifferent between offering and not offering bilateral incentives in addition to multilateral incentives, and  $y$  the member that makes the founder indifferent between including and excluding that member.

In the next section we formalize these arguments to clarify the relationships among these variables and to offer more precise predictions.

### 3 A Founder-Member Model of Instrument Choice

Regimes require that states who agree on a set of principles must then select a set of legal instruments. To that effect, we posit a simple bargaining structure featuring the founder (or founders) and the rest of the world. In the case of multiple founders, we leave their interaction out of the model; they are assumed to act like a single player by means of an iterated play. We are making this assumption for reasons of tractability and also because we are looking only at global regimes, where there already exists a consensus among a core group of founders.

The members are indexed  $i \in [1, N]$  with  $N > 1$  a positive integer. Each member  $i$  maximizes her individual utility  $u_i(s_i, s_j) = f(s_i, s_j) - cs_i$ , with  $s_i \geq 0$  a continuous choice variable and  $c$  the marginal cost. Function  $f$ , which is assumed to be strictly concave, makes each member  $i$ ’s utility a function of both her choice  $s_i$  and the choice of all other agents  $s_j$ , with  $j$  standing for all agents other than  $i$ . For the sake of calculating point predictions, we opt for

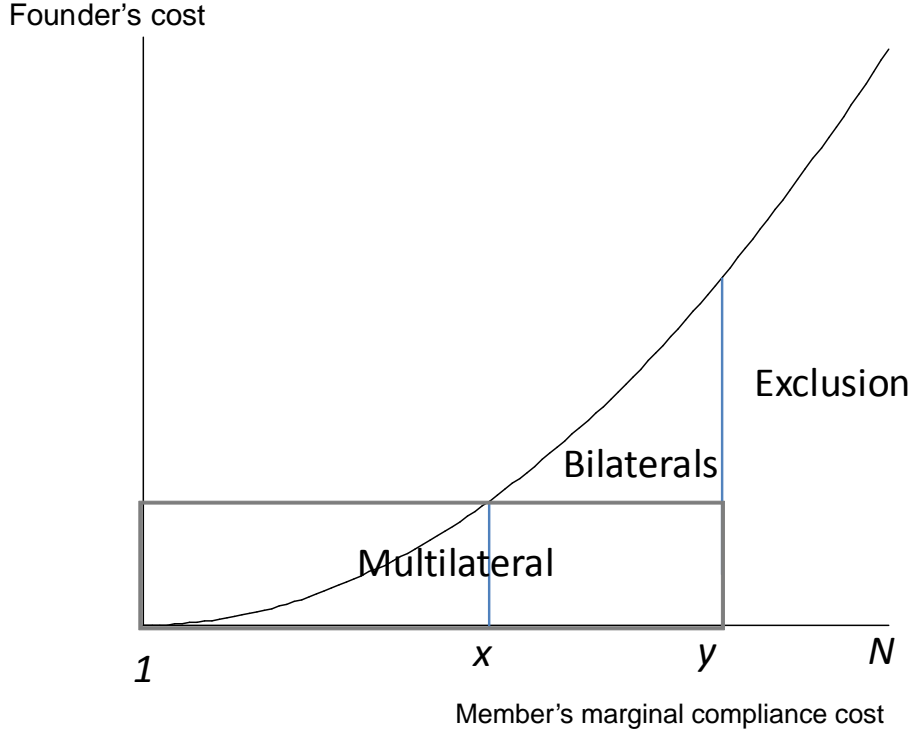


Figure 5: Template of a regime combining instruments (with convex distribution of compliance costs)

the following specific functional form  $f(s_i, s_j) = a_i\sqrt{s_i} - \rho \sum_{j \neq i} s_j$ .<sup>3</sup> Variable  $s_i$  may be thought of as an investment in a polluting technology or any activity producing an externality, for instance fishing in the high seas, setting protective tariffs, or pursuing a security policy with negative consequences for human rights abroad. In each case, an investment  $s_i$  generates a negative externality  $\rho s_i$  inflicted upon every other member.<sup>4</sup> Parameter  $\rho$  is the externality index; it is greater than or equal to zero, with a value of zero indicating no externalities and a value greater than zero indicating their presence. Variable  $a_i$  is member  $i$ 's marginal gain for engaging in the activity, specific to each member.

In the absence of a founder, each member maximizes  $u_i(s_i, s_j)$  with respect to her choice variable  $s_i$  and such that  $s_i, s_j \geq 0$ . This version of the game yields a competitive equilibrium in which every member produces  $s_i^\# = \left(\frac{a_i}{2c}\right)^2$ . This quantity is greater than the individual production level that would maximize

<sup>3</sup>This functional form is appropriate for cases in which the externality is responsible for a suboptimal outcome of the PD type, with all participants overproducing the negative externality. On cases in which the externality is of the public good type, with all but one actor taking a free ride, see Mas-Colell, Whinston, and Green 1995: 362.

<sup>4</sup>The sign of the externality has no bearing on the substantive results.

the social optimum,  $\sum_{i=1}^N u_i$ , and which is equal to  $s_i^\circ = \left(\frac{a_i}{2(c+\rho(N-1))}\right)^2$  (see the appendix for the demonstration of both results). As one would expect, the presence of a negative externality yields a competitive equilibrium that is economically inefficient because agents overinvest in the activity that causes the negative externality.

Enter the founder, intent on designing a regime that would lead a large number of members to reduce their excessive investment level under the competitive equilibrium. We use the social optimum to operationalize the founder's optimum, yet it is important to note that the model and results can accommodate any notion of optimum as long as it is socially more desirable than the competitive equilibrium.<sup>5</sup> The founder achieves this result by offering an incentive to each member. For the sake of simplicity, we assume the incentive to be a positive transfer—a payment— $t(s_i)$ .<sup>6</sup> As shown in Figure 5, the transfer can be given in several ways: through a multilateral instrument in which each member is treated identically (they are given the same transfer); through a series of bilateral agreements by which the founder is able to customize transfers to each member's need; or through a mix of multilateral and bilateral instruments, where a subset of members is treated identically and another is treated based on individual need.

We capture formally the idea that transaction costs for the multilateral approach are lower than for the bilateral approach by assuming that any single deal, bilateral or multilateral, costs constant  $T$  to process, with  $T$  positive. We model the distribution of instruments according to the template of Figure 5.

On the founder's side, we assume that the founder values at constant  $V$  any member  $i$ 's investment that conforms with the founder's notion of what is optimal. In other words, the demand curve for compliance that would intersect the supply curve of Figure 5 is a flat line (not drawn), reaching the vertical axis at a value equal to  $V$ .<sup>7</sup> For the sake of convenience, we also assume that

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<sup>5</sup>The principal's optimum cannot be less desirable than the competitive equilibrium lest it alienate some countries and lose its normative content.

<sup>6</sup>The model and the empirical illustrations refer to regimes that rely on positive incentives. If, instead of offering a reward, the founder merely threatened to sanction nonparticipation, the model would still work provided that one thinks of sanctions as negative prices. For instance, Santa Lucia, a country better known for its beaches than its desire to pursue nuclear weapons, would comply with the proliferation ban even if it were given negative price  $-t$  or, to put it more intuitively, even if she were asked to pay  $t$  in addition to complying. The fact that she is not asked anything besides compliance means that she saves  $t$ . Generally speaking, positive incentives set the member's reservation value to zero, whereas negative incentives set the reservation value below zero. Except for this, the two forms of incentive are interchangeable (Verdier 2008).

<sup>7</sup>Alternatively, one might have assumed a positively-sloped curve on the grounds that an additional unit of compliance is valued more because it is from a member who would have produced a larger externality. Our specification is arguably most appropriate when founders value country compliance per se, as they do with human rights issues, while the

$V$  is sufficiently large for the founder not to run into a budget constraint.

Last, we posit the following functional form for transfers:  $t(s_i) = ts_i$ , with  $ts_i$  the transfer given to member  $i$  and  $t$  a positive variable standing for the subsidy rate.

