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Energy resources and the risk of conflict in shared river basins

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Abstract

This study examines the effect of energy resources on the chances for militarized conflict, water related conflict and cooperation events, and cooperative river treaties between pairs of states on shared international river basins. We examine trade-offs that riparian states can make between energy resources such as oil or natural gas and fresh water resources. Integrating upstream and downstream states' geographical position in a river basin with energy resource information, we examine four related scenarios of states sharing rivers: (1) *Joint energy* where both upstream and downstream countries have energy resources, (2) *Downstream energy* where only the downstream state has energy resources, (3) *Upstream energy* where only an upstream country has energy resources, and (4) *No energy*. Theoretically, we argue that *Downstream energy* dyads are most likely to find cooperative solutions to conflicts over shared river resources because downstream states can offer oil and natural gas side payments to upstream states in exchange for greater water supplies. Empirical analyses of dyadic data in shared river basin dyads from 1945 to 2001 provide strong support for the theory. Riparian cooperation through river treaties and diplomacy is best achieved in *Downstream energy* dyads, where the downstream states have energy resources that can be traded for water resources with upstream states. Militarized conflict and water related conflict events are most likely in *Joint energy* dyads. Case illustrations from the Aral Sea and Ganges river basins are used to demonstrate the theoretical arguments.

Keywords

Amu Darya, conflict, downstream, energy, Ganges, oil, Syr Darya, shared river basins, upstream, water

In August 2013, several Central Asian countries attended the Dushanbe forum to discuss future water issues involving two major international rivers in the region, the Amu Darya and the Syr Darya. Negotiators discussed the use of river water resources with two competing positions arising, the 'inefficient use' position posited by Kyrgyzstan and Tajikistan, and the 'fair and rational use' position urged by Uzbekistan.[1] Kyrgyzstan and Tajikistan, both located in upper areas of the Amu Darya and the Syr Darya, pushed to construct more hydropower facilities on the rivers to supplement their deficient energy supplies. Uzbekistan and Kazakhstan, as downstream agricultural states, raised concerns about water shortages caused by upstream power plants.[2]

States in the Aral Sea basin have not fully agreed upon negotiated targets for water release and water distribution, so disputes over energy and irrigation sectors are

[1] Central Asian countries discuss water cooperation at Dushanbe forum, *Times of Central Asia* 28 August 2013.

[2] BBC Monitoring Central Asia Unit supplied by CCV Worldwide Monitoring 23 August 2013.

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ongoing (Libert, 2008: 35; Siegfried & Bernauer, 2007).[3] In 2007–08, when an unprecedented cold winter was followed by a dry spring and summer, a severe water crisis arose in the region. Kyrgyzstan extracted higher than normal levels of hydropower from its dams on the Syr Darya river to resolve its national energy crunch. This created severe water shortages in Uzbekistan and Kazakhstan, harming downstream farmers who depended on river water for irrigation in the spring and summer growing seasons (Libert, Orolbaev & Steklov, 2008: 9). Seven months before an August 2013 meeting, Islam Karimov, the President of Uzbekistan, blamed upstream countries of the rivers, arguing that those in the upper stream such as Kyrgyzstan and Tajikistan should know that the Syr Darya and Amu Darya rivers are not their own property.[4] While tensions were high, the riparian states signed cooperative agreements in 1992 and 1998 that allowed for downstream countries to provide upstream countries with energy resources in exchange for greater water supplied in the growing seasons. The environmental performance of this international regulatory regime has been characterized by low performance and high variability (Siegfried & Bernauer, 2007), yet states in the Aral Sea Basin have avoided using militarized force to settle water conflicts.

Thus, while there have been disagreements over water resources, Central Asian riparian countries have been willing to cooperate with one another to resolve water-energy problems through diplomacy (Libert, Orolbaev & Steklov, 2008: 9). Situations where downstream states can trade energy resources for water resources from upstream states may be more cooperative than environments where the upstream state has exclusive control over water and energy resources or situations where neither side has energy resources to trade. We explore these resource configurations more generally by examining whether downstream states can promote cooperation and reduce the chances for militarized conflict by trading valuable resources like oil.

We analyze the effect of energy resources on the chances for militarized conflict, water related conflict events, and cooperative river treaties between states on shared international river basins. We consider states to have energy resources if they produce natural gas or crude oil through onshore or offshore sources. Integrating upstream and downstream states' geographical position in a river basin with energy resources information, we examine four related scenarios of states sharing rivers:[5] (1) *Joint energy* where both upstream and downstream countries have energy resources, (2) *Downstream energy* where only the downstream state has energy resources, (3) *Upstream energy* where only an upstream country has energy resources, and (4) *No energy*. We show that militarized conflict and water related conflict events are most likely in *Joint energy* dyads. Riparian cooperation is best achieved in the *Downstream energy* situation, where the downstream state has energy resources that can be traded for water resources with the upstream state. Cooperation among Asian riparian dyads demonstrates this more general pattern.

The remainder of the article is organized as follows. First, we review the literature on shared rivers and conflict between countries. The general arguments linking shared rivers, energy resources, and interstate conflict are then discussed. We illustrate the theory using cases from the Aral Sea and Ganges river basins. We formulate general hypotheses and conduct a large-N analysis using shared river basin and petroleum datasets. In the last section, we discuss the results of the study and identify avenues for future research.

Conflict and cooperation in shared river basins

Water is vital not only to an individual's survival, but also to the survival of a nation's economy and society (Brochmann & Hensel, 2009: 394; Wolf, 1998: 252). With growing concerns for the environment and increasingly limited water resources, states are seeking stronger footholds to secure water resources for their survival. States sharing river basins are more sensitive to guaranteeing state access to shared river water resources, especially if they depend on water supplies that originate outside their borders.[6] To manage shared rivers and water resources, interaction among riparian countries is inevitable. Scholars are interested in whether cooperation

[3] After the dissolution of the Soviet Union, Kyrgyzstan, Tajikistan, Uzbekistan, Kazakhstan, and Turkmenistan in Central Asia established the Interstate Commission for Water Coordination (ICWC) in 1992, based on the formal Soviet system to regulate the water resource. They signed multilateral agreements to mitigate regional conflicts and to manage water resources in the shared river basins.

[4] Uzbek President Karimov on the Soviet legacy and territorial disputes, *Times of Central Asia* 30 January 2013.

[5] Our unit of analysis is a shared river basin dyad that is contiguous and upstream/downstream in configuration.

[6] For example, Iraq and Syria depend, for up to 85% of their total water supply, on the Tigris and Euphrates Rivers, which flow from upstream Turkey into these states.

or conflict is more prevalent in these negotiations over transnational water resources.

Homer-Dixon (1994, 1999) argues that renewable resource scarcity and decreasing access to resources aggravates socio-economic frustration, increasing risks for violent conflicts. Urdal (2005) articulates a similar idea of relative deprivation associated with resource scarcity.[7] These arguments connect environmental issues and resource problems to human and national security, covering broad aspects of a society (Homer-Dixon, 1999; Myers, 1993; Renner, 1996; Suliman, 1998). Worsening resource scarcity and environmental problems give rise to social and political instabilities and increase security risks for individuals and countries. States and citizens may engage in violent conflicts with one another to secure their access to resources essential to their survival and security. Research on lateral pressure theory suggests additionally that increases in population size raise the demands for natural resources, which can also increase the likelihood for resource conflicts between countries as states seek to secure access to natural resources outside their borders (Choucri & North, 1975). This research shows that both demand side and supply side factors influence the relationship between resources and conflict.

