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UNCERTAINTY, CONTEXT, AND THE DURATION OF INTERNATIONAL AGREEMENTS

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ABSTRACT

Why are some international agreements set up to operate indefinitely while others are of limited duration? In a recent *American Political Science Review* article, “Contracting Around International Uncertainty”, Barbara Koremenos argues that uncertainty about the distribution of future gains from cooperation is a key determinant of *ex ante* limitations on agreement duration. This article explores a potentially serious omitted variable problem in Koremenos’ analysis. Using a modified version of Koremenos’ dataset, we show that institutional ‘context’—by which we mean the particular legal and institutional environment in which states negotiate and design international agreements—conditions the specific variables she identifies as key to explaining design choices. In neglecting to control for institutional context, we argue, Koremenos’ model risks misspecifying the nature and extent of these variables’ influence on patterns of international cooperation. More broadly, our findings suggest that ‘rational design’ theories of international institutions can benefit from greater attention to institutional context.

Introduction

What explains variation in the design of international institutions? More specifically, why are some international agreements set up to operate indefinitely while others are of limited duration or contain explicit escape clauses or withdrawal provisions? In a recent article, “Contracting Around International Uncertainty” (2005), Barbara Koremenos tackles these questions, and in so doing makes an important contribution to the literature on “rational design” of international treaties.¹ Her central claim is that uncertainty about the distribution of future gains from cooperation is a key determinant of whether states negotiating agreements are likely to opt for *ex ante* limitations on their intended duration. Koremenos tests her argument using data collected on a random sample of 145 international agreements drawn from the United Nations Treaty Series (UNTS) across four major issue areas. The agreements span the time period between 1925 and 1986. She finds that states negotiating international agreements are most likely to seek time limitations when uncertainty over future gains is high, when expected costs from periodic renegotiation are low relative to anticipated gains from cooperation, and/or as risk aversion increases. Under these conditions, Koremenos concludes, duration provisions offer states a form of “insurance” against unfavorable changes in the distribution of future gains from international cooperation (Koremenos 2005:549).

The primary purpose of this article is to explore what we see as a potentially serious omitted variable problem in Koremenos’ analysis. More broadly, our goal is to highlight the limits of what ‘rational design’ arguments that analyze international institutions as independent (or ‘atomistic’) phenomena can tell us about the design features of agreements among states. To be clear, our objective is not to challenge Koremenos’ basic approach, which seeks to identify

¹ *American Political Science Review*, 99:4, November 2005, 549-565.

causal links between types and levels of uncertainty in the international system and the institutional forms interstate cooperation assumes (Koremenos, Lipson, & Snidal 2001:763). We argue instead that efforts to explain states' institutional design choices, including those concerning duration limitation and escape clauses, can benefit from greater attention to institutional 'context'—by which we mean the particular legal and institutional environments in which states negotiate whether and on what terms to enter into particular international treaties. We show, further, that the institutional context in which states seek to create (or renew) international agreements conditions the specific variables Koremenos identifies as key to explaining design choices: uncertainty over the distribution of gains from cooperation, expected costs from renegotiation, and risk aversion among states. Our approach suggests that in neglecting to control for contextual features of strategic decision environments, Koremenos' model risks misspecifying the nature and extent of these variables' influence on patterns of international cooperation.

We also examine two secondary, but important, issues. The first involves Koremenos' specification of 'uncertainty' as a dichotomous variable along a single dimension. We argue that this specification, which we find largely drives Koremenos' statistical results, is overly narrow and thus overlooks theoretically relevant points of variation across different issue areas and types of agreements. The second issue concerns Koremenos' strategy for minimizing selection bias in her statistical analysis. Specifically, we question the soundness of the data transformation Koremenos utilizes to avoid testing explanatory variables in the latter part of her argument exclusively on 'finite' agreements, which involves assigning to agreements with 'indefinite' duration a long (but nonetheless finite) period of operation. This move, we argue, conflates the choice between an indefinite and a time-limited agreement with subsidiary decisions about

duration in the event states opt for a time-limited agreement—a distinction of critical importance to Koremenos’ theoretical argument.

The good news, as we demonstrate empirically, is that the omitted variable problem can be at least partially addressed with straightforward modifications to the underlying model. We introduce a series of variables to control for the institutional context in which the international agreements included in Koremenos’ dataset were negotiated. The addition of these variables also facilitates specification of a further set of models that test for interaction effects among Koremenos’ key explanatory variables, and between these variables and various aspects of institutional context. The results of these exercises clarify the conditions under which Koremenos’ argument operates. Thus, while we find that uncertainty as defined by Koremenos does influence states’ choices about the duration of international agreements, it does so only in limited circumstances. And finally, we also demonstrate an alternative approach to managing selection issues in Koremenos’ sample using propensity score matching techniques—albeit with results that challenge the robustness of her original findings.

The remainder of the paper proceeds as follows. We begin with a brief review of the literature on the rational design of international institutions and a theoretical pitch for how incorporating elements of prior institutional context into accounts of design choice can add to their explanatory power. We next undertake a more detailed discussion of Koremenos’ argument that highlights our concerns with both its overall framing and the model’s specification of uncertainty. In the third section, we introduce four hypotheses intended as an initial probe of whether and how institutional context influences states’ choices about the duration of international agreements. We then present the results of our statistical tests and discuss the

implications for Koremenos' argument.² The final section draws upon the results of our empirical analysis to suggest how institutional context might be used to expand and sharpen future research into the design and operation of international treaties and institutions.

Institutional design: why context matters

International relations scholars have long been interested in the study of international institutions as mechanisms for overcoming barriers to collective action and realizing joint gains from cooperation. Only recently, however, have scholars begun to treat the design features of international institutions as important variables in their own right (Koremenos, *et. al.* 2001; Goldstein, *et. al.* 2001; Koremenos 2005). In this emerging literature, states undertake international agreements in order to resolve specific problems. The form and attributes of resulting institutions are thus conjectured to follow from deliberate ('rational) choices on the part of their creators operating under varying competitive and informational constraints (Bordo & Kydland 1995; Martin & Simmons 1998; Koremenos, Lipson, & Snidal 2001; Koremenos 2005; Koremenos 2007). Koremenos' argument about the duration of international agreements thus has roots in a broader functionalist tradition of inquiry into the origins of international regimes and institutions that emphasizes the difficulties of cooperation under anarchy (Krasner 1983, Stein 1983 & 1991; Snidal 1985; Baldwin 1980; Keohane & Nye 1977; Mitrany 1975).

Koremenos, like other scholars in the rational functionalist tradition, approaches international institutions and agreements largely as isolated, or self-contained phenomena. A

² The authors wish to thank Barbara Koremenos for generously providing replication data for several of the variables used in "Contracting Around International Uncertainty" and for discussing her research extensively with us.

countervailing approach, however, expressly calls attention to the politics generated by what have been termed “nested”, “overlapping”, or “parallel” regimes (Aggarwal 1983 & 1985; Raustiala & Victor 2004; Alter & Meunier 2006). The central insight of this perspective is that many issue areas contain a plurality of international regimes and institutions which, in turn, influence states’ decisions about whether to work within these existing agreements, to seek new institutional arrangements, or to alter the scope and functions of existing institutions (Jupille and Snidal 2005). From here it requires only a short conceptual leap to suggest that aspects of the broader institutional context in which institutions arise, or are purposefully transformed, might also influence states’ collective choices regarding the internal features of subsequent agreements.