The founder moves first, offering a contract to all members simultaneously. Then the members simultaneously decide to reject or accept the offer. No subset of members has the capacity to organize a coordinated response to the founder's offer. If a member rejects, there is no contract with that member. If a member accepts, the contract is executed as written; we are not giving the founder the capacity to make the signing of a contract with one (or more) member(s) contingent on the acceptance of all contracts by all other agents. There is no room for shirking once the member has accepted the founder's offer—signing an international instrument makes the commitment credible for both sides. Credibility is the result of a costly signaling game or a reputation game that is not modelled here because it is unnecessarily complex.<sup>8</sup>

A strategy for the founder specifies the  $(t, x, y)$  regime she proposes. A strategy for any member  $i$  is the mapping  $(t, x, y) \rightarrow s_i$ , specifying for every combination of institution and subsidy rate an investment level in the activity causing the externality. The solution concept is the subgame perfect Nash equilibrium.

Solving the game involves the founder choosing cutpoints  $x$  and  $y$  and subsidy rate  $t$  that maximize her aggregate utility while simultaneously offering transfer levels sufficiently high to induce the  $y$  agents to invest optimally. This means that each member chooses her investment level  $s_i$  so as to maximize her individual utility, which now includes the founder's transfer. Formally, it

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sloped demand curve is more appropriate when they value reducing the overall size of the externality. In any case, the shape of the demand curve does not affect the comparative statics presented in the next section.

<sup>8</sup>There are sound theoretical and empirical reasons to believe that legalized international commitments are credible. See Simmons 2000 and Abbott and Snidal 2000.

means for the founder and the agents to simultaneously solve the program

$$P = \left\{ \begin{array}{l} 1. \max_{x,y,t} U_P = xg(x) - T + \sum_{z=x+1}^y (g(z) - T), \\ 2. \text{with } g(i) = \delta V - t(s_i^\# - s_i), \text{ and } \begin{cases} \delta = 1 & \text{if } s_i = s_i^\circ \\ \delta = 0 & \text{if } s_i \neq s_i^\circ \end{cases}, \\ 3. \max_{s_i} u_i = a_i \sqrt{s_i} - \rho \sum_{j \neq i} s_j - cs_i + t(s_i^\# - s_i), \text{ for all } i, j \in [1, N], \\ 4. \text{with } s_i^\# = \left(\frac{a_i}{2c}\right)^2 \text{ for all } i \in [1, N], \text{ and } s_i^\circ = \left(\frac{a_i}{2(c+\rho(N-1))}\right)^2, \\ \text{subject to:} \\ 5. a_i \sqrt{s_i} - \rho \sum_{j \neq i} s_j - cs_i + t(s_i^\# - s_i) \geq a_i \sqrt{s_i^\#} - \rho \sum_{j \neq i} s_j - cs_i^\#, \\ 6. s_i \geq 0, \text{ for all } i, j \in [1, N], \text{ and} \\ 7. 1 \leq x \leq y \leq N. \end{array} \right.$$

The first clause of the program formalizes the founder's maximization problem, choosing subsidy rate  $t$  and cutpoints  $x$  and  $y$  so as to offer a single multilateral treaty to agents 1 to  $x$ , and bilateral contracts to agents  $x + 1$  to  $y$ .<sup>9</sup> Clause 2 specifies the founder's utility function, earning positive constant  $V$  for every member who cuts activity down to the level required to implement the social optimum, at the cost of transfer  $t(s_i^\# - s_i)$  given to each member.

Clause 3 features the maximization problem for included member  $i$ , who now receives transfer  $t(s_i^\# - s_i)$ , calculated to give her an incentive to reduce activity below the competitive equilibrium,  $s_i^\#$ , whose value is reported in clause 4, along with that for the socially optimum value  $s_i^\circ$ .

Clause 5 specifies the incentive constraint for each included member, insuring that none of them has an interest in unilaterally deviating from the founder-induced optimum equilibrium. The last two clauses are boundary conditions.

The program is solved in the appendix. The equilibrium value of the subsidy rate,  $t^*$ , is equal to  $(N - 1)\rho$ , which can be interpreted as the externality rate, since each member causes  $N - 1$  externalities, each time with marginal impact  $\rho$ .

The equilibrium value for  $x$  identifies the member on the  $[1, N]$  continuum, left of whom the founder prefers multilateralism, right of whom, the bilateral approach. Assuming, in order to be able to make a point prediction, the following functional form for marginal gains,  $a_i = ia$ , with  $i \in [1, N]$  and  $a > 0$ , we are ready to state the solution.

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<sup>9</sup>To build the summation term, we took advantage of the mathematical identity between offering each of the  $y - x - 1$  members (1) a multilateral treaty and a supplementary bilateral treaty or (2) a bilateral treaty with incentives that subsume those of the multilateral treaty.

**Proposition 1** *There exists a subgame perfect equilibrium in which the founder offers*

(1) *transfer  $t^*s_x^\circ$  to agents  $i$  indexed 1 to  $x^*$  and in which these agents invest social optimum  $s_i^\circ$ ;*

(2) *transfer  $t^*s_i^\circ$  to agents  $i$  indexed  $x^* + 1$  to  $y^*$  and in which these agents invest social optimum  $s_i^\circ$ ;*

(3) *no transfer to agents  $i$  indexed  $y^* + 1$  to  $N$  and in which these agents invest competitive equilibrium  $s_i^\#$ ;*

with  $t^* = (N - 1)\rho$ ,

$$s_i^\circ = \left( \frac{a_i}{2(c+\rho(N-1))} \right)^2,$$

$$s_i^\# = \left( \frac{a_i}{2c} \right)^2,$$

$$x^* = \begin{cases} N & \text{if } \bar{T} < T \leq \hat{T} \\ x \in [\underline{x}, \bar{x}] & \text{if } \underline{T} \leq T \leq \min \{ \hat{T}, \bar{T} \} \\ 1 & \text{if } T < \min \{ \underline{T}, \hat{T} \} \end{cases},$$

$$y^* = \begin{cases} N & \text{if } \bar{\bar{T}} < T \leq \hat{T} \\ y \in [\underline{y}, \bar{y}] & \text{if } \underline{\underline{T}} \leq T \leq \min \{ \hat{T}, \bar{\bar{T}} \} \\ 1 & \text{if } T < \min \{ \underline{\underline{T}}, \hat{T} \} \end{cases},$$

$$\underline{x} = \frac{1}{4} \frac{\sqrt{(a^2\rho^3(N-1)^3 + 32Tc^2(c+\rho(N-1))^2 + 2ca^2\rho^2(N-1)^2)}}{a\rho(N-1)\sqrt{2c+\rho(N-1)}} - \frac{1}{4},$$

$$\bar{x} = \frac{1}{4} \frac{\sqrt{(a^2\rho^3(N-1)^3 + 32Tc^2(c+\rho(N-1))^2 + 2ca^2\rho^2(N-1)^2)}}{a\rho(N-1)\sqrt{2c+\rho(N-1)}} + \frac{3}{4},$$

$$\underline{y} = 2\frac{c}{a\rho} \frac{\sqrt{V-T}}{\sqrt{2c+\rho(N-1)}} \frac{c+\rho(N-1)}{N-1} - 1,$$

$$\bar{y} = 2\frac{c}{a\rho} \frac{\sqrt{V-T}}{\sqrt{2c+\rho(N-1)}} \frac{c+\rho(N-1)}{N-1},$$

$$\underline{T} = \frac{3}{4}a^2\rho^2(N-1)^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2},$$

$$\bar{T} = \frac{1}{4}a^2\rho^2(2N-1)(N-1)^3 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2},$$

$$\underline{\underline{T}} = V - \frac{1}{4}N^2a^2\rho^2(N-1)^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2},$$

$$\bar{\bar{T}} = V - a^2\rho^2(N-1)^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2}, \text{ and}$$

$$\hat{T} = \arg \text{solve } \underline{x} = \underline{y}.$$

Note the convexity of the  $t(z) = t^* (s_i^\# - s_i^o)$  curve, confirming, to the extent that the model builds on realistic assumptions, the choice of the model in Figure 4A as more plausible than the one in Figure 4B.

