

# International Agreement Design and the Moderating Role of Domestic Bureaucratic Quality: The Case of Freshwater Cooperation

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**Abstract:** Much of international cooperation research has long assumed that building and deepening (i.e. institutionalizing) international agreements can substitute for weak domestic bureaucratic capacity when it comes to promoting cooperative policies between countries. Qualifying this assumption, we argue that domestic bureaucracies are a key piece of international cooperation: the cooperation-inducing effect of international institutions is *conditional* on the quality of domestic bureaucracies. We examine this relationship in the context of the politics of interstate cooperation over transboundary rivers, an important test case given concerns about looming water conflict in face of increasing water scarcity. Using data on freshwater-related events, 1984–2006, on the level of institutionalization of river treaties, and on the quality of domestic bureaucracy, we find that domestic bureaucracies moderate the ability of international institutions to elicit cooperative interstate behavior. The finding is robust to a multitude of specifications and provides important implications for institutional research and policy approaches to cooperation problems beyond freshwater.

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**Data and supplementary material:** The data and supporting information for this article can be found at <https://www.prio.org/JPR/Datasets/> and <https://dataverse.harvard.edu/dataverse/jkarreth>. All analyses were conducted using R (R Core Team 2017).

Under what conditions can international institutions successfully promote international cooperation? For a long time, research on international cooperation has argued that building and deepening international institutions — that is, “institutionalizing” international cooperation<sup>1</sup> — can resolve interstate cooperation dilemmas. This approach has received particular attention in the area of managing transboundary rivers, such as the Danube, Indus, and Mekong. Economic development, population growth, and climate change have made the effective collaborative management of these important freshwater sources critical for providing sufficient and clean water supply, promoting sustainable use, and avoiding political conflicts.<sup>2, 3</sup> Institutionalizing cooperative arrangements over freshwater resources has therefore been a key part of the international community’s attempts to prevent interstate violence over water.

This study, however, shows that institutionalizing international cooperative arrangements alone will not yield uniformly beneficial results for dyads participating in treaties. High-quality domestic bureaucracies crucially support the cooperation-inducing effects of international treaty institutionalization. Where domestic bureaucracies are weaker, institutionalizing cooperative arrangements at the international level will likely fail to promote notable cooperation between countries. For example, to curtail use or prevent pollution by the many individual users of water will require close, on-the-ground policing and a system of fines. A treaty, even if institutionalized, cannot accomplish this task, but a capable bureaucracy can. Strong and capable bureaucracies tend to take implementing countries’ commitments from institutionalized treaties seriously, while governments may be subject to intermittent pressure to disregard or circumvent them for political expediency. Such motives may lead governments to meddle in domestic water-use enforcement. A capable, autonomous bureaucracy is better able to withstand such interference, consequently positioning the country to maintain its obligations from institutionalized treaties and ultimately making the country a better international cooperation partner. Therefore, relationships over water should be better where treaty

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<sup>1</sup>By “institutionalizing,” we mean adding to formal arrangements institutional features such as centralized decision-making, behavior monitoring, conflict management, rule enforcement, and other mechanisms (Abbott et al. 2000; Koremenos, Lipson & Snidal 2001).

<sup>2</sup>For one example emphasizing these factors, see McDonald et al. (2011).

<sup>3</sup>Some researchers warn that conflicts over water use could trigger militarized disputes and wars (Hensel, Mitchell & Sowers 2006; Brochmann & Gleditsch 2012; Brochmann & Hensel 2011).

members have quality bureaucracies, compared to treaties where at least one member state's bureaucracy is weak. This argument and the evidence in this study add an important qualification to recent findings about the impact of institutionalized treaty features on international cooperation.

International cooperation research has not explicitly addressed the question of whether institutionalized international arrangements can alone, i.e. in the absence of capable domestic bureaucracies, promote international cooperation. Studies have shown that institutionalizing international agreements enhances interstate cooperation in the area of freshwater resources (see, e.g., [Tir & Stinnett 2011](#); [Mitchell & Zawahri 2015](#)). Others suggest that adding formal elements to international institutions can help overcome problems associated with lacking domestic capacity ([Ginsburg 2005](#)). This is consistent with the influential managerial school of thought ([Chayes & Chayes 1995](#)), which attributes international cooperation failure not to ill intent but to inadequate domestic resources and expertise. Policy efforts have long relied on this perspective. For instance, the 2006 United Nations Human Development Report ([UNDP 2006](#), 226-7) identifies low institutionalization of river treaties as a major challenge to managing water resources and consequently suggests that member states should “contribute their financial shares to the [centralized] authority.”

We argue here that such suggestions might overstate the extent to which institutionalizing international treaties can alone address sources of some of the problems that hamper cooperation, such as policing the many individual farmers who may be siphoning off too much water. Ignoring the conditioning influence of domestic bureaucracies may have been less of a problem in the past, when river treaties covered developed countries and when high-quality domestic bureaucracies could be assumed to be present. But as river treaties have spread to less developed parts of the world, high levels of domestic bureaucratic quality can no longer be taken for granted.<sup>4</sup>

This study focuses specifically on issue-specific *political* rather than environmental or ecological outcomes, as we are particularly interested in international institutions' ability to improve interstate relations. And, as we show below, institutionalized treaties are far less effective in pro-

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<sup>4</sup>In 1960, the typical treaty in most regions outside of North America and Western Europe had 0 or 1 institutionalized feature on average. In 2000, in all regions of the world, including the developing world, the typical number of treaty features was higher than 2 in most regions.

moting issue-specific interstate cooperation when member states' bureaucracies are weak and insufficiently independent from governments. We find that this dynamic applies regardless of what type of institutionalized feature we examine.

### **The Problem: Promoting Interstate Cooperation over Transboundary Rivers**

A recent survey of the literature reveals that while such results are not uniformly unconditional and robust, increasing water scarcity can heighten the risk of countries engaging in hostile interactions (Bernauer, Böhmelt & Koubi 2012). To prevent such undesirable outcomes, both scholars and practitioners have promoted the development of river treaties, which states have been increasingly using to respond to the challenge of transboundary freshwater management. International river treaties can help countries engage in cooperation and prevent developments that are commonly associated with interstate conflict over water resources, such as disputes over the distribution of water and over water quality (Brochmann 2012; Tir & Stinnett 2011). Investigating the institutional design of river treaties, researchers report that adding design features such as provisions for joint monitoring, conflict resolution, treaty enforcement, and the delegation of authority to intergovernmental organizations make river treaties more effective conflict managers (Brochmann 2012; Tir & Stinnett 2012; Mitchell & Zawahri 2015).

