

The Effectiveness of Negotiations over International River Claims

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Abstract: Rising demands for fresh water in already water-scarce areas have created a common perception that "water wars" are going to occur frequently in coming years, although evidence suggests that water is at least as important a source of cooperation as of conflict. This paper follows up on recent research suggesting that river disagreements are more likely to lead to both militarized conflict and peaceful negotiations when water demands and water scarcity are greatest, but that river treaties have generally prevented militarization while increasing negotiations. Here we examine the effectiveness of these negotiations, in order to determine whether these factors that promote negotiation onset tend to lead to successful negotiations (as seems plausible for river treaties) or whether the negotiations that result more typically end in failure (as seems plausible for negotiations prompted by armed conflict). Empirical analysis suggests that river negotiations are most likely to succeed when demands for water are greater, when they concern a current rather than future problem, and when the adversaries share closer overall relations, but less likely when there is a recent history of failed negotiations over the same river and when water scarcity is more acute.

Shared rivers have an important influence on relations between neighboring states. Neighbors' interactions over shared rivers range from the creation of river treaties or institutions to armed conflict over the use of the rivers. In order to improve the management of international rivers, we believe it is crucial to understand how these interactions can be pushed in a more cooperative direction, particularly where interactions over a shared river have already led states to the point of diplomatic disagreement. If nothing is done to manage or resolve such disagreements, the relationship could quickly begin a spiral of increasing conflict and decreasing cooperation, leaving each riparian worse off than they had been before the disagreement began. If such disagreements can be managed and then resolved, though, agreement over the use of the river can lead to mutual benefits for each riparian.

In several recent papers we have begun to investigate the conditions under which states that share rivers are most likely to begin disagreements over the rivers, and to attempt to manage these disagreements through both militarized conflict and peaceful negotiations. The present paper follows up on these earlier works by investigating the conditions that influence the *success* of such peaceful negotiations over river disagreements, as measured by the ability to reach agreement over the substantive issue being negotiated. This should allow us to make an important contribution to the emerging literature on the management of water and other shared resources, as well as benefiting the study of international negotiations and peaceful conflict management by examining the outcome of negotiations over a highly contentious issue that many predict to be an important source of future conflict.

We begin by presenting a simple model of interaction over rivers that emphasizes characteristics of the river as obstacles to successful agreement and considers ways that the riparians or third parties can help to overcome these obstacles. Empirical analysis suggests that

negotiations are most likely to be successful when the river in question is highly salient or if there is a generally cooperative relationship between the two states. On the other hand, negotiations are less likely to succeed at reaching agreement when the negotiation is over future rather than current concerns, or when negotiations over the river have recently failed. We conclude by discussing some of the implications of these results.

International River Negotiations: A Theoretical Framework

States can be understood as rational egoists that pursue their own interests in an anarchic state system. In such a system, states often find their interests colliding with those of other states over contentious issues (Diehl 1992; Hensel et al. 2008), creating the opportunity for both conflictual and cooperative interactions as the states seek to resolve the matter. Traditional realist scholars (e.g. Morgenthau 1948; Waltz 1979) argue that cooperation is only desirable as long as it does not threaten a state's primary interests and that conflictual behavior is more typical in the international system. Other scholars suggest that states are likely to cooperate, though, when they expect to gain more from joint action than unilateral action or they seek to prevent a pending threat from leading to a costly conflict (e.g. Stein 1989; Zartman 1989; Keohane and Ostrom 1994; Keohane 2002). We draw on implications from general research on negotiations and bargaining (e.g. Fearon 1995, 1998; Morrow 1994; Oye 1985; Snidal 1985) to examine international negotiations over shared rivers, seeking to gain insights that might improve river management as well as provide more general lessons for international interactions.

Transboundary rivers, along with other natural resources, are receiving an increasing amount of scholarly attention. While the traditional focus has been on the conflict-inducing effects of shared rivers and the potential for "water wars" (e.g. Gleick 2008; Irani 1991), greater

effort is now being devoted to explaining cooperation in the management of shared water resources (e.g. Brochmann and Hensel 2009; Tir and Ackerman 2009). Although there appears to be an emerging consensus that cooperation outweighs conflict in international river basins, both do occur, and are often closely intertwined (Dinar 2008). When a disagreement over shared waters occurs, it can evolve in both conflictual and cooperative directions. In previous research we have investigated when these disagreements are most likely to emerge, as well as when they are most likely to lead to armed conflict or peaceful negotiations. Here we focus on the next step and ask what accounts for the success or failure of such negotiations to produce agreements over the disputed use of the river.

We start with a simple conceptual model of interaction between two states that share an international river.¹ Each riparian state may choose to take advantage of the river's water resources for such purposes as human consumption, industry, irrigation, and damming for hydroelectric power generation. The mere sharing of a river makes states' interests interdependent, though, because a finite amount of water traverses any given river system. Although water is considered a renewable resource, water reserves can be depleted if overused (as has happened most notably with the Aral Sea), and the quality of water can be degraded through misuse. Any action taken on the river by one state thus has the potential to create externalities that might harm the interests of the other state(s) in the basin (Barrett 2003), perhaps reducing the quantity or quality of the water that is then available to the other state or limiting the other state's ability to navigate the river.

If the affected state believes that the first state's actions are having such an effect (or will have this effect in the future), it may respond by making explicit demands that the state causing

¹ Although we focus on bilateral relations here, many rivers are shared by several states, which complicates river management even further. Indeed, according to Elhance (2000), the complexity of hydrogeopolitics makes it one of the most challenging arenas of international interaction in some regions of the world.

the harm stop or modify its actions in such a way as to protect the affected state's interests. If such demands are made, the two sides may choose from any number of actions to address the demands: the state causing the harm may decide to comply with the demands, the two states may attempt to settle the issue peacefully (whether through bilateral negotiations, talks with non-binding third party assistance, or submission of the issue to a binding third party judgment), or either state may threaten or use military force to support its position.

In previous research, this simple model has guided studies of the onset of both militarized conflict and negotiations over rivers. But what accounts for the success or failure of negotiations once begun? We suggest that characteristics of the river and of the riparians' specific disagreement over its use pose important obstacles to successful agreement, but characteristics or actions of the riparians or third parties may help to overcome these obstacles. We now elaborate on this general argument and suggest specific hypotheses to be tested.

Obstacles to Agreement

Research modeling international cooperation has identified a number of obstacles to successfully reaching or carrying out agreements. For example, Fearon (1995) notes that there is always some agreement that both sides would prefer to full-scale war over an issue, but that such peaceful agreement can be difficult to reach when factors such as private information and incentives to misrepresent information limit the apparent bargaining range in a negotiation. Morrow (1994) argues that four problems must be overcome to obtain lasting cooperation; sanctioning, monitoring, information, and distribution. Here we focus on the latter two problems with respect to negotiations over international rivers.

The distributional problem is the most obvious concern in disagreements over rivers, as such disagreements arise when the parties have different preferences regarding the ultimate distribution of the shared resource. Sufficient access to water is essential to human livelihood, and competition for access to an especially limited resource might cause diplomatic if not military conflict. States often depend on water for human consumption, agricultural uses, industry, or power generation; when there is a finite amount of water to allocate from a shared resource, the distributional obstacle is hard to overcome to both sides' satisfaction, making it much more difficult for leaders to reach an acceptable compromise.