## 4 Comparative Statics and Predictions

The model produces two sets of comparative statics that are relevant to the mix of lateralisms and exclusion:

(1) Transaction costs ( $T$ ) : A rise in  $T$  causes an increase in  $x^*$ , that is, a rise in the transaction cost yields a greater scope for multilateralism. In contrast, a rise in  $T$  causes a drop in  $y^*$ , that is, a drop in bilateralism and a rise in exclusion. In contrast, if the transaction cost is low, holding everything else constant, the bilateral approach is dominant (the "Coase Theorem").

(2) Member surplus ( $a$ ) : one may approximate the member surplus by the slope of the  $t(z)$  curve of Figure 5. We find that  $t(z) = t^* (s_i^\# - s_i^o)$ , with slope  $\frac{\partial t(z)}{\partial a} > 0$ , that is, a positive function of  $a$ , with  $a$  being a component of the marginal profit of investing in the activity generating the externality. In turn, it is easy to see that an increase in the value of  $a$  yields a reduction in  $y$ , that is, a rise in the member surplus yields an increase in exclusion. Likewise it is also easy to show that an increase in  $a$  yields a reduction in  $x^*$  ( $\frac{\partial x^*}{\partial a} < 0$ ), that is, a rise in the member surplus yields a decrease in multilateralism .

These comparative statics yield the following four predictions:

1. If transaction costs alone are high, multilateralism should be the instrument of choice.
2. If the member surplus alone is high (that is, if there is great variation in compliance costs), bilateralism should be the instrument of choice.
3. If both transaction costs and the member surplus are high, some combination of lateralisms should be the outcome.
4. If both transaction costs and the member surplus are high, exclusion is high.

The case where neither transaction costs nor member surplus are high are likely to yield indeterminacy, as it leaves the instruments open to the influence of parameters not included in this model.

For the sake of empirical relevance, we need to further refine prediction 3 and the strategy of combining bilateralism and multilateralism. In practice,

we tend to encounter two different types of combination. A first, which we call "customized" multilateralism, consists in sorting out countries into categories, for instance, LDC's versus non-LDC's, and agreeing in the context of a multilateral bargain to provide the former with a treatment different from the latter. A second type of combination, which we call "mixed" lateralism, features both a common set of obligations, generally prescribed in a multilaterally negotiated agreement, and multiple bilateral agreements between the regime founders and some of the members taking place outside the multilateral bargain. Although both the customized and mixed formats occur when both the member surplus and transaction costs are high, they still reflect different priorities: customization is a better response when transaction costs are the primary concern, while the mixed format is a better response when the member surplus is more important.

We summarize our predictions in Figure 6.

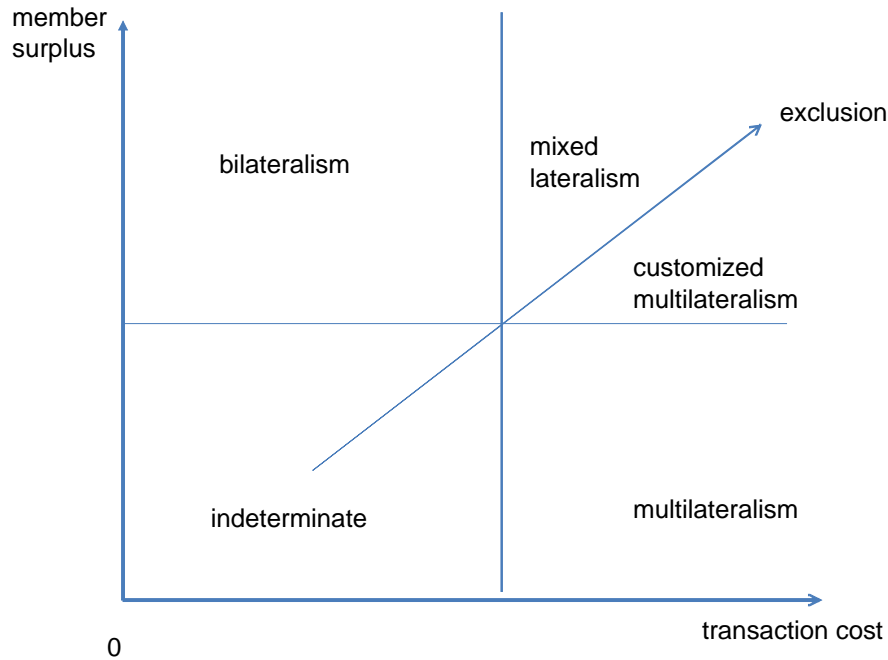


Figure 6: Predictions

## 5 Empirical Illustrations

We illustrate the logic of our theoretical argument by focusing on four important cases: (1) a case of bilateralism—the FDI regime; (2) a case of

multilateralism—the human rights regime; (3) a case of “customized multilateralism”—the climate change regime; and (4) a case of “mixed” bilateralism and multilateralism—the trade regime. In addition to offering variation on the dependent variable, the nature of "lateralism," these cases demonstrate the generalizability of the model by covering a broad range of issues areas. We use the predictions generated by the model and presented in the previous section to guide the empirical discussion.

## 5.1 The FDI Regime

Since the 19th century, there has existed an international investment regime consisting of a set of "widely shared standards regarding the proper treatment of foreign capital" (Lipson 1985: 81). Nevertheless, despite efforts by the United States in particular to promote rules on seizure and compensation, there exists no multilateral treaty or comprehensive customary law on the treatment of foreign direct investment (Guzman 1998; Sornarajah 2004: 167). Instead, over the last fifty years rules governing FDI have rested overwhelmingly on more than 2,600 bilateral investment treaties (BITs). Consistent with predictions 1 and 2, moderately low transaction costs and a large member surplus combine to make bilateralism the design of choice. Because it is relatively easy to conclude new BITs, there is little incentive to exclude states from participating in the regime (prediction 4).

The fundamental cooperation problem underlying BITs involves the time-inconsistent preferences of governments hosting investment. Once the investment is made, the government is tempted to employ a variety of policy tools—from higher taxes, to new performance requirements, to outright expropriation—in order to siphon off benefits from the investment. This creates a credibility problem for governments hoping to attract foreign firms and a situation in which both sides are better off with a commitment device (Stasavage 2002). Another incentive to cooperate comes from competition among host governments, which can produce race-to-the-bottom efforts to attract FDI (Elkins, Guzman and Simmons 2006). States involved in FDI have sought international agreements to address both problems.

A multilateral instrument to deal with FDI is potentially attractive insofar as it would set uniform rules and thereby dampen race-to-the-bottom effects.<sup>10</sup> However, in practice a viable multilateral instrument would have to be too watered down—in an effort to include hosts with the highest com-

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<sup>10</sup>While race-to-the-bottom competition still occurs among host states, capital-rich countries in European and North America, under pressure from environment and labor groups, have increasingly included safeguards against this in their BITs. The U.S. Model BIT, for instance, contains provisions that prevent the host government from relaxing environmental and labor regulations to attract FDI, and Canada’s standard BIT similarly disallows the weakening of health, safety and environmental measures. See, for example, Article 11 of the recently concluded Canada-Peru Foreign Investment Protec-

pliance costs, such as Brazil and China—to be comprehensively effective and would thus be inefficient in incentives. This reflects the logic of the member surplus underlying prediction 2. The WTO's agreement on Trade-Related Investment Measures (TRIMs) illustrates precisely this point; it addresses only a narrow range of FDI issues and "imposes only rudimentary disciplines on the regulation of foreign investment" (Neumayer and Spess 2005: 1571). Because the costs of participating in the regime—that is, of forgoing policy control over foreign investors—is so uneven across states, a multilateral approach would generate a substantial member surplus.