Institutional context is a broad concept that itself has many possible dimensions and points of variation. Most states are at any given time subject to numerous bilateral or multilateral commitments to other states on a range of issues. The vast majority of international agreements among states are bilateral, although in some issue areas, such as human rights, multilateral treaties are more common. Multilateral commitments may involve multi-faceted (or ‘universal’) arrangements (such as the United Nations), agreements organized around regional blocs, and a variety of issue-specific arrangements.³ The commitments embodied in formal international agreements can also vary along a number of other dimensions, including the specificity or ‘depth’ of obligation, whether obligations are ‘binding’ or ‘non-binding’, whether

³ Examples from the latter category include those with broad membership, such as the World Health Organization and the Geneva Conventions, as well as agreements to manage more defined or geographically specific issues (e.g. managing pollution or fishing rights in internationally shared waterways). While such treaties can easily be multilateral, they may have only a handful of members.

the agreements include provisions for monitoring and enforcement—and, of course, intended duration (Goldstein *et al.* 2002; Downs, Rocke, and Barsoom 1996; Chayes and Chayes 1995).

Another critical dimension of variation in institutional context is the way in which states' past international commitments fit together. Even within a single issue area (*e.g.* international trade), several types of arrangements may be operative at one time—from those purporting to have global or regional reach (*i.e.* the WTO versus NAFTA, EU, or ASEAN) to a host of bilateral and smaller-scale multilateral arrangements. It is, in addition, fairly common for international legal commitments to be embedded in, or to derive from, other more general agreements and/or membership in broader international organizations (IOs). Where treaty commitments take part of their operational structure from more general arrangements, agreements can be described as having a hierarchical (or 'nested') relationship (Alvarez 2005). And finally, international agreements may also reference other agreements in delineating the obligations of prospective members—and their limits.⁴

Our central claim in this paper is that the institutional context generated by *past* instances of international cooperation can be expected to influence the institutional design choices of prospective members of new international agreements. We observe that structural features of decision environments – such as uncertainty over the distribution of gains from cooperation – vary substantially across issue areas, and may also vary over time within a single issue as agreements are added or subtracted from the decision environment. Our primary misgiving with

⁴ For example, the 1996 Trade in Intellectual Property (TRIPs) agreement, negotiated under WTO auspices, states “Nothing in this agreement shall be construed [...] to prevent a Member from taking any action in pursuance of its obligations under the United Nations Charter for the maintenance of international peace and security.”

Koremenos' findings, therefore, concerns the possibility that the correlations she finds between high levels of uncertainty about the distribution of future gains from cooperation (and also risk aversion and expected renegotiation costs) and the duration of international agreements are at least partially the result of a failure to control for relevant aspects of the existing institutional context.⁵ If our instinct is correct, incorporating even a few relevant measures of the institutional context in which individual agreements in Koremenos' sample were negotiated into her empirical analysis should provide grounds for reassessing both the results of that analysis and its causal implications.

Institutional context and the duration of international agreements

Few scholars have focused expressly on how institutional nesting and overlap influence the dynamics of international institution building. Most of these efforts, to date, have been directed toward identifying the conditions under which states attempt to create new institutions, or seek to modify the scope, authority, or functions of existing institutions (Aggarwal 1998; Abbott & Snidal 1998; Helfer 2004; Raustiala & Victor 2004; Jupille & Snidal 2005). We expand this inquiry by asking whether elements of the institutional environment in which international agreements are negotiated might likewise influence the institutional design outcomes Koremenos seeks to explain. We posit that – to the extent the design features of international agreements are chosen to overcome particular barriers to collective action – the institutional context in which states make such choices should tell us something about their

⁵ We also find the inferences Koremenos draws from these results to be overly broad insofar as they do not factor in the rather substantial effects of having sampled only cases involving *successful* attempts to reach agreement. We elaborate this point further below.

beliefs regarding the nature and severity of those underlying problems. More narrowly, we expect that prior cooperative arrangements—whether in the form of a broader ‘umbrella’ international organizations (IOs) or experience with a directly prior specific arrangement on the same issue—will influence states’ choices regarding *ex ante* limitations on the duration of new international agreements.⁶

We identify two key ways in which institutional ‘context’ can play a critical role in shaping states’ preferences over the duration of international treaties. First, contextual factors can reduce states’ concerns about future distributional gains from international cooperation and improve their ability to estimate future renegotiation costs.⁷ The core logic here is that ‘repeat play’ between states in international cooperation generates information relevant to the outcomes Koremenos seeks to explain—namely those concerning choices over *ex ante* limitations on the duration of agreements. In particular, past interactions or negotiations provide information about: (1) how one’s negotiating partners can be expected to deal with the distributional consequences of the external ‘shocks’ that drive Koremenos’ theoretical model and specification

⁶ ‘Umbrella’ IOs are broad, multilateral organizations within which subsidiary organizations and agreements are negotiated and implemented, either by all of the umbrella IO’s members or by subsets of member-states. Examples include the United Nations (UN), International Labor Organization (ILO), and the Organization of American States (OAS).

⁷ Axelrod (1984) for example argues that “repeat play” in international cooperation is likely to mitigate states’ concerns about distributional uncertainty in international agreements.

of uncertainty; and (2) information about the ease of renegotiating international agreements with a given state, or states.⁸

Of course, exactly how information derived from past instances of cooperation affects states' preferences about the duration of prospective international agreements depends critically on its character. If what states learn from prior contracting or joint membership in an umbrella organization causes them to become *more* concerned about distributional issues and/or *more* risk averse, we might expect a shift toward shorter international agreements—or for cooperation to cease altogether. On the other hand, if states receive positive signals through cooperation (about either the distributional consequences of external 'shocks' or the ease of (re)negotiating agreements with current parties), they may be more willing to engage in cooperation of longer duration. In short, while there are good reasons to believe that "repeat" cooperation influences the variables Koremenos identifies as key determinants of the duration of international agreements, the direction of that influence is unclear *ex ante*.

Second, institutional context can also affect a state's degree of 'risk aversion' to international commitments. 'Risk aversion', unlike the distribution of future gains and renegotiation costs, is a function of individual states' expected utilities conditioned on known risks. By generating information about different types of risk in the decision environment, contextual variables can help to widen (or narrow) the range of possible outcomes that meet any given state's threshold for participation in a prospective international treaty.

⁸ Although formally outside the specifications of Koremenos' model, it would not be unreasonable to expect that incorporating contextual variables might also yield information about the frequency and magnitude of 'shocks'—particularly to the extent that their origins have a strategic, or at least a behavioral, component.

Treaty function and the duration of international agreements

Formulating reasonable expectations about when states should opt to incorporate *ex ante* limitations on the duration of international agreements also depends critically on identifying what agreements actually ‘do’ in terms of creating obligations among states. We identify four types of international agreements, all of which are present in Koremenos’ sample of UNTS treaties. The first involves agreements that formally create international organizations. The second (and largest) type articulates international rules and standards,⁹ or clarifies intended terms of interaction between states on specifically defined issues.¹⁰ A third type of agreement spells out the terms of discrete (‘one-shot’) transactions between states.¹¹ A fourth encompasses non-transactional agreements expressly labeled as ‘interim’.

Breaking down the sample in this way raises questions about whether agreements in the latter two categories differ systematically from the first two in their likelihood of containing duration limitations. Indeed, where an agreement’s termination is either expressly tied to the performance of an obligation (*e.g.* the transfer of assets, sale of goods, or provision of technical expertise) or explicitly deemed to be temporary or ‘interim’, the agreement may be best understood as having an inherently ‘finite’ quality. Such agreements, therefore, are by definition unlikely to contain a time-limitation clause, regardless of the negotiating parties’ concerns about

⁹ Examples include the U.N. Convention on the Prevention and Punishment of Genocide and the Biological Weapons Convention.