This distributional problem is compounded by the inherent asymmetric relationship among the riparians. This asymmetry favors the upstream state in most cases, as this state has uninterrupted access to the river water before its downstream counterpart, and its actions may create harm downstream. The upstream state thus needs to feel that it can gain more from a negotiated solution than from the continuation of the status quo. This is complicated further by the importance of the water resources. Access to sufficient supplies of water will always be essential, and where water is scarce or under heavy demand it is likely to constrain and put pressure on political leaders in negotiation processes. This may make agreements even more difficult to reach because neither state can afford to lose.

Illustrating the importance of the distributional problem for rivers, Dinar (2008) argues that the main obstacle to fostering cooperation in international river basins is negotiating the terms of institutional arrangements that make lasting cooperation beneficial to all parties. Because fresh water is of such importance, he argues, strategic interaction is instrumental in understanding the formation of this cooperation with issue-linkage, reciprocity and side-payments as building blocks (2008: 16ff; see also Song and Whittington 2004). Because of the

inherent asymmetries between riparians it is likely that in a negotiation situation the upstream state, although causing the harm (or externality) on the downstream state, will expect to be compensated in some way in order for negotiations to be successful. Side payments of some form may thus be necessary to alter the incentive structure so that the distributional problems are overcome (Dinar 2008). This is exactly what happened between the Rhine riparians in their effort to reduce the pollution of the river. The Netherlands, although the country furthest downstream and also the country that suffered the worst from the salt pollution on the river (mainly caused by Germany and France) ended up after rounds of negotiations with having to pay the largest percentage of the costs of reducing the pollution. The Netherlands ends up paying 34% of the total costs, while Germany and France paid 30% each and Switzerland 6% (Barrett 2003: 128f).

An informational problem, related to Fearon's incentives to misrepresent private information, may worsen the distributional problem with respect to rivers because of uncertainties in the bargaining process. Knowing that the resource is likely to be of high importance also to the negotiating partner, a state may be inclined to misinform the other about its own plans for the river and may be reluctant to share water data. This is a common problem in international river basins and creates an environment of uncertainty among the riparians which, in turn, makes credible commitments less likely. This problem is particularly evident in rivers with a clear upstream-downstream relationship between the states, where the downstream state is highly dependent upon the good will of the upstream state. The upstream state -- reluctant to share information about its own water allocation or development plans -- holds the upper hand in negotiations, which may make agreements harder to strike. In the case of China on the Mekong River for example, the fact that China considers all river issues as national matters increases

uncertainties among the lower riparian states of Laos, Thailand, Cambodia, and Vietnam (Goh 2004)

We now turn from a general discussion of obstacles to agreement to specify testable hypotheses. We begin with the importance of the contested issue. The more important the issue in question, the harder the bargaining process is likely to be, as neither state will want to “lose” with respect to how the resource is distributed. This in turn is likely to also affect the negotiation environment and create incentives to misinform counterparts or withhold information. One must keep in mind that there is an important distinction between starting talks and reaching a successful agreement. In particular, factors like issue salience or recent armed conflict over the river might increase the likelihood that states will begin negotiations, as they note the greater urgency and the risk involved in leaving the conflict festering without a resolution.²

Yet while there may be greater urgency to seek a peaceful settlement in situations such as these, it is plausible that we should expect to see a lower likelihood that the negotiations will produce a successful solution. As discussed above, the more important the river is to the riparians, the harder they should each fight to protect their own interests and ensure an adequate supply of water for their needs -- a classic example of a distributional problem. Furthermore, recognition of the importance of the resource to one's adversary offers a clear temptation to misrepresent private information about current water usage or future development plans.

Although it is plausible that negotiations over important rivers will be more difficult to succeed, as the bargaining range will be limited, scholars have argued that countries nevertheless are likely to succeed in their cooperation over water, and that cooperation far outweighs conflict on international rivers (Yoffe et al. 2003). These scholars argue that states tend to cooperate

² An earlier study (Brochmann and Hensel 2009) found that states disagreeing over the use of a shared river are more likely to begin negotiations when the river under contention is longer and when water is more scarce in the river's basin, suggesting that negotiations are more likely to be attempted where there is greater urgency.

more over water even if their overall international relations are not that good (Yoffe et al. 2003), suggesting that water issues -- especially if they are considered important -- should lead states to recognize that there is more to be gained by settling their disagreements over the shared water resource than by limiting both sides' usage through continued conflict. Armed conflict over water resources is costly and risky (Wolf 1998), and -- as in the US-Mexico example discussed above -- the long shadow of the future and possible issue linkage can help reach agreements. Finally, the more important the river is, the more likely it is that the states have had some form of previous cooperation over it, and water institutions tend to be resilient (Wolf 1998); existing cooperation can further increase chances of new successful cooperation (see Conca et al. 2006; Keohane 2002). The distributional problem in this scenario is thus actually helped by the importance of the river as this means that the states are eager to reach agreements. This is very much in line with the argument from Chayes and Chayes (1993) that states will not enter into negotiations without having a sincere interest in solving the dispute.

It is not completely obvious, then, whether or not negotiations over especially important rivers should be likely to succeed. We thus seek to investigate two competing hypotheses:

Hypothesis 1A (salience as conflictual): *Negotiations over a river claim are less likely to be successful if the river is considered to be more important.*

Hypothesis 1B (engines of cooperation): *Negotiations over a river claim are more likely to be successful if the river is considered to be more important.*

A second consideration is the nature of the grievance(s) being contested. Parties to a negotiation will be under greater pressure to solve a current issue that is already injuring the

interests of at least one of them than an issue that may or may not cause such injury in the future. Whether a given disagreement involves the quantity or quality of water reaching the downstream state or navigation rights, there would seem to be an important distinction between current problems resulting from one state's actions that are already affecting another state and pending problems that are seen as likely to affect it in the future. The parties to a negotiation will be under higher pressure to solve a current problem (although this may in turn lead to a worse agreement that creates new problems when implemented). For example, there should be a difference between a dam project that is being planned or constructed (but not yet affecting the amount of water flowing across the border) and a similar project that is in operation and actively reducing the water flow.