The alternative is bilateral treaties that can be both deeper and more customized, and therefore less wasteful in terms of the member surplus. BIT participants vary considerably in terms of their political systems, the ideological orientation of their governments, the political influence of labor and other special interest groups, and their level of economic development. Accordingly, BIT provisions are tailored to the political and economic needs of signatories (in particular, of the developing country parties) in terms of what is counted as an "investment," the standards of treatment and protection that are applied, and the precision and options for dispute settlement (UNCTAD 2007).

The main potential drawback of bilateralism is the high negotiation and safeguarding costs involved in the signing and monitoring of thousands of treaties. These costs, however, have so far been relatively low. Monitoring and enforcement costs are typically low when it comes to agreements involving FDI. In almost all cases, violations of the agreement are noticed almost immediately by the affected firm, which by definition has a presence on the ground in the host country. This supplies a built-in "fire alarm" system of inexpensive monitoring (McCubbins and Schwartz 1984). This can be contrasted with trade, for example, where a wide range of opaque, non-tariff barriers can violate an agreement or otherwise impair the benefits expected to flow from it. Negotiation and renegotiation costs have also been contained because BITs are similar in terms of their basic components and are seldom negotiated from the ground up. The United States, Canada, the European Union and other investor countries offer a "model" structure that forms the basis of their respective BITs. The UN Conference on Trade and Development (UNCTAD) also promotes a standard BIT that is widely used as a starting point for negotiations. This uniformity minimizes the transaction costs of negotiating agreements with other countries and reduces the governance costs of managing the treaty over time by making implementation and interpretation more straightforward (UNCTAD 1998: 24). Of course, standardization also reduces room available for customization and may pave the way in the long run for a shift to the negotiation of a multilateral instrument.

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tion Agreement. Available at <http://www.international.gc.ca/trade-agreements-accords-commerciaux/agr-acc/peru-perou/report-rapport.aspx?lang=en>.

Our theoretical model offers no reason to expect high rates of exclusion from the regime (prediction 4). Indeed, BITs have proliferated rapidly along with the globalization of capital. From only \$700 billion in 1980, the world's stock of FDI now stands at \$10 trillion, and more than 60,000 multinational corporations are active in the global economy today. To promote these interests, the founders (i.e., large investor states) have sought to include more and more members in the regime through bilateral efforts. By the mid-1990s, 162 countries had concluded BITs and today the number stands at 176. Only a handful of countries, mostly least-developed and politically unstable, lie outside of the regime, and these nonmembers are mostly unattractive destinations for FDI whose participation is not economically valuable.

## 5.2 The Human Rights Regime

The international human rights regime is underpinned by an array of multilateral legal agreements and institutions, an approach that reduces the transaction costs of bargaining and of safeguarding agreements in ways that cannot be achieved through bilateral instruments (prediction 1). Moreover, participants in the regime face compliance costs that are almost uniformly low, making bilateral deals unnecessary as a way of minimizing the member surplus (prediction 2) and rendering exclusion largely unnecessary as a way to save on transfers (prediction 4).

The horrors of World War II served as a catalyst for the emergence of a coherent international human rights regime, centered on the norm that individual human beings should be protected regardless of their nationality or location (Morsink 1999). The founders of the regime were the western democracies, who have sought to expand membership in the face of some resistance from nonwestern countries, especially in Asia and the Islamic world (Ignatieff 2001). The regime is governed by a broad and growing set of multilateral instruments. In addition to the UN Charter, which calls for "universal respect for, and observance of, human rights," the three core agreements are the Universal Declaration of Human Rights (1948), the International Covenant on Civil and Political Rights (1966), and the International Covenant on Economic, Social and Cultural Rights (1966). These are complemented by more specific treaties on genocide (1948), racial discrimination (1973), discrimination against women (1979), torture (1984), rights of the child (1989), rights of migrant workers (1990), and rights of persons with disabilities (2006). These treaties enjoy widespread participation.<sup>11</sup>

While human rights might seem to be a largely domestic matter, there are substantial cross-border effects created by human rights policies that make international agreements attractive. First, moral concerns arise over events

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<sup>11</sup>Except for the two newest treaties, on migrant workers and persons with disabilities, all have been ratified by more than 100 countries.

in other countries that threaten individual well-being—what Donnelly refers to as a sense of "moral interdependence" across states (Donnelly 1986: 617). Second, there are practical externalities. States with humanitarian problems and oppressed minorities are more conflict-prone, less appealing as partners in trade and investment, and more likely to generate refugee flows (Goldsmith and Posner 2005: 110). This explains why international cooperation is necessary but it does not explain why the regime has evolved primarily on the basis of multilateral legal instruments. Following our theoretical arguments, we expect bilateralism to prevail when there are no significant transaction cost savings to be gained through multilateralism. This is not the case: The multilateralization of human rights has helped to reduce both the bargaining costs and the safeguarding costs entailed in the regime.

Because they involve "taboo trade-offs" and depend on their normative weight to matter, human rights rules do not lend themselves to side-payments and compromises, making bargaining difficult.<sup>12</sup> Moreover, any claim to universality requires that many states be involved in the negotiations. These factors make a multilateral approach to bargaining more appealing, and accordingly the UN has offered a natural forum for the efficient negotiation of many human rights agreements. The General Assembly was used as a venue for the final negotiations of the Universal Declaration, facilitating speedy agreement across most of the international community. The UN's Human Rights Commission has been used to generate draft texts for many human rights treaties, originally with the administrative support of various secretariat officials, who have proven crucial in reconciling diverse views on human rights and producing draft texts that serve as focal points for intergovernmental negotiations. The costs of forging a wide network of bilateral agreements would have been considerably higher and likely impossible.

Transaction costs also arise from the difficulty of monitoring and enforcing human rights law in a purely bilateral context. First, it is difficult for individual governments to monitor the wide range of human rights rules, especially since the relevant behavior is usually occurring at the domestic level in other states. Second, even when governments have evidence of violations, this information may not be viewed as impartial and credible by other governments. Third, it is difficult for individual governments to punish rights violators through the normal bilateral channels of tit-for-tat retaliation. While in some issue-areas a government can respond in kind to noncompliance—for example, by suspending concessions in the trade or expelling diplomats—there are no direct reciprocal benefits to be withdrawn in human rights (Hathaway 2007: 589). And a pro-human rights government cannot credibly threaten to mistreat its own population in response to the actions of another government.

The primary mechanisms for promoting compliance in human rights are

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<sup>12</sup>On the notion of taboo trade-off, see Fiske and Tetlock 1997.

reputation concerns and shaming, both of which are more effective in multilateral contexts (Guzman 2008: 64; Johnston 2001). Accordingly, the various human rights treaties establish an array of institutions—UN bodies, as well as independent committees and commissions—that provide centralized monitoring and reporting. Their findings, though not binding, do have legal and normative significance that "puts pressure on states" (Buergethal 2006: 791). The Security Council has also adopted the role of enforcing international human rights law, increasingly authorizing responses to some of the most egregious violations (Le Mon and Taylor 2004). Since none of this would be possible with a series of bilateral treaties, safeguarding the human rights regime requires a multilateral approach.

While the logic of transaction costs helps explain why the regime is primarily multilateral, there is still the possibility that multilateral instruments would be complemented by bilateral ones, resulting in a "mixed" regime. Our theoretical argument, captured in prediction 2, is that bilateral instruments are most appealing when compliance costs vary significantly across states, such that founders prefer to tailor additional incentives to bring reluctant states on board (thereby minimizing the member surplus). In the human rights case, this is largely unnecessary because compliance costs are low for almost all states. Most treaties are shallow, requiring little change in status quo behavior. The Universal Declaration reflected an "agreement across cultures" that papered over a "lack of consensus on foundations" to maintain sovereignty prerogatives (Glendon 1998: 1156, Lauren 2003: 154-60). Since, as Donnelly (1986) notes, growth in the rights regime was relatively easy precisely because states have been unwilling to increase the depth of their commitments.