However, shared rivers and water resources are not always associated with violent conflicts between countries. Sometimes states prefer peaceful solutions to violent conflicts fraught with risks. Cross-border diplomatic claims and riparian interstate disputes are more likely to occur where water resources are insufficient to meet high water demands (Hensel, Mitchell & Sower, 2006). Yet, peaceful negotiations are also more likely to occur in these situations (Brochmann & Hensel, 2009). Wolf (1998) argues that wars over water are neither strategically rational nor economically viable. States have shared interests that overwhelm conflict-inducing factors. Other scholars have pointed out that water scarcity does not necessarily increase the chances of violent conflicts. Water scarcity can be resolved through peaceful agreements designed to share the resource. In fact, states more often cooperate over shared water resources than fight over them (Hensel, Mitchell & Sower, 2006; Tir & Ackerman, 2009). Lonergan (2001) and Wolf (1998) also suggest that interested actors sharing waters are more likely to solve shared water issues through cooperation, and once cooperative patterns are established, they become resilient over time. Cooperation can also be enhanced through river treaties, river basin organizations, and regional international organizations, which help to improve the prospects for peaceful negotiations of contested water quantity, water quality, and navigational issues (Hensel, Mitchell & Sower, 2006; Tir & Stinnett, 2012). The development of international water law has also played an important role in helping states to resolve water conflicts (Libert & Lipponen, 2012). As we show, however, such situations for establishing cooperative solutions may vary based on other types of resources that states can leverage in their negotiations with riparian neighbors.

Several factors influence whether countries in a shared river basin engage in conflict or cooperation over river water resources. One critical factor is the upstream/downstream relationship (Barrett, 2003; Bernauer, 2002; Kemelova & Zhalkubaev, 2003) which results in interstate conflict more frequently than other types of shared river configurations such as mixed or sideways relationships (Brochmann & Gleditsch, 2012).[8] Power asymmetries in river basin dyads also influence the chances for conflict and the emergence of regional water governance institutions (Dinar, 2009b; Zeitoun & Warner, 2006). The presence of a hydro-hegemon on the river, such as Egypt on the Nile or India on the Ganges, increases the potential for cooperation as the hegemonic state can use its power advantage to negotiate a cooperative settlement. An imbalance in the supply and demand for water often provokes conflict over shared rivers (Bernauer, 2012; Elhance, 1997). This is also related to the water scarcity issue and one that induces peculiar water governance problems among riparian states (Brochmann, 2012; Giordano, Giordano & Wolf, 2005). Moderate levels of scarcity might produce more conflict than situations of high scarcity, where riparians seek side-payments or institutional solutions to their resource conflicts (Dinar, 2009a).

Many of these geographical and political factors are examined in case studies of rivers in the Americas, Western Europe, and the Middle East, including the Ganges, Jordan, La Plata, Nile, Rio Grande, and Tigris and Euphrates river basins (Crow & Singh, 2000; Daoudy, 2009; Fischhendler, 2004; Lowi, 1993). While some scholars point to the potential for side-payments in

[7] For a review of this literature, including a discussion of more critical perspectives about the link between natural resources and conflict, see Koubi et al. (2014).

[8] In mixed relationships, states are both upstream and downstream on the same river. In sideways relationships, two countries each have a share of the river basin, but no water runs from state A to state B or vice versa (Brochmann & Gleditsch, 2012: 522).

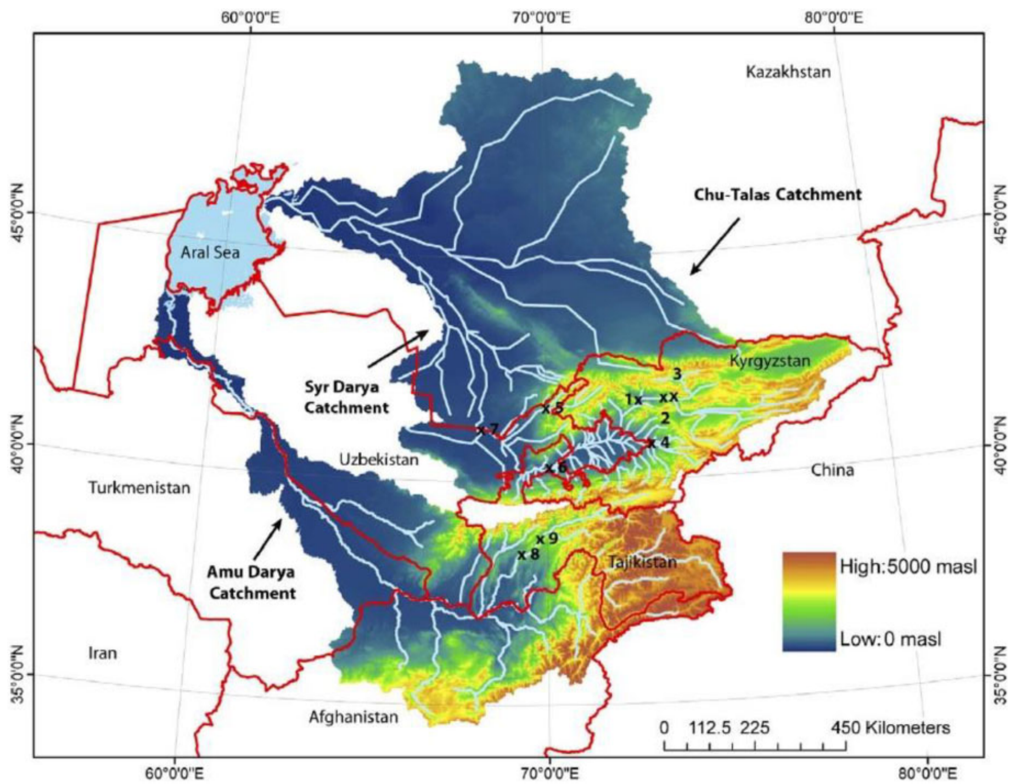

Figure 1. Map of Central Asia

Map of Central Asia with major river catchments (Bernauer & Siegfried, 2012: 229).

cooperative agreements (Dinar, 2009a,b), we know less about the specific resources that are used as carrots in riparian negotiations. In the next section, we describe several cases where states trade energy and water resources to promote interstate riparian cooperation before developing a more general theory to describe these relationships.

Cases of conflict and cooperation over water and energy

In this section, we describe conflict and cooperation in several dyads in the Aral Sea and Ganges river basins. We show that states' geographical positions on a river combined with domestic energy production help explain variance in riparian conflict behavior. In particular, we argue that the *Downstream energy* configuration, where a downstream state has oil or gas resources to trade with an upstream state in exchange for water resources, best enhances the possibility of cooperative interactions in shared river basins.