¹⁰ Agreements on the avoidance of double taxation, exchange rate coordination, the production and pricing of sugar on the world market, and the allocation of liability of damage from environmental pollution are examples of this type.

¹¹ See the hypotheses section below for examples of inherently short-term agreements.

uncertainty, risk aversion, and renegotiation costs. The danger, as we see it, is that not recognizing this distinction may artificially inflate the count of ‘indefinite’ agreements in Koremenos’ UNTS sample.

Uncertainty and institutional design: conceptual issues

Our discussion of Koremenos’ argument in “Contracting Around Uncertainty” has thus far treated her conceptualization of ‘uncertainty’ uncritically. Although our primary criticism of Koremenos’ analysis is its lack of attention to contextual determinants of decisions regarding the design features of international agreements, we also have concerns about her specification and operationalization of uncertainty in international cooperation.

In Koremenos’ model, uncertainty varies according to the likelihood that an exogenously given ‘shock’ will dramatically alter the distribution of future gains from international cooperation. This likelihood may take either a ‘high’ or ‘low’ value. ‘High uncertainty’ agreements are those in which changes in the economic or political environment can “cause the distribution of gains to vary substantially over time,” despite the fact that cooperation is welfare-enhancing in the aggregate (Koremenos 2005: 555). In contrast, where period-to-period changes in the distribution of gains are unlikely, agreements are classified as ‘low uncertainty’. In these situations, Koremenos explains, ‘efficiency concerns’ dominate choices about the inclusion of design features such as duration limits and escape clauses. In terms of the distribution of uncertainty across the substantive issues covered in Koremenos’ data sample, some categories of agreements (monetary, trade, and investment) are classified exclusively as ‘high uncertainty’, while other issue areas (environment, human rights, finance, security) contain a mix of high and low uncertainty agreements (Koremenos 2005:555).

To begin, we are not convinced a single dichotomous variable can adequately capture all theoretically relevant aspects of how ‘uncertainty’ might manifest itself across the range of substantive issue areas Koremenos covers.¹² We raise this issue, while acknowledging that ‘uncertainty’ is a highly abstract concept and, therefore, difficult to describe in terms of measurable indicators (Goertz 2005). More to the point, we worry that Koremenos’ operationalization of uncertainty to some extent masks (or enables) the omitted variable problem identified above. To be clear, we agree that the prospect of future shifts in the distribution of gains from cooperation can be an important dimension of bargaining uncertainty. Nevertheless, to serve on its own as a reasonable measure of ‘uncertainty’, concerns over the future distribution of gains from cooperation would need to dominate states’ decisions about whether to enter into agreements. To the extent this is a dominant issue, however, we would also expect that states have taken this into account when negotiating and designing *prior* international agreements. We submit, therefore, that institutional features of the international environment can mitigate concerns over distributional gains, which are attributed to actors without being derived in Koremenos’ model.¹³

Second, it is not apparent in terms of Koremenos’ theory why agreements in the ‘low uncertainty’ category would ever contain time limitations or escape clauses, since the need for

¹² For example, degrees of susceptibility to external shocks may vary within the category of ‘high uncertainty’ agreements.

¹³ Another way in which this problem might be addressed is to increase the variable’s sensitivity by expanding its scale of measurement. This option, however, would require more detailed information about the criteria by which Koremenos classifies agreements as being primarily about ‘distributional’ or ‘coordination issues.

‘insurance’ against changes in distributional outcomes, by definition, is not a factor. Indeed, if the level of uncertainty depends entirely on the purpose of international cooperation – that is, on whether the international agreement is intended to coordinate national policies, rather than to divide joint gains – we should not observe states seeking to ‘insure’ themselves against future distributional shocks.¹⁴ Once again, we maintain that incorporating contextual variables into the model can help to illuminate such distinctions, and in so doing, create a basis for more extensive theorization of vulnerability to and/or the production of ‘shocks’.

Other critiques of rational design research have pointed to possible shortcomings of excluding information about the broader institutional environment from analysis (Duffield 2003:411; Wendt 2001). However, to our knowledge, no one has yet attempted empirical tests of whether and how such variables affect patterns of international cooperation. In the next sections we elaborate and test a set of hypotheses that incorporate variables intended to capture variation in key aspects of the international institutional environment. This exercise will allow us to identify whether any qualifications, or scope conditions, might be usefully proposed for rational design arguments concerning *ex ante* limitations on the duration of international agreements. Identifying such conditions can also help to improve the explanatory capacity of these models and enhance their predictive power.

Hypotheses: leveraging context

Building on the above discussion of institutional context, we now define a set of four variables, together with hypotheses for how they are likely to behave in Koremenos’ base model.

¹⁴ In Koremenos’ UNTS sample, however, 16 of the 97 ‘finite’ agreements (16.5%) are classified as ‘low uncertainty’ cases of international cooperation.

Individually, each of these variables is intended as an initial probe of one of the ideas discussed in the preceding sections. While these variables are, admittedly, rough measures of ‘institutional context’, they nevertheless provide an initial test of the general proposition that context influences states’ choices about whether to limit the duration of international agreements *ex ante*.

The first variable is the year in which each agreement was concluded (*YEAR*). This variable is a proxy for the overall increase in the extent of international cooperation over the time period covered by Koremenos’ UN treaty sample—1925 to 1986. As the UN Treaty Database from which Koremenos’ dataset is taken shows, this increase over time has led to both widening (an expansion in the number of states involved in international agreements) and deepening (an expansion in the scope and number of issues covered by cooperative agreements) of international cooperation. All else equal, we expect this increase in the density of patterns of international cooperation to be a factor mitigating states’ concerns about uncertainty over future gains from cooperation. Thus, according to the logic of our argument above, *YEAR* should be negatively associated with the probability of a finite agreement. Put simply, we expect the ‘baseline’ level of concern about uncertainty (among all states in the international system) to decline over time as cooperation both widens and deepens to include more states and more issue areas.

Second, we include a dummy variable (*IO*) measuring whether or not a given international agreement was negotiated under the auspices of a larger international organization, such as the United Nations, International Labor Organization (ILO), or the Organization of American States (OAS). Of the 145 agreements in the sample, 31 fit this description. The remaining agreements can be classified as “stand-alone” agreements negotiated outside the framework of an existing IO. All else equal, we expect uncertainty (as well as risk aversion and renegotiation costs) to be lower—and therefore, the probability of a finite agreement to decline—

when international cooperation occurs within the context of an existing international organization. To reiterate, states conducting negotiations within the context of an existing, ‘umbrella’ IO are, all else equal, expected to be less concerned about the factors Koremenos identifies as key determinants of the duration of international agreements. We therefore anticipate a negative coefficient (i.e., a decreased probability of a finite agreement) for the *IO* variable.

The third variable, *FOLLOW_ON*, is likewise a dummy variable that tracks whether a given international agreement ‘follows-on’, supplements, or replaces a previously negotiated agreement between the same group of states. Twenty of the 145 agreements in the sample fit this description. As our discussion above suggests, we do not have clear prior expectations about the effect of this variable on the duration of international agreements. In some cases repeated cooperation between states may indicate reduced levels risk aversion and uncertainty over the distribution of gains from cooperation. Under these conditions ‘follow-on’ agreements can be expected to decrease the probability that the parties will select an agreement of finite duration. In other cases, repeated cooperation may be a function of low renegotiation costs. Where this occurs, states negotiating ‘follow-on’ agreements may be more likely to limit duration, in the expectation that future cooperation and renegotiation will be relatively easy. Thus, while we expect *FOLLOW_ON* to be significantly affect the duration of international agreements, the direct of that influence is unclear *ex ante*.