The theory behind these findings suggests that adding the aforementioned institutional features to treaties can change the nature of how countries deal with shared freshwater resources, by promoting cooperative behavior and consequently reducing conflict potential. Considering the functions of these treaties, one would expect that pairs of states that have signed river treaties with institutionalized features would rely on these features to promote cooperation. This can take forms such as addressing water-related grievances within existing institutions, deepening extant institutional arrangements, or pursuing joint efforts to conserve or manage shared water resources. We therefore examine evidence dealing specifically with riparian states' cooperative interactions over transboundary rivers. Doing so allows us to evaluate the effectiveness of institutionalizing river treaties — conditional on the quality of domestic bureaucracies — in addressing interstate

political relations over this shared resource.

Countering some of the optimism derived from international institutional theory, recent investigations suggest that river treaties too often fail to produce anticipated levels of cooperation. One example comes from a detailed case study of the Administrative Commission of the Uruguay River, a commission created as an institutionalized feature of the 1975 treaty on the *Statute of the River Uruguay*. Even though creating a commission provided institutionalized opportunities to cooperate over and coordinate matters related to the shared river, Argentina and Uruguay failed to achieve cooperative solutions to a disagreement about the planned water usage of pulp mills in Uruguay in the early 2000s. [Berardo & Gerlak \(2012, 109\)](#) conclude that “the existing set of formal [international] institutions in place to facilitate a negotiated bilateral solution to the problem had become ineffective.”

This and other case studies skeptical of (institutionalized) river treaties examine river treaties in areas of the world where domestic bureaucracies are rated as not particularly effective and insulated from political pressures. The example of Argentina and Uruguay is a case in point, as neither country’s bureaucracies were all that effective by conventional measures at the time ([The PRS Group 2009](#)). This compares unfavorably to those geographic areas that saw the first institutionalized river treaties, such as Western Europe with the Rhine and Danube. We suspect that the lack of effective cooperation over freshwater even in the presence of institutionalized treaties may be due to a lack of domestic bureaucratic capacity to implement and advance the policy objectives stated in the treaties. For instance, a treaty calling for reduced river water withdrawal rates will be meaningless without the ability and willingness to, for instance, curtail farmers from individually siphoning off river water. If a domestic bureaucracy is unable to regulate such behavior, or if it cannot withstand pressure from governments trying to placate farmers, the inability to meet environmental objectives set forth in the treaty sets the member states up for cooperation-inhibiting discord. Broadly, this means that the ultimate promise of institutionalizing international agreements to promote international cooperation and prevent conflict is contingent on domestic institutional quality — much more so than extant research has taken into explicit account.

Mostly in international political economy, some scholars have begun to note that international institutions may fail to reach their goals in the absence of capable bureaucracies (e.g., [Gray 2014](#)). This has broader implications: much work has explained international cooperation by considering separately domestic or international factors — such as democracy, international trade, or international regimes. Theoretical and empirical models of international cooperation outcomes focusing exclusively or overwhelmingly on either domestic or international factors therefore risk being inaccurate.

We follow this insight, but also go beyond it, as the aforementioned research does not take into explicit account the *institutional design*, rather than just the presence, of international institutions. The additional focus on the design, or institutionalization, of international institutions is necessary in part because policymakers and international organizations (and accordingly, scholars) have dedicated much attention to designing international agreements in a way to promote more cooperative outcomes and therefore enhance these agreements' effectiveness. In the context of managing shared water resources, policymakers and academics have proposed and implemented a push toward developing new river-sharing treaties and, explicitly, international *institutional* features as parts of these treaties ([Tir & Stinnett 2011](#); [De Stefano et al. 2012](#); [Giordano et al. 2014](#); [UNDP 2006](#), 227-228).

Accordingly, studies report evidence that treaty institutionalization is indeed associated with lower odds of militarized disputes ([Tir & Stinnett 2012](#)) and better prospects for peaceful conflict management ([Mitchell & Zawahri 2015](#)). But whether treaty design and institutionalized features uniformly improve the political relations between states over water is unclear, according to a review of research on this issue ([Bernauer & Kalbhenn 2010](#)). When states sharing river basins are unable to adequately monitor water consumption and quality themselves, or face problems in regulating water usage, international river treaties with institutionalized features could help. In this logic (see [Tallberg \(2002, 614 and fn. 19\)](#) and [Wolf, Yoffe & Giordano \(2003\)](#) specifically on freshwater institutions), international agreements are able to fill the gap left by weak domestic institutions. This argument is built on the premise that enhancing international river treaties with

institutionalized provisions can compensate for a lack of domestic bureaucratic capacity and quality. These provisions in turn help overcome and minimize barriers to cooperation that stem from weak domestic bureaucracies. This logic, however, is likely too optimistic.

One study suggests that low domestic capacity may complicate interstate cooperation over water resources (Bernauer & Kuhn 2010) while another argues that river-sharing states are more likely to slip into water conflicts under conditions of stress where the domestic “institutional capacity to absorb stress” is lacking (Wolf, Yoffe & Giordano 2003, 42). We thus argue that domestic capacity to absorb stress and political pressures qualifies the positive impact of treaty institutionalization on political cooperation over water issues. By emphasizing both bureaucratic quality and the degree of treaty *institutionalization* simultaneously, we advance international cooperation research, which has heretofore considered the two factors separately.

### **Institutionalized River Treaties and the Conditioning Role of Bureaucratic Quality**

Even institutionalized treaties, which include specific monitoring, adjudicating, enforcing, or centralized management features, will need to rely on domestic bureaucracies to contribute administrative functions or information. Capable domestic bureaucracies might still be needed to measure water quality and regulate dams, hydroelectric facilities, and industrial use. If domestic institutions are unable to perform these tasks effectively, even highly institutionalized river treaties will lack the (domestic) foundation to promote interstate cooperation over water issues.

While highly institutionalized river treaties may therefore perform a number of cooperation-inducing functions, the absence or weakness of quality domestic bureaucracies will ultimately make the implementation of treaty terms difficult and consequently keep transboundary freshwater cooperation fragile. Treaties have little ability to engage within countries to directly affect the behavior of many individual water users (e.g., households, farmers, or industry). Without this ability, changing the behavior of the very users from which problematic water diversion, consumption, or pollution behavior stems will not be easy to accomplish. For instance, monitoring institutions formed by river treaties rely on information provided by domestic bureaucracies. Enforcement

agencies of river treaties and even international organizations emanating from treaties need to rely on cooperating with domestic bureaucracies to implement obligations from treaties.

Accordingly, we see a capable bureaucracy performing three important sets of tasks that have a bearing on international cooperation. First, a capable and autonomous bureaucracy is more likely to implement treaty obligations consistently. Such obligations can include upgrading inefficient water infrastructure, cleaning polluted water before it is released back into the river, or reporting information about water consumption and quality. None of these tasks, including those that involve monitoring individual use, is necessarily easy. Without functioning and strong bureaucracies, there is a high potential that undesirable water use behavior goes undetected or cannot be effectively curtailed. This in turn creates negative externalities for other water users both at home and abroad.