Aral Sea Basin

River water is an increasingly important resource in Central Asia. The two main rivers in the region, the Amu Darya and Syr Darya, flow across multiple countries impacting critical issues such as energy generation, the agricultural industry, environmental sustainability, and human security (Granit et al., 2010). As shown in Figure 1, six countries share the Amu Darya and Syr Darya rivers: Afghanistan, Kyrgyzstan, Tajikistan, Uzbekistan, Kazakhstan, and Turkmenistan. The most active states concerning river water management are two upstream countries, Kyrgyzstan and Tajikistan, and two downstream ones, Uzbekistan and Kazakhstan. The Soviet Union established extensive irrigation systems to grow cotton in downstream states, directing upstream states to provide water in exchange for coal and natural gas from the downstream states (Dinar, 2009a: 346). The trading system for energy and water resources was thus mandated by the central government when all of the countries were part of the USSR.

After the dissolution of the Soviet Union, problems began to emerge as states in the Aral Sea Basin sought to establish water rights. In 1992, Kyrgyzstan, Tajikistan, Kazakhstan, and Turkmenistan established the Interstate Commission for Water Coordination to manage water resources. However, after failing to implement the 1992 agreement, negotiations in 1996 established that

Kyrgyzstan would guarantee sufficient flow of water through the Syr Darya to the cotton fields of Uzbekistan and Kazakhstan. Uzbekistan and Kazakhstan, in return, promised to supply gas and coal to Kyrgyzstan.[9] Three Central Asian republics signed the Water and Power Accord in 1998, institutionalizing the trade for water and energy resources (Micklin, 2002).[10] However, the disputes over water resources were not resolved (Libert, 2008). Kazakhstan blamed Uzbekistan for non-compliance with the water accord, while Uzbekistan officials denied Kazakhstan's claim; Kyrgyzstan also failed to comply with the water-energy deal.[11]

Non-compliance occurred because Central Asian countries suffered increasing levels of water scarcity following the 2008 record-breaking drought (Bernauer & Siegfried, 2012). Downstream countries were particularly affected by rising water scarcity given their critical interests in agriculture using irrigation.[12] Kyrgyzstan and Tajikistan have limited (and declining) gas and coal deposits and therefore suffer from energy shortages in the winter season, facing substantial energy insecurity at the national level. Kyrgyzstan and Tajikistan rely on hydropower for more than 90% of their power output, while Kazakhstan and Uzbekistan utilize their abundant fossil fuels such as natural gas and oil for power generation (Frenken, 2012).[13]

The winter river water usage by upstream states creates problems for farmers in downstream countries in the agricultural season. The cotton industry has produced the only major product in the Kazakh southern region eligible for export and cash income to a number of small farmers. The cotton crop industry takes nearly one-fifth of Uzbekistan's hard currency revenues.[14] The shortage of water in the spring–summer growing season jeopardizes downstream countries' national economic production. Kazakhstan has only 64% of potential agricultural areas irrigated, while Uzbekistan has 88% of potential areas irrigated. In contrast, both upstream countries have fully irrigated areas. Thus, Kazakhstan and Uzbekistan, having vital interests in irrigation waters as downstream countries, try to guarantee a stable water supply by paying for electricity produced in the upstream areas, consequently hindering these upstream countries' access to river water resources during the cold season (Libert, Orolbaev & Steklov, 2008). This followed from the Soviet era policy of having downstream states provide oil, natural gas, and coal to the upstream states during the winter months in exchange for water during the growing season (April to September) (Siegfried & Bernauer, 2007: W11406).

In spite of competing economic interests between upstream and downstream countries in Central Asia, the parties have settled diplomatic conflicts over shared river resources with cooperative treaties in the post-Soviet era (Vinogradov, 1996). Recent forums in 2013 focused on balancing the riparians' water and energy needs, with downstream states voicing concerns about plans by Tajikistan and Kyrgyzstan to build major power plants on the rivers.[15] Yet there are still many unresolved issues. Due to power generation needs in the winter, upstream countries (e.g. Kyrgyzstan) failed to keep to the promised schedule of water releases, while downstream states (e.g. Kazakhstan) failed to deliver natural gas and oil supplies as promised (Petrenko, 1999). These problems are likely to worsen in the future given predictions from a 2013 Asian Development Bank report that all five countries will see annual increases in energy demands, from 1.1% (Uzbekistan) to 3.1% (Tajikistan), between 2010 and 2035. While implementation of river treaties has faced challenges, militarized disputes have not occurred between the countries in the Amu Darya and Syr Darya basins. We develop this idea more fully in our theory section, where we show that riparian states' abilities to trade energy and water resources, even if not fully executed in existing cooperative agreements, allow the parties to avoid violent confrontations.

[9] Central Asian reach common ground over water: An agreement signed at the weekend will improve cross-border deliveries of water and energy, *Financial Times* 9 April 1996.

[10] Central Asian premiers sign water and power accord, BBC Monitoring Central Asia by BBC Worldwide Monitoring 19 March 1998.

[11] Uzbek official rejects Kazakh claims of non-fulfilment of water accord, BBC Monitoring Central Asia Unit by BBC Worldwide Monitoring 7 August 2000. Kyrgyz fail to stick to water-energy deal – Uzbek TV, BBC Monitoring Central Asia Unit by BBC Worldwide Monitoring 23 January 2002.

[12] Downstream Kazakhstan has a mean annual runoff of 3.30km^3/year, only about 12% of upstream Kyrgyzstan's runoff in the Syr Darya basin. In the Amu Darya basin, downstream Uzbekistan has 4.70km^3/year, less than 10% of Tajikistan's annual runoff (http://www.fao.org/family-farming/detail/en/c/345588/).

[13] Kyrgyzstan switched the operation of the Toktogul reservoir from irrigation to electric power production in the early 1990s which shifted flow river peaks from the summer to the winter (Siegfried & Bernauer, 2007: W11406).

[14] Faltering Kazakhstan cotton industry, Ferghana Ru. Information Agency 7 May 2008 (http://enews.fergananews.com/articles/2412). Irrigation water shortage could mean disaster for Uzbekistan, Ferghana Ru. Information Agency 5 December 2008 (http://enews.fergananews.com/articles/2375).

[15] Central Asian states discuss water cooperation at Tajik forum, BBC Monitoring Central Asia Unit by BBC Worldwide Monitoring 23 August 2013.