Empirical evidence on state behavior bears out the argument that human rights law imposes low compliance costs across the board. Overall, human rights treaties have a very limited impact on state behavior (Neumayer 2005; Hathaway 2002). This is especially true for democracies, which tend to respect human rights anyway. However, the costs of joining a human rights treaty are so low that repressive and nondemocratic governments are just as likely to join as those which protect human rights (Hathaway 2007; Vreeland 2008; Hafner-Burton and Tsutsui 2007). Consistent with predictions 2 and 3, these uniformly low compliance costs translate into a small member surplus and help explain why bilateral instruments have been largely unnecessary as a complement to multilateralism. And as prediction 4 suggests, the fact that most states can participate with little change in their status quo behavior also helps explain why exclusion has been largely unnecessary: it is relatively inexpensive to bring new members on board.

### 5.3 The Climate Change Regime

The regime for climate change addresses the problem primarily by restricting emissions of the greenhouse gases that contribute to global warming. From the beginning, the Europeans have assumed a leadership role in establishing international treaties and calling for the deepest cuts in greenhouse gas emissions (Gupta and Grubb 2000; Yamin and Depledge 2004: 42-4). They are thus the primary founders of the regime and have endeavored to bring other members on board, including more reluctant industrialized countries and developing countries. We use the case to illustrate that a combination of multilateralism and bilateralism is one logical and interesting possibility resulting from situations where both transaction costs and the member surplus are high (prediction 3). In this case, we see “customized multilateralism,” where a single multilateral agreement contains differential obligations across its members in order to get the incentives for participation right.

Multilateralism is appealing in the climate case because of the high transaction costs associated with forging agreement. The global nature of the problem means that climate negotiations, of whatever format, must include many states (most recently, the December 2009 Copenhagen conference included 192 nations). The problem of large numbers is exacerbated by the reality that addressing climate change requires policy changes at the domestic level and across a range of sectors, raising the “two-level” problem of satisfying domestic constituencies (Putnam 1988). Indeed, domestic actors have consistently posed obstacles to governments in their climate negotiations (Sprinz and Weiss 2001). Negotiations are further hampered by the serious distributive implications of choosing different approaches to address climate change, which raises the stakes of bargaining and makes governments more cautious about signing on to any agreement (Fearon 1998; Thompson 2006). Beyond the bargaining phase, transaction costs also play a role when it comes to safeguarding climate agreements. Few international commitments pose a more severe monitoring and enforcement problem than those associated with climate change, where emissions and carbon “sinks” must be tracked on territories around the world, with clear incentives for each country to free-ride on the efforts of others.

The most important multilateral components of the regime are the two core treaties, the 1992 UN Framework Convention on Climate Change (UNFCCC) and the 1997 Kyoto Protocol, and the institutions established by these treaties to manage the regime. All parties must submit national reports to the UNFCCC Secretariat on their efforts to reduce and track emissions. Industrialized countries are further monitored by “expert review teams,” coordinated by the Secretariat, and a Compliance Committee, which can investigate and identify violations. Incentives to comply include public reporting of noncompliance, a penalty of additional emissions reduction requirements, and suspension from use of the emissions trading mechanism. The climate regime also provides a

forum for regular negotiations by the entire membership, the Conference of the Parties (COP), and by various subsidiary bodies that handle more technical issues. These are classic transaction cost-reducing functions performed by multilateral institutions (Keohane 1984).

The main drawback of the multilateral approach is that the costs of reducing emissions are highly variable, making it difficult to attract participation from those who place a high value on emitting greenhouse gases without generating a surplus from those more willing to curb emissions. Consistent with our model, the surplus was minimized through the use of bilateral mechanisms as a complement to multilateral agreements.

Developing countries offer the most obvious example of countries with a higher cost of compliance. They were reluctant from the start to join the regime, fearing that efforts to tackle climate change would compromise their main priorities of poverty reduction and economic growth (Bodansky 2007; Najam, Huq and Sokona 2003). To attract their participation, obligations are customized within the context of multilateral agreements. The Framework Convention notes that countries should address climate change in accordance with their “common but differentiated responsibilities and respective capabilities” (Section 3.1). This principle was carried over to Kyoto, which imposes binding obligations only on industrialized countries. Both treaties also encourage richer countries to transfer technology and financial resources to help developing countries with the costs of emissions abatement. The Kyoto Protocol’s Clean Development Mechanism (CDM) does this with a project-based approach, allowing industrialized countries to earn credits by investing in emissions-reducing projects in the developing world. Developing countries benefit from the transfer of capital and technology under CDM, which in effect pays them to address global warming (Victor 2007).

Even among industrialized countries, the distributive impact of reducing emissions is widely variable in terms of the economic and political costs required to reduce emissions. Economists studying cross-national variation in the costs of implementing emission reductions consider factors such as the carbon intensity of an economy, consumer habits, and transportation modes and infrastructure. Simplifying somewhat, among the major emitters we see significantly higher compliance costs for the United States, Canada, Japan and Australia, and lower costs for most European countries. The former have higher emissions per capita, rely heavily on coal for energy, and have steeper emissions projections in the baseline case (Novak 1999; Cooper et al. 1999). For example, after Kyoto was signed projections for the EU suggested that “business-as-usual”—i.e., no efforts at abatement—would lead to an 8-percent increase in emissions over 1990 levels, whereas similar projections for the United States predicted a 30-percent increase (Hourcade and Grubb 2000: 174). The latter scenario obviously implies greater adjustment costs and foregone economic growth (Viguier, Babiker and Reilly 2002). Economies in

transition, especially Russia, also faced a greater risk of disrupting their more fragile economic growth by accommodating climate concerns.

Rather than set uniform obligations to satisfy the lowest-common-denominator, Kyoto customizes obligations across members to reflect this variation and to bring those with high compliance costs on board. Two mechanisms were used to achieve customization. First, targets for emissions vary substantially across industrialized countries; the EU’s target is set at eight percent below 1990 levels while Australia’s is set at eight percent above, for example. While political factors obviously played a role in setting these targets, they can also be understood in efficiency terms. Jeffrey Frankel (2010: 58-9) notes that the costliness of emissions cuts outlined in Kyoto, expressed in terms of the amount of deviation required from the “business-as-usual” scenario, correlates highly with countries’ GDP per capita, a good proxy for compliance costs. The second mechanism used for customization was deployed after Kyoto was signed and awaiting sufficient ratifications to enter into force. It involved bilateral enticements to Japan, Canada and Russia, who were allowed to count additional sources of carbon sinks toward their targets at the COP meetings in 2001. These countries used the threat of nonparticipation to negotiate carbon sink allowances in the amounts of 12 million, 13 million and 33 million metric tons of carbon per year, respectively (UN Doc. FCCC/CP/2001/L.7; UN Doc. FCCC/CP/2001/12/Add.1: 64). In contrast, no other industrialized state had a cap larger than 1.24 million. These allowances, which substantially reduced the compliance costs for their beneficiaries, represented a major concession by the EU—one that succeeded in prompting all three hold-outs to ratify.

The question remains of why, given the incentive to combine multilateralism and bilateralism, the climate regime employs customized multilateralism rather than a mix of multilateral and bilateral instruments (as in the case of trade, discussed below). As Figure 6 illustrates, we have theoretical reasons to believe that this reflects a greater concern over transaction costs relative to the member surplus. This seems plausible in the climate case. While building in flexibility and offering customized incentives provide an endogenous strategy to even out compliance costs, little can be done to reduce transaction costs. Indeed, negotiations have become more complex over time, as developing countries are now heavily involved, as the range of policy options to address the problem expands, and as governments face the specter of actually implementing costly commitments. One observer of the Copenhagen conference described it as “the most complicated COP in the history of the parties.”<sup>13</sup>

Finally, because both transaction costs and the member surplus are high in the climate case, we expect to see relatively high levels of exclusion from the regime (prediction 4). If we conceive of participation in terms of the

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<sup>13</sup>The commentator is Alden Meyer of the Union for Concerned Scientists, who has attended every COP. See [http://www.copenhagenclimatetalks.info/news/news\\_story.asp?id=17394](http://www.copenhagenclimatetalks.info/news/news_story.asp?id=17394).

adoption of binding commitments, this is clearly the case: only 38 countries have assumed emissions reduction targets. No developing country has yet agreed to assume binding obligations and the United States has not ratified Kyoto and is therefore not bound by its target. This means that the two largest emitters of greenhouse gases, China and the United States, remain excluded. More generally, ratifications for Kyoto were slow in coming and the treaty did not enter into force until 2005, eight years after it was signed.