Second, curtailing water users' behavior is likely to be controversial as it increases costs for them. Users then have the incentive to pressure the government to stop enforcing unpopular treaty provisions. If governments give in, the state's compliance with treaty provisions will be inconsistent, which creates problems for the cooperative relationship with other treaty member countries. Capable and autonomous bureaucracies, however, will be more resistant to such government interference. This makes treaty compliance more systematic and predictable. Such bureaucracies, in other words, will leave room for fewer externalities and thus fewer obstacles to international cooperation. This logic arguably extends to changes in political leadership as well. Bureaucracies can help ensure policy consistency even when changes in political leadership result in changes in policy preferences that in turn endanger extant formalized commitments (Leeds, Mattes & Vogel 2009; Mattes 2012). Actual policy changes at the specific level of meeting treaty obligations will be far less likely in the presence of high-quality bureaucracies that are professional and capable of implementing policies without direct intervention by the political leadership.<sup>5</sup>

Third, because water is a fundamental resource and its shortage is quickly visible, the politics of freshwater are often salient. This applies especially when water resources involve other countries, as is the case with transboundary river basins. Rather than addressing water shortages or pollution

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<sup>5</sup>The importance of *general* bureaucratic quality and independence even in issue-specific domains is also emphasized in a recent study on physical integrity rights (Cole 2015).

within the framework of institutionalized treaty features (e.g. conflict resolution mechanisms), governments may be tempted to shift the blame to a neighboring state or a river basin organization. Precedents for such behavior exist, for instance in a recent case in Pakistan, where “leaders of political parties ... blamed ... Pakistan’s neighbors for the nation’s water woes” (Nayani 2013). With a weak bureaucracy that depends directly on governments, such diversionary behavior even in the presence of institutionalized treaty features is unlikely to be prevented. However, when bureaucracies are stronger and more autonomous, they are considerably less likely to allow room for governments to pursue freshwater policies that may give rise to conflict with other countries.

Two examples help illustrate some of these dynamics and the differing trajectories of countries’ relationships.<sup>6</sup> Institutionalized treaties govern freshwater relations within both the Israel-Jordan and India-Pakistan dyads: the Water Annex of the 1994 peace treaty (Israel-Jordan) and the 1960 Indus Water Treaty (India-Pakistan). The Water Annex calls for water transfers from Israel to Jordan and cooperative development and management of water sources. The Indus Water Treaty, among other regulations, stipulates water transfers from India to Pakistan and allows India to build a system of canals and hydroelectric dams without impeding the flow of water toward Pakistan.

Despite the population’s dislike of the idea of having to conserve water in order to turn it over to a (former) enemy, Israel’s high-quality bureaucracy has been able to implement measures to generate water savings so that the country could comply with treaty terms. These include increasing the price of water, establishing allocations and monitoring consumption closely, and providing water-saving devices to households. Meanwhile, Jordan’s mid-quality bureaucracy has been able to increase the efficiency of water use in the Jordan River Valley, by helping farmers switch from inefficient surface to more efficient sprinkler irrigation methods. This has helped quell dissatisfaction among the sizable and politically influential Palestinian (refugee) population, which sees cooperation with Israel as highly undesirable. In both countries, the effectiveness of the respective bureaucracies has made a potentially politically explosive issue more palatable to domestic populations and improved the potential for international-level cooperation.

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<sup>6</sup>Sources for these cases are documented in the Supporting Information.

In contrast, despite significant funding from the World Bank, India's below-average quality bureaucracy has struggled to develop the watershed in the ways stipulated by the treaty while preserving Pakistan's water rights. The bureaucracy has been overwhelmed by growing domestic demand for water, due to a growing population, and discontent over the potential of under-supplying water to domestic users so that it could flow to Pakistan. Meanwhile, Pakistan's bureaucracy (also ranked at lower quality) struggles to deal with water shortages. One result has been the Karachi "tanker mafia", which steals water from hydrants and then sells it to locals at highly inflated prices. The bureaucracy has been unable to prevent major domestic discontent over how Pakistan governs its water relations with India. This implies that the Pakistani government has very little domestic support to look for potential solutions and compromises with India to fix problems related to sharing the Indus watershed.

Underlining these dynamics, international legal scholarship suggests that bureaucracies are predisposed toward implementing and enforcing treaty obligations. Institutionalized treaties may require "agencies from different states [to] interact [...] with each other" directly (Posner 2005, 812-813). Some have argued that such direct interactions generate a predisposition among bureaucracies to act in accordance with formalized international treaties.<sup>7</sup> For our argument, this implies that bureaucracies with more autonomy and higher quality are likely to reduce the odds that governments will act against institutionalized treaty provisions and block cooperation with neighboring water users. A corollary of this argument is that bureaucratic quality can somewhat improve cooperation even in the absence of institutionalized river treaties. Strong bureaucracies can mitigate some, but certainly not all, of the frustrations that prompt failures of cooperation. Following this logic, international organizations and environmental agreements have recently sought to improve the capacity of domestic institutions and bureaucracies. The Indus treaty and the South Asian Association for Regional Cooperation are one example.

Some evidence for our overall argument also comes from studies of a highly institutionalized regime beyond water issues, the European Union. Börzel et al., for instance, find that when the

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<sup>7</sup>Examples include Raustiala (2002) and Slaughter (2004).

legalization and institutionalization of international rules are held constant in the form of EU rules, states still vary substantially in their rates of implementation and violation of these rules. This variation can be explained by bureaucratic quality, while the preferences at the country-level play virtually no role (Börzel et al. 2010, 1377). Notably, Perkins & Neumayer (2007) find no relationship between bureaucratic quality and implementation of another type of EU directives, but point out that this might be due to the low variance of bureaucratic quality among the European countries in the sample. This is the argument we make above: only as institutionalized river treaties expand to less developed regions with weaker bureaucracies should the moderating role of bureaucracy become apparent.<sup>8</sup> Where bureaucracies are more beholden to government interference and lack capacity, even institutionalized treaties will be far less effective in promoting cooperation and improving interstate relations. In short, capable and autonomous bureaucracies are indispensable to the actual implementation of international-level water cooperation policies. While institutionalized river treaties resolve international-level coordination problems and set behavioral standards, it is up to domestic bureaucracies to actually implement the terms of transboundary river treaties and deal with problems on the ground. This joint action in turn decreases the conflict potential between river-sharing states and sets the stage for cooperative behavior.

To be sure, we are *not* arguing that institutionalized treaties are irrelevant. While they need capable domestic bureaucracies, treaties themselves offer value added beyond what domestic bureaucracies can themselves accomplish. Most notably, due to their centralization and independence properties, institutionalized treaties can, for example, help assure that the information being passed between participating states is accurate, that interstate disagreements are resolved effectively, and that rules for violations are clear so that disputes do not escalate.