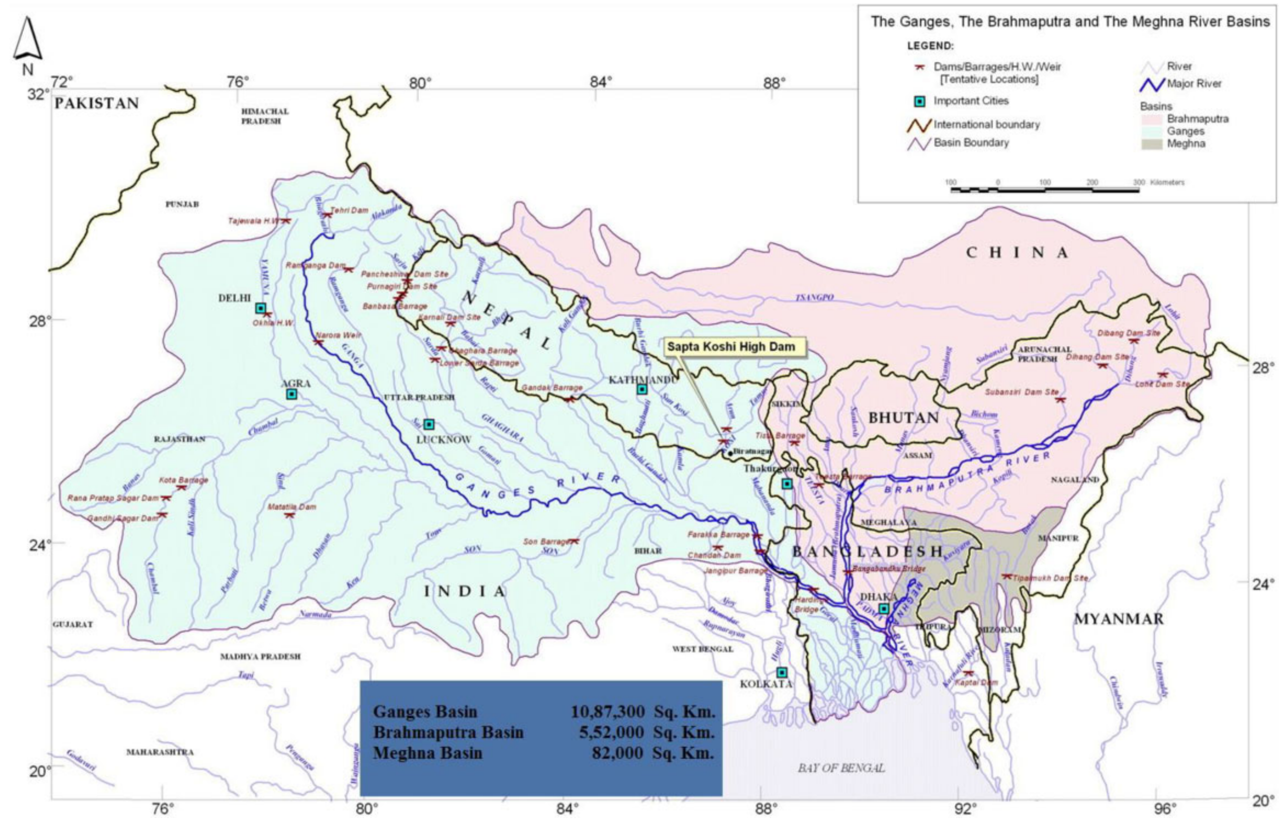

Figure 2. Ganges-Brahmaputra-Meghna river basin map
Source: Joint Rivers Commission Bangladesh (JRCB) (http://www.jrcb.gov.bd/basin_map.html).

Ganges-Brahmaputra-Meghna river basin

The Ganges-Brahmaputra-Meghna river basin (Figure 2) provides additional examples of river conflict and cooperation being influenced by riparian states' energy resources and upstream/downstream river position. This river basin has witnessed a very large number of cooperation and conflict river-related events (Yoffe, Wolf & Giordano, 2003: 1114). As a downstream state in the river system, Bangladesh has vast interests in irrigation and industrial water usages, in particular during the dry season, while upstream India has relatively good quality of water and much hydroelectricity capacity in hand. Because of the importance of river waters to both countries, the Indo-Bangladesh Joint Rivers Commission (JRC) was established in March 1972 and other agreements were struck by the two governments to manage shared water resources. However, little success was made 'because of the objections from either side on various grounds' (Frenken, 2012: 123) based on each side's interests and positions over the shared rivers. There have been multiple militarized disputes between India and Bangladesh since the mid-1970s, but their clashes stopped following the establishment of Bangladesh's independent petroleum production in 1998. Over the past 20 years, Bangladesh and India have initiated new cooperative ventures over riparian issues, including energy security.[16] While the relationship between India and Bangladesh is not directly about the water–energy trading relationship, like countries in the Aral Sea Basin, it is clear that Bangladesh's energy production and capacity allows the country to have more leverage over the diplomatic relationship with India and thus increased the likelihood of cooperation over water issues with India since the late 1990s.

Compared to the India–Bangladesh relationship, Bhutan and India have experienced a stable and peaceful relationship over their shared rivers. Bhutan, as an upstream state in the river basin, has constructed several large dams for hydroelectricity production and its energy sector contributes about a quarter of its gross domestic

[16] India–Bangladesh energy cooperation: historic newer trends, Mainstream LI(14) 23 March 2013, Special Supplement on Bangladesh (https://www.mainstreamweekly.net/article4073.html).

product (Frenken, 2012: 121). However, India is downstream in this dyad and has been producing petroleum since 1976; thus India has more leverage for negotiating cooperative water-energy deals. It is partially because India is located in an upstream area in other rivers and thus has relatively less water stress than Bhutan. However, the fact that there are no recorded militarized disputes between India and Bhutan since 1971 suggests that India's and Bhutan's upstream/downstream locations and water and energy resource endowments have influenced their diplomatic interactions over shared rivers.

Theory

The Aral Sea and Ganges river basin cases show that energy resources, when considered jointly with upstream/downstream geographical factors, induce complex dynamics for the likelihood of conflict or cooperation over shared rivers. If an upstream country has enough energy resources such as natural gas or oil along with control over river water, the country could be free from energy insecurity. Since it has no imminent threat to its survival or critically conflicting interests, the upstream state might be willing to establish peaceful relations with neighboring downstream countries over shared rivers, especially if the country is a hydro-hegemon in the basin. However, the opposite relationship is also logically possible: if upstream countries have sufficient energy resources, they have fewer incentives to negotiate with downstream countries, leading to potentially non-cooperative behaviors of upstream states over shared river basins. If the upstream state is not an energy producer, however, downstream countries that produce ample energy resources can trade energy resources to upstream countries to resolve the upstream state's energy problems. In this scenario, energy resources serve as a useful medium to mitigate conflicting interests over shared river waters, leading to more cooperative interactions in shared river basins.

The literature on energy resources often finds a positive relationship between energy resources and interstate/intrastate conflict. Fearon & Laitin (2003) show that oil producing states experience higher risks for civil wars. Theisen (2008) reaches a similar conclusion, finding that energy resources increase the likelihood of intrastate armed conflict. Lujala (2009) suggests that oil and gas in a conflict zone increases the severity of a conflict. These studies focus on armed civil conflicts, but similar relationships are observed in the interstate conflict literature. Sandler (2000: 724–725) argues that disputes over resources are one of the leading causes of interstate conflicts, while Stalley (2003) finds connections between various natural resources and interstate conflicts.