Finally, we include a fourth variable, *SHORT_TERM*, which is a dummy variable tracking whether an international agreement is ‘inherently’ short-term—that is, whether the very nature of the interstate cooperation at issue mandates the choice of a finite agreement. Inherently short-term agreements (ISTAs) are those in which termination turns on either (1) the

performance of acts desired by the parties, or (2) events external to the agreement that the parties expect to occur in the relatively near term. Examples in the former category include agreements for the sale or transfer of goods, or the production of reports following a commissioned study. Examples of the second category include agreements concluded as extraordinary measures during wars and other emergencies; technical assistance agreements to build independent capacity to carry out the functions that form the substance of the agreement; and interim arrangements pending passage of more comprehensive agreements already under negotiation. In Koremenos' original sample of 145 agreements, 38 fit this description.

Empirical analysis

Replication

We begin our empirical analysis with straightforward replications of Koremenos' basic probit model (Table 2, 558), in which the dependent variable is the probability of a finite international agreement. Model 1 of Table 1 presents the replication results for the probit analysis of the presence of a finite agreement.

[TABLE 1]

As model 1 illustrates, the coefficients vary slightly from those reported by Koremenos. There are two reasons for these differences. First, we undertook a recoding of Koremenos' participant totals due to concerns about the unreliability of UNTS 'participant' lists. These lists often include states that either (1) signed but never ratified the treaty in question, or (2) acceded at a later date.¹⁵ Second, Koremenos tests three different measures of risk aversion. We utilize only

¹⁵ We coded a state as a 'participant' if it ratified the agreement within 6 months of the UNTS signature date. This coding rule is, however, still not ideal since it may exclude states that were

the Bueno de Mesquita (1985) measure based on states' alliance portfolios, since it is the most consistently significant in Koremenos' original analysis.¹⁶ Although our coefficients differ slightly, the substantive results do not. The probability of a finite agreement decreases as renegotiation costs increase (as measured by the number of participants), but increases with the levels of distributional uncertainty and risk aversion. In addition, finite agreements are more likely in the environmental and economic issue areas than in security or human rights.

Institutional context and the duration of international agreements

Having replicated Koremenos' initial result, we now introduce the four additional variables described above. Model 2 in Table 1 presents the probit results using the base model. Koremenos' original results hold: renegotiation costs decrease the probability of a finite agreement, while uncertainty, risk aversion, and environmental/economic issues are all positively associated with finite international agreements. In addition, two of the four institutional context variables are significant. First, *FOLLOW_ON* is significant at the 90% confidence level and *positively* associated with the probability of a finite agreement. Based on our earlier discussion, we interpret his finding as an indicator that the duration of agreements in repeated international cooperation is shorter because the probability of future cooperation is higher; in other words, states that repeatedly cooperate feel less need to lock in distributional gains, since they anticipate future renegotiation costs to be relatively modest and therefore expect to cooperate again in the future with their current negotiating partners. Holding other features constant at their means,

in fact involved in the negotiation process, but which chose not to ratify (or perhaps even sign) the final agreement.

¹⁶ For a detailed description of the BDM measure, see Koremenos 2005: 555.

follow-on agreements are 17.6% more likely to be of finite duration than ‘initial’ agreements between two states.¹⁷ Second, *SHORT_TERM* is also positive and significant and the 99% confidence level. Again, all else equal, ‘inherently’ short-term agreements (ISTAs) are 28.1% more likely to be of finite duration than other types of agreements. A complete table of first differences for all significant variables is presented in Table 2.

[TABLE 2]

Interactive models: the conditional effects of uncertainty

While the probit analysis above reconfirms Koremenos’ original finding that uncertainty, renegotiation costs, and risk aversion influence states’ choices about the duration of international agreements, it also provides strong evidence that the prior institutional context in which international cooperation occurs also shapes these decisions. In this section, we explore the possibility that these two sets of variables may be related in more complex, interactive ways.

We first test whether states’ concerns about uncertainty (as defined by Koremenos) are conditional on renegotiation costs. In both Koremenos’ original models and our extensions above, uncertainty *increases* the probability of a finite agreement, while higher renegotiation costs (as measured by the number of participants) *decrease* the probability of finite agreements. We ask whether these two effects are conditional on each other: that is, are states’ incentives to conclude finite agreements (because of uncertainty about the future distribution of gains from cooperation) conditional on the size of renegotiation costs? The underlying logic here is that uncertainty may indeed influence states’ decisions about the duration of international

¹⁷ First differences calculated holding all other variables constant at their means. Calculations done in Stata using *CLARIFY* (King, Tomz, and Wittenberg 2000).

agreements, but it might do so only when renegotiation costs fall below a certain level, or threshold. Model 3 of Table 1, in which we interact *UNCERTAINTY* and *PARTICIPANTS*, tests this hypothesis. Because the coefficients on interactive terms cannot be readily interpreted from the regression results (Braumoeller 2004; Brambor, et. al. 2005), we test the significance of *UNCERTAINTY*, *PARTICIPANTS*, and their interaction graphically (Figure 1).¹⁸

[FIGURE 1]

The most prominent finding from these results is that they confirm a conditional, interactive relationship between uncertainty and renegotiation costs. As Figure 1 clearly illustrates, uncertainty has a positive and significant effect on the probability of a finite agreement only when the number of states negotiating an agreement (and, therefore, renegotiation costs) is sufficiently low. In contrast, when cooperation is broadly multilateral and renegotiation costs increase, uncertainty has no statistically significant effect on the duration of international agreements. In other words, concerns about renegotiation costs ultimately ‘trump’ concerns about uncertainty over distributional gains in cases involving broad multilateral cooperation (i.e., when the number of states involved in negotiations exceeds ~ 20). Thus, Koremenos’ central claim – that states “contract around uncertainty” when negotiating international agreements – holds true, but only in a limited subset of cases

Having shown that the effects of uncertainty are conditional on the magnitude of renegotiation costs, we next test whether the effect of renegotiation costs is itself conditional on the institutional context in which a given international agreement is negotiated. The logic here is

¹⁸ Interaction charts calculated using the Stata modules developed by Bear Braumoeller (<http://www.people.fas.harvard.edu/~bfbraum/interactgraphstata.do>) and Brambor, et. al. (<http://homepages.nyu.edu/~mrg217/interaction.html#code>).

straightforward: states' concerns about renegotiation costs should be less serious when cooperation occurs under the auspices of a larger IO, since states have already surmounted the initial barrier to cooperation – namely, selecting and assembling the relevant group of states and the forum for negotiations. Thus, while the cost of 'hammering out' an agreement among a group of states remains, the forum for launching negotiations already exists. We therefore expect IO 'sponsorship' of an international agreement to mitigate states' concerns about renegotiation costs. All else equal, the negative effect of *PARTICIPANTS* on the probability of a finite agreement should be greater in cases where the agreement is *not* negotiated under the auspices of a larger IO.

Model 4 in Table 1 provides the results of this analysis, and Figure 2 provides the substantive, graphical interpretation.

[FIGURE 2]

Once again, the results confirm our expectations. Renegotiation costs, as measured by the number of participants in international negotiations, only have a negative effect on the probability of a finite agreement in the absence of IO sponsorship. In contrast, when an international agreement is negotiated under the auspices of a larger IO, renegotiation costs have no statistically significant effect on the duration of the agreement. This suggests strongly that states' concerns about renegotiation costs are contingent on the institutional context in which international cooperation occurs.