For the *political relationship over water issues* between the river treaty member states to be cooperative rather than conflictual, *both* institutionalized treaties and high-quality, autonomous domestic bureaucracies are needed. The inability to implement treaty terms due to low bureau-

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<sup>8</sup>It is possible that environmental conditions outside Europe are harsher (in our case, drier), making cooperation more difficult. But this is not uniformly the case. Our analyses also control for water availability to incorporate this ecological diversity.

cratic quality will be problematic for the relationship between states that have signed a river treaty. Problems with water quality and quantity that may have spurred riparian states to pursue river treaties in the first place will persist and fail to improve the relationship between these states. And the situation can become even more difficult: in addition to the original water-related problems, the states are now also frustrated by failures of implementing treaty terms.

In sum, to ultimately and positively affect the politics of freshwater cooperation between countries, international treaties and their institutionalized features require assistance from domestic bureaucracies that can help address domestic sources of collaboration problems. This in turn improves the chances of subsequent cooperation between states over water resources. Our argument thus yields a conditional hypothesis:

The positive impact of institutionalized river treaties on freshwater-related cooperation between riparian dyads is contingent on the quality of domestic bureaucracies. Dyads sharing the same river will cooperate most when they are part of treaties with institutionalized features and when they have domestic bureaucracies with high quality. We expect cooperation to be higher in this scenario compared to one where only one factor (either treaty institutionalization or high-quality bureaucracies) is present.

## **Research Design**

The empirical domain consists of all country pairs that share an international river basin.<sup>9</sup> Following common practice in international relations scholarship based on the observation that most interstate interactions are bilateral, we conduct the empirical analysis at the level of the dyad. This is also consistent with our argument, emphasizing how cooperative and conflictual interactions over water foremost occur between pairs of states. Data availability for the quality of domestic bureaucracies limits the analyses to the years 1984–2006. The dyad-year is the unit of analysis.

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<sup>9</sup>For our purposes, an international river basin ‘comprises all the land that drains through a given river and its tributaries into an ocean or an internal lake or sea and includes territory of more than one country’ (Yoffe, Wolf & Giordano 2003, 1110).

## Outcome: Cooperation over Shared Freshwater Resources

Our argument requires specific data on countries' freshwater-related interactions. Using such data allows for the closest possible link between theory and empirics, matching river treaty institutionalization to the type of state behavior it is meant to affect. That is, our hypothesis requires a measure of the degree to which states cooperate specifically over shared water resources. This observed behavior is a good measure for gauging the degree to which treaties can actually impact the quality of interaction between riparian states. To build this measure, we rely on the well-known Transboundary Freshwater Dispute Database (TFDD; [Wolf 2014](#)). Along with providing information on freshwater treaties, the TFDD contains the Basins at Risk (BAR) Water Events data. The authors of this database define “water events as instances of conflict and cooperation that occur within an international river basin, involve the nations riparian to that basin, and concern freshwater as a scarce or consumable resource (e.g., water quantity, water quality) or as a quantity to be managed (e.g., flooding or flood control, water levels for navigational purposes)” ([Yoffe, Wolf & Giordano 2003](#), 1110). That is, events in the database relate to issues of water quantity, riparian infrastructure development, joint management of river resources, and hydropower generation.<sup>10</sup>

These data are advantageous because they are limited to only those events that concern shared river basins. They cover behavior such as military, economic, and diplomatic activity, verbal support and hostility, and military, cultural, and economic cooperation — when related to freshwater issues. The events were collected systematically from a variety of news sources and existing international events databases. The intensity of interactions is mapped onto the conflict-cooperation BAR scale. This scale classifies political interactions in the manner used in other event data projects, such as the COPDAB coding procedures ([Azar 1980](#)). Event codes in our time period range from most conflictual (−5 for small-scale military acts) to most cooperative (+6 for major cooperative events such as establishing joint programs or forming strategic alliances). TFDD data have been used extensively in past studies of international freshwater politics.<sup>11</sup> Using in-

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<sup>10</sup>[Yoffe, Wolf & Giordano \(2003\)](#) provide a detailed description of coding sources and procedures as well as descriptive statistics relating to the database.

<sup>11</sup>Examples include [Brochmann \(2012\)](#), [Brochmann & Hensel \(2011\)](#), [Brochmann & Gleditsch \(2012\)](#), [Yoffe et al.](#)

formation on interstate relations over freshwater resources *only*, rather than broader interactions in economic or security affairs, is crucial to isolating the impact of treaty institutionalization and domestic bureaucracies on water politics.

Information about river treaties and domestic bureaucracies is available at a yearly level. Therefore, we aggregate event-level data to the yearly level by calculating the average level of interactions in a given year for a given dyad. This average level is positive when countries mostly engaged in cooperative events, neutral (0) when they engaged in neutral or non-significant acts or an equal level of cooperative and conflictual events, and negative when they mostly engaged in water-related conflicts. Dyad-years without any events recorded in the BAR database are coded as neutral (0), although our results are also robust to excluding these dyad-years (see Model 4 in Table A2). Using this aggregation method, we find substantial variance across years as well as across dyads in the time period under examination (see Figure A3 in the SI). Some years see substantially more cooperation than others (with several standard deviations in between some years), and some dyads are significantly more cooperative than others across time.

#### Predictors: Treaty Institutionalization and Domestic Bureaucratic Quality

**Treaty institutionalization.** Because our theoretical argument emphasizes the role of *institutionalized* treaty features, our first key explanatory variable is an additive river treaty institutionalization index, capturing the degree of river treaty institutionalization and adapted from a study by Tir & Stinnett (2011).<sup>12</sup> The index is composed of the following institutional features potentially contained in each of the agreements: monitoring, enforcement, conflict resolution, and delegation of authority to an international organization. For each basin-sharing dyad, we score each potential institutional component as 0 or 1, and then add them up. This produces a scale of institutionalization ranging from 0 to 4, where 0 indicates informal dyadic cooperation only (i.e. no treaty or no institutionalized features if a treaty was signed) and 4 indicates that a dyad has institutionalized all

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(2004), Wolf, Yoffe & Giordano (2003), Tir & Stinnett (2011), and Mitchell & Zawahri (2015).

<sup>12</sup>The treaties under consideration can be bilateral or multilateral.

four features.<sup>13</sup> Among dyads that have at least one river treaty in place, these treaties have a mean and median of 2 institutionalized features.