It is important to note, however, that not all states with petroleum resources are aggressive in their foreign policy behavior. Colgan (2010) argues that Kuwait has as many oil and military capabilities as Libya, but its leaders have behaved far less aggressively. Thus, energy resources are said to have two contradictory effects. Energy resources can have conflict-enhancing effects, by reducing the national leaders' risk of domestic punishment for foreign policy adventurism and increasing the state's military capacity. Yet, energy resources can have conflict-reducing effects by increasing economic incentives for peaceful international trade and stability in the economic market (Colgan, 2010: 662).[17]

When water and energy resources are being traded between countries, such interdependent exchanges may reduce the risks for militarized disputes (Russett & Oneal, 2001). This relates to the research connecting trade and economic interdependence to militarized conflict. Trade increases the opportunity costs of fighting, especially if the economic gains are essential or strategic for a country. Yet, opportunity costs for trade vary across sectors (Dorussen, 2006). Energy supplies are concentrated in the hands of a small number of suppliers, increasing the opportunity costs for conflict. Water resources from river basins also face few substitutes for many countries. These high opportunity costs increase the possible gains from cooperative agreements, especially in situations where both sides have something to offer and gain from trade. The pacifying effects of globalization and foreign direct investment have been shown to be stronger in contiguous dyads than noncontiguous dyads (Gartzke, 2006). Given that states in a river basin share either direct land contiguity or indirect contiguity through the basin, resource and economic interdependence in the region may exhibit strong influences on how states bargain over shared water resources.

Peterson & Venteicher (2013) argue that increased sensitivity to trade partners' actions resulting from dependence influences crisis perceptions and interactions between states. States sharing river basins will face greater sensitivity to their neighbors' actions on the river. A state importing fuel or minerals on which its economy is highly dependent may be more vulnerable to interrupted trade (Peterson & Venteicher, 2013: 227). As seen in the

[17] Colgan (2010) argues that this difference can be explained by whether a state has a revolutionary regime in power.

cases of the Amu Darya and Syr Darya, states could have more incentives to cooperate with each other if they are highly dependent on the other side's resources to maintain overall stability in their economy. In particular, since energy and water resources are very specialized trading goods for each other and important for domestic actors, the opportunity cost of militarized disputes increases, lowering the chance of conflicts (Oneal & Russett, 1999). More generally, growing economic interdependence decreases the likelihood of militarized conflicts and encourages cooperative behaviors among political actors (Keohane & Nye, 1977; Mansfield & Pollins, 2001; Polachek, 1980; Polachek & Xiang, 2010; Stein, 1993).

Among contentious and contiguous dyads, highly connected economic relationships and trade are important to induce cooperation (Oneal et al., 1996). The symmetry in the exchange relations, or the balance of dependence in trading with one another, creates a strong pacifying effect on diplomatic conflicts between countries in a dyad (Barbieri, 1996; Hegre, 2004).[18] This is the likely scenario that unfolds in river basins like the Aral Sea and Ganges; upstream states can provide access to enough water to the downstream countries for their use in agriculture, while downstream countries provide energy resources to help countries in the upper river basins to meet their national energy needs. Without such an arrangement, the upstream states have incentives to build hydroelectric dams to meet their citizens' energy demands, actions we have seen in many river basins globally. Through the highly dependent and balanced exchange relations between upstream and downstream states, countries in shared river basin are less likely to use coercive foreign policy strategies. Furthermore, by having comparative advantages in the provision of distinct resources, such as downstream states providing oil and upstream states providing water, the possibility of cooperative agreements is much higher.

To consider the interactions between geographical configurations in river basins and water–energy interdependence relations, we identify four possible scenarios in Table I and construct hypotheses based on each different case.[19] The first scenario, *Joint energy*, is a case where both a downstream country and an upstream country have energy resources, such as the USA and Mexico in the Rio Grande. The second scenario, *Downstream energy*, indicates a situation where an upstream country has no energy resources while a downstream country does, such as the Syr Darya case. *Upstream energy*, the third scenario, is a case where an upstream country has an energy resource, but the downstream country does not, such as Brazil and Paraguay on the La Plata river. Finally, *No energy* represents the remaining cases where neither the upstream nor downstream countries have significant energy resources, such as Nicaragua and Costa Rica on the San Juan river.

Table I. Energy resource and upstream/downstream relationships

		Upstream country energy resources?	
		Yes	*No*
Downstream country energy resources?	*Yes*	Joint energy Example: Rio Grande	Downstream energy Example: Syr Darya
	No	Upstream energy Example: La Plata	No energy Example: San Juan

If we look at the empirical relationship between these four types of scenarios ($\chi^2 = 157.1$; $p < .001$) and the occurrence of militarized disputes in contiguous shared river basin dyads from 1946 to 2001 in Table II, we see that conflict occurs most frequently in dyads without oil or natural gas production (8,710/15,771 or 55% of the total). However, with respect to conflict risks, we see that *Joint energy* dyads have the highest risks for MIDs (15.55%), while *Downstream energy* dyads have the lowest rate of MIDs (6.18%). This shows that the Central Asian river dynamics may generalize to other regions where militarized conflict is least likely when downstream states have oil or natural gas to trade for water with upstream states.

Let's consider the dynamics of the *Downstream energy* case where an upstream country has no energy resources but a downstream country does – exactly the situation happening in Central Asia. A downstream country can utilize its energy resources as the strategic means of guaranteeing its national interests concerning shared river basins. In these situations, as we see in the negotiations involving Kazakhstan and Kyrgyzstan, there is a side-payment possible that the downstream state can make to the upstream state in exchange for water. The lack of oil or natural gas production by the upstream state makes it more amenable to a cooperative solution. Our general expectation is that if a downstream country has energy resources to trade with its upstream counterpart state which is not an oil or natural gas producer, the country

[18] For a comprehensive review of the literature on globalization and conflict, see Schneider (2014).

[19] Our analyses treat energy producers as any states that have a non-zero value of oil production. Future analyses may consider thresholds to identify larger oil producers from smaller ones.

Table II. MID onset, energy resources, and upstream/downstream relationships

Scenario	*No MID onset*	*MID onset*	*Total*
Downstream energy	2,917 (93.82%)	192 (6.18%) Pearson Chi2(1) = 23.7 Pr = 0.000	3,109 (19.71%)
Joint energy	1,629 (84.45%)	300 (15.55%) Pearson Chi2(1) = 149.1 Pr = 0.000	1,929 (12.23%)
Upstream energy	1,861 (91.99%)	162 (8.01%) Pearson Chi2(1) = 0.3 Pr = 0.565	2,023 (12.83%)
No energy	8,049 (92.41%)	661 (7.59%) Pearson Chi2(1) = 14.3 Pr = 0.000	8,710 (55.23%)
Total Pearson Chi2(3) = 157.1 Pr = 0.000	14,456 (91.66%)	1,315 (8.34%)	15,771 (100%)

% in No MID onset and MID onset are row percentages. % in Total are column percentages.

can use energy resources as a means for inducing cooperation with its upstream neighbor, guaranteeing both sides' interests without the use of violent tactics. In other scenarios where such trades are less feasible, the bargaining process is more likely to fail, increasing states' incentives to use coercive foreign policy tools to pursue their riparian goals. Our primary hypothesis captures this relationship:

> *Hypothesis 1:* Militarized conflicts over shared river basins are less likely and riparian cooperation more likely under the *Downstream energy* scenario than in the *Joint energy*, *Upstream energy*, or *No energy* scenarios.