## 5.4 The Trade Regime

The norm of free trade has existed in Europe since the 19th century and is now widely accepted. The regime founders in this case are Britain in the 19th century and, since the Second World War, the United States and a growing cast of advanced industrialized countries that have been opening their economies and convincing others do so as well.<sup>14</sup> We focus on the postwar era since this is the period during which a coherent and widespread regime can be said to exist. How free trade is pursued internationally has varied over time and space but has always involved a combination of multilateral and bilateral instruments. It thus represents a “mixed” case in our terminology. We explain this outcome in terms of the importance of both transaction costs and the member surplus (prediction 3), and suggest that a “mixed” outcome was chosen over a “customized multilateral” outcome because transaction costs have been eased somewhat over time while compliance costs have remained uneven across countries. Furthermore, the concurrence of transaction costs and the member surplus has resulted in high exclusion historically (prediction 4).

Beginning especially with the British in the 19th century, international trade agreements originally took a bilateral form. However, bilateralism by itself is inefficient for two reasons, both related to transaction costs. First, participants in bilateral agreements cannot be sure that the value of concessions they gain will not be undermined in the future by more generous agreements signed by their trading partner with other countries. This is a very real problem since bilateral and regional arrangements tend to divert trade, taking business away from the low-cost producers outside the group and reducing the welfare of third parties (Magee 1980: 75). Other countries therefore have an incentive to strike their own bilateral deals to defend against these effects (Oye 1992: 25-7). Second, and most directly, the bargaining costs of signing many bilateral agreements are high. Moravcsik (1999: 301) argues that the costs of cooperation are especially high when domestic interest groups are involved in an issue area, and this is certainly the case with trade politics. The administration of George W. Bush experienced this when it signed free

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<sup>14</sup>We might think of the original postwar founders as the first developed-country signers of the GATT treaty in 1948: the United States, the U.K. France, Canada and the Benelux countries.

trade agreements with Colombia, South Korea and Panama, only to see them languish without congressional approval. In sum, the costs of safeguarding and negotiating bilateral trade agreements is high, creating a transaction-cost motivation to move in a multilateral direction.

Historically, some of the transaction costs of bilateralism have been offset through the application of the most-favored nation (MFN) principle as a sort of multilateralizing feature of bilateral agreements. By automatically extending lower-tariff treatment to other trading partners who also have MFN status (though not to others), MFN has a modest multiplier effect that produces more trade liberalization. More importantly, with respect to the safeguarding problem MFN makes countries more willing to negotiate concessions bilaterally because they know that the benefits will not be impaired by subsequent, more generous concessions to other countries (Schwartz and Sykes 1996: 29). However, as the volume of trade increased over time, and especially as the risk of opportunism increased with greater trade-related investments in the modern era (Yarbrough and Yarbrough 1992), these features proved inadequate to offset the down-side of bilateralism.

The GATT represented an effort to formalize the MFN principle (enshrined in GATT Article I) and, as the GATT evolved, to combine it with a set of multilateral institutions that would increase the efficiency of trade cooperation by further reducing transaction costs. The multilateral institutions that are now at the center of the trade regime perform three functions in particular: they reduce negotiation costs, they supply monitoring, and they settle disputes.

Cooperating through one large agreement not only reduces the number of discussions that must take place, it provides an established and predictable forum for negotiations and offers opportunities for side-payments and issue linkage to grease the skids of agreement (Martin 1992). Moreover, an important source of transaction costs in a decentralized setting is the effort required to gather information on other states' trade policies, especially the existence and likely effect of barriers to trade. A multilateral institution that can provide such monitoring more efficiently. As Donald Keesing (1998: 4) notes, "Some means of mutual surveillance, of sharing the costs of gathering unbiased information on each and every country's changing practices and making that information available to the rest, is needed if the system of multilateral trade negotiations is to operate efficiently and fairly." Today's WTO secretariat plays a central role in monitoring and transparency, especially through the Trade Policy Review Mechanism (TPRM). While the TPRM is not designed to detect violations and trigger dispute settlement cases, some argue that it does serve an enforcement function indirectly (Qureshi 1995). At the very least, it increases the transparency of trade policies and has the effect of institutionalizing a system of peer pressure that promotes compliant behavior (Curzon Price 1991).

Centralized dispute settlement, which began under the GATT and has been enhanced with the WTO (Hudec 1999), has deservedly received much attention as a key feature of the multilateral trading system. The ability to address noncompliance is "vital for the smooth functioning of the trading system" (Hoekman and Kostecki 2001: 74) as it reduces fears of cheating and helps clarify whether given behavior constitutes a violation of regime rules. This makes cooperation over new rules more appealing and reduces the risks of ongoing trade. As such, centralized dispute settlement offers enormous economies of scale when it comes to reducing the costs of trade cooperation.

While multilateralism helps address some of the inefficiencies that arise from bilateralism, it comes with its own downside. Specifically, it does not effectively address the problem of variable compliance costs that lies behind the member surplus problem. Some countries benefit more from free trade than others, depending on their size, on how competitive they are at the international level, and on how much they value social protection and other goals more than the aggregate benefits of trade (Alesina, Spolaore and Wacziarg 2005; Rodrik 1997). Others go further, arguing that developing countries are locked into a state of dependence on their richer counterparts as a result of free trade.<sup>15</sup> In any case, the actual and perceived cost of participating in the free trade regime varies considerably across countries.

As our model predicts, in the presence of both transaction costs and variable compliance costs the trade regime combines multilateralism and bilateralism. As in the climate case, this is done partly through customization in the form of the GATT/WTO's "special and differential treatment" for developing countries. It is also done through the use of separate agreements of a bilateral and regional nature, which have proliferated in recent years (Mansfield and Milner 1997; Trakman 2008). Trade is thus a "mixed" case.

As our theoretical argument anticipates, many larger free trading countries use bilateral agreements as a way to entice their less-developed counterparts to undertake free trade commitments. The United States, for example, has free trade agreements with 17 trading partners, all but two of which are developing countries (the exceptions are Canada and Australia). While these agreements do call on the partner to liberalize, the policy changes required are typically modest and gradual. In some cases, the United States offers explicit inducements to make participation attractive. The Andean Trade Preference Act, for example, provides Bolivia, Colombia, Ecuador and Peru duty-free access to the U.S. market on almost all goods, going beyond the U.S. Generalized System of Preferences program. The goal of the program is to expand development opportunities and to provide alternatives to drug-crop production in these countries (USTR 2007).

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<sup>15</sup>For a summary of "dependency theory" and other structural arguments against free trade, see Gilpin 1987: Chapter 7.

The EU goes even further, using bilateral trade agreements as a major policy vehicle for distributing aid and other transfers. Of the EU's 36 bilateral trade agreements, 29 are with transition and developing countries. Through its Aid for Trade program, the EU provides over 70 billion euros per year to these trading partners to help them with infrastructure and technical assistance projects designed to boost exports. The EU Trade Commissioner explains the rationale behind this program: "Developing countries cannot take full advantage of the benefits of open and fair trade if their exports fall at the first hurdle. Trade facilitation is vital for developing countries' growth prospects" (European Commission 2009). In other words, if the Europeans are going to expect these countries to participate in a free trade regime, they must offer them special deals that go beyond reciprocal liberalization of barriers to trade.

The trade case is therefore consistent with our prediction 3 in that we see a combination of bilateralism and multilateralism in the presence of both transaction costs and a member surplus. The fact that bilateralism has gained in popularity in recent years may be an indication that developing countries feel increasingly vulnerable under globalization and continue to perceive free trade as a double-edged sword. Insofar as transaction costs have been progressively reduced with the help of GATT/WTO institutions, these persistent concerns over compliance costs may be responsible for tipping the regime toward a "mixed" outcome rather than toward further customization (see Figure 6).