**Domestic Bureaucratic Quality.** A good measure of this concept evaluates the degree to which bureaucracies are competent, equipped, and autonomous enough to maintain treaty obligations. A variety of government agencies are arguably relevant to freshwater policy, ranging from water-specific institutions to agencies enforcing property rights and dealing with corporate and private demand for resources. The breadth of these functions and agencies involved — and our focus on political rather than environmental outcomes — would make a measure of water-related institutions too narrow to evaluate our argument. For a conceptually broader measure with sufficient empirical coverage, we turn to the International Country Risk Guide (ICRG) project and its indicator of *Bureaucratic Quality* (The PRS Group 2009). This measure captures the degree to which bureaucracies are well-trained and insulated from political influence and rapid disruptions; high scores are assigned to countries with strong bureaucracies with high levels of expertise. The original source defines high-quality bureaucracies as able to “minimize revisions of policy when governments change” and “somewhat autonomous from political pressure” (The PRS Group 2009). These are the qualities our theoretical argument emphasizes as well. Other work has used this measure in studies of economic growth or government performance, and also in the area of human and physical integrity rights — similarly foregoing the use of narrower, economically-focused institutional measures in favor of a broader indicator.<sup>14</sup>

The weak link logic in international relations research suggests that the dyad member with the lower bureaucratic quality will be determinant actor in the relationship (Oneal & Russett 1997). We follow this logic and use the lower bureaucratic quality score in the analyses. The bureaucratic quality measure is rescaled to range continuously from 0 to 1, with a mean (median) of 0.48 (0.25). More specific information on the distribution of both main predictors is provided in the SI.

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<sup>13</sup>All information on treaty characteristics, including the overall index, are coded with respect to changes over time. That is, if a treaty is renegotiated and deepened, the new information is reflected in the treaty institutionalization index from that point forward.

<sup>14</sup>Examples include Sachs & Warner (1997); Knack (2001); Busse & Hefeker (2007); Rajkumar & Swaroop (2008); Papaioannou (2009); and Cole (2015).

## Control Variables

Our empirical models control for potential influences on cooperation patterns drawn from the water politics and international relations literature. These control variables include indicators for water stress, the number of treaties covering a basin, liberal influences (broader political regime type, economic development, states' participation in intergovernmental organizations), and factors associated with realist accounts of international relations (the distribution of power within the dyad and military alliances). More specific motivations, sources, and results are discussed in the supporting information.

## Estimation

The data cover several hundred cross-sectional units (dyads) and varying amounts of years per dyad. Preliminary tests indicate no notable problems with the data structure that would warrant corrections; the main models presented below pool observations, allowing us to compare cooperation levels of different dyads in different years, depending on their configuration of treaty institutionalization and domestic bureaucratic quality. In robustness tests, we also present results from models containing fixed effects for dyads or years, restricting inferences to the effect of changes in treaty institutionalization within and between dyads. Unless otherwise specified, we report linear regression estimates.

Each model includes a multiplicative term between the measures of river treaty institutionalization and domestic bureaucratic quality, along with the constitutive terms. The core of our argument implies that the positive impact of treaty institutionalization on cooperation should be substantially higher when both states in a dyad have high-quality bureaucracies compared to dyads where at least one state's bureaucracy is less effective. Because estimates and their standard errors vary across the range of bureaucratic quality, we present marginal effects as well as predicted cooperation levels at different values of treaty institutionalization and domestic bureaucratic quality in Figures 1, 2, 3, and A7.

**Table I.** Estimates of water-related cooperation, 1984–2006.

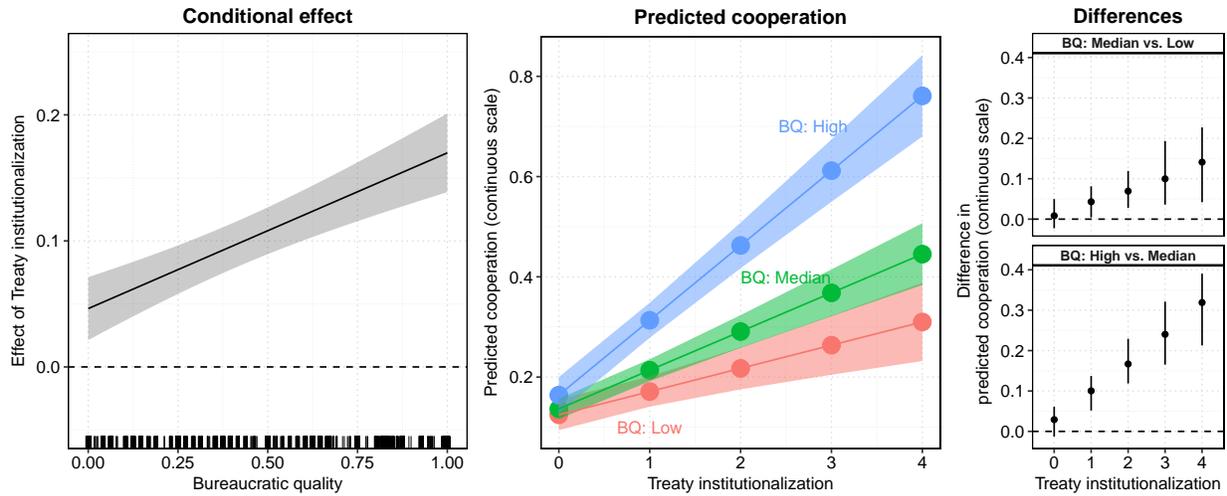
Outcome Model (Estimator)	Avg. cooperation 1 (OLS)	1+ cooperative events 2 (Probit)
Treaty institutionalization	0.046* (0.013)	0.146* (0.027)
Bureaucratic quality (lower)	0.047 (0.040)	0.225* (0.094)
Treaty institutionalization × Bureaucratic quality (lower)	0.124* (0.022)	0.070 (0.045)
Water availability (lower)	−0.006 (0.005)	−0.056* (0.013)
Treaty count	−0.011* (0.005)	−0.019 (0.010)
Democratic dyad	−0.083* (0.025)	−0.201* (0.058)
GDP p.c. (higher, logged)	−0.008 (0.008)	−0.005 (0.019)
Power ratio	0.011 (0.006)	0.023 (0.013)
Alliance	0.002 (0.019)	0.001 (0.044)
Intercept	0.220* (0.078)	−1.209* (0.179)
Dyad-years	11197	11197

\* $p < 0.05$ . Standard errors in parentheses.