Although agreeing on the distribution of an important river is likely to be difficult in general terms, we expect that the uncertainties inherent in concerns regarding future activities will make reaching agreements even harder. And due to the general tradition of most river management being undertaken unilaterally (Waterbury 1997), co-riparians are not likely to be fully informed about each others' plans. We expect that the lack of current harm to the affected state coupled with the hope of great future benefits for the state causing the externality should make the successful resolution of such negotiations less likely:

Hypothesis 2: *Negotiations over a river claim are less likely to be successful if the river claim only involves the challenger state's concerns about future usage of the river than if it involves concerns about the current usage of the river.*

We have argued above that the inherent asymmetries in most river basins, due to the geographical configuration of the river, complicate river negotiations. These asymmetries, which are closely connected with the importance of the river, often create a relationship where one state is inferior by nature. This is likely to complicate negotiations as the downstream state is likely to have much more to gain from reaching an agreement, and may be reluctant to share information as it is already in a vulnerable situation. The upstream state, on the other hand, may feel more constrained by an agreement, which gives it an interest in dragging out the negotiation process. Although Dinar (2008: 3) identifies fourteen different types of river configurations, we will focus here on the upstream/downstream relationship in general (meaning that a river has to run through the territory of state A before it enters into state B). As outlined above, such a geographic configuration provides inherent asymmetries among riparians that favor the upstream state. As has been suggested elsewhere (Brochmann and Hensel 2009), such a configuration provides greater opportunity for the upstream state to take actions towards the river that risk harming the interests of the downstream state. These rivers are indeed the most conflictive (Brochmann and Hensel 2007). We also expect that these rivers give rise to disagreements that are harder to solve through negotiations, because they are likely to depend on some form of compensation for the upstream state that will need to reduce its own benefit from the river.³

By contrast, states that enter into negotiations to solve issues over rivers that simply form the international border will be less affected by this asymmetry, as both sides will be affected simultaneously by changes in the quality or quantity of the river water. Such rivers should be less likely to experience claims over water in the first place, and if they experience such claims and

³ We do not provide an hypothesis for the impact of river course on negotiation success because the Heckman selection models that we employ in this paper require somewhat different lists of variables in the two stages of the model (in this case the onset and success of negotiations) in order to run accurately. We chose to omit river course from the second stage of the model for this purpose, because we had less reason to expect a systematic impact on negotiation success from this than for the other variables in the model.

negotiate over them, we expect the distributional obstacle to be easier to overcome as the state causing the harm will be equally harmed itself. States that share multiple rivers should also more likely to be successful in their negotiations, especially if they are upstream on different rivers and can benefit from issue linkage. A third river configuration that seems less likely to create difficult negotiation situations involves U-shaped rivers, which run from state A to state B and then back into state A. The state causing the harm in this case is likely to eventually be harmed itself, or to suffer from sanctions or actions on the river from the other state taken in return; if disagreements occur, these should also be easier to solve than the once where there is a clear offender and a clear harmed party.

Hypothesis 3: *Negotiations over a river claim are less likely to be successful if the claim involves a river that crosses the border from one state into the other than over claims involving rivers with other courses.*

Another related problem involves the relative capabilities of the riparian states. If the upstream state -- in addition to having access to the water resources first, and thus having an inherent advantage -- also is preponderant in power compared to its counterpart, it may be difficult for the latter to even raise claims contesting the river use of the most powerful. If the downstream state is the most powerful, on the other hand, such claims may be much more likely.

Lowi (1995, 1999) emphasizes the role of power even more and argues that in general it is the interest of the hegemonic state in a basin that is decisive for the nature of the interaction. Egypt's role in the Nile basin is an example of a downstream state that is able to dictate much in

the basin due to its relative power. It is superior to the other riparian states, such that the latter are unlikely to engage in actions that could provoke a hostile response downstream (Lowi 1999).

Irrespective of how disagreements emerge though, once the disagreements have come to the point that states have chosen to enter into negotiations over them, however, we expect that the negotiations will be shaped at least to some degree by the relative capabilities among the states. We argue that negotiations are more likely to succeed when the power disparity between the two states is greater. We argue that when either state has a substantial preponderance in relative power, this state will be able to pressure its opponent to make concessions, making a successful settlement of the negotiations more likely.

Hypothesis 4: *Negotiations over a river claim are more likely to be successful when there is a greater disparity in the claimants' relative capabilities.*

Overcoming These Obstacles

We have discussed obstacles to agreement over rivers, suggesting that characteristics of the river and of the riparians' specific disagreement can create important obstacles to agreement in river-related negotiations. In order for negotiations to succeed, the negotiating states may need to overcome the distributional and informational obstacles discussed above. This is our next focus, emphasizing both generally cooperative relations between states that might spill over to a specific issue area, as well as the assistance of third parties. We begin with the level of cooperation in general relations between the riparians. River negotiations do not take place in political vacuums, and their outcomes are likely to be affected by the overall relationship between the riparians.

Our first hypothesis along these lines concerns the institutionalization of a river through existing treaties. To the extent that the use of the river is already governed by one or more treaties -- even if the treaties concern some other aspect of the river beyond the specific question covered in the present disagreement -- negotiations over the river should be more likely to succeed, because there is already an agreed-upon starting point for negotiations. In contrast, where there are no treaties between the claimants over the river in question, negotiations should be more difficult because the two sides are starting from scratch; rather than converging around an existing framework that might be modified based on current needs, they need to establish an original framework for the first time. Not surprisingly, earlier work (Brochmann and Hensel 2009) find that the existence of treaties over the river makes negotiations more likely to begin; we now expect that such treaties will also make such negotiations more likely to succeed. An established environment for cooperation can help overcome all the three obstacles of distribution, information and river asymmetry.

Hypothesis 5: *Negotiations over a river claim are more likely to be successful when they share at least one relevant treaty over the river that addresses the substance of the claim.*

Beyond river-specific cooperation, a more general history of non-hostile relations and previous cooperation between states should also increase the chances for cooperation on this specific issue. Previous cooperation is likely to ease the uncertainties that typically characterize interactions under anarchy and provide safer grounds for positive interaction. A more cooperative relationship may help to alleviate the obstacles of distribution and information, as states with such a relationship will have a basis of trust among them as well as an interdependent

relationship that creates incentives to make credible commitments. Furthermore, a more cooperative and generally closer overall relationship should also indicate that states' ideal solution points are likely to be closer together -- the friendlier the relationship, the less likely either is to make extravagant demands that entail grave losses for the other, so cooperation should be easier when the two sides' initial demands are relatively closer together.

The more cooperative two states' overall relationship, the more they may also be able to deal with problems over a single issue through issue linkage and “long shadows of the future” (e.g. Song and Whittington 2004). When parties to a negotiations know that there will be longtime interaction (repeated games), as is almost always the case for international river basins, they are more likely to be able to make credible commitments because bluffing or threats at one point in time may backfire in later negotiations.⁴ An example of how these longtime relations can lead to successful negotiations was the 1973 river agreement between the U.S. and Mexico (“The Permanent and Definitive Solution to the International Problem of the salinity of the Colorado River”). The United States, although it is a much larger country than Mexico and is located upstream on the Colorado River, pledged to reduce the salt concentration in the water entering Mexico (and especially the Morelos Dam), and built a large desalination plant to fulfill the agreement. A major reason for this is that the U.S., although upstream on the Colorado, is downstream on other rivers such as the San Pedro, and thus partly dependent on Mexico on those rivers. In addition, this particular example illustrates possibilities for issue linkage beyond the realm of rivers, as the U.S. is also highly dependent on Mexico for cooperation over immigration issues, drug trafficking, and other problems (Barrett 2003: 120).

⁴ Fearon (1998) argues, however, that a long shadow of the future may in fact make negotiations less likely to succeed, because it may lead states to bargain harder in order to get a better deal. And indeed, many river negotiations have been lengthy; the Indus River agreement, for one, took more than ten years to negotiate (Baxter 1967)).