Finally, prediction 4 suggests that we should see high levels of exclusion in the trade case. This is only partly true. The regime certainly began with a very limited membership—only 23 countries signed the original GATT agreement. Other than a jump in the 1960s that reflected decolonization (i.e., the introduction of more states into the international system), the growth of membership was steady but relatively slow for forty years. However, the rate of joining then increased dramatically during the Uruguay Round (1986-1994) and has been impressive ever since; today the WTO has 152 members, more than three-quarters of all states.

Nevertheless, some states are still excluded from the regime for reasons consistent with our logic. These nonparticipants are mostly least-developed countries (18 of WTO nonmembers fall into this category), politically volatile countries (e.g., Sudan, Iraq and Afghanistan), and statist economies (e.g., North Korea, Serbia, and Iran), all of which would require excessive additional incentives (side-payments or highly favorable bilateral agreements) or a very watered-down multilateral agreement to be included in a liberal trade regime. These high costs lead to exclusion, even from bilateral agreements. Belarus, for example, is not a WTO member and the EU has suspended any efforts to forge a bilateral trade agreement with its government, which is viewed as too repressive and volatile to work with.

## 6 Asymmetric Information

The model assumes complete information. What if, instead, the founder were ignorant of each member's compliance cost and dependent on their own declarations? We argue that in such conditions it is in the interest of each member to claim a cost greater than his actual one and thereby extract a higher payment. Asymmetric information disqualifies bilateralism in favor of multilateralism.

To see this, imagine that the founder has a good sense of the overall distribution of marginal gains,  $a_i$ . We further assume that the founder does not know where member  $i$  is located on that distribution, with  $i$  being any member. Hence, even if the founder has a good sense of the nature and scope of instruments she should use to build the regime, she does not know which instrument to offer to which member. A rational strategy for any member under such circumstances is to claim to be the high marginal gain type  $a_y$ , with  $y$  being the presumed highest-marginal-gain member to be included in the regime. As a result, all agents with an actual marginal gain located on and to the left of cutpoint  $y$  would claim to be at that very cutpoint.

The founder's best response to such misrepresentation is to give up on bilateralism and offer a multilateral deal calculated to include the member with marginal gain  $a_y$  (looking at Figure 5,  $a_x$  shifts toward, and becomes,  $a_y$ ). In response to such an offer, all agents with marginal gains inferior or equal to  $a_y$  accept the regime and all those with marginal gains above that threshold stay out. The multilateral instrument is optimal here because it functions like a partial information revelation mechanism. It leads each member to truthfully sort themselves out into a camp of members and a camp of nonmembers. The revelation is partial, however, because nothing is revealed on how agents are distributed within each camp. But note that such information is unnecessary in the context of the multilateral instrument, which treats everyone the same way and thus can be successfully used in the absence of any information on members' individual characteristics.

The situation is very different for bilateral instruments. Individualized information is needed in order to tailor the bilateral incentive to each member's type. In the case where all agents claim to be the  $a_y$  type, the bilateral strategy is suboptimal: it does not enable the founder to save on the member surplus, since all agents are given the transfer that corresponds to the  $a_y$  claim, thus multiplying transaction costs for no offsetting benefits. Bilateralism fails in the presence of asymmetric information.

Note that along with multilateralism comes exclusion. In order to reduce the member surplus generated by the multilateral contract, the founder must exclude more agents (reduce the value of  $y$  to some value below what would have been its complete-information equivalent, though still above what  $x$  would have been) than she would have under complete information. Combining these

various points together, we offer the following conjecture:

**Conjecture 1** *Asymmetric information makes multilateralism more appropriate than bilateralism and increases exclusion.*

An illustration is the practice known as "nuclear blackmail" (Gilinsky 1997). North Korea and Iran have been suspected of investing in nuclear weapons programs in order to raise their price of compliance with the nonproliferation regime. The possibility of blackmail, which can neither be proven or disproven, makes it difficult for the West to strike a deal with nuclear aspirants. More generally, asymmetric information leads agents to engage in behavior that undermines the bilateral instrument.

## 7 Conclusion

In this paper we shed light on a variation in the design of international regimes that has not received proper attention in the literature. Regimes vary widely with respect to whether the legal instruments that support them are bilateral, multilateral, or a combination thereof. Multilateral agreements are not the only way to design regimes; dyadic agreements, as in the case of the FDI regime, are viable alternatives. Moreover, the different instruments are not incompatible, as is too often believed, but complementary, as the trade and climate regimes illustrate. States must resolve these fundamental questions before they can negotiate other aspects of the regime.

We offer an explanation for the variation in lateralisms that builds on three propositions: transaction costs favor multilateralism, the member surplus favors bilateralism, and combinations of lateralisms are likely when both transaction costs and the member surplus are high. We also conjecture that the introduction of information asymmetry works against bilateralism.

We do not claim to have provided an exhaustive treatment of the question of lateralisms and acknowledge that there are other rationales. For example, in her study of the intellectual property rights regime, Sell (2007) argues that bilateralism is no complement to the existing TRIPs regime but a divide-and-conquer bargaining strategy in the service of a stronger protection regime that most developing countries are loath to accept.<sup>16</sup> Nor did we address the question of which approach is more legitimate in a given context.

Despite its limitations, this study has substantive consequences for how we conceptualize international regimes. The commonality of norms is more

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<sup>16</sup>Sell 2007. For a similar analysis of the international telecommunications regime, see Krasner 1991; for the international aviation regime, see Nayar 1995; and for the foreign direct investment regime, see Guzman 1998.

important to the existence of a regime than the laterality of the instruments that implement them. The two dimensions should be kept separate analytically. Moreover, the degree of institutionalization of an issue, usually defined by how much of it falls under the supervision of a multilateral instrument or organization, is by itself no indication of the strength of that regime.

# Appendix: Proofs

## 8 Competitive equilibrium

Each member  $i \in [1, N]$  chooses her level of  $s_i \geq 0$  to maximize her utility  $u_i = a_i\sqrt{s_i} - \rho \sum_{j \neq i} s_j - cs_i$ , a function that is twice-differentiable and concave. Assuming  $\lambda_i \geq 0$  to be the Lagrangian parameters, the optimal level of  $s_i$ ,  $s_i^\#$ , satisfies the necessary and sufficient first-order conditions  $a_i \frac{1}{2} s_i^{-\frac{1}{2}} - c + \lambda_i = 0$  and the Kuhn-Tucker conditions  $s_i \lambda_i = 0$  for any  $i \in [1, N]$ , thus forming a system of  $2N$  equations and  $2N$  variables ( $s_i$  and  $\lambda_i$ ). There is no solution possible in which, for any member  $i \in [1, N]$ ,  $\lambda_i > 0$ , because it would imply  $s_i^\# = 0$ , making the corresponding first-order condition indeterminate. Therefore, the only possible determinate solution has  $\lambda_i = 0$  and  $s_i^\# = \left(\frac{a_i}{2c}\right)^2$  for all  $i \in [1, N]$ .

## 9 Social optimum

In any Pareto optimal allocation, the optimal level of  $s_i$ ,  $s_i^\circ$ , must maximize the joint surplus of the  $N$  agents and so must solve  $\max_{s_i \geq 0, i \in [1, N]} \sum_{i=1}^N (a_i\sqrt{s_i} - cs_i) - \sum_{i=1}^N \rho \sum_{j \neq i} s_j$ . This problem gives the necessary and sufficient first-order conditions  $a_i \frac{1}{2} s_i^{-\frac{1}{2}} - c - (N-1)\rho + \gamma_i = 0$ , with  $\gamma_i \geq 0$  the Lagrangian parameters, and the Kuhn-Tucker conditions  $s_i \gamma_i = 0$  for all  $i \in [1, N]$ . The problem is solved like the precedent, yielding interior solution  $s_i^\circ = \left(\frac{a_i}{2(c+\rho(N-1))}\right)^2$  for all  $i \in [1, N]$ .