Taken together, these two findings suggest a complex interactive relationship between uncertainty, renegotiation costs, and the institutional context. Moreover, the pair of two-way interactions presented in Figures 1 and 2 together necessarily implies a third (or "tacit") interaction between IO sponsorship and uncertainty (Brambor, Clark, and Golder 2005).

Consequently, we conclude our interactive tests with an additional model, in which we explicitly model the three-way interaction between *UNCERTAINTY*, *PARTICIPANTS*, and *IO*. Model 5 in Table 1 presents the results, while Figure 3 presents the substantive and graphical interpretation.

[FIGURE 3]

As Figure 3 illustrates, the effect of uncertainty on the probability that states choose a finite international agreement is conditional on both renegotiation costs and IO sponsorship. Indeed, Figure 3 shows that uncertainty increases the probability of finite agreements – as claimed by Koremenos – only under limited circumstances. First, uncertainty increases the probability of finite international cooperation in cases of bilateral negotiations that aren't under an IO 'umbrella' (i.e., cases in which the log of the number of participants is less than 1). Second, uncertainty also increases the probability of a finite agreement in cases of multilateral international cooperation under IO sponsorship; however, as Figure 3 illustrates, this effect loses significance as the number of participants increases (i.e., once $N > \sim 20$).

Table 3 provides further insight into the magnitude of these conditional effects. It presents predicted probabilities of finite agreements under a variety of different scenarios, based on variation in IO sponsorship, levels of uncertainty, and the number of participants in international negotiations.

[TABLE 3]

As the table makes clear, uncertainty over future distributional gains, as defined by Koremenos, does indeed influence the duration of international agreements. However, it does so only under certain conditions. Its effects are, moreover, conditional upon other variables – namely, the magnitude of renegotiation costs and the existing institutional context in which international cooperation occurs in a given case. In most cases of broad multilateral cooperation, where the

number of states involved is large (50 or more), uncertainty has no statistically significant effect on states' choices about the duration of international agreements.

Addressing the possibility of selection effects

Thus far, our empirical analysis has tested and found support for two claims. First, the institutional context in which international cooperation takes place influences states' choices about the duration of international agreements. And second, the effects of uncertainty, renegotiation costs, and the institutional context are conditional and interactive. In this section, we explore the selection effect and data transformation issue identified above.

In her article, Koremenos predicts that “if states choose to conclude a series of renegotiated agreements, increases in renegotiation costs will lead them to choose agreements with longer intended durations,” while “increases in uncertainty and increases in relative risk aversion will lead states to choose agreements with a shorter duration” (559). She argues that we cannot test these hypotheses about the duration of finite agreements by focusing only on the sample of finite agreements, because of the problem of selection bias (559): since finite agreements might differ systematically from indefinite agreements in accordance with the explanatory variables, focusing only on the subsample of finite agreements might lead to biased conclusions about the effects of uncertainty, risk aversion, and renegotiation costs on states' choices about patterns of international cooperation. In order to address this problem, Koremenos transforms the data by coding “infinite” agreements as longer finite agreements.¹⁹ She then uses Tobit regression to test for the impact her chosen independent variables on the

¹⁹ In the empirical results presented in Koremenos 2005, “infinite” agreements are coded as having a duration of 100 years.

duration of finite agreements, with the full sample (both finite and “indefinite” agreements) now recoded as finite agreements.

Our concern with this approach is that, in attempting to address one selection issue, Koremenos arguably creates another, more serious problem with implications for the inferences she draws from her theory. While Koremenos’ data transformation enables her to avoid selecting on the dependent variable (i.e., by only including finite agreements in the sample), it does so only by conflating the decision to choose a finite agreement over an “indefinite” one with the separate (and subsequent) choice about the duration of the finite agreement. As Koremenos acknowledges in her theoretical discussion, these two choices are distinct. The empirical specification of a Tobit model on the full treaty sample of both finite and “infinite” agreements does not, however, retain this distinction. Thus, we remain concerned about the possibility of selection bias in Koremenos’ original results.

To test whether selection bias remains, and, if so, whether it affects Koremenos’ findings, we employ an alternative strategy: propensity score matching. The matching process controls for the possibility that factors influencing selection into the sample of finite international agreements may not be exogenous to our explanatory variables. More concretely, the same variables that explain whether or not states choose a finite international agreement rather than an indefinite one also may explain states’ subsequent decisions about the duration of a finite agreement. A common statistical method of addressing selection bias is the Heckman selection model (Heckman 1979). This method has been widely used in the political science literature (Berinsky 1999, Vreeland 2003, Von Stein 2005). Recent studies, however, have highlighted a number of significant weaknesses of these models, including their sensitivity to specification and strong reliance on distributional assumptions about the model’s residuals (Simmons and Hopkins 2005,

Sartori 2003, Winship and Mare 1992). Most importantly, the Heckman model requires that at least one ‘extra’ explanatory variable influences selection but not the subsequent outcome of interest in the second stage of the model; if this “exclusion restriction” is not met, then the model is identified solely on its distributional assumptions (Achen 1986). Ideally, one could identify the exclusion restriction(s) from theory. In our analysis and Koremenos’ original models, however, it is not clear which variables influence selection (i.e., whether states choose an indefinite agreement or not) but not subsequent decisions about duration within the subsample of finite agreements. Thus, we are left with a difficult choice when using the Heckman model: risk specification error by including potentially inappropriate exclusion restrictions, or rely exclusively on the model’s distributional assumptions (Sartori 2003).

The key advantage of matching estimators is that they do not require the identification of exclusion restrictions, nor do they depend on modeling and distributional assumptions (Simmons and Hopkins 2005). Rather, matching allows the analyst to “preprocess” available data to minimize selection effects. Thereafter, standard single-stage regression analyses can be conducted (Ho, et. al. 2007). The idea behind propensity score matching is to match each “treated” observation (in this case, each observation of a finite agreement) with a “control” observation (i.e., an observation of an indefinite agreement) for which all the values of the explanatory variables are as close to identical as possible.²⁰ For each observation, this process generates a “propensity score” (*PSCORE*) ranging from 0 to 1, which measures the predicted

²⁰ This strategy is known as “nearest neighbor” or “one-to-one” propensity matching. Other matching methods are also available, although the results presented here do not vary based on the choice of matching estimators. Matching was done using the PSMATCH2 add-on module for Stata (Leuven and Sianesi 2003).

probability that a given treaty will fall into the sample of finite agreements, given the observed values of the explanatory variables. Including *PSCORE* in subsequent regressions testing the duration of finite agreements controls for potential selection bias in the data without requiring us to identify exclusion restrictions or to make the strong modeling assumptions required of Heckman-type selection models.

To address this possibility of selection bias, we follow a strategy of one-to-one (nearest neighbor) propensity score matching using all of the explanatory variables. We also utilize a “common support” strategy, which seeks to maximize the accuracy of matching by dropping treatment observations whose propensity score is higher than the maximum or less than the minimum of the control sample. Since the propensity matching estimation utilizes a probit model, the raw results of the matching estimation mirror those of model 2 in Table 1. Of greater interest, however, is the post-estimation comparison of bias in the unmatched and matched samples, which is presented in Table 4.

[TABLE 4]

As these results indicate, the matching process effectively controls for the possibility of selection bias. Our sample is now ‘balanced,’ with no systematic differences in the treated and untreated samples.

We now move on to estimate the duration of agreements within the sample of finite treaties, with the primary difference being the inclusion of the propensity score (*PSCORE*) parameter for each observation (i.e., the predicted probabilities from the matching estimation equation). Having calculated and included the propensity score, however, we also no longer need to employ a Tobit model, since our data are no longer artificially “right censored.” Rather, we can select exclusively on finite agreements and run a regular OLS regression on the (log)

duration, in years, of the finite treaties, without artificially transforming and including the “indefinite” agreements in the finite sample. The results are presented in Table 5.