Thinking through the chances for conflict in the other scenarios becomes more complicated. In general, we think conflict is more likely in scenarios where the upstream state has oil resources (*Joint energy*, *Upstream energy*) relative to the *Downstream energy* scenario, a pattern we observe in Table II. If both states have energy resources (*Joint energy*), then the downstream state is in a weaker negotiating position and more likely to use force to protect its water interests. Our prediction is also based on the generally positive relationship observed between oil/natural gas and interstate conflict in the literature. In the upstream energy scenario (*Upstream energy*), the upstream country has more leverage for using river water without any seasonal or volume restrictions. In this situation, downstream countries have fewer resources to trade in riparian negotiations. Situations where neither state has energy resources (*No energy*) are governed by other factors that we mentioned earlier such as relative power in the river basin dyads, the degree of water scarcity, and the history of conflict or cooperation in the region. Our analyses utilize a baseline model of conflict onset in shared basin dyads to see how the interaction of energy resources and upstream/downstream locations influence the chances for militarized conflict beyond factors already identified as influencing riparian conflict in the literature.

Research design

To test the effects of energy resources on riparian conflict and cooperation, we construct a shared river basin dataset by merging various datasets. The first dataset is the shared rivers dyadic dataset from Brochmann & Gleditsch (2012). This is a revised and updated version of the Owen, Furlong & Gleditsch (2004) dataset and includes 788 river-sharing dyads in 261 international river basins. We integrate information from the Brochmann & Gleditsch (2012) dataset with the Shared River Basin Database from PRIO to code the geographical location of upstream and downstream countries. We focus only on the cases of pure upstream and downstream relationships and exclude the cases of mixed and sideways river relationships.[20] In addition, we include only cases of land contiguous dyads in shared river basins in our analysis.

The second important data source is the PRIO petroleum dataset or PETRODATA v.1.2 (Lujala, Rød & Thieme, 2007). The petroleum dataset excludes solid forms of hydrocarbons and includes only natural gas and crude oil, consisting of 884 records for onshore and 378 records for offshore occurrences in 114 countries, from 1945 to 2003. The dataset records the year for the first discovery in the region as well as the first year of production. The river basin dataset covers 1816–2002, while the petroleum dataset covers a more limited period, 1945–2003.

[20] See footnote 8.

In terms of identifying whether upstream and downstream countries have energy resources, we adopt the production variable from PETRODATA. First, the petroleum dataset considers two different pieces of information related to natural resources – the discovery of resources and the production of resources. Concerning our hypotheses, the issue is whether a country has energy resources which can make a country freer from potential external dependence on energy sources and at the same time be used as leverage to bargain with other riparian states if necessary. We capture both the discovery and production information and code energy resource as 1 if energy production status and year are known and 0 otherwise. If production year is unknown while we recognize production status, we adopt discovery year as the alternative time indicator. If we discover information when production status is unknown, we code energy resources as 1 by using the discovery information. We merge this information with states' position in the river basin dyad. If an upstream country in a dyad has energy resources, it is coded as 1 (13.4% of cases) and 0 otherwise. If a downstream country in a dyad has energy resources, it coded as 1 (18.3% of cases) and 0 otherwise.

Based on these variables, we construct measures for our four scenarios relating energy production and pure upstream/downstream location on a shared river. The *Joint energy* variable is a dichotomous variable, coded as 1 if both the upstream and the downstream country in a dyad have energy resources such as natural gas or crude oil and 0 otherwise. The *Downstream energy* variable is a dichotomous variable, coded as 1 if the upstream country does not have an energy resource but the downstream country has an energy resource and 0 otherwise. The *Upstream energy* variable is a dichotomous variable, coded as 1 if the upstream country has an energy resource but the downstream country does not have an energy resource and 0 otherwise. *No energy* variable is a dichotomous variable, coded as 1 if neither the upstream nor the downstream country has oil resources. We see in Table II that of the 15,771 total shared contiguous river basin dyads from 1946 to 2002, 19.71% are *Downstream energy*, 12.23% are *Joint energy*, 12.83% are *Upstream energy*, and 55.23% are *No energy*. We estimate models using *Downstream energy* as the omitted category given that our theory predicts this dyad configuration to have the lowest risks for conflict and the highest chances for cooperation.

The main dependent variable for our analysis comes from the Militarized Interstate Dispute (MID) dataset as coded by Brochmann & Gleditsch (2012) from 1885 to 2001. This captures the onset of a militarized interstate dispute (MID) in a given year with the value of 1 and 0 otherwise; this includes both originators and joiners to a MID. Water resources and the risk of conflict are associated with each other in that water is an instrument of war or a strategic target (Brochmann & Gleditsch, 2012: 520). Moreover, as the importance of water resources to countries in a dyad is heightened, it narrows down the possible peaceful negotiation range between countries and thus increases the potential benefits of more coercive strategies in interstate relations (Tir & Stinnett, 2012: 214). While full-scale wars have not occurred in the context of river disputes, many lower-level threats, displays, and uses of force have taken place (Brochmann & Gleditsch, 2012: 520; Wolf, 1998; Yoffe, Wolf & Giordano, 2003). Thus, we follow other large-N studies of shared river waters and interstate conflicts by using MID as a dependent variable (Furlong, 2006; Gleditsch et al., 2006; Hensel, Mitchell & Sower, 2006; Toset, Gleditsch & Hegre, 2000).[21]

We use four additional dependent variables to capture conflict and cooperation in river basins. The first is a measure of conflict events as coded by Kahlbenn & Bernauer (2012) in the International Water Conflict and Cooperation (IWCC) dataset.[22] Events are coded on a conflict (to –6) and cooperation (to +6) scale for all river basin dyads from 1997 to 2007. We created a dummy variable that equals 1 when a river dyad experiences one or more conflict IWCC events in a given year and 0 otherwise. The second and third measures are created with the International Water Events Database from 1950 to 2008 as coded by Aaron Wolf and colleagues at Oregon State University.[23] We take the water event intensity scale (Basins at Risk, BAR) which ranges from –7 to +7 and code a dummy variable that equals 1 when a river dyad experiences one or more BAR conflict events (–7 to –1) in a given year and 0 otherwise. We also create a measure for cooperation coded 1 when a river dyad experiences one or more BAR cooperative events (1 to +7) and 0 otherwise. The final measure captures river-based cooperation in a riparian dyad using data on the onset of river treaty commitments. We use a version of the Oregon State University TFDD

[21] We also use fatal MIDs as an alternative dependent variable and the results are presented in Table A8 in the Online appendix.

[22] https://www.researchgate.net/profile/Thomas_Bernauer2/publication/256039984_International_Water_Cooperation_and_Conflict_A_New_Event_Dataset/links/5672793708aecc73dc0c633d.pdf.

[23] http://www.transboundarywaters.orst.edu/database/interwatereventdata.html.

river treaty data compiled by Zawahri & Mitchell (2011) that equals 1 in a riparian dyad-year if one or more new river treaties were signed that year and 0 otherwise.