This basic argument about cooperative general relations improving the management of specific river issues has already received some empirical support with respect to rivers in several recent studies. Hensel, Mitchell, and Sowers (2006) argue that the presence of institutions in a basin increase the chances of positive conflict management. Brochmann (2006) finds that a signed treaty increases the chances of later water-specific cooperation in a dyad, and at least under special conditions, may reduce later water conflicts. Conca et al. (2006) find that a history of prior cooperation in a basin is a significant determinant of whether a basin will reach a treaty and whether individual states will join it. Brochmann and Hensel (2009) also find that states with greater foreign policy similarity -- as measured by the number of shared IGO memberships between them at a given point in time -- are more likely to begin negotiations over their river claims, although joint democracy does not have any systematic impact. This discussion suggests the following hypothesis:

Hypothesis 6: *Negotiations over a river claim are more likely to be successful when they share a more cooperative general relationship.*

While previous treaties and closer overall relationships may help to create a more cooperative and trustful relationship, though, previous interactions between the riparian states may also have the opposite effect. One particularly noteworthy example is militarized conflict. Even if past research suggests that armed conflict over rivers has been relatively rare for most of human history, when it does occur such conflict should make subsequent cooperation more difficult. A substantial literature on recurrent conflict and rivalry has shown the negative impact of conflict on future relations between the adversaries, and cooperation over rivers is an area

where we expect to see this effect manifested. While the greater urgency posed by armed conflict over the issue should be more likely to bring the adversaries to the negotiating table -- either on their own initiative or through the action of third parties seeking to prevent escalation -- this should also make it much more difficult to trust the other side sufficiently to enable a mutually acceptable compromise solution.

Hypothesis 7: *Negotiations over a river claim are less likely to be successful when the two states have recently experienced militarized conflict over the river claim*

Similarly, a history of failed negotiations should also reduce the effectiveness of efforts to settle disputed issues peacefully. We do not expect a significant impact of failed negotiations on the onset of future negotiations, as we do for a history of recent armed conflict over the issue. When negotiations do occur in the context of recent negotiation failures, though, we expect them to be less successful. A failed previous negotiation is an indication that this adversary cannot be trusted, which should decrease the chances of a successful outcome.

Hypothesis 8: *Negotiations over a river claim are less likely to be successful when the two states have recently experienced unsuccessful negotiations over the claim.*

Research Design

We test these hypotheses using the Issue Correlates of War (ICOW) project's data set on cross-border river claims (e.g. Hensel et al. 2008; Hensel and Brochmann 2009). This data set attempts to identify every case of explicit disagreement between two or more nation-states over

the usage of a cross-border river, and currently covers the Americas, Western Europe, and the Middle East from 1900-2001.

Dependent Variable

We measure the success of a given round of negotiations by whether or not it ended in a treaty or agreement over the substance of the river issue.⁵ Producing such an agreement clearly indicates that the negotiations were more successful than they would have been had they ended without agreement. Further research might profitably investigate the aftermath of river agreements, as a given agreement may or may not be ratified (if necessary) and carried out by both sides, and may or may not end all contention over the river claim in question. Matters of ratification and compliance are conceptually distinct from the process of reaching an initial agreement, though, involving very different political processes in different states. Such processes lie beyond the scope of the present project, which focuses on the processes by which state leaders attempt to reach agreement in negotiations over river claims. In any case, most agreements over river claims have been ratified (where needed) and carried out by both signatories.⁶

⁵ For the purposes of this paper's analyses, we are only considering agreements that covered the substance of the claim. This excludes what the ICOW project terms "functional" agreements, which involve essentially stopgap measures that may help to increase confidence between the adversaries but do not address the substance of the issue, as well as "procedural" agreements that typically involve an agreement to meet again for further talks in the future. To us, neither type of agreement indicates a successful round of negotiations over a river claim.

⁶ There have been 60 substantive agreements in negotiations over the river claims addressed in this paper. Of these, fully 70% have been both ratified and carried out by both parties; only nine (15%) failed to achieve ratification in both governments and nine others (15%) failed to be carried out by one or both sides.

Independent Variables

River Importance

We conceptualize the importance of a given river in a number of ways. We begin with basin-level data on both water supply and water demands, which allows us to determine the amount of pressure on fresh water resources in the area; a river that flows through an area where water is scarcer or where demands are greater should be considered more important in the sense that we describe in this paper. The Transboundary Freshwater Dispute Database (TFDD) spatial data set at Oregon State University (TFDD 2008) includes two particularly useful basin-level measures of water supply: water discharge (the volume of water that flows through rivers in the basin) and water runoff (the amount of water -- whether from rain, snow melt, or other sources -- that flows over the land surface) in each basin; each measure is log-transformed for our analyses.⁷ The TFDD also includes a number of possible basin-level measures of water demands, which offer a second way to measure the relative importance of different rivers (with rivers in areas experiencing higher water demands being considered more important). We use the average population density in the river basin (logged) to capture the impact of human settlement on water demands.

It should also be noted that the TFDD data that we employ is only available in snapshot form, with one observation per river basin; there is no time series equivalent that could come close to covering the century-long domain of this study. We thus use this data for the entire time period of the study, arguing that while imperfect, this approach is better than the alternative of

⁷ Where one or both sides of a given international river are governed as colonies or other dependencies of a foreign power, the water scarcity variables that are used reflect the value for the colony rather than the colonizer, because that is the area affected by the river in question. For example, the water supply and demand figures for France have very little impact on the demand for rivers shared by French Guiana and Brazil, although French Guiana's water supply and water demands likely have a significant impact. All other variables in our analyses (such as democracy and relative capabilities) reflect the colonial ruler, though, as this is the actor that is involved in any conflict or negotiations over the use of the river.

excluding water scarcity variables from the analysis entirely. We supplement these different models with a measure of international droughts from the EM-DAT Emergence Events Database, which is available for the entire world back to 1900.⁸ This data set includes droughts that kill at least ten people, affect at least 100 people, or lead to the declaration of a state of emergency or a call for international assistance. While this is available annually for the entire period of our study, it has the disadvantage of only being available at the nation-state level, so there is no way for us to determine which basin(s) are affected by a given period of drought. Nonetheless, we believe that the combination of annual state-level data on drought and snapshot basin-level data on water scarcity and water demands offers the best available picture of the importance of water in a given area over this period of study.

We also measure the importance of the river using the ICOW project's index of river claim salience (Hensel, Mitchell, and Sowers 2006; Hensel, et al. 2008). This index attempts to measure the overall value of the river that is involved in the claim, based on six factors that are believed to make the river more valuable to one or both of the claimants: (1) river location in the state's homeland territory rather than in colonial or dependent territory, (2) navigational usage of the river, (3) level of population served by the river, (4) the presence of a fishing or other resource extraction industry on the river, (5) hydroelectric power generation along the river, and (6) irrigational usage of the river. Each factor contributes up to one point per state to the overall salience index, producing a dyadic measure that can range in principle from zero (for a river with essentially no measurable salience) to twelve. For more detail on the coding of salience see Hensel, et al. (2006, 2008).