[TABLE 5]

The findings here are striking. Within the sample of finite agreements, the variables upon which Koremenos’ argument rests are no longer significant. Thus, while uncertainty over future gains, renegotiation costs, and risk aversion appear to influence the *choice* of a finite vs. “indefinite” agreement, they do not significantly affect decisions about the *duration* of finite agreements once the decision to make an agreement finite has been made. Several other interesting findings also emerge from Table 5. First, the non-security issue-area dummies in Koremenos’ original model are significant, but they are now *positively* rather than negatively signed. Second, the *Year* variable is also positive and significant, suggesting that, in general, international agreements have increased in length over time. This result provides further support for the logic that ‘repeat play’ and/or increases in the sheer density of international cooperation over time have lengthened states’ time horizons when negotiating international agreements. Third, follow-on finite agreements are shorter in length. As with our findings in Table 1, this suggests that states which engage in frequent, repeated cooperation will be more likely to enter into finite agreements. Those agreements, moreover, tend to be of shorter duration, since the prospects for future cooperation and renegotiation are high. Finally, “inherently” short-term agreements (ISTAs) are longer in duration than other finite agreements. Although we did not have strong priors in either direction about the relationship between *SHORT_TERM* and duration within the sample of finite agreements, this result is not surprising. Indeed, states negotiating finite agreements that are, by definition, inherently short-term should see no reason to shorten their duration because of uncertainty and/or risk aversion.

While our treatment of selection bias raises some doubts about Koremenos' findings, it does not address a deeper, underlying selection problem in both our analysis and Koremenos': the fact that the UNTS data allow us only to examine existing treaties – i.e., those in which negotiating parties succeeded in reaching agreement. This focus selects out failed proposals for agreements that may have been salvageable under a different set of design choices. It likewise excludes instances where prospective gains from cooperation among states may have been possible in a hypothetical world, but were never proposed due to factors exogenous to both sets of models. And finally, our extension of Koremenos' analysis is likewise incomplete insofar as it contains no information about non-'ISTA' finite agreements that are not renewed once their terms have expired. Because an unknown number of these agreements may have dropped out of the sample (*i.e.* by failing to be extended) due to negative feedback on the explanatory variables highlighted in Koremenos' analysis, caution should be exercised in evaluating these results in the absence of such information. In short, when drawing inferences from analyses of these data, it is important to remember that the ultimate response to generalized cooperation-based uncertainties, high levels of anticipated renegotiation costs, and risk-aversion is not to conclude (or attempt) a formal international agreement at all (Lipson 1991, Abbott and Snidal 2000).

The hypotheses elaborated and tested here are, consequently, limited to certain effects of institutional 'nesting'. The underlying logic posits that where conditions are such that repeated cooperation is attempted, institutional context—whether in the form of membership in an umbrella IO, or follow-on contracting among governments—reduces uncertainty in ways that influence *ex ante* choices about the duration of international treaties. This exercise, however, merely scratches the surface of what is possible in exploring the influence of prior institutional context on *ex ante* duration clauses and other design characteristics of international institutions.

More elaborate models of institutional context that substitute our simple dummy variables either with issue-specific measures of treaty density (i.e., the number of treaties and/or IOs currently in operation within a given issue area), or with variables that track individual country membership within various clusters of agreements, will undoubtedly reveal instances of overlap and redundancy. It is, however, not unrealistic to anticipate that treaty overlap may in some circumstances *generate*, rather than alleviate, uncertainty surrounding international treaty commitments—and may be used strategically as such. For example, where agreements overlap in terms of membership or performance obligations, it may give rise to opportunities for ‘forum shopping’, requests for exception based upon conflicting imperatives, and other attempts by states and private actors to use environmental complexity to their advantage (Raustiala & Victor 2003; Helfer 2004; Jupille & Snidal 2005).

Institutional design and international cooperation: the path forward

The empirical results presented in this paper provide considerable support for our contention that institutional context ‘matters’ in explaining states’ choices about the design of international agreements. More narrowly, these results demonstrate that controlling for existing features of the international environment can sharpen our understanding of the ways and extent to which anticipated renegotiation costs, levels of risk aversion, and states’ uncertainty over the future distribution of gains from cooperation affect the likelihood that an agreement will contain an *ex ante* duration limit. The variables we introduce to probe the effects of introducing institutional context into rational design analysis are, admittedly, rather rudimentary. Their strong performance in Koremenos’ original model, in our subsequent interactive models, and also in the matching exercise, therefore, suggests much more might be learned through additional

elaboration and testing. Indeed, we fully expect that if work in this direction is undertaken, it will reveal a need for as yet unspecified qualifications on our findings reported here.

Our principal recommendation for future research on accounting for the incidence of this design feature, and for ‘rational design’ analysis more generally, is, therefore, to develop and test additional and/or more fine-grained measures of institutional context. As we have shown already, incorporating contextual variables into rational design models offers a way to refine measures of ‘uncertainty’ already identified as important by helping to (selectively) endogenize determinants of their operation and variance. This approach can also bring into focus additional dimensions of uncertainty that, in turn, can be leveraged for the elaboration and testing of rational design theories. We discuss briefly two directions such research might take.

The first direction concerns development of a clearer understanding of which aspects of international cooperation vary according to issue area. Koremenos’ sampling strategy suggests that she believes (as do we) that some characteristics of international agreements vary systematically across issue areas. However, identifying those characteristics – and understanding how and why they vary across cases – will almost certainly require more rigorous attention to decision environments. The literature on institutional nesting and overlap and on the politics of regime complexes provides some theoretical signposts for where to start (Aggarwal 1998; Raustiala & Victor 2004; Alter & Meunier 2006). In our analysis above, we track variation in purely structural attributes of the institutional context, and also in the functional tasks underlying international agreements. To extend this analysis, one could, for example, replace or supplement our simple dummy variables indicating whether negotiation occurred under the auspices of an ‘umbrella’ IO with an issue-specific measure (scaled or continuous) of

institutional density over time as agreements are added or subtracted.²¹ Additional sensitivity could be achieved by weighting this measure according to membership totals and degrees of overlap between the various agreements or institutions. Interacting agreement type with issue-specific measures of institutional density would likewise allow analysts to explore the incidence—and hypothesize about the utility—of particular design features, including *ex ante* duration limitations and escape clauses, across various settings. Finally, further attention to the specific goals of international agreements – that is, more clearly delineating whether prospective agreements are intended to create new international organizations, clarify expectations for policy coordination, formalize commitments to aspirational norms, or to specify the terms of one-shot transactions – might, also help to illuminate the politics of states’ decisions to form, or transform, international agreements (Jupille & Snidal 2005).

A second direction in which exploration of contextual variables might be productively extended is more ‘behavioral’. This would entail expanding the body of statistical data on international agreements to include not only participant totals, but also the identity of participants. Neither Koremenos’ model, nor our extensions here, contain much information in this regard.²² However, to the extent competition among states in the international system may

²¹ Exploration of model sensitivity to different definitions of what constitutes an ‘issue area’, and therefore which agreements should be grouped together for these purposes, may be quite challenging for some types agreements (*e.g.* those concerning labor rights), but would be relatively straightforward for others (*e.g.* species protection).

²² One exception is a dummy variable intended to track the effects of superpower participation, which fails to attain statistical significance in Koremenos’ empirical tests and in robustness checks of our present analysis.

take on different forms and/or levels of urgency depending on the states involved, tracking which states are members of which agreements is important. Once the identity of participants has been added, this information can be used to identify patterns of interactions among specific states within and across issue areas. It will also facilitate incorporation of additional data about unit-level attributes that may enable helpful synergies between rational design studies and other international relations research. We offer two examples.