## 10 Solving program $P$

### 10.1 The subsidy rate

We start by determining the optimal subsidy rate,  $t^*$ . The rate must satisfy two conditions: first, it must be large enough to entice each member to abandon the competitive equilibrium for the social optimum; second, it must be high enough to deter any member from defecting to the competitive equilibrium while holding constant the optimal activity of other agents. To meet the first condition,  $t$  must make the equilibrium activity under the socially optimal equilibrium at least equal to the equilibrium activity under the competitive equilibrium. Comparing the first-order conditions for each equilibrium (see above), it is straightforward to see that the condition for the optimal equilibrium is the same as that for the competitive equilibrium minus expression  $(N-1)\rho$ . Therefore,  $t^* \geq (N-1)\rho$ .

To meet the second condition, the incentive constraint in program  $P$  must be met for  $s_i^* = s_i^\circ$ . This means that  $a_i\sqrt{s_i^\circ} - \rho \sum_{j \neq i} s_j^\circ - cs_i^\circ + t \left( s_i^\# - s_i^\circ \right) \geq a_i\sqrt{s_i^\#} - \rho \sum_{j \neq i} s_j^\circ - cs_i^\#$ . Substituting the values of  $s_i^\#$  and  $s_i^\circ$  into the constraint yields  $t^* \geq \frac{c(N-1)\rho}{2c+(N-1)\rho}$ . Since the right hand side term is smaller than  $(N-1)\rho$ , it follows that this second constraint is not binding, only the first is, and thus  $t^* = (N-1)\rho$ .

## 10.2 Convexity

To show that program  $P$  is convex with respect to  $x$  and thus has a fixed-point solution, one needs to show that the founder's utility function, in which we have substituted the values for  $s_i^\#$ ,  $s_i^\circ$ , and  $t^*$ , is concave with respect to variables  $x$  and  $y$ . Concavity requires that for any pair of distinct points  $(x_1, y_1)$  and  $(x_2, y_2)$  in the domain of  $U_P$ , and for  $0 < \theta < 1$ , the following weak inequality holds:  $\theta U_P(x_1, y_1) + (1 - \theta) U_P(x_2, y_2) \leq U_P(\theta(x_1, y_1) + (1 - \theta)(x_2, y_2))$ . Developing  $U_P$  and rearranging yields  $U_P = Ax^3 + Bx^2 + Cx + Dy^3 + Ey^2 + Fy + G$  with  $A = -\frac{1}{6}R$ ,  $B = \frac{1}{8}R$ ,  $C = T + \frac{1}{24}R$ ,  $D = -\frac{1}{12}R$ ,  $E = -B$ ,  $F = V - C$ ,  $G = -T$ , and  $R = \rho^2(N-1)^2 a^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2}$ .

This and all subsequent calculations use the functional form for an member's marginal gain  $a_i = ai$ .

Concavity thus requires  $\theta(Ax_1^3 + Bx_1^2 + Cx_1 + Dy_1^3 + Ey_1^2 + Fy_1 + G) + (1 - \theta)(Ax_2^3 + Bx_2^2 + Cx_2 + Dy_2^3 + Ey_2^2 + Fy_2 + G) \leq A(\theta x_1 + (1 - \theta)x_2)^3 + B(\theta x_1 + (1 - \theta)x_2)^2 + C(\theta x_1 + (1 - \theta)x_2) + D(\theta y_1 + (1 - \theta)y_2)^3 + E(\theta y_1 + (1 - \theta)y_2)^2 + F(\theta y_1 + (1 - \theta)y_2) + G$ . Rearranging and simplifying, one obtains  $(x_1 - x_2)^2 ((x_1(1 + \theta) + x_2(2 - \theta))A + B) + (y_1 - y_2)^2 ((y_1(1 + \theta) + y_2(2 - \theta))D - B) \leq 0$ , which is true since both components of the addition are negative. The first term is negative because  $A + B < 0$  and  $A$ 's coefficient is greater than one, while the second term is negative because  $D < 0$ , and both  $D$ 's coefficient and  $B$  are positive. It follows that  $U_P$  is concave with respect to  $x$  and  $y$  and that there exists a unique internal maximum  $(x^*, y^*)$ .

## 10.3 Lower and Upper Bounds of $x^*$

Since  $x^*$  is the unique maximum over the relevant domain, it yields a utility to the founder that is greater than the utility yielded either by  $x^* - 1$  or by  $x^* + 1$ . Formally, we have  $U_P(x) \geq U_P(x + 1)$  and  $U_P(x) \geq U_P(x - 1)$ . After developing and rearranging terms in each inequality, we obtain a lower and an upper

bound for  $x^*$  of the form  $\underline{x} \leq x \leq \bar{x}$ , with  $\underline{x} = \frac{1}{4} \frac{\sqrt{(a^2 \rho^3 (N-1)^3 + 32Tc^2(c+\rho(N-1))^2 + 2ca^2 \rho^2 (N-1)^2)}}{a\rho(N-1)\sqrt{2c+\rho(N-1)}}$   
 $\frac{1}{4}$ ,  $\bar{x} = \frac{1}{4} \frac{\sqrt{(a^2 \rho^3 (N-1)^3 + 32Tc^2(c+\rho(N-1))^2 + 2ca^2 \rho^2 (N-1)^2)}}{a\rho(N-1)\sqrt{2c+\rho(N-1)}} + \frac{3}{4}$ . Given that  $\underline{x} + 1 = \bar{x}$  and

that  $x^*$  is an integer, the value of  $x^*$  may fall anywhere in the closed interval  $[\underline{x}, \bar{x}]$ .

## 10.4 Lower and Upper Bounds of $y^*$

The equilibrium value is what makes the founder indifferent between extending the offer to  $y^{th}$  member and earning  $V - t^* (s_y^\# - s_y^\circ) - T$  and not extending the offer and earning 0. Equating the two outcomes and substituting the corresponding values for transfer and investment into the equation yields the upper bound value  $\bar{y} = 2 \frac{c}{a\rho} \frac{\sqrt{V-T}}{\sqrt{2c+\rho(N-1)}} \frac{c+\rho(N-1)}{N-1}$ , and thus the lower bound value  $\underline{y} = 2 \frac{c}{a\rho} \frac{\sqrt{V-T}}{\sqrt{2c+\rho(N-1)}} \frac{c+\rho(N-1)}{N-1} - 1$ . The value of  $y^*$  may fall anywhere in the closed interval  $[\underline{y}, \bar{y}]$ .

## 10.5 Domain

Since  $x^*$  must fall in interval  $[1, N]$ , we infer the domain of the function for which this result is verified.  $\underline{x} \geq 1$  yields condition  $T \geq \frac{3}{4}a^2\rho^2(N-1)^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2} \equiv \underline{T}$ , while  $\bar{x} \leq N$  yields condition  $T \leq \frac{1}{4}a^2\rho^2(2N-1)(N-1)^3 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2} \equiv \bar{T}$ .  $\underline{y} \geq 1$  yields  $T \geq V - \frac{1}{4}N^2a^2\rho^2(N-1)^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2} \equiv \underline{\underline{T}}$ , while  $\bar{y} \leq N$  yields  $T \leq V - a^2\rho^2(N-1)^2 \frac{2c+\rho(N-1)}{c^2(c+\rho(N-1))^2} \equiv \bar{\bar{T}}$ . Also,  $x^* = \begin{cases} N & \text{if } T > \bar{\bar{T}} \\ 1 & \text{if } T < \underline{\underline{T}} \end{cases}$  while  $y^* = \begin{cases} N & \text{if } T > \bar{\bar{T}} \\ 1 & \text{if } T < \underline{\underline{T}} \end{cases}$ . One last condition must be met:  $T = \arg \text{solve } \underline{x} \leq \underline{y} \equiv \hat{T}$ . Too long to be reported here, this condition is available from the authors.

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