⁸ This data set is maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at the School of Public Health at the Université Catholique de Louvain, in Brussels, Belgium, and is available at <<http://www.emdat.be/Database/terms.html>>.

Current vs. Future Problems

The ICOW river claims data set identifies the specific issues involved in each claim. These might include problems related to river quantity, river quality, or navigation. Furthermore, these might include current problems -- i.e., those where the contentious dam, irrigation or diversion project, pollution, or other root of the problem is already in effect -- and/or future problems, which are being protested before they actually take effect. We measure this with a dummy variable indicating whether the river claim exclusively involves future problems, such as a dam or diversion project that is under construction but not yet in operation. The alternative includes claims over problems that are currently in operation as well as claims that are partly over currently operating problems and partly over future problems; our expectation is that problems that are not currently causing any perceived harm to the challenger state will be handled differently from those that are already causing at least some harm.

River Course

The ICOW project categorizes the course of each river based on a number of major world atlases and geographic reference sources.⁹ This is measured with two dummy variables: “cross-border rivers” are those that cross from the territory of one state into the territory of the other, and “U-shaped rivers” are those that cross from the territory of one state into the territory of the other before returning to the territory of the first state. The referent category of alternative river courses includes rivers that form the border between the two states but only pass separately through one or neither state's territory, as well as tributaries that pass through one state's territory

⁹ These sources include the *National Geographic Atlas of the World*, 8th edition; *Times Atlas of the World*, 10th comprehensive edition; *Hammond Concise World Atlas*; Macmillan's *Planet Earth Atlas*; *Merriam-Webster's Geographical Dictionary*; and the *Columbia Gazetteer of the World*.

and then end by flowing into a separate river along the border (but do not themselves cross the border into the other state's territory).

Relative Capabilities

We measure state capabilities with the Composite Index of National Capabilities (CINC) score from the Correlates of War (COW) project's National Material Capabilities data set, which ranges from zero to one and indicates the total percentage of the international system's capabilities held by the state in question during the year of observation (COW 2008). We use this CINC score to measure each riparian state's relative capabilities as the percentage of the total dyadic capabilities held by that state, by dividing that state's CINC score by the combined CINC scores of the two riparians being studied.

River Institutionalization

The institutionalization of rivers is measured by the presence of previous river treaties between the two states in question, and is collected from the TFDD project. We focus on the subset of TFDD treaties that directly address river issues related to the three types of ICOW river claims mentioned above: treaties over the allocation of water quantities between two or more riparian states, treaties with specific water quality provisions, and treaties concerning navigation of international rivers. Because we are studying how a specific claim is managed, we are only interested in relevant treaties, which are those that cover the type of river issue(s) involved in the claim. Thus, for a river claim over water quantity, we code this as a dummy variable indicating whether or not these two states share at least one TFDD treaty that addresses water quantity issues on this river.

General Context of Relations

The general context of relations between two riparian states will be measured by two states' shared memberships in international organizations (IGOs). If two countries have many joint memberships, it is reasonable to assume that they share at least a minimum of common preferences and a history of cooperation, and that they are more likely to seek to cooperate in the future. IGOs provide a forum for information sharing and ease transaction costs of cooperation and we expect spill-over effects to other forms of cooperation. We measure joint memberships in IGOs by summing the number of IGO memberships shared by the two countries in a dyad based on the most updated IGO membership data described in Pevehouse, Nordstrom, and Warnke (2004).¹⁰

Recent Interactions over the River Claim

We also examine the effect of two dimensions of recent interactions over the river claim: militarized conflict and unsuccessful negotiations. This conflict variable is originally based on the Correlates of War (COW) project's Militarized Interstate Dispute (MID) data set, which identifies every case where one nation-state threatens, displays, or uses military force against another (Ghosn, Palmer, and Bremer 2004). As we are only interested in militarized disputes that explicitly attempt to resolve river claims we use the ICOW project's restrictive coding of militarized disputes over each specific river claim, as described by Hensel, Mitchell, and Sowers (2006). Unsuccessful negotiations are those where the states failed to reach agreement, or where agreement was reached but at least one side failed to ratify or comply with the agreement. Both

¹⁰ The dataset used to compile this variable records membership in 495 different IGOs of all kinds, dating back to 1815 (Pevehouse, Nordstrom and Warnke 2004).

militarized conflict and failed negotiations over the issue should indicate to each side that the other is not trustworthy, suggesting that future cooperation should be difficult to achieve. These two variables following the coding scheme described by Hensel et al. (2008), which is a weighted scale whereby the impact of an event (whether militarized conflict or failed negotiation) is greatest effect in the first year after its occurrence and declines each year afterward, disappearing entirely after ten years.

Control Variables

Although we do not offer an explicit hypothesis, we control for the effects of joint democracy, which we expect (based on past research) to create an expectation of stability and an atmosphere where agreements are likely to be honored. Joint democracy is measured using the Polity IV data (Marshall, Jaggers, and Gurr 2008), in the form of a dummy variable indicating whether both riparian states are considered democratic (as measured by a value of seven or greater on the Polity index that subtracts a 10-point index of autocratic characteristics from a 10-point index of institutionalized democracy).

We also control for the type of settlement technique being employed. Drawing from research such as Mitchell and Hensel (2007), we expect to find important differences in the effectiveness of different techniques, although in this paper we have not offered theoretical explanations that would justify treating this as a separate independent variable. In particular, past research leads us to expect that non-binding third party techniques such as good offices or mediation should be somewhat less effective than bilateral negotiations, while binding third party arbitration or adjudication should be much more effective.

Empirical Analyses

We begin with a brief description of the data. For the spatial-temporal domain covered by the current ICOW river claims data set, there have been a total of 82 dyadic river claims, ranging from disagreements over navigation on the San Juan River between Nicaragua and Costa Rica to numerous disagreements in the Jordan or Tigris-Euphrates river basins. These 82 dyadic river claims have lasted for a total of 644 claim-years. The vast majority of these observations -- 536 of 644, or 83.2% -- have maintained the status quo, with no effort to negotiate over the substantive issues under contention.

The remaining 108 claim-years each saw at least one round of negotiations, for a total of 155 distinct rounds of talks.¹¹ Sixty of these rounds (38.7%) ended successfully with a substantive agreement over the underlying issues under contention, while the remaining 95 failed to produce agreement. In an earlier paper we investigated the conditions under which river claims are most likely to see the onset of negotiations; the present paper seeks to determine which of these negotiations were successful, differentiating between the 60 rounds of talks that produced substantive agreements over the river claim and the 95 rounds that did not. Descriptive statistics for the variables in our model are presented in Table 1.

[Table 1 about here]

Table 2 presents a probit analysis of negotiation success.¹² Four separate models are attempted, differing only in the variable that is used to measure the importance of the claimed

¹¹ For years that included multiple rounds of negotiations, few of the variables will change in value because most are coded annually; the two noteworthy exceptions are the measures of recent conflict and failed negotiations over the river claim, which are coded by ICOW based on the start of a given round of negotiations and thus reflect conflicts or failed talks from earlier in the same year. For rounds of negotiations that lasted more than one year, all variables are coded based on the year when the negotiation began; practically speaking, very few of the variables would be likely to change notably between the beginning and ending of the negotiations.