First, greater focus on unit-level characteristics would permit future research to incorporate the concept of *reputation* into research on the design of international agreements. In both Koremenos' model and our analysis, all parties to agreements are assumed to follow through on their commitments; consequently, all states have identical 'reputations.'²³ In our extension we test whether repeated (or 'follow-on') cooperation is related to a preference for, or against, *ex ante* limitations on duration. This measure, among its other shortcomings, is limited to interactions on single agreements. It might be the case that negotiating behavior depends not only on states' direct prior experience within issue areas, but also more generally on their experiences with cooperation (or its failures) within issue areas, however broadly or narrowly defined—or even on non-issue-specific past encounters with the same negotiating partner(s) in the international arena. A growing body of literature in international relations offers insights into the ways that states' reputations may influence international interactions (e.g., Tomz 2007, Walter 2006; Downs & Jones 2002; Simmons 2000; Mercer 1996; Chayes & Chayes 1995; Keohane 1984). This work suggests prior patterns of direct interactions or observed behavior

²³ This approach implicitly brackets a common focus in the institutional literature, namely problems associated with identification and punishment of cheating (Stein 1982; Keohane & Martin 1995).

within particular issue areas should, at a minimum, factor into states' levels of risk aversion anticipated renegotiation costs, but could also condition other aspects of 'uncertainty'. Ultimately, such variables might also be usefully interacted with information about other characteristics of agreements mentioned above; for example, measures of 'precision' and 'obligation' among existing agreements, or with respect to the types of dispute resolution mechanisms they contain.

A second way in which attention to unit-level characteristics can enhance rational design analyses is by allowing for the introduction of information about *power differentials* among prospective parties to agreements. To the extent international agreements can be viewed as solutions to coordination problems with multiple equilibria, it may not be possible to explain how any given equilibrium was arrived at without some information about the actors involved and their respective preferences (Moe 2006; Duffield 2003:416; Krasner 1991). Information about the institutional context in which choices about the design features of specific institutions are made can, in turn, add texture and explanatory weight to the beliefs, preferences, and strategies ascribed to actors involved.

In sum, rational design research, with its objective of explaining why international agreements take the forms they do, offers a multifaceted framework by which to explore the evolution of international cooperation. We have argued that incorporating variables intended to capture aspects of the existing institutional context in which choices over prospective rules and institutional forms are made can extend the foundational work of Koremenos, Lipson, Snidal, *et al.* (2001). Although we recognize the effort needed to develop and code many of the variables and measures we have proposed would be far from trivial, we also anticipate substantial payoffs in terms of additional avenues of analysis that would open up as a result of this new data.

Conclusion

Barbara Koremenos' work in "Contracting Around Uncertainty" represents a significant theoretical and empirical contribution to the international relations literature on international institutions and cooperation. It advances a provocative theory of international cooperation and contributes a rich new dataset of broad interest to scholars of international institutions and international law. In this paper, we offer what we intend as a constructive rejoinder in the interest of building on the many strengths of Koremenos' work, and furthering our collective understanding of the politics of institutional design. More narrowly, our goal has been to bring insights and approaches from the rational design literature into contact with research on the politics of institutional nesting and overlap in the hope that both may benefit. To this end, we have sought to identify and test more clearly the conditions under which Koremenos' argument applies 'as is', and those where our elaboration suggests the need for qualifications. Our results suggest that the degree to which uncertainty over distributional gains from cooperation, renegotiation costs, and risk aversion matter for states' choices about institutional design depends critically on the institutional context in which international negotiations take place. Our results demonstrate further that the relationship between these variables, and the institutional context in which international cooperation occurs is complex, dynamic, and interactive.

In directly addressing Koremenos' work, this analysis has focused mainly on *ex ante* limitations on the duration of international agreements. Its logic, however, is generalizable to a wide range of other institutional design questions, including those concerned with dispute resolution provisions, voting rules, and membership criteria (Koremenos 2007; Guzman 2002; Pollack 2003; Schimmelpfennig 2003). Indeed, we conjecture that for virtually any empirical study in which the outcome of interest is a legal rule or regime, incorporating relevant aspects of

prior institutional context will yield more nuanced, and more robust, findings. Adopting the approach described here can likewise facilitate bridging the divide between functionalist models of institutions and institutional change, and accounts that emphasize the contingent and path dependent character of such processes (Pierson 2000).

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Table 1 – Probit Regression Results*Dependent variable: Probability of a finite agreement*

Variable	1	2	3	4	5
Renegotiation costs (PARTICIPANTS)	-0.4751*** [0.1427]	-0.5510*** [0.2124]	-0.3984 [0.2542]	-1.2885*** [0.4142]	-2.922 [2.1635]
UNCERTAINTY	1.1735*** [0.2793]	1.3129*** [0.3081]	1.7509*** [0.5452]	1.5912*** [0.3503]	0.5072 [1.6582]
BDM risk aversion (BDMRISK)	0.6331** [0.2728]	0.6116** [0.2904]	0.6195** [0.2981]	0.6187** [0.3014]	0.5889* [0.3049]
Human rights agreement (HR)	0.8203 [0.5031]	0.9085 [0.5800]	1.0032* [0.5839]	1.4855** [0.6877]	1.5977** [0.7099]
Environmental agreement (ENV)	0.9619** [0.4491]	1.0870** [0.4905]	1.2858** [0.5350]	1.6726*** [0.5876]	2.0115*** [0.6606]
Economic agreement (EC)	1.0696*** [0.3773]	1.0907*** [0.4214]	1.1739*** [0.4320]	1.1785*** [0.4464]	1.3607*** [0.4641]
YEAR		0.0035 [0.0116]	0.0032 [0.0117]	0.0009 [0.0119]	-0.0059 [0.0130]
IO sponsorship (IO)		0.5801 [0.5669]	0.5589 [0.5542]	-2.1076* [1.1339]	-7.0928** [3.2917]
Follow-on agreement (FOLLOW_ON)		0.7070* [0.4230]	0.7479* [0.4229]	0.8045* [0.4686]	1.1777** [0.5377]
Inherently short-term agreement (SHORT_TERM)		1.0797*** [0.3920]	1.1549*** [0.4101]	1.1546*** [0.4019]	1.1658*** [0.4192]
PARTICIPANTS*UNCERTAINTY			-0.2709 [0.2695]		1.5901 [2.1567]
PARTICIPANTS*IO				1.3491** [0.5352]	4.0771* [2.3505]
IO*UNCERTAINTY					6.0815* [3.4903]
PARTICIPANTS*IO*UNCERTAINTY					-3.1541 [2.4002]
Constant	-0.6384 [0.4215]	-7.9222 [22.9188]	-7.6934 [23.0501]	-2.7222 [23.4140]	11.6908 [25.9837]
<i>Observations</i>	145	144	144	144	144
<i>Pseudo-R-squared</i>	0.318	0.382	0.388	0.421	0.446
<i>Adjusted R-squared (McFadden's)</i>	0.242	0.262	0.257	0.290	0.283
<i>Log-likelihood</i>	-63.273	-56.624	-56.124	-53.082	-50.756

Standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 2 – First Differences (Model 2, Table 1)*

Predicted probability of a finite agreement, all variables at means: 72.70%

Variable	Change in predicted probability
Follow-on agreement (0 to 1)	17.58%
Inherently short-term agreement (0 to 1)	28.10%
Renegotiation costs/number of participants	-23.43%
Risk aversion	18.07%
Environmental issue	25.64%
Human rights issue	21.12%
Economic issue	33.87%
Uncertainty (0 to 1)	45.50%