Our baseline logit models include four control variables: (1) the lowest democracy score in the dyad (from Polity IV), (2) a dummy variable for the presence of one or more major powers in the dyad,[24] (3) the natural log of the differences in capabilities between the two states (using CINC scores),[25] and (4) year and polynomials of year to capture temporal dependence in the data (Carter & Signorino, 2010). We also include several other resource related control variables. First, we estimate models with the measure of primary energy consumption (PEC) of each state from the Correlates of War National Material Capabilities (NMC) data to capture the demand for energy resources.[26] Since energy resources are a key part of our argument, the level of energy demands influences a state's bargaining over energy and water resources and thus we use the PEC measure as a proxy for a state's energy resource demands. Second, we control for trade exports between states in dyads (Gleditsch, 2002). Dyadic trade may pacify the relationship between states and capture general levels of interdependence. Third, we control for dams in shared river basins because dams influence the quantity of water resources downstream and may escalate tensions between riparian states. We create variables counting the total number of dams as well as the number of hydroelectric dams that upstream and downstream states possess using the International Commission of Large Dams (ICOLD) World Register of Dams dataset.[27] We also create a dummy variable of whether upstream and downstream countries have hydroelectric dams. Lastly, we include measures of water dependence and average precipitation (Zawahri & Mitchell, 2011) and a dummy variable for whether one or both states are land-locked.

Empirical analyses

We begin with an analysis of our baseline models in Table III using *Downstream energy* as the omitted category. We find strong support in favor of our theoretical argument. Our key hypothesis is that militarized conflicts are less likely and cooperation more likely over shared river basins under the *Downstream energy* scenario than in other scenarios (*Joint energy*, *Upstream energy*, and *No energy*). First, we find that *Joint energy* dyads are significantly more likely to experience MIDs and TFDD conflict events and significantly less likely to sign river treaties or have cooperation events over their shared rivers compared to *Downstream energy* dyads. Second, *Upstream energy* dyads are more likely to experience MIDs and TFDD conflict events than *Downstream energy* dyads, while they are not statistically different in terms of cooperative behavior. Third, even though there are few differences between *Downstream energy* and *No energy* scenarios in the baseline models, we observe more distinctions in the bivariate cross-tabulations.[28] *Downstream energy* dyads have a significantly higher percentage of river treaties than *No energy* dyads (2.38% vs. 1.36%), a lower rate of IWCC conflict events (4.18% vs. 8.8%), and a smaller number of MIDs (6.18% vs. 7.59%).[29] In the Online appendix, we estimate models with just our key theoretical variables and time polynomials. We find that *Joint energy*, *Upstream energy*, and *No energy* dyads are significantly more likely to experience conflict and less likely to sign river treaties than *Downstream energy* dyads. We also compare the area under the receiver operating characteristic curve (ROC) for the baseline model (excluding energy/geography scenario variables) to the area under the ROC curve for the full model to check model fit. We find that the *MIDs* model with the energy/geography variables included (*Joint energy*, *Upstream energy*, and *No energy*) improves our ability to predict conflict between states in shared river basins.

As seen in Table IV, *Downstream energy* dyads have a lower probability of MID onset (0.060) than *Joint energy* (0.135) and *Upstream energy* (0.078) dyads. We also calculate the first differences of the predicted

[24] See the Correlates of War State-System Membership Dataset (http://www.correlatesofwar.org/data-sets/state-system-membership).

[25] Hegre (2008) shows that asymmetric dyads are less likely to experience militarized disputes when he measures relative capabilities with a power capability ratio variable. However, he also finds that unilateral increases in power by one country in a dyad can increase the risks of conflict. Our empirical results are consistent with this conjecture when we find that increases in one state's population (a component of overall capabilities) raise conflict risks, while the capability ratio measure has a negative effect on conflict.

[26] Primary Energy Consumption is 'a state's consumption of energy (metric ton coal equivalent) in each year' (http://www.correlatesofwar.org/data-sets/national-material-capabilities).

[27] See http://www.icold-cigb.net/.

[28] See Online appendix, Tables A1–A5.

[29] The bivariate cross-tabulations for all dependent variables are presented in the Online appendix. We also estimate models using fatal MIDs as an alternative dependent variable (Table A8) and find results similar to the MID results in Table III.

Table III. Energy resources and river conflict/cooperation

	MIDs	*IWCC*	*River Treaty*	*TFDD conflict*	*TFDD cooperation*
Joint energy	0.883**	–0.039	–0.450*	0.535**	–0.313†
	(0.102)	(0.358)	(0.228)	(0.185)	(0.169)
Upstream energy	0.277*	0.272	–0.193	0.566**	–0.105
	(0.112)	(0.328)	(0.200)	(0.181)	(0.161)
No energy	–0.019	0.024	–0.134	0.114	0.337*
	(0.089)	(0.301)	(0.149)	(0.167)	(0.149)
Lower democracy	–0.038**	–0.104**	0.038**	0.022**	0.014*
	(0.005)	(0.017)	(0.007)	(0.008)	(0.007)
Major power	0.529**	0.632†	–0.250	–0.492**	0.473**
	(0.093)	(0.355)	(0.162)	(0.175)	(0.157)
Ln capability ratio	–0.334**	–0.451**	0.148**	–0.270**	0.148*
	(0.033)	(0.124)	(0.046)	(0.069)	(0.059)
Year	0.415	0.243**	0.907**	–1.343	8.705**
	(0.523)	(0.074)	(0.299)	(1.277)	(1.164)
Year squared	–0.000	0.000	–0.000**	0.000	–0.002**
	(0.000)	(.)	(0.000)	(0.000)	(0.000)
Constant	–410.604	–488.429**	–903.809**	1,333.950	–8,600.188**
	(516.396)	(148.348)	(292.590)	(1,263.082)	(1,151.602)
Number of observations	15,771	1,836	22,455	1,995	1,995
ROC	0.6423	0.7349	0.6406	0.6114	0.6285
ROC vs. Baseline (χ^2)	34.24	0.64	0.08	4.39	1.72
AIC	8,743.050	755.451	3,574.927	2,045.793	2,335.193
BIC	8,812.044	799.574	3,647.100	2,096.179	2,385.579

Standard errors in parentheses. †$p < 0.10$, *$p < 0.05$, **$p < 0.01$. Baseline model is a model excluding energy/geography scenario variables.

Table IV. Predicted probability of MIDs for energy/geography types

Energy/geography types	*Pr (MID)*	*95% confidence interval*	
Downstream energy	0.060	0.05197	0.06971
Joint energy	0.135	0.11811	0.15381
Upstream energy	0.078	0.06610	0.09104
No energy	0.060	0.05379	0.06482

Predicted probabilities are calculated based on the baseline model of MIDs, presented in Table III; we dropped year squared when calculating predicted probabilities.

probabilities of MIDs for the three control variables used in the baseline MIDs model in Table V.[30] We see that more democratic (–0.032 first difference) and more asymmetric power (–0.050 first difference) dyads experience less militarized conflict over their shared rivers. On the other hand, major powers are more likely

[30] The first difference captures the change in the probability of the dependent variable equaling 1 when a variable is moved from one standard deviation below its mean to one standard deviation above its mean, holding all other variables at their mean or mode.