¹² The reported analyses use robust standard errors. There is no substantive change in our main conclusions if the standard errors are clustered based on the dyad, river, river claim, or year.

river to the claimants (basin runoff, basin discharge, basin population density, and ICOW river claim salience). Separating these models is important for several reasons. First, there are high correlations between these different measures (ranging from .70 to .99); while they are measuring different aspects of the importance of a river, these aspects are closely related to each other. Furthermore, several of these measures are not available for every river basin in the data set, so using separate equations allows us to study the impact of each measure on as many cases as possible. All four models generally provide a good fit to the data ($p < .01$ in Model I and Model II, $p < .03$ in Model III, and $p < .09$ in Model IV).

[Table 2 about here]

We also employed a Heckman selection model of negotiations over river claims, using the population of 644 claim-years mentioned above, in order to determine if there are any systematic selection effects that must be considered.¹³ It is plausible, for example, that factors that promote negotiation onset systematically increase the likelihood of successful negotiations (as might be the case for negotiations in the context of existing treaties) or increase the risk of negotiation failure (as might be the case for negotiations prompted by serious armed conflict or high degrees of water stress). The first stage of the model (the selection stage) investigates the conditions under which the claimants are most likely to begin substantive negotiations over their river claim. For cases in which such negotiations are begun, the second stage of the model (the outcome stage) investigates the conditions under which the negotiations are most likely to produce a substantive treaty or agreement.

The results do not show evidence of a systematic selection effect that would require the use of such models for our analyses. Each model has a statistically insignificant rho parameter

¹³ Some of the observations do not appear in Table 2 due to missing data on one or more of the variables, mostly due to three variables: joint democracy (which is missing for 37 of the 644 cases), basin runoff (101 cases), and basin discharge (139 cases).

($p < .77$ in the basin runoff model, $p < .50$ in the basin discharge model, $p < .67$ in the basin population density model, and $p < .67$ in the river claim salience model). This is not especially surprising, since -- as we noted earlier -- there are likely to be very different processes at work in the decision to begin negotiations over an issue and the decision to reach a specific agreement with the adversary over that issue. Furthermore, the Heckman model provides a very poor fit to the data; in none of these models does the model's Wald X^2 statistic approach conventional levels of statistical significance ($p < .51$ in the basin runoff model, $p < .52$ in the basin discharge model, $p < .29$ in the basin population density model, and $p < .08$ in the river claim salience model). Because of the lack of a significant selection effect and the overall model fit, the remainder of the paper will be based on the probit models presented above.

Obstacles to Agreement: Empirical Evidence

Our first hypothesis suggested that states should be more likely to begin negotiations when the river is more important to them, but less likely to be able to reach a mutually satisfactory agreement. The results for this hypothesis are mixed. Consistent with Hypothesis 1A, Model I reveals that rivers in regions with greater levels of water scarcity -- indicated here by lower basin runoff -- tend to see much less success in negotiations over river claims ($p < .01$). This is also true when the importance of rivers is measured by total basin discharge rather than runoff, as seen in Model II ($p < .02$). Yet consistent with Hypothesis 1B, negotiations are significantly more likely to be successful when they involve rivers in basins whose higher population density reflects greater demands on water ($p < .04$ in Model III) and when they involve rivers that are more salient to the states involved in the claim ($p < .05$ in Model IV). Negotiations

during years in which at least one of the claimants experiences drought are no more or less likely to be successful in any of these models ($p > .30$ in most cases).

[Table 3 about here]

A useful way to help interpret the results of our analyses is through the analysis of marginal effects. Table 3 presents the predicted probability of negotiation success for each measure of river importance. Most notably, the results here show that the importance of the river that is under contention has a considerable impact on negotiations. An increase from the minimum to the maximum value of total basin runoff more than triples the likelihood of successful negotiation, and an increase from the minimum to the maximum value of total basin discharge roughly doubles this likelihood. On the other hand, negotiations over rivers in basins with the highest levels of population density see more than triple the likelihood of success, and negotiations over river claims with the highest overall levels of claim salience see more than double the likelihood of success.

Taken together, these results seem to suggest that the impact of river importance is more complex than most observers seem to recognize. Rivers in regions experiencing greater demand for fresh water, measured here by population density in the region as well as by the overall salience of the river itself, are more likely to be negotiated successfully. This is quite consistent with scholars who have described fresh water as an engine of cooperation rather than conflict between states, and suggests that leaders are often able to negotiate successfully when there are substantial benefits to a peaceful agreement over the shared use of the river. Yet rivers in water-scarce regions are much more difficult to negotiate successfully, suggesting that there are limits to the cooperative incentives to share water resources. Where water is most scarce, even the best

of intentions and the most positive incentives may be unable to produce lasting agreement over the shared use of the scarce resource.

Our second hypothesis suggested that negotiations over a challenger's future concerns about river usage are less likely to succeed than negotiations over current issues, where there is already greater urgency to settle the matter quickly rather than delaying in hope of achieving better terms in the future. This hypothesis is generally supported by our data, as the variable has a negative and significant impact in each models in Table 2, indicating that negotiations over future claims are indeed more difficult to reach agreement on. As in Table 3, Table 4 presents the marginal probabilities for statistically significant effects, calculated from Model I of Table 2. Successful negotiations over river claims are less than half as likely when the claim involves only future grievances, with a predicted probability of success of .59 for claims in which at least part of the challenger's grievance is already in operation and only .27 for claims that only involve concerns about future developments along the river.

[Table 4 about here]

Hypothesis 3 suggested that the course of the river should have a considerable impact on negotiations, with success being less likely for rivers that cross from one state's territory into the other's territory. There is little support for this hypothesis, though. Negotiations over cross-border rivers are somewhat less likely to succeed in Model I ($p < .07$) and Model II ($p < .09$), although there is no systematic impact in the other models. Negotiations over U-shaped rivers have no systematic impact in Models I, II, or IV, but are somewhat more likely to succeed in Model III ($p < .06$). states would be more likely to enter into negotiations over these rivers. It appears that the relative level of water scarcity, demands on water, and the nature of the specific grievances involved in a given river claim have much more of an impact on the success of

negotiations than does the course of the river. The net effect is that cross-border rivers are the least likely to experience successful negotiation, with success predicted in somewhat more than half of all cases; U-shaped rivers tend to see a higher level of success, with the highest level predicted for rivers following other courses. Yet the low levels of statistical significance for these variables in the analyses suggest that we should not read too much into these apparent differences.

Turning to the riparians' relative capabilities, Hypothesis 4 suggested that negotiations are more likely to be successful when there is a greater capability disparity between the two (whichever is more powerful) than when they are roughly equal. There is weak support for this hypothesis, with the capability disparity increasing negotiation success in Model III ($p < .01$) and having a weaker effect in Models I ($p < .13$), II ($p < .08$), and III ($p < .23$). Further investigation reveals even weaker support if the variable is calculated to reflect the relative capabilities of the claim challenger, suggesting (probably unsurprisingly) that capabilities can work either way -- a stronger challenger may be able to pursue its goals more effectively, while a stronger target may be able to protect its interests more effectively.