*One standard deviation (or equivalent) change, other variables held constant at means

Table 3 – Predicted Probabilities of a Finite Agreement Under Different Scenarios

IO sponsor?	Number of Participants	Low Uncertainty	High Uncertainty	Change in Probability (Low to High Uncertainty)
No	2	48.2%	93.1%	44.9%*
	5	11.3%	62.9%	51.6%
	20	9.7%	13.7%	4.0%
	50	9.6%	5.0%	-4.6%
	100	7.3%	0.9%	-6.4%
Yes	2	3.9%	80.5%	76.6%*
	5	4.3%	75.2%	70.9%*
	20	9.5%	58.8%	49.3%*
	50	30.8%	45.9%	15.1%
	100	55.4%	37.8%	-17.6%

*Statistically significant from zero at 95% confidence level

Table 4 – Selection Bias in the UN Treaty Sample Before and After Propensity Matching

Treated = Finite agreements

Control = Indefinite agreements

Variable	Sample	Mean		%bias	%reduct bias	t-test	
		Treated	Control			t	p> t
PARTICIPANTS	Unmatched	.98454	2.0126	-92.0		-5.68	0.000
	Matched	1.2243	1.1978	2.4	97.4	0.13	0.894
UNCERTAINTY	Unmatched	.83333	.375	105.2		6.23	0.000
	Matched	.69388	.77551	-18.7	82.2	-0.91	0.365
BDMRISK	Unmatched	.32254	.21588	22.0		1.23	0.220
	Matched	.14914	.0644	17.5	20.6	0.92	0.360
HR	Unmatched	.125	.25	-32.2		-1.91	0.058
	Matched	.16327	.16327	0.0	100.0	-0.00	1.000
ENV	Unmatched	.15625	.20833	-13.4		-0.77	0.440
	Matched	.18367	.06122	31.5	-135.1	1.86	0.066
EC	Unmatched	.60417	.27083	70.8		3.95	0.000
	Matched	.42857	.5102	-17.3	75.5	-0.80	0.423
YEAR	Unmatched	1968.5	1966.8	13.7		0.78	0.438
	Matched	1967.4	1965.8	12.3	10.2	0.65	0.517
IO	Unmatched	.125	.39583	-64.3		-3.89	0.000
	Matched	.22449	.14286	19.4	69.9	1.04	0.302
FOLLOW_ON	Unmatched	.16667	.08333	25.2		1.36	0.175
	Matched	.20408	.16327	12.4	51.0	0.52	0.606
SHORT_TERM	Unmatched	.36458	.0625	78.8		4.07	0.000
	Matched	.18367	.2449	-16.0	79.7	-0.73	0.465

Table 5 – OLS regression results, duration of finite agreements

Dependent variable: (log) number of years

Variable	
Renegotiation costs (PARTICIPANTS)	-0.3524 [0.4657]
UNCERTAINTY	1.2275 [0.8880]
BDM risk aversion (BDMRISK)	0.2212 [0.4192]
Human rights agreement (HR)	1.3884* [0.8188]
Environmental agreement (ENV)	1.4209* [0.8438]
Economic agreement (EC)	1.5647* [0.8111]
YEAR	0.0234** [0.0104]
IO sponsorship (IO)	0.9082 [0.9135]
Follow-on agreement (FOLLOW_ON)	-1.0779* [0.6371]
Inherently short-term agreement (SHORT_TERM)	1.4162** [0.5742]
Propensity score	-3.0486 [2.2160]
Constant	-44.2483** [20.3931]
<i>Observations</i>	61
<i>R-squared</i>	0.374
<i>Adjusted R-squared</i>	0.233
<i>Log-likelihood</i>	-64.457

Standard errors in brackets

** significant at 10%; ** significant at 5%; *** significant at 1%*

Figure 1 – Effect of Uncertainty at Different Levels of Renegotiation Costs

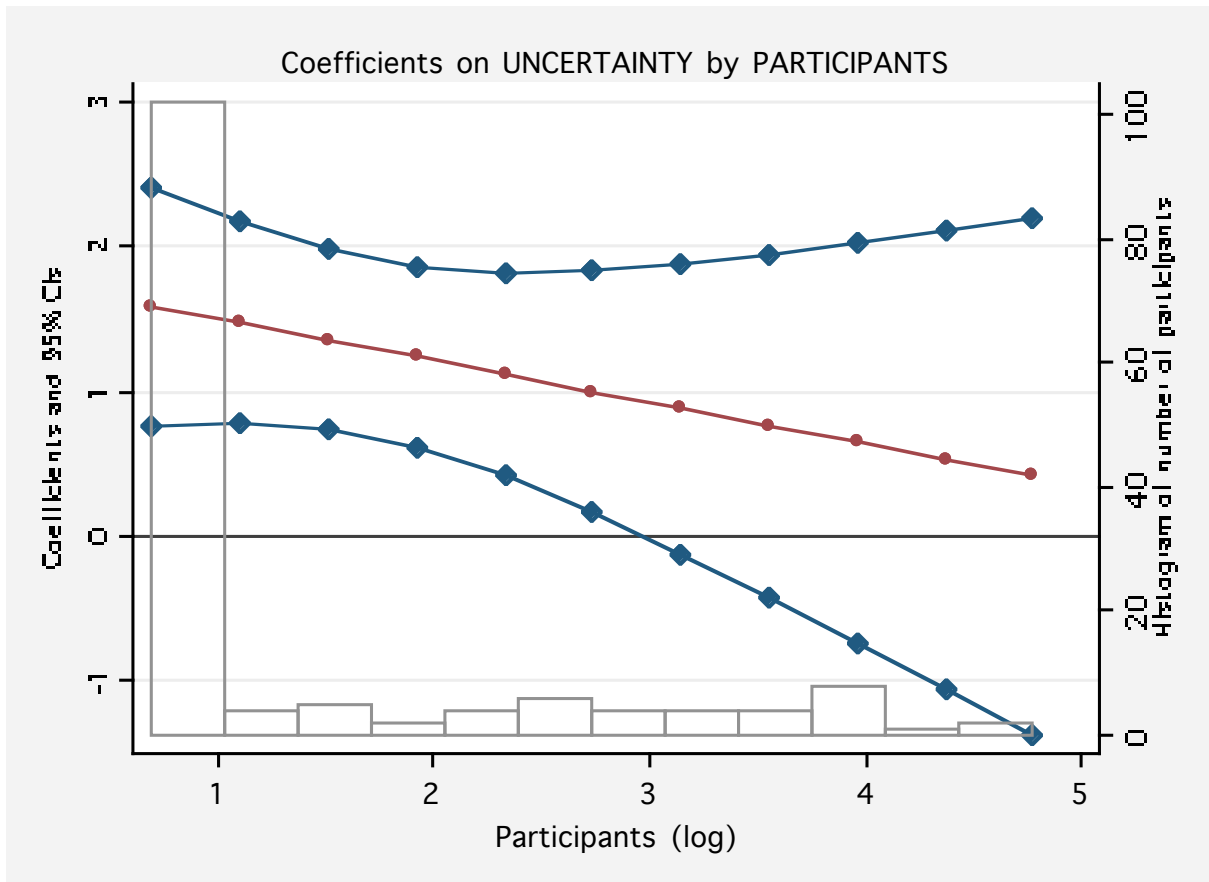


Figure 2 – Effect of Renegotiation Costs (PARTICIPANTS) by IO Sponsorship



Figure 3 – Effect of Uncertainty by Renegotiation Costs and IO Sponsorship