## Discussion

Table I reports the main regressions, and Figure 1 focuses on the conditional relationships in particular. Model 1, visualized in Figure 1, shows clear evidence for a conditional relationship. Panel (a) demonstrates that the effect of adding institutionalized treaty features more than triples when comparing a dyad with low bureaucratic quality to a dyad where both states have high-quality bureaucracies. Further illustrating the size of this effect, panel (b) shows the predicted cooperation levels on a continuous scale for three types of dyads: one where at least one country in the dyad has low bureaucratic quality (at the 10<sup>th</sup> percentile), one at the median level of bureaucratic quality, and one with high bureaucratic quality (at the 90<sup>th</sup> percentile). As institutionalist scholarship would suggest, dyads that have signed river treaties with more institutionalized features cooperate more. However, this effect is considerably more pronounced in those dyads where both states can rely on high-quality domestic bureaucracies. Where that is the case, adding two or three institutionalized features (the modal number) to a treaty increases the predicted cooperation level almost

three- or fourfold (from 0.17 to 0.46 or 0.61). Conversely, institutionalizing treaty features results in smaller and much less meaningful increases in cooperation in dyads with lower domestic bureaucratic quality. At low levels of domestic bureaucratic quality, adding two institutionalized treaty features increases predicted cooperation slightly and barely at a statistically distinguishable margin, but far less than in dyads with higher domestic bureaucratic quality.



**Figure 1. Model 1 (OLS).** The effect of river treaty institutionalization on water-related cooperation between countries at different levels of bureaucratic quality in the dyad. Panel (a) shows the conditional effect on the y-axis, across the range of bureaucratic quality with tick marks indicating the distribution of this moderating variable. Panel (b, top) shows predicted cooperation levels at low (at the 10<sup>th</sup> percentile), median, and high (at the 90<sup>th</sup> percentile) bureaucratic quality. Panel (c, bottom) shows first differences between the predicted values:  $\widehat{\text{Cooperation}}_{\text{median BQ}} - \widehat{\text{Cooperation}}_{\text{low BQ}}$ , etc. For the predicted values and first differences, all control variables are held at typical (median) values. Shaded areas/whiskers represent 95% confidence intervals around the estimates. Full results in Model 1, Table I.

These results are fully consistent with the hypothesized conditional relationship between treaty institutionalization and the quality of domestic bureaucracies. Adding institutionalized features to river treaties promotes interstate cooperation most effectively when the respective states contain high-quality domestic bureaucracies. This counters the expectation that institutionalizing interstate agreements can solve collaboration problems and promote cooperation all on its own, regardless of domestic institutional characteristics of participating countries. Solely institutionalizing the features of international agreements has a small (and, across robustness tests, only inconsistently significant) effect on interstate cooperation when participating states lack high-quality bureaucra-

cies.

## Robustness tests

These results are robust to a number of alternative measurements and empirical specifications.

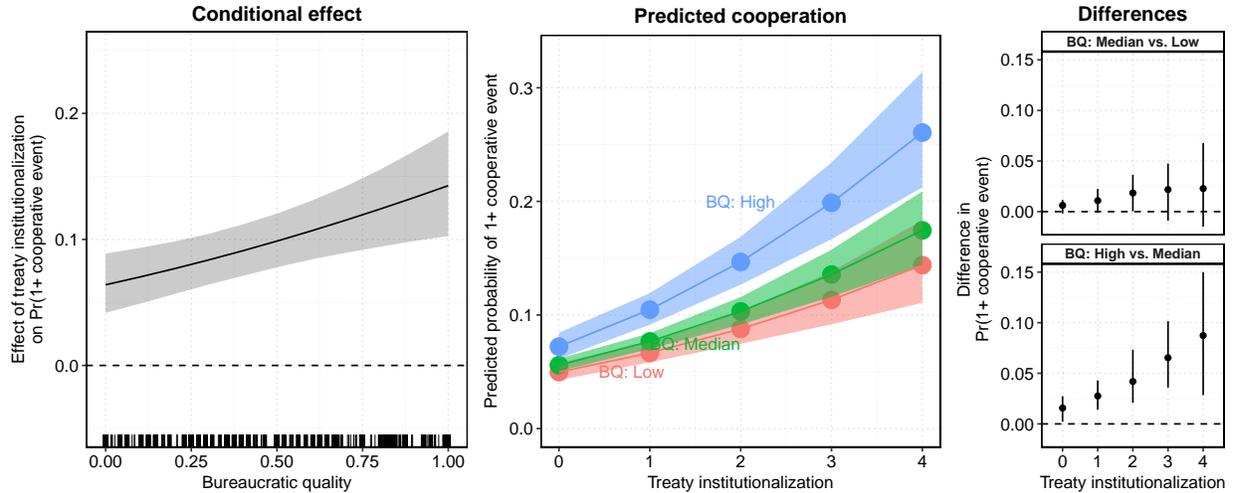
**Binary cooperation indicator.** As an alternative to averaging events, and given that we are primarily interested in cooperation, we also create a second indicator of interstate cooperation over water resources. This indicator is binary and takes a value of 1 in those dyad-years where states engaged in at least one significant cooperative act. It is 0 in all other dyad-years. The advantage of this approach is that it values cooperation, the goal of river treaty institutionalization, independently of conflict and does not discount cooperative events if a dyad experienced conflictual events in the same year (Bernauer & Böhmelt 2014). The marginal effect of adding institutionalized treaty features on the probability of cooperation is significantly larger at higher levels of bureaucratic quality, holding all other predictors at typical values; see Figure 2.<sup>15</sup> The probability of at least one cooperative event occurring in one year increases from 7 percent to 20 percent by adding three institutionalized treaty features and to over 25 percent with four features — but only when the quality of domestic bureaucracies in both states ranks highly. When the quality of domestic bureaucracies is in contrast low, the probability of cooperation only increases to 14 percent even with all four institutionalized treaty features added.

**Median cooperation** As an alternative to average cooperation that is less sensitive to outliers, we use the median cooperation level in a given dyad-year. Figure A7 (3) and Model 3 (Table A2) are again consistent with our conditional hypothesis.

**Excluding years without events.** In Model 1, we assume that years with no events recorded in the BAR database are tantamount to neutral interactions. To relax this assumption, we estimate

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<sup>15</sup>Even though the estimate of the interaction term falls short of the significance threshold, examining the marginal effects or predicted probabilities rather than coefficients alone is particularly necessary for a correct interpretation of interaction terms in generalized linear models (Ai & Norton 2003, 129).