Table V. First differences of predicted probability of MIDs for control variables

Variables	*Diff. Pr (MID)*	*95% confidence interval*	
Lower democracy	–0.032	–0.04111	–0.02401
Major power	0.038	0.02350	0.05313
Ln capability ratio	–0.050	–0.06097	–0.03833

First differences calculated from the MIDs model in Table III; we dropped year squared when calculating predicted probabilities.

(0.038) to use force to contest their shared rivers than pairs of minor power states.

In Table VI, we add several additional control variables to our models including dyadic *Exports*, *PEC*, *Dams*, *Water scarcity*, and *Land-locked*. The analyses confirm that our primary hypothesis that *Downstream energy* dyads are most cooperative finds support even when we control for other resource, economic, and geographical factors that influence conflict in shared river basins. Conflict is more likely in shared river basin dyads as exports increase, as the number of dams increases (especially those that generate hydroelectric power), and as water dependence increases. The chances for militarized conflict are reduced by increases in primary energy consumption

Table VI. River conflict (MIDs) with additional control variables

	Export	*PEC*	*All dam*	*HydroDam1*	*HydroDam2*	*Water*	*Land-locked*
Joint energy	0.824**	0.887**	0.778**	0.870**	0.865**	0.849**	0.790**
	(0.105)	(0.104)	(0.105)	(0.106)	(0.102)	(0.102)	(0.102)
Upstream energy	0.266*	0.279*	0.218†	0.307*	0.253*	0.253*	0.249*
	(0.113)	(0.112)	(0.124)	(0.126)	(0.114)	(0.113)	(0.113)
No energy	–0.111	–0.032	–0.042	–0.005	–0.011	–0.036	0.074
	(0.090)	(0.089)	(0.097)	(0.098)	(0.090)	(0.090)	(0.090)
Lower democracy	–0.039**	–0.038**	–0.047**	–0.047**	–0.040**	–0.040**	–0.041**
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
Major power	0.478**	0.495**	0.760**	0.994**	0.501**	0.518**	0.449**
	(0.099)	(0.127)	(0.131)	(0.125)	(0.093)	(0.092)	(0.093)
Ln capability ratio	–0.344**	–0.342**	–0.433**	–0.452**	–0.325**	–0.353**	–0.302**
	(0.034)	(0.034)	(0.043)	(0.042)	(0.034)	(0.034)	(0.034)
Exports state A to B	0.000*						
	(0.000)						
State A PEC		0.000					
		(0.000)					
State B PEC		–0.000**					
		(0.000)					
Upstream state's number of dams			–0.000				
			(0.000)				
Downstream state's number of dams			0.000*				
			(0.000)				
Upstream state's number of hydroelectric dams				–0.001**			
				(0.000)			
Downstream state's number of hydroelectric dams				0.000**			
				(0.000)			
Upstream state's hydroelectric dam (dummy)					0.230**		
					(0.089)		
Downstream state's hydroelectric dam (dummy)					0.003		
					(0.083)		
Water dependence (low)						23.663**	
						(8.164)	
Average precipitation (low)						–0.688**	
						(0.143)	
Land lock							–0.408**
							(0.065)
Year		0.356	0.324	0.399	0.268	0.473	0.397
		(0.524)	(0.606)	(0.612)	(0.525)	(0.525)	(0.524)
Year squared		–0.000	–0.000	–0.000	–0.000	–0.000	–0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant		–352.261	–324.376	–399.623	–264.667	–466.684	–395.604
		(517.088)	(598.814)	(604.970)	(518.726)	(518.340)	(517.398)
Number of observations	14,868	15,771	12,085	12,085	15,771	15,735	15,771
ROC	0.6429	0.6446	0.6652	0.6669	0.6449	0.6563	0.6538
ROC vs. Baseline (χ^2)	27.30	29.67	31.68	31.58	26.31	23.12	17.08
AIC	8,427.796	8,738.430	6,913.239	6,888.510	8,739.780	8,695.138	8,702.292
BIC	8,503.866	8,822.755	6,994.636	6,969.907	8,824.105	8,779.438	8,778.952

Standard errors in parentheses. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

(state B), increases in average precipitation, and the presence of at least one land-locked country in the dyad. In the Online appendix, we also show that our results are robust to inclusion of additional control variables capturing trade, river treaties, and shared regional or global international organizational memberships.

The results show that the Central Asian and Ganges-Brahmaputra-Meghna cases generalize to other contexts in the post-World War II era. Dyads in which downstream states have energy resources to trade with upstream riparians show lower rates of conflict and higher rates of cooperation than other dyadic pairings. Conflict is most likely between petroleum-producing riparian dyads or in situations where upstream states alone produce oil or natural gas.

Conclusion

This project examines how energy resources and upstream/downstream configurations in interstate river basins influence the chances of militarized conflict and cooperation in river basin dyads. We find that the most cooperative configurations involve downstream energy producers who can trade oil and natural gas resources for water with upstream states that are not energy producers. We illustrate the theory using the Aral Sea and Ganges river basins in Asia. The Soviet-era legacy of having downstream states provide coal and oil to upstream states in exchange for water has been carried forward in the post-Cold War world by the successor-states in the Aral Sea region. While some countries have not fully complied with water sharing provisions in cooperative treaties to manage these rivers, they have been able to avoid escalating diplomatic conflicts to militarized confrontations. On the other hand, the dynamics in other energy dyads are more complex. We see joint energy producers and upstream energy dyads having more militarized conflict and less interstate cooperation than downstream energy dyads. This meshes with Colgan's (2010) argument about the two-sided effects of oil. If a downstream country has energy resources which can be used as effective tools to manipulate the relationship between upstream and downstream countries, states are likely to use them to create more beneficial cooperative outcomes in shared river negotiations. In other situations, though, the presence of oil and gas resources can significantly increase the risks for militarized clashes.

This study sheds light on new aspects of the likelihood of conflict and cooperation in dyads within shared river basins. Our findings show that resource interdependence influences bargaining in international relations and demonstrate that the linkages to interstate conflict and cooperation depend on the specific resource and geographical positions of countries in international river basins. The project also shows how insights from the Kantian peace literature on trade and conflict can be extended to the resources literature. Resource endowments and dependence on outside suppliers interact with geographical forces to raise or lower the opportunity costs of fighting. Future research will explore other possible resources that could be traded in riparian negotiations (e.g. coal). We will also consider states' dependence on external suppliers for goods like oil and natural gas. Countries that are more vulnerable to outside suppliers may be even more likely to strike peaceful accords with their riparian neighbors. There could be cases where private multinational companies are in charge of oil or gas production facilities and make contracts with countries. In this case, the relationship between a company and a state could yield other effects on the chances for conflict and cooperation in a given shared river basin. Recent datasets on hydro-political dependencies will also provide more sophisticated ways to measure water catchments in future research (Beck et al., 2014). Exploring these dynamics will give us better insights into the risks for conflict over fresh water and other natural resources.

Replication data

The dataset and do-files for the empirical analysis in this article, along with the Online appendix, can be found at http://www.prio.org/jpr/datasets and http://www.saramitchell.org/research.html.

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