Overcoming the Obstacles: Empirical Evidence

We now turn from details of the river and its environment to ways that the claimants or third parties might be able to help overcome these obstacles. Hypothesis 5 suggested that negotiations should be more successful over rivers that are already covered by relevant river treaties. Surprisingly this does not seem to have any sort of systematic impact in any of these models ($p > .14$ in each model). Our previous research has suggested that river treaties do seem to reduce the likelihood that river claims begin or that such claims will become militarized, while

increasing the likelihood that negotiations begin over the river claims. But there seems to be little added benefit of river treaties with respect to the success of these negotiations once they have begun, and other factors appear to play a much larger role.

Hypothesis 6 suggested that a more cooperative overall relationship between the two claimants should increase the success of their negotiations over a specific river question. The analyses reported in Table 2 measure this relationship through joint IGO memberships, and find strong support. States that share more IGO memberships are significantly more likely to reach successful conclusions to their negotiations ($p < .04$ or better) in each model except Model II. Moving from the minimum value of shared memberships to the maximum substantially increases the probability of a negotiation success by over 50%.¹⁴

Focusing on previous interaction over the specific river claim that is under contention, Hypotheses 7 and 8 suggested that negotiations should be less likely to succeed when there is a longer history of recent armed conflict and/or failed negotiations over the claim. There does not seem to be any systematic effect of recent armed conflict, which may be related in part to the relative rarity of such conflict; the ICOW river claims data set currently identifies only nineteen militarized disputes over the 82 river claims included in these analyses, and even those few disputes tend to cluster in a few claims. Our earlier research suggests that recent armed conflict does increase the likelihood of negotiations, though, even if it appears to have little systematic impact on the success of these talks. There is much stronger evidence for Hypothesis 8, with a history of recent failed negotiations over the claim reducing the success of negotiations in each model. As Table 4 indicates, roughly two-thirds of negotiations are predicted to succeed (*ceteris*

¹⁴ Measuring the overall relationship in terms of dyadic trade produces weaker results. One important reason is the prevalence of missing trade data, though, which reduces the number of cases in this already small data set of negotiations by several dozen observations.

paribus) when there is no history of past negotiating failure, but the predicted likelihood of success is less than one-sixth as great at the highest levels of recent failures.

Our controls for regime type and type of settlement attempts suggests that joint democracy has little impact on the outcome of negotiations, even if earlier research suggested that pairs of democracies are more likely than other regime types to attempt peaceful settlement. As expected, though, binding third party attempts to settle disagreements have a probability of success that is about 1/3 higher than bilateral disagreements and roughly double the probability of success compared to non-binding activities.

All in all, several of our hypotheses received empirical support. The importance of a given river matters, with water scarcity complicating negotiations (Hypothesis 1A) and water demands facilitating success (Hypothesis 1B). Claims over future use of a river claims are less likely to be negotiated successfully (Hypothesis 2), as are claims that have accumulated a history of recent negotiating failures (Hypothesis 8). A generally cooperative relationship increases the chances of negotiation success (Hypothesis 6), though, as does a greater disparity in relative capabilities (Hypothesis 4). Several of our hypothesized effects received little support, though, including the impact of river course (Hypothesis 3), existing treaties (Hypothesis 5), and recent armed conflict over the river (Hypothesis 7).

Discussion

In this study we have presented a simple model of negotiations over international rivers that emphasizes both characteristics of the rivers and their surrounding basins and characteristics of the countries sharing these rivers. This model suggests that factors that are specifically related

to a disputed river as well as more general factors expected to affect the overall relationship between to river sharing states matter for how rivers are managed.

Our results offer several important insights regarding the factors that influence the success of negotiations over international rivers. First, no systematic selection effects seem to be at work; the factors that influence the decision to begin negotiations do not seem to be related systematically to the factors that influence the decision to reach agreement in these negotiations. Many of the same factors that have been found in earlier work to affect the decision to enter into negotiations though also affect the outcome, albeit somewhat differently.

Second, the importance of a river matters for how negotiations evolve. Not surprisingly, the salience of a contested issue affects the negotiation process. It seems, however, that different forms of importance relates differently to the chances of success of negotiations. While negotiations are more likely to succeed over more salient river claims and rivers that face greater demands from local populations, water scarcity reduces the chance of a successful agreement as expected. A river that is highly salient due to many different uses of the river, may be easier to reach agreements on as there will be more issues to bargain over and the opportunities to “give and take”, and possibilities for issue linkage within the same river, will be greater and thus also making the distributional issue easier to overcome. This can expand the bargaining range in a negotiation, contrary to a river where the main (or only) concern is a reduced flow of freshwater, and this may explain the differing impacts of these two variables on negotiation success.

Not surprisingly, future concerns over river usage are difficult to degree upon. Uncertainty among the parties regarding the other party's real plans for the river and also incentives to withhold information about own plans narrows the bargaining range, and there may also be in the interest of the target state to avoid reaching a decision as this will constrain future

actions. Successful negotiations thus seem more likely in environments with a combination of a broad range of issues to bargain over combined with these issues being of current importance.

The fact that a previous treaty does not seem to help reach successful agreements appears troubling at first. Is this because the parties have bad experiences with earlier treaties? Another possibility is that since a treaty already exists both parties expect more from new negotiations and that they thus are harder to agree on. Seen together with the results from a previous paper (Brochmann and Hensel 2009) that found previous treaties to have a positive effect on the beginning of negotiations, this suggests that previous treaties are less relevant for the resolution of specific problems are addressed. This runs somewhat contrary to theoretical expectations of spill-over effects, but more generally spill-over effects seem to affect negotiation success. Even if specific river treaties do not increase the chances of successful negotiations, a generally cooperative relationship does seem to do so, which is very much in line with institutionalist theory. Recent armed conflict does not seem to have an impact on negotiations, but recent failed negotiations make negotiations much more difficult. This may indicate that once negotiations have failed there is a need to involve other parties, as trust is diminished in future bilateral negotiations due to the expectation that future talks are also unlikely to succeed.

Third parties may also be a possible solution to deal with especially problematic rivers, as we find some results that cross-border rivers are the most problematic to succeed in negotiations over. We must keep in mind that although third parties may be helpful in reaching agreements, these agreements may in turn be harder to implement, as one or both parties may have made concessions under pressure that they find hard to uphold in the aftermath of the negotiations. Either way, the scenario of the upstream/downstream configuration as the most difficult still holds. Rivers with other courses such as border rivers are probably much easier to negotiate over

as each riparian will be affected by changes in water quantity and quality on the river in similar ways. This seems to be regardless of the relative power of the two riparians as these factors not appear to have much of an impact in our analyses. Finally, pairs of democracies do not have a higher success rate in their negotiations. As shown previously (Brochmann and Hensel 2009) they enter into more negotiations, though, and it may be that because of a mutual trust that prolonged negotiations will not have dramatic effect in such way of a conflict erupting, these negotiations are not more successful.