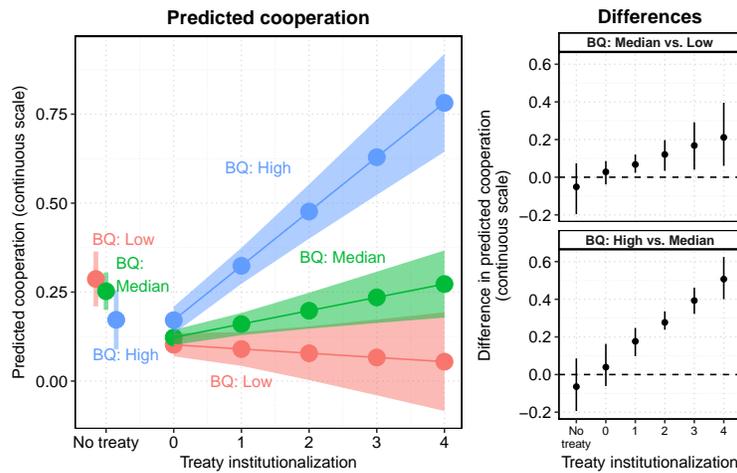
**Figure 2. Model 2 (Probit).** The effect of river treaty institutionalization on at least one instance of water-related cooperation between countries at different levels of bureaucratic quality in the dyad. Conditional effects are based on simulating the effect of changing the number of institutionalized treaty features from 0 (the 10<sup>th</sup> percentile) to 3 (the 90<sup>th</sup> percentile) on the probability of a cooperative event. Conditional effects of other changes in the number of institutionalized treaty features (0 to 1, 1 to 2, etc.) are equally significant, but respectively smaller or larger. See Figure 1 for further details on plots. Full results in Model 2, Table 1.

our base model on only those dyad years for which events were recorded. The results of Model 4 (Table A2) reveal even clearer support for the conditional view. Figure A7 (4) shows that adding institutionalized features to river treaties does not increase the predicted cooperation between states in the first quartile of bureaucratic quality and returns positive effects only at higher levels of domestic bureaucratic quality. Again, the increase in predicted cooperation is substantively larger at high bureaucratic quality than at median levels.

**Treaty institutionalization and no treaties.** In the original analyses, we assign an institutionalization score of 0 to those dyads that have either not signed treaties or have signed treaties that contain no institutional features at all. This reflects our focus on treaty *institutionalization* as the potential answer to interstate freshwater cooperation dilemmas. As a robustness check, we differentiate between these two types of situations. This specification requires an additional indicator to be included in the model for dyads that have not signed any treaties at all.

Model 5 in Table A2 and Figure 3 report these results. The figure shows that there is no sig-

nificant difference in the predicted cooperation scores at different levels of bureaucratic quality for those dyads that have signed no treaties at all. The left part of the figure illustrates this in the form of overlapping confidence intervals for predicted cooperation at different levels of bureaucratic quality — all in the absence of treaties. When dyads have signed treaties, however, a notable and significant increase in predicted cooperation exists only when both states in the dyad have high-quality bureaucracies; see the right part of the figure. For the marginal effects derived from this model, see Figure A7 (5).



**Figure 3. Model 5 (separate indicator for no treaties).** Predicted cooperation, differentiating between dyads with no treaties and dyads with different counts of institutionalized treaty features. See Figure 1 for further details on plots. Full results in Model 5, Table A2.

**Dyad-specific or year-specific effects.** Higher collaboration levels could also be a function of heterogeneity among dyads or between time periods as well as unobserved confounders, such as better overall relations that are not captured by any of the covariates in our models. To address this concern, Model 6 (Table A2) presents our main results including fixed effects for dyads. The fixed effects here account for any between-dyad variance not captured in the control variables. The results remain unchanged and now represent the effect of treaty institutionalization *within* a dyad, that is, the effect of adding institutionalized treaty features to the same dyad while holding all other predictors constant; see also Figure A7 (6). To exclude the potential of autocorrelation biasing the results, we also add a lagged average cooperation score to this fixed effects model (7a) and, as

an alternative, estimate a dynamic panel model using a generalized method of moments (GMM) estimator. These demanding models still return the same result of domestic bureaucratic quality moderating the effects of river treaty institutionalization; see also Figure A7 (7a) and (7b). Alternatively, we investigate differences *between* dyads by absorbing all temporal variation in fixed effects for years in Model 8 and Figure A7 (8). Again, the conditional impact of treaty institutionalization persists. Finally, we allow dyad and year effects to vary in a random effects model and again obtain similar results (Figure A7 (9) and Model 9 in Table A2)

**Quality of overall dyadic relationships.** A more specific way of addressing differences between dyads is to include a control variable that captures long-term disputatious relationships between dyads. For this purpose, we use a binary indicator for enduring political rivalries between countries, taken from Thompson & Dreyer (2011). Model 10 (Table A2) shows the results of this model and returns similar results; see also Figure A7 (10).

**Endogeneity of treaty institutionalization.** A typical concern in the literature on international institutions is that more cooperatively-minded states might selectively establish international institutions with other cooperative states. With our explanatory variable, this would extend to treaty *institutionalization*. If that were the case, any resulting cooperative behavior cannot be attributed to the treaties themselves (see, e.g., Downs, Rocke & Barsoom 1996; von Stein 2005). We offer three responses to this concern. First, previous work has not found conflictual relations (for instance, the occurrence of militarized interstate disputes) as a significant predictor of (un)successful treaty negotiation or (lower or higher) degrees of treaty institutionalization (Brochmann & Hensel 2009). Second, the correlation between treaty institutionalization and past cooperation itself is not as strong as one might expect if such selection processes were present; Spearman's  $\rho$  is only 0.09. Similarly, anecdotes such as of Uruguay's and Argentina's disputes over the Uruguay river *despite* the presence of an institutionalized treaty indicate that treaties and institutionalized treaty features are not exclusive to "cooperative" dyads.

Third, for a more systematic evaluation, we also report results from an instrumental variable

(IV) solution. As an instrument, we use the number of states in the basins shared by the dyad members. This instrument predicts the institutionalization of river treaties (see Table A5), and there is also a theoretical argument that the number of states affects cooperation through treaty institutionalization only. The more states in a basin, the more difficult it is for all basin members to ascertain others' behavior due to the multiplicity of strategic options, and the more difficult it is to enforce behavior bilaterally. Following this rational design logic (e.g., Koremenos, Lipson & Snidal 2001), states in these situations are more likely to turn to treaties with institutionalized features. The resulting IV estimates shown in Figure A7 (11) and Table A2, Model 11 are substantively similar to the main results in the preceding discussion. Notably, the cooperative effect almost triples at high levels of bureaucratic quality, again supporting our conditional effect hypothesis. More details on the choice of instrument, estimation, and first-stage results can be found in the supporting information.

**Does bureaucratic quality explain treaty institutionalization?** These findings may be obsolete if treaty institutionalization were a tool used mostly by OECD countries with high bureaucratic quality and the resulting expertise to negotiate and contribute to additional treaty features. If this were the case, the moderating role of bureaucratic quality might be due to a data structure where river treaties only have many institutionalized features in dyads with high bureaucratic quality. The data suggest that this is unlikely. Treaties with 3 or 4 institutionalized features are found in dyads with low and high domestic bureaucratic quality alike. Over 900 dyad-years in the data are subject to river treaties with at least 3 institutionalized features despite being below the 10<sup>th</sup> percentile of domestic bureaucratic quality (see Figure A4 in the SI). In a comparison of two dyads with lowest and highest bureaucratic quality, the dyad with higher bureaucratic quality would exhibit, on average, 0.4 more institutionalized treaty features—one-third of a standard deviation of that measure, further indicating that there is no notable relationship between bureaucratic quality and treaty design (Figure A6 in the SI).