The results of this study suggest several implications for river policy. First, negotiations depend on several factors in the negotiation process, and seem most likely to succeed when the negotiation concerns current problems. While it might generally be expected that more difficult issues -- rivers that have more uses, and/or that flow through basins with high scarcity or high demands -- should be more difficult to resolve, this paper suggests that talks in such cases actually have a relatively high likelihood of success, so riparians should not be afraid to enter into such talks or to pursue a mutually beneficial solution. Third parties should also be involved in negotiations where the claimants themselves are unable to reach bilateral settlement, as this increases the chance for success.

These results do not offer the final word on negotiations over rivers, though. Future research could benefit greatly from further investigation of the effect and implementation of treaties. In this paper we have focused on the process of reaching agreement in negotiations over rivers, but this does not tell the complete story. In order to get a fuller picture of the management of international rivers we also need to examine the implementation of these agreements once reached, as well as their long-term success in managing the river without future challenges.

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Table 1: Descriptive Statistics

<u>Variable</u>	<u>N</u>	<u>Mean (S.D.)</u>	<u>Range</u>
Negotiation success	155	0.39 (0.49)	0 - 1
Log(basin runoff)	115	9.65 (2.00)	6.60 - 12.46
Log(basin discharge)	109	3.63 (2.12)	0.69 - 6.60
Log(pop. density in basin)	141	3.82 (1.24)	0 - 6.08
River claim salience	155	5.68 (2.42)	2 - 10
Drought in either claimant	155	0.12 (0.33)	0 - 1
Claim only over future	155	0.39 (0.49)	0 - 1
Cross-border river	141	0.84 (0.37)	0 - 1
U-shaped river	141	0.03 (0.17)	0 - 1
Relevant river treaty	141	0.43 (0.50)	0 - 1
Stronger side capabilities	155	0.77 (0.14)	0.50 - 0.98
Log(shared IGOs)	141	2.29 (1.76)	0 - 4.49
Recent armed conflict	155	0.16 (0.50)	0 - 3.17
Recent failed negotiations	155	1.14 (1.72)	0 - 9.16
Joint democracy	155	0.32 (0.47)	0 - 1
3rd party: Non-binding	155	0.36 (0.48)	0 - 1
3rd party: Binding	155	0.05 (0.21)	0 - 1

Table 2: Probit Model of the Effectiveness of Negotiations over River Claims

	Model I	Model II	Model III	Model IV
Variable	Coefficient	Coefficient	Coefficient	Coefficient
Log(basin runoff)	0.31 (0.12)***		---	---
Log(basin discharge)	---	0.23 (0.11)**	---	---
Log(pop. density in basin)	---		0.25 (0.14)**	---
River claim salience	---		---	0.14 (0.08)**
Drought in either claimant	- 0.22 (0.43)	- 0.34 (0.42)	- 0.10 (0.37)	- 0.15 (0.36)
Claim only over future	- 0.84 (0.33)***	- 1.15 (0.39)***	- 0.59 (0.25)***	- 0.48 (0.26)**
Cross-border river	- 0.93 (0.62)*	- 0.81 (0.56)*	0.36 (0.43)	- 0.52 (0.48)
U-shaped river	- 0.53 (1.34)	- 0.63 (1.22)	1.74 (1.07)*	0.51 (0.94)
Relevant river treaty	- 0.10 (0.38)	- 0.40 (0.38)	- 0.18 (0.26)	- 0.19 (0.27)
Stronger side capabilities	1.52 (1.35)	2.13 (1.51)*	3.39 (1.43)***	0.92 (1.22)
Log(shared IGOs)	0.16 (0.09)**	0.09 (0.10)	0.18 (0.07)***	0.13 (0.07)**
Recent armed conflict	0.14 (0.20)	0.10 (0.21)	0.20 (0.19)	0.22 (0.19)
Recent failed negotiations	- 0.18 (0.12) *	- 0.17 (0.12)*	- 0.17 (0.10)**	- 0.17 (0.10)**
Joint democracy	- 0.30 (0.50)	0.07 (0.44)	- 0.18 (0.30)	- 0.18 (0.31)
3rd party: Non-binding	- 0.30 (0.29)	- 0.58 (0.33)**	- 0.20 (0.25)	- 0.18 (0.25)
3rd party: Binding	1.60 (0.82)**	1.44 (0.83)**	0.87 (0.68)	0.96 (0.70)*
Constant	- 3.30 (1.50)**	- 1.09 (1.40)	- 3.98 (1.76)*	- 1.09 (0.99)
Wald X ² :	27.84	31.73	24.14	20.65
	13 df, p<.01	13 df, p<.01	13 df, p<.03	13 df, p<.09
N:	115	109	141	141

* p < .10, ** p < .05, *** p < .01 (one-tailed tests). Standard errors in parentheses are clustered by dyad.

Table 3: Marginal Effects of River Importance on Negotiations

<u>Condition</u>	<u>Predicted Probability of Negotiation Success (Change)</u>
<i>Water Availability: logged basin runoff</i>	
6.60 (minimum)	.232
9.65 (mean)	.590 (+ .358)
12.46 (maximum)	.867 (+ .277)
<i>Water Availability: logged basin discharge</i>	
0.69 (minimum)	.475
3.63 (mean)	.727 (+ .252)
6.60 (maximum)	.900 (+ .173)
<i>Water Demands: logged population density in basin</i>	
0.00 (minimum)	.215
3.82 (mean)	.568 (+ .353)
6.08 (maximum)	.771 (+ .203)
<i>ICOW River Claim Salience</i>	
2.00 (minimum)	.317
5.68 (mean)	.511 (+ .194)
10.00 (maximum)	.733 (+ .222)
<i>Drought in Either Claimant</i>	
No drought	.590
Drought year	.505 (- .085)

Notes

- Predicted probabilities computed with the MFX command in STATA 9.2, based on the models reported in Table 1 (and one additional model for basin discharge that was not reported), with all other variables are held at their mean or modal values.

Table 4: Marginal Effects of Other Statistically Significant Variables

<u>Condition</u>	<u>Predicted Probability of Negotiation Success (Change)</u>
<i>Present vs. Future River Claims</i>	
Claim involves present grievance(s)	.590
Claim only involves future	.271 (- .319)
<i>River Course</i>	
Cross-border river	.590
U-shaped river	.737 (+ .147)
Other river course	.877 (+ .140)
<i>Recent Failed Negotiations over Claim</i>	
0.00 (minimum)	.671
1.14 (mean)	.592 (- .079)
9.16 (maximum)	.108 (- .484)
<i>Shared IGOs</i>	
0.00 (minimum)	.424
2.29 (mean)	.571 (+ .147)
4.49 (maximum)	.704 (+ .133)
<i>Type of Settlement Attempt</i>	
Non-binding third party activities	.471
Bilateral negotiations	.590 (+ .119)
Binding third party activities	.966 (+ .376)

Notes

- Predicted probabilities computed with the MFX command in STATA 9.2, based on Model I from Table 1, with all other variables are held at their mean or modal values.