An alternative robustness test estimates the determinants of (a) freshwater cooperation and (b)

treaty institutionalization jointly in a seemingly unrelated regression framework. Estimates for the conditional impact of treaty institutionalization depending on bureaucratic quality remain virtually identical, and the residuals of the two equations are not correlated; see Table A4. We find no evidence that dyads with more capable bureaucracies are more likely to sign or create treaties with more institutionalized features.

### The individual impact of treaty features

Our argument reflects on the long-term trend toward institutionalizing and legalizing international cooperation as a solution to international cooperation problems under anarchy. Separate from examining treaty features in an additive manner, we can also tease out whether the relationships between *individual* treaty features and cooperation differ in their dependence on domestic bureaucracies. In these separate models, each of the potential institutionalized treaty features (monitoring, enforcement, conflict resolution, and delegation of authority to an international organization) enters as a covariate interacted with bureaucratic quality. Across the board, we find in Table A3 and Figure A7 (14–17) that each institutionalized feature by itself increases cooperation over freshwater the most in dyads with capable bureaucracies. We note two additional trends. Conflict resolution provisions are not associated with cooperation in dyads with low bureaucratic quality, but do increase cooperation when bureaucratic quality is high. When treaties provide institutionalized enforcement mechanisms (12% of our observations), they increase cooperation in dyads with high bureaucratic quality; but they decrease cooperation in dyads with lower bureaucratic quality. This observation is consistent with our proposition that giving international bodies the ability to enforce rules can backfire when domestic conditions inhibit the policies necessary to comply with international rules. In this case, dyads with treaties with enforcement features may cooperate less than dyads without these features when underperforming bureaucracies fail to implement treaty obligations despite formal enforcement features in the treaty. This is the scenario we describe in our argument: treaty institutionalization can set countries up for frustration when domestic shortcomings undermine treaty obligations.

For example, consider the treaties between Israel-Jordan and India-Pakistan discussed above. Both dyads' freshwater relations are governed by treaties that provide institutional mechanisms — such as monitoring, joint management, and enforcement — to help implement treaty terms. In the Israeli-Jordanian case, mid- to high-quality domestic bureaucracies have been able to take necessary steps to improve water-use efficiency, upgrade the related infrastructure, and thus attenuate worries about water shortages. This has not only helped improve the prospects of treaty-based cooperation but, by also heading off domestic political discontent, helped positively transform the Israeli-Jordanian relationship over water. None of these outcomes has transpired in the Indus basin, where below-average quality bureaucracies have struggled to facilitate the implementation of treaty terms. Despite a treaty institutionalized along three of the four dimensions we measure (the 90<sup>th</sup> percentile), the inability of domestic bureaucracies to implement changes called for by the treaty has resulted in a fair amount of both domestic- and international-level political discontent — and in a lack of cooperation over freshwater.

### Control Variables

The findings reported above are robust to controlling for the influence of several variables that may have a bearing on the relationship between riparian states. While we find no consistent evidence for other, broadly-based liberal factors (economic development, democracy, and shared IGO memberships) to promote cooperation at a meaningful scale, our key explanatory variables perform consistently well in our models — and more precisely capture liberal-institutionalist influences in the context of cooperation in the arena of water politics. Findings on other control variables are discussed in detail in the supporting information.

### Implications and Conclusion

This study uses the critical case of the politics of cooperation over transboundary rivers to assess the degree to which international institutions can promote cooperation in the absence of well-functioning domestic bureaucracies. Our findings suggest that institutionalizing international

cooperative arrangements to promote cooperation between states requires the presence of high-quality domestic bureaucracies in order to create a substantial positive effect on cooperation. Building up international treaties with multiple institutional features, while desirable, cannot on its own resolve barriers to interstate cooperation, unless capable domestic bureaucracies are present to support these treaty features. This finding is consequential, considering that much of international cooperation research to date has suggested that properly designed international institutions can resolve various interstate cooperation dilemmas. In line with this view, states with shared water resources have used river treaties to enhance transboundary freshwater management and improve water-related cooperation. Our findings raise doubts about this implicitly optimistic view of a constant positive effect of international institutions, independent of domestic institutions, on interstate cooperation.

States often fail to cooperate over water resources due to domestic problems, such as water use and management, or political incentives to prioritize national goals over treaty obligations. The solutions to cooperation problems thus also hinge on domestic factors. Yet, the frequent turn towards the buildup of institutionalized river treaties in the domain of international freshwater politics suggests that our findings have important implications for the way in which policymakers in governments and international organizations deal with the management of transboundary freshwater resources. In fact, practitioners have recently highlighted the importance of *domestic* capacity building for strengthening international regimes in environmental politics. In 2011, the UN Framework Convention on Climate Change created the Durban Forum on capacity-building. This happened 19 years after the UNFCCC was first established as a treaty. That formal efforts to boost capacity-building took such considerable time can be read to support our conjecture: states have long used international treaty instruments to resolve collaboration problems while implicitly assuming that these treaties and institutionalized features associated with them could fulfill their function regardless of domestic institutions, and even substitute for them.

The implications of our findings transcend the politics of river cooperation and environmental issues. If strong domestic bureaucracies are central to achieving meaningful international coop-

eration, researchers wishing to study the function and effects of international institutions need to direct more explicit attention to the moderating effect of these domestic institutions. For instance, after World War II, international institutional cooperation started with highly developed countries, mostly in Western Europe. Scholarship examining these institutions focused on the institutions themselves and their design. Later on, this type of institutionalized cooperation has spread beyond the OECD, to countries in the middle ranges of economic development. Yet, in both high and middle income countries, some degree of domestic bureaucratic quality can be assumed.

A potential problem of omitted variable bias in the analysis of institutions thus does not become apparent until the least developed countries participate in international institutions. For the proper theoretical and policy-oriented analysis of institutionalized cooperation it is therefore paramount to consider the moderating role of domestic institutions. This is not to say that institutionalist researchers would deny the importance of domestic institutions — but only that domestic bureaucracies have not received as much explicit attention in studies of international institutions as this study suggests they deserve. We argue that institutionalist research has been focusing on international institutions and their design to explain how states interact, but implicitly assumed that there is no meaningful conditional relationship between international institutional design and domestic institutions beyond broad concepts such as democracy. Our conjecture is that the functioning of international regime design often depends on specific domestic institutions and that researchers should more explicitly incorporate this relationship in theory development and empirical tests. Doing so can facilitate a more accurate evaluation of the relationship between international institutions, their design, and policy outcomes ranging from interstate collaboration over freshwater, as we showed in this study, to the resolution of specific transboundary challenges in other issue areas